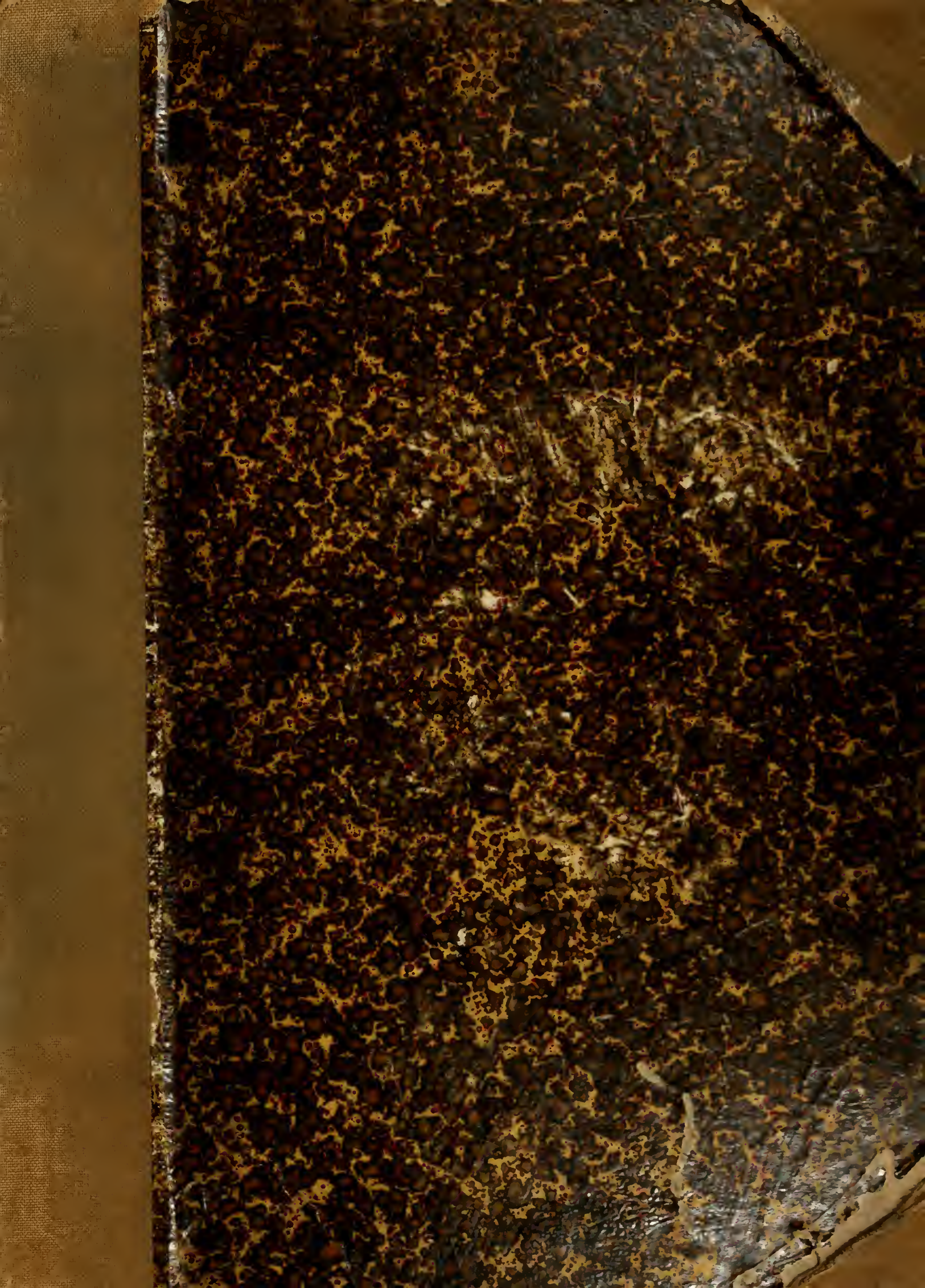

THE

STREET RAILWAY REVIEW

INDEX TO VOLUME IX

1899

CHICAGO
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MONON BUILDING

PAGING BY MONTHS.

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*Articles marked with an asterisk are accompanied by maps or other illustrations; d indicates daily edition; e, editorial.
The name of a month instead of a number indicates that the article is to be found in the advertising pages of that issue.

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CORRESPONDENCE.

We cordially invite correspondence on all subjects of interest to those engaged in any branch of street railway work, and will gratefully appreciate any marked copies of papers or news items our street railway friends may send us, pertaining either to companies or officers.

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VOL. 9. JANUARY 15, 1899. NO. 1.

The Indiana legislature started out on its first day's session by introducing a 3-cent fare bill; and regulations relating to heating, speed, manner and time of operation, and several other matters which are and always will be questions of local condition. If the Hoosier statesmen would only go out and undertake the management of even a 10-car road for a few weeks they would return and make short work of these biennial bills.

As the opening days of the new year grow into weeks the outlook for construction, reconstruction, betterments and increased service becomes more and more promising. A single supply house in this city has already made bids on the line of material it handles to no less than one hundred and fifty roads existing or proposed,and this instance is duplicated in the experience of many others. The inevitable result will be a grand scramble upon the advent of warm weather for materials, machinery and cars, and those who delay will have to pay the penalty in waiting for delivery of their orders.

The question of speed is one which will interest operators of interurban roads, as the latter come to compete more frequently with the steam lines. To obtain motors is an easy matter, and trucks and cars will safely travel as fast as the motors can drive them. The vital point is in the track, as is being demonstrated in the present competition for the fast mail contract between Chicago and Omaha. Builders of interurbans will do well to sacrifice something of ornament if need be in their buildings, and at the start make retrenchments if necessary along other lines, but by all means have a good roadbed. It will wear out fast enough under the most favorable conditions, and high speed is neither pleasant or desirable on a poor track.

The mayor of Chicago continues his persecution of the local street car companies, and apparently is losing much sleep in his efforts to devise new methods of annoyance. In the meantime our streets are left uncleaned, and their condition would disgrace a town of five thousand. Citizens are waylaid and held up at all hours of the day and night, and within ten days this has been carried to the extent of holding up a passenger on a passenger train in broad daylight, and before the train had gone a mile from the depot. As usual no arrests were made. Policemen are being constantly attacked and shot and one was killed by these bandits. But the chief executive appears to have no time for such incidents as long as he can harass a street car company.

A Brooklyn divine in a sensational sermon characterizes corporations, notably street car companies, as robbers, against whom the public has no voice. The average manager is laboring under the impression that it is the dear public which deems it a virtuous act to "beat" a company; and as for the public having no voice, we have always found it one grand chorus of kicks when through some accident or inadvertence a car was late, or the customary comforts were temporarily disarranged. Then he goes on to commend what he calls "the Chicago rope and gallows act" in language for which if he was in the least informed of the actual facts would make him blush or stamp him as an anarchist. Business men and reputable citizens had nothing to do with the threats of which he speaks with so much commendation, except to disown them. The Rev. Frank is evidently either the victim of a wild hallucination or easily gullible.

The necessity of signals or interlocking devices at grade crossings of street railways with steam railroads has frequently been mentioned in these columns, and recent accidents as well as some narrow escapes call again attention to the subject.

At Scranton, Pa., last month a motorman ran his car through the gates at a railroad crossing and it was struck by a freight train, one of the 14 passengers on the car being fatally injured.

From San Francisco comes the story of a narrow escape; a train of two coupled street cars was stopped on the tracks of the Southern Pacific by an accident to the electrical apparatus while crossing. In this instance the passengers, over 100 in number, left the cars and the men of the party were able to push them across the tracks, just in time to avoid a collision with an approaching train.

At Indianapolis recently, the trolley left the wire while a car was crossing the tracks of a steam railroad, and the car stopped directly in front of an approaching train. By an emergency application of the brakes the train was stopped within four feet of the car which was filled with passengers. It so happened that the brake leverage on this particular train had been increased a short time previously and a quicker stop was made than would otherwise have been possible.

In any of these cases there might have resulted an accident, to settle the damage claims arising out of which would have paid for the installation of several interlocking systems.

During the late controversy over the franchise question in Chicago there were some astonishing figures and arguments presented in the newspapers regarding street railway properties. The ignorance of the contributors and the editors of the Chicago dailies was painfully evident. Possibly they had not informed themselves on the subject, but that did not deter them in the least from discussing the financial and operating affairs of the street railway corporations. The printing of such matter holds the writer up to ridicule to those conversant with the actual conditions, but the harm comes from the impression made on the public mind. An ordinary business man has no time or inclination to figure out the receipts of the company by the number of nickels collected by the conductor on the car in which he rides, and it is impossible for him to estimate the expense of operating a large railway system, for there are hundreds of items which go to make up the total. For this reason figures utterly at variance with the truth can be taken as an hypothesis, and false and impossible conclusions deduced therefrom, and at the same time be received with credulity by the public.

Last month attention was called to a statement which was credited to the REVIEW in an article printed in the "Chicago Record" which never appeared in our columns. In the next contribution on street railway affairs in that paper, it is one of our contemporaries which suffers from the legerdemain method of making copy. Under the caption of "Underground Traction" (the article, however, treats of conduit, not a tunnel system of railways) Edward W. Bemis argues that the "unsightly trolleys" should not be tolerated longer. Mr. Bemis is the professor who about two years ago proved decidedly obnoxious to Chicago on account of his socialistic utterances, and had to seek employment elsewhere.

Reference is made to a report by F. S. Pearson (who for years was chief engineer of the Metropolitan Street Railway Company, of New York) to the city of Liverpool, and from this an argument is deduced against the trolley. Elsewhere in this issue is a description of the first trolley line in Liverpool, just completed. Mr. Pearson's report is not against the trolley and Liverpool wisely decided upon that system in preference to all others after the most extensive investigations in Europe and America.

The most glaring fabrication in this article is contained in the following figures: Receipts per car-mile—Cable, $33.27; Electric, $26.03; horse car, $28.82. Operating expenses per car-mile—Cable, $17.55; electric, $10.06; horse car, $17.89. To the casual reader this does not appear so ridiculous as a few more figures will reveal. The statistics are credited to the report of the Metropolitan Street Railway Company, of New York, for the quarter ending September 30, 1898. For the three months referred to, the car-mileage of the cable lines was 2,804,383, for the electric 4,059,756 and for the horse cars 3,501,088. According to the above table the receipts of the company for that time would be $299,879,626.15, and which would make an annual income of $1,199,518,504.60. Under these financial conditions there would be good reason for the 4-cent fare clamor, and compensation sufficient to run the entire city government, which would be a mere incidental expense of $30,000,000 a year, and in addition the company could well afford to help out the government by assuming the entire pension roll which might be enlarged to include worn out professors of political economy who are no longer acceptable in our universities; municipal reformers, theorists and others of that class.

Apparently it makes no difference to some newspaper proprietors what they say as long as it hits street railways and they appear to delight in prostituting their columns to these malicious falsehoods.

A street railway company is one of the largest, if not the largest, consumer of power in any community, and where there is current available from a water power plant a great saving can be effected. As a rule the current has to be conducted for some distance and alternating current transmission is adopted for the sake of economy. For lighting and general power purposes it is only necessary to reduce the voltage by means of static transformers, but for electric railways direct current is necessary and some means must be used to convert the alternating current to drive the direct current machinery of the street railways.

The most natural solution was to operate a direct current generator by an alternating current motor and this has been done successfully. The two machines have been combined in one and the name rotary converter applied to it. The advantage is obvious as the same fields and windings are used both for the alternating and direct currents and the functions of an alternating synchronous motor and a direct current generator are performed by the converter. It is merely an ordinary generator with collector rings connected to the windings at one end of the armature; of course no driving attachment is necessary. It is well understood that alternating currents are generated in every armature winding and rectified by the commutator. In the converter the alternating currents are led into the winding from the transmission lines by collector rings and as the commutator segments from each winding pass under the brush the process of commutation goes on as with an ordinary direct current generator. The converter is not only simpler than two machines but it is cheaper in first cost and less expensive to maintain; it has a much greater capacity for the same weight; there are no serious armature reactions, due to combining the functions of a motor and a generator armature in one, and for the same reason there is an absence of mechanical torque and field distortion. The effect of the current driving the armature balances the dragging effect of current generation. In some converters of the earlier types there were two sets of windings on the armature but this practice is now obsolete for there is no advantage in having more than one set of windings.

One peculiarity of the converter is that the ratio of voltages in converting the currents is practically fixed, being approximately as 1 is to 1.41, or, to illustrate, with an impressed effective e. m. f. of 350 volts at the collector rings a current would be taken from the commutator at 500 volts. This would not be so if there were two machines, a motor and a dynamo, for in the latter case the voltage could be regulated by the field excitation. However, nearly the same effect can be accomplished as over-compounding with direct current generators by a certain amount of self-induction being interposed in the alternating current lines feeding the converter which is excited by a compound winding.

On another page may be found the reprint of a paper read by Prof. S. P. Thompson before the Institute of Electrical Engineers on "Rotary Converters" which is well worth the time required for its perusal. The paper is quite long and complete, including several tables and diagrams, but the subject is treated without resorting to mathematics. The author mentions the growing favor for alternating currents in railway work and the fact that in America the converter has found its application on a larger scale than in Europe, which is largely due to the numerous water-falls in this country. The street railways about Niagara Falls, Buffalo, Salt Lake City, Ogden, Sacramento, the interurban between Barre and Montpelier, Vt., and others receive currents from water power plants which after passing through converters is fed into the lines.

But alternating current transmission is not by any means confined to water power plants. The economy of large power stations with units of great capacity is recognized. Recent progress in alternating current transmission and the development of the converter has made it more economical to generate the current in a large central station, transmit it a high voltage and convert it at suitable points to feed the lines. The tramway system of Dublin has a three-phase transmission for the lines at a distance from the station and those nearby are fed direct from the generators which are steam driven. The same plan has been carried out on the Chicago & Milwaukee Electric Railway, the alternating current being transmitted at 4,500 volts. The power station of the Metropolitan Street Railway Company, in New York, of 70,000-h. p. capacity, is designed for supplying current to all parts of the borough of Manhattan at a voltage of 6,000. The current will be reduced in potential and converted at eight sub-stations conveniently situated with reference to the various railway lines. The same system has been adopted for the Central London Railway.

The latest and most complete feeding systems in our large cities provide for alternating current transmission. From a theoretical and practical standpoint this is even more applicable to interurbans with long straight lines. For the interurban systems now being planned high voltage transmission is in nearly all cases favorably considered, for it is recognized as a step in advance. The rotary converter has made this possible and it is particularly fortunate that it should be developed just at the time when electric railways are lengthening and alternating current transmission is finding wide application. The development of the converter has been so recent and rapid that literature on the subject is very meager; so that a comprehensive paper by so eminent authority as Prof. Thompson commends itself to street railway men who are keeping abreast of the times.

The reorganization of the naval personnel is a subject which should interest our readers for two reasons. First, as citizens of the republic we should all wish for what will increase the efficiency of the navy. Second, as men engaged in a business (like so many modern industries) having its foundation upon the work of the engineer, civil, mechanical or electrical, we can appreciate the importance of the naval engineer, as well as the injustice of the system which denies him proper recognition.

We have nowhere seen a better statement of some of the facts which render necessary a reorganization of the United States navy than that presented by Arthur Warren in current issue of the "Engineering Magazine," in his article on the "Fighting Engineers at Santiago."

A few weeks after the battle in which Cervera's fleet was destroyed one of our technical contemporaries, in rebuking the author of an English comment on the battle,said editorially: "We venture to say that when the full official reports are made public that editor will be convinced that the blockade of the Spanish fleet in the harbor of Santiago was one of the most beautiful examples of sustained vigilance and discipline that he ever heard of. There is no probability that the ships of the blockading fleet lay off the harbor with their fires banked. There is, on the other hand, great probability that every one of those ships was always ready for instant motion and action." This is an engineer's view of what should have been done during the blockade, and knowing the professional ability of the engineer corps of our navy the natural conclusion was that this is what was done. And we thought, judging by the result accomplished, that these were the facts.

If Mr. Warren's information is correct, and at this late date there is no good reason why it should not be, the fleet at Santiago was far from ready for instant motion and action. Mr. Warren says: "The American ships had been off the coast for weeks, waiting for the enemy to come out. When the enemy came out, the American ships were ready to shoot, but not to give chase. This was no fault of the engineers. It was not the effect of over-confidence. It was the result of a condition. The condition is peculiar to naval practice. It was long ago discarded in the merchant service. In the merchant service the chief engineer controls his department. In the navy the captain controls the engineers and is in turn controlled by the commanding officer of the fleet. The chief engineer of an Atlantic liner looks to his captain for starting and stopping signals only; for the rest he takes his orders from his owners and reports to them. The chief engineer alone is responsible for the care, operation and economy of the machinery. In the navy the ship's captain decides how many boilers shall be used, how much coal shall be burned, what pressure shall be carried. And the American captains at Santiago had everything in readiness except their engines and boilers. There were two exceptions,—the Oregon and the Gloucester."

On nearly if not quite all the vessels, save these two, engines were uncoupled, fires out, boilers empty, and some of the commanding officers were seeking to make records for coal economy! As it is aptly put, "in time of war the boiler rooms were prepared for peace."

In railroad service the conductor has charge of his train, but that does not enable him to direct what steam pressure his engineer shall carry or how much oil he shall use. The engineer is given his locomotive and held accountable for results.

The naval personnel bill now before congress is a well-considered attempt to remedy some of the recognized defects in the present organization. By it the engineer officers are to be transferred to the line and thus given the rank heretofore denied them, and henceforth all officers must be to some extent engineers. It would be well if the engineer officers were further given the same authority in their special department as is enjoyed by engineers in the merchant service.

THE GRAB-HANDLE MAN GETS SIX MONTHS.

In the Review for December, 1898, page 852, was published an account of the operations in Massachusetts of a man of many aliases whom we have named "the grab-handle man," together with references to former numbers giving details as to the attempts made by the same man to defraud other companies.

Jas. J. Valentine, treasurer of the South Middlesex Street Railway Company of South Framingham, Mass., sends us the following account of the trial of this man, from which it will be seen that he was quite active in Massachusetts:

"Sidney A. Phillips appeared as counsel for the South Middlesex Street Railway Company, into whose meshes the man of so many aliases had become entangled within one short week. The following witnesses appeared: W. B. Rockwell of Staten Island, N. Y., president of the Staten Island Midland Railway Company, also holding the same position with the Electric Mutual Casualty Assurance Company of Philadelphia, which makes a specialty of electric railway accident risks; Benjamin J. Weeks, superintendent of the Quincy & Boston Street Railway Company; Dr. Fred E. Jones, employed by the same company, Charles C. Barron, superintendent of the Lowell Suburban Railroad; Chief of Police Michael Eagan of Framingham; Superintendent John W. Sullivan of the South Middlesex Street Railway Company; Conductor Osgood D Childs of the same company, and Dr. Peter Owen Shea of South Framingham. Nearly all testified against Zimmerman in the most positive manner. Chief Eagan, the arresting officer, in his testimony, read a letter from Chief of Police Homer G. Bradley of Joliet, Ill., in which he stated that the person in question whose photograph (Street Railway Review, September, 1897, page 559) he inclosed had served a short jail sentence.

"President Rockwell fully identified the prisoner as the man who in July, 1898, made a claim in his office for $35 for personal injuries alleged to have been received by a defective grab handle on his system, but which he was not paid. He then gave his name as John Schaeffer (Street Railway Review, August, 1898, page 583) and his residence as a certain number on Fifth avenue, New York, which proved to be fictitious on examination.

"Superintendent Weeks' testimony was to the effect that in consequence of a claim for damages made in his office October 17, 1898, the same party got $25 in settlement and his receipt, which was produced in court, the name of John Dietz being signed. He gave his residence to Superintendent Weeks as Weymouth landing, but it is proved that he lied in that regard. The Quincy & Boston official brought in his pocket a warrant issued from the district court of East Norfolk in which Dietz was charged with obtaining money under false pretenses.

"Superintendent Sullivan detailed the facts leading to the arrest of the swindler last week in South Framingham, as the result of his claiming $25 damages for an alleged accident on his road and in Natick.

"Dr. Peter Owen Shea, who was called to examine the prisoner and who, after considerable effort, made him unloose the bandages on his arm at the time of his arrest, stated on the witness stand that Zimmerman was afflicted with 'pure faking,' and that he found nothing at all the matter with him, although on the day he was called the man feigned both sickness at the stomach and injury to his arm.

"Chief Eagan exhibited in the court the tools found in Zimmerman's room, which consisted of a screw driver, covered with cloth way down to the point, a wrench and two pairs of pliers.

"The man was sentenced by Judge Kingsbury to six months in the house of correction for vagrancy. It is believed that the career of a successful swindler has been temporarily checked.

"It quite likely that all the other corporations will also lodge complaints against the swindler as soon as he serves the sentence meted out to him yesterday."

Mr. Valentine also advises us that "John Walter," in March, 1898, attempted a similar fraud on the Cleveland (O.) City Railway Company, and "Charles Zimmerman," on the North Jersey Street Railway Company, Jersey City, N. J., April 23, 1898.

THE SHOREDITCH REFUSE BURNER.

In the "Chicago Record" of December 28, 1898, William E. Curtis, the Washington correspondent, makes the following statement:

"In a letter from London a year ago last summer I described a novel enterprise which had been entered upon by the Shoreditch parish of London to supply electricity for lighting the streets dwellings and public buildings by using the street sweepings for fuel. Up to that date the parish had paid about $30,000 per year for carting the refuse to a barge on the river Thames and towing it to a dumping place in the sea, and about $20,000 annually for gas to light the streets and parish buildings. About $60,000, or $10,000 more than these annual charges, which was met by taxing the people, was invested in an electric plant, which has since been run 24 hours for six days in the week, and 12 hours on Sunday, furnishing electrical power for small manufactories during the day and for illuminating purposes at night. The street sweepings have furnished almost all the fuel necessary. The cost of coal in addition was only $432. The total expenditures for the first year were $19,070 for wages, stores, supplies, insurance, repairs and other purposes. The interest, sinking fund, rents, and the ordinary allowance for the depreciation of the property was $10,205, making a total of $29,275.

The gross receipts for the sale of light and power, including a credit equal to the average charge for street lighting by gas, were $45,205, thus leaving a net profit of $15,930 for the benefit of the parish treasury, which will be used in enlarging the plant."

This article resembles many of the statements we see concerning the municipal enterprises of English cities in that it is inaccurate. The Shoreditch undertaking is a joint one comprising the electric light plant and the refuse burning plant, the accounts of which are presented separately. The figures quoted by Mr. Curtis and given above were taken from the report for the electric light plant only, the reduction from pounds to dollars being made by multiplying by five. The cost of coal is given above as $432; in the vestry accounts this is £432 ($2,160).

The net profit in the electric light plant is stated by the vestry to be £3,184 ($15,930, if we call $5 equal to £1). The refuse burning plant, the accounts for which were overlooked by Mr. Curtis, showed on their face a loss of £2,679 ($13,395) without making any allowance for interest and sinking fund, or for depreciation of the boilers and furnaces. An allowance of £1,435 ($7,175) was made for interest and sinking fund, and the sum charged to the general taxes levied on the parish, but none whatever for the depreciation.

These accounts have caused much discussion in England, and the "Electrical Review" after analyzing the combined accounts which show a net profit and saving of £2,679 ($13,395) says: "The profit has been arrived at by making no proper allowances for depreciation and repairs, which we roughly estimate at £2,000; by charging £1,435 for interest and repayment of capital on the destructor, to the general rates; and further by taking credit for an imaginary saving of £1,253 on the old system of scavenging, making a total of over £4,600 ($23,000) which has been 'hocussed' out of the accounts."

It must also be stated that even this showing is made only by charging the scavenging department of the parish 50 cents a ton for all the refuse that is burnt; another parish in London has contracted for the same service at less than 25 cents per ton. In fact it was freely stated at the meeting of the Shoreditch vestry that the burning of the refuse cost the scavenging department more than the old method of barging.

One thing of interest in this connection is that the vestry clerk has, up to the date of our latest advices, refused to sign the accounts; one reason given was that £1,255 advanced out of the general rates to pay deficits in the electric light plant between March, 1895, and March, 1897, was credited as income earned during the year ending March, 1898.

DAM WRECKED AT TAMPA, FLORIDA.

By the courtesy of George D. Munsing, general manager of the Consumers' Electric Light & Street Railroad Company, we have been furnished with an account of the explosion which wrecked the dam of the company on December 13 last. The dam which was built across the Hillsborough river about six miles from Tampa was described in the REVIEW for October, 1897, page 687. The flumes and weir were built of concrete masonry; the flumes occupy a space 110 ft. by 24 ft. and 30 ft. high from the base, and the weir is 132 ft. long and 19 ft. high. The power-house is on the south side of the river, just below and parallel to the masonry flumes, and is 150 by 50 ft., containing two 300-k. w. alternators, two 200-k. w. direct current generators and other smaller apparatus; there are two 400-h. p. engines for use as auxiliaries in times of low water.

North of the weir, that is on the side opposite the flumes, were the flood-gates, which were 15 ft. wide; beyond the gates the dam was built of dirt with sheet piling of timber through the center. The masonry wall which held the dirt at the end of the gate was 100 ft. long, 7 ft. thick at the base and 30 ft. high.

On the night of Tuesday, December 13, three charges of dynamite which had been placed against the lower side of the retaining wall, one near the bottom, one half-way up and one at the top, were exploded, shattering the wall and breaking through the gates. In less than half an hour 225 ft. of the earth wing dam, including the retaining wall, was carried down the stream.

The fall from the dam to the mouth of the bay is only a few feet, the water could not pass away very rapidly and hence backed up into the power-house. All the machinery was submerged for some three or four hours. The loss including the damage to machinery is estimated at $75,000. The accompanying illustration is a view of the dam taken after the water had subsided; the point of view is on the south or power-house side.

No explanation is given of the dastardly outrage, but one of the watchmen is now under arrest.

A local paper states that J. A. Tucker, one of the watchmen who was on duty at the time the explosion took place, and on whose side of the dam the great catastrophe occurred, has been arrested, charged with complicity in the affair, and is now in the county jail. In three minutes after the affair, the other watchman by the name of Morgan, whose post was on the opposite side of the river, says that Tucker had crossed the stream and was talking to him about

DAM AFTER THE EXPLOSION.

the affair. He is reported as having told several very fishy tales concerning it, and it is believed that this man knows a good deal about the matter. Morgan shot twice at a moving object just as soon as the explosion had occurred, but thinks now that it was Tucker who was crossing the river in a boat. Tucker's post is located at the far end of the dam, and it gave way up to a few feet from where he says he was sitting when the explosion happened. There are 12 electric lights strung on top of the dam clear across the river, and it would be impossible for a man to get within 50 yards of it without being discovered by the watchmen if they were doing their duty, and it cannot be conceived how this man Tucker was on duty and at the same time allowed a person to slip by him and set the dynamite cartridge which played so much havoc, without noticing him.

MORE THIRD RAIL FOR N. Y., N. H. & H.

The announcement is made that the New York, New Haven & Hartford Railroad is to use electricity (third rail system) on the New Haven and Derby division between New Haven and Ansonia. In case this improvement is immediately carried out it will probably result in the abandonment of the fight for a trolley line between Derby and New Haven.

There has been a warm fight waged at the last two sessions of the legislature for a charter for such a trolley line; the first time the matter came up the railroad secured an easy victory, but in 1897 the trolley charter failed only by a small majority, and the present plan is to forestall a rival electric road.

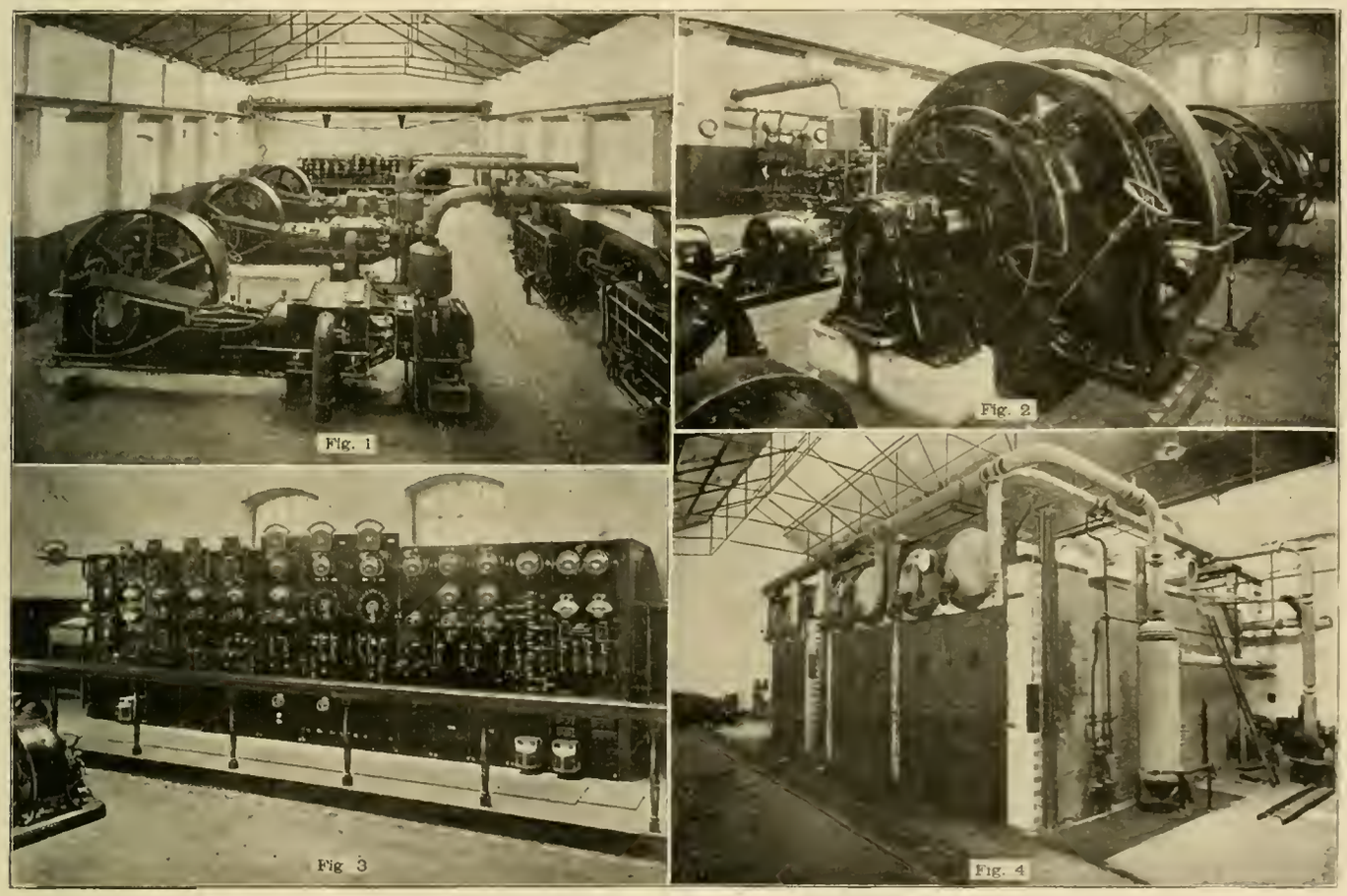
It is said further that Derby is to become the central point of an extensive third rail system, and that with a central power station here the Consolidated will be enabled to replace steam locomotives as far as Waterbury on the north, New Haven on the east, Naugatuck Junction on the south and Botsford on the west. These are all junction places, and including Derby, Ansonia and Shelton, comprise a population of 190,000.

The new street railway between Worcester and Grafton, Mass., was opened on December 15. The first car over the line carried 50 guests of the company who were entertained at dinner in Grafton.

THE ELECTRIC TRAMWAYS OF CORK, IRELAND.

Cork is the third city of Ireland, having a population in excess of 80,000. Until within the present century it was second only to Dublin, but Belfast has become the industrial city of the island and has surpassed its two rivals. Cork is situated upon an island in the River Lee and on both banks, near the southern coast of Ireland. There are numerous handsome public, commercial and church buildings in the city, and many fine residences are in the pretty suburbs on the surrounding hills. The village and laurel groves of Blarney are only four miles distant, and also the celebrated castle of the same name.

In 1896 the municipality obtained an electric light provisional order and later transferred its powers to a company which had been formed to construct a tramway system in the city. The organization then became the Cork Electric Tramways & Lighting Company and carried out the plans for supplying electricity for light, power and traction services. The operation of the tramways for the past month has proved entirely successful. From the station, current is also supplied to 217 customers having 11,622 incandescent lamps and 18 motors aggregating 113 h. p. In addition to this there are 100 city arc lamps. The charge for lighting current is 10 cents per k. w. h. and for power 8½ cents per k. w. h. for the first two hours and 2 cents per k. w. h. afterwards.



VIEWS IN THE POWER STATION OF THE CORK ELECTRIC TRAMWAYS & LIGHTING COMPANY.

A map of the lines, together with feeder circuits and connections, is given in Fig. 5. The tramways are for the most part single lines with turn-outs, and have a total length of 11 miles. Double tracks are laid through the principal streets; branch lines run to Tivoli, St. Lukes, Western Road, Blackpool and Douglas. The longest branch is to Douglas, a village about two miles south of Cork. The tramway crosses the river twice, first over Parnell bridge, a steel swing bridge, and again over Patrick's bridge, which is built of stone.

The rails are of the girder type, of steel, weighing 83 lbs., per yd., and are of American manufacture. They are 30 ft. long, 6¼ in. deep, and are slotted for the tie-bars, and drilled for the fish-bolts and electrical bonding. The fishplates are of steel, 26 in. long, weighing 56 lbs. per pair, and the outer plate is the larger, giving support to the rail head. The tie-bars are of wrought iron 2 in. by ⅜ in., weighing 10½lbs., with two nuts at both ends, placed at 8 ft. centers and 3 ft. from the ends of the rails. The crossings are built up as the work proceeds, and the rails are cut and scarfed for this purpose by a cold steel cutting saw. The scarf is held to the crossing rail by specially made fishplates, forged to suit, and a plate 6 ft. long by 1 ft. 6 in. by ½ in. is placed beneath and bolted up to the rail flange with 10 bolts 2½ in. by ⅝ in. The crossing is completed by cutting a groove through the head of the crossing rail. The rails are laid upon a continuous bed of Portland cement concrete (5 to 1), 6 in deep and 7 ft. wide. The roadway between the rails, and 18 in. outside each rail, is paved with Welsh granite setts 6 in. deep and 3½ in. wide laid on a ½ in. bed of sand, and grouted with Portland cement mortar (3 to 1) well swept into the joints. Outside the city boundaries, the rails are laid on creosoted sleepers, 6 in. by 4½ in. by 9 in. The rails are fixed to the sleepers by 30 dog spikes and 14 fang bolts and chips to each rail length. The switches are cast steel, made by Dick, Kerr & Co.

The steepest grade is 7 per cent, and the sharpest curve has a radius of 27 ft. The turn-outs are 200 ft. in length, and the space between each pair of rails is 4 ft. 6 in.; but when center poles are used the space between the tracks is 6 ft. 6 in. The gage is 2 ft. 11½ in., and was determined with a view to the probable use of the tramway for conveying the cars of the Muskerry Light Railway Company to and from the quays, and for interchange of traffic with the Cork & Passage Company. The Muskerry Company's gage is 3 ft., and that of the Cork & Passage Company is being converted from 5 ft. 3 in. to a 3 ft. gage. A section of double track construction is

shown in Fig. 6. The rails form the return circuit, and are electrically connected at each straight joint by two No. 000 B. & S. Chicago bonds, 35 in. long. At every switch there are two 13-ft. bonds spanning the steel casting, and there are also for each switch four 35-in. bonds, arranged as shown in Fig. 7. At each crossing there are four No. 000 B. & S. 35-in. bonds. The rails are cross-

FIG. 5.—CORK TRAMWAYS.

bonded every 240 ft., and where double tracked, the tracks are also cross-bonded in every 240 ft. These tracks cross bonds are placed half way between the rail cross bonds. Where there is double track with central poles the cross bonds between the two tracks are 7 ft. long, and where there is double track with side poles, 5 ft. long. All the cross bonds on single track are 42 in. in length. In all the loops on the single line there is a cross bond between the two tracks. The return circuit is continued over the river at Parnell bridge by four 250,000-c. m. cables, connected by bonds to the rails on either side of the water; this arrangement is necessary to avoid any interruption in the circuit when the bridge is swung open.

The trolley wire is of hard-drawn copper, double throughout. The portion of the trolley wire over the swing part of Parnell bridge is supported on special poles and brackets fastened to moveable parts of the bridge; the connections on the trolley wire are heavy spring clips, which allow the bridge to be moved in either direction. Center poles with double bracket arms are used in the principal streets, and side poles with single bracket arms elsewhere on the line. Span wires are employed only in a few places. The poles are 31 ft. long, composed of three sections of 5, 6 and 7-in. steel tubing with joints overlapping, and shrunk on while hot.

In the principal streets an arc lamp is fixed on every alternate pole. The lamps are of the enclosed arc type, connected up five in series; they are also connected so that the consecutive lamps are on different circuits. Switches and resistances are contained in the bases of the poles, so that a resistance can be placed in the circuit instead of a lamp, if necessary; also, each circuit can be controlled from any lamp in its circuit. The lighting distribution is the three-wire system, with 460 volts between the outer ones, the mains in the majority of cases consisting of jute covered, lead sheathed, tape armored cables, laid direct in the streets. Altogether over 20 miles of cable for the lighting and traction systems have been laid; the distance between the feeding points, of which there are two at present, and the station is a little less than half a mile.

In their course from the power station to the feeding points, the cables cross the River Lee, and as there is only a swing bridge at this point the cables had to be laid in a trench excavated in the bed of the river, Callender's vulcanized bitumen wire armored cable being adopted as most suitable for the purpose. Four additional feeder cables of 900,000 c. m. have been laid across the river to provide for future extensions; the vulcanized bitumen cables being brought together in a pit on each side of the water, where they are connected to the ordinary jute covered, tape armored cable laid in the streets. The greater proportion of the distributing cables in the center of the city are of the three-core type; the largest distributor used having a sectional area of 200,000 c. m. In all the outlying districts, three single distributing cables are used, and, in addition to their armoring, they are further protected by a covering layer of bricks. At the crossing and junction points of the net work, Callender's disconnecting boxes are fixed, and of these, 19 are at present installed.

The power house is on Albert street near the Cork & Passage river terminus, and about 220 ft. distant from the river. The site upon which the station was built was once a morass, and to obtain solid foundations 137 pitch-pine piles were driven. These are each 37 ft. long, 12 in. in diameter and placed zigzag at 5 ft. centers. Upon these concrete was laid. The building is of brick, faced with Ruabon brick. The arrangement of the power station and car shed is clearly shown in Fig. 8.

Figs. 1 to 4 show views of the engines, generators, switchboard and boilers.

Three McIntosh & Seymour side-crank tandem compound condensing engines, running at 150 r. p. m. are each fitted with expansion governors, with separate exhaust valves on both high and low pressure cylinders. The high pressure cylinder is steam jacketed and exhausts into a receiver, in the interior of which are fixed three copper coils, which can be heated with live steam. The diameter of high pressure cylinder is 12 in., the low pressure cylinder 22 in., with a stroke of 30 in. The crank shaft is 11½ in. in diameter. The fly-wheel is 11 ft. in diameter with a 15-in. face, and weighs 55,000 lbs. The engines are worked condensing with a vacuum equivalent to 26 in. The valve gear is positive and is composed of simple links and levers, and the cut-off can take place at any point between zero and 8-10 stroke. The engines are guaranteed to regulate from no load to full load within 2 per cent variation of speed, and when cutting off at ¼ stroke will develop 313 h. p., at 6-10 cut-off, 557 h. p., the maximum point of cut-off being 8-10 stroke. The engine beds are 6 to 1 Portland cement concrete, 8 ft. in depth, laid upon 96 pitch pine piles, 12 in. by 12 in., driven at 5 ft. centers. The two condensers are of the Wheeler admiralty type. The engines are in the center, the air pump at one end and the circulating pump at the other end, each capable of dealing with 12,000 lbs. of steam per

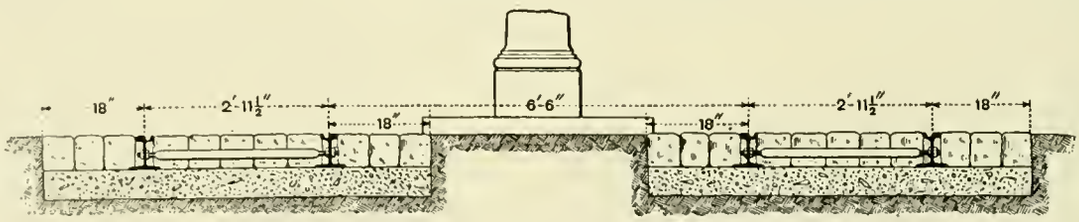
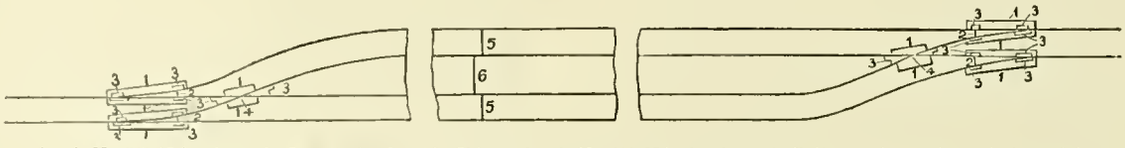


FIG. 6.—SECTION OF DOUBLE TRACK WITH CENTER POLE.



1—Chicago bonds No. 000, 13 feet long; 2—Cast-steel points; 3—Chicago bonds No. 000, 35 inches long; 4—Built crossing main road, through loop scarfed; 5—Chicago bonds No. 000, 42 inches long; 6—Chicago bonds No. 000, 5 feet long.

FIG. 7.—ARRANGEMENT OF BONDS.

hour. The water is taken direct from the river through 12 in. cast iron pipes. There is also an auxiliary supply from the water works which can be relied upon to start the pumps in the event of the suction pipe being emptied, through the retaining valve not being perfectly water-tight.

Direct connected to each engine is a six-pole 200-k. w. compound-wound generator giving 500 volts at 135 r. p. m. The fields are compound-wound, so as to give a potential at terminals of 500 volts at no load and at full load. A field rheostat is provided for reducing the potential to 460 volts for lighting service. The generators are capable of sustaining an overload of 25 per cent for half an hour without undue heating, and of sustaining momentary fluctuations in load up to 40 per cent above the rated capacity without injurious heating or shifting of brushes. There are three motor-driven boosters which are compound-wound. The winding is such as to give 5 per cent rise of voltage from no load to full load, running at constant speed, and the shunt winding is such as to give a range of potential from 220 to 240 volts when the series winding is cut out.

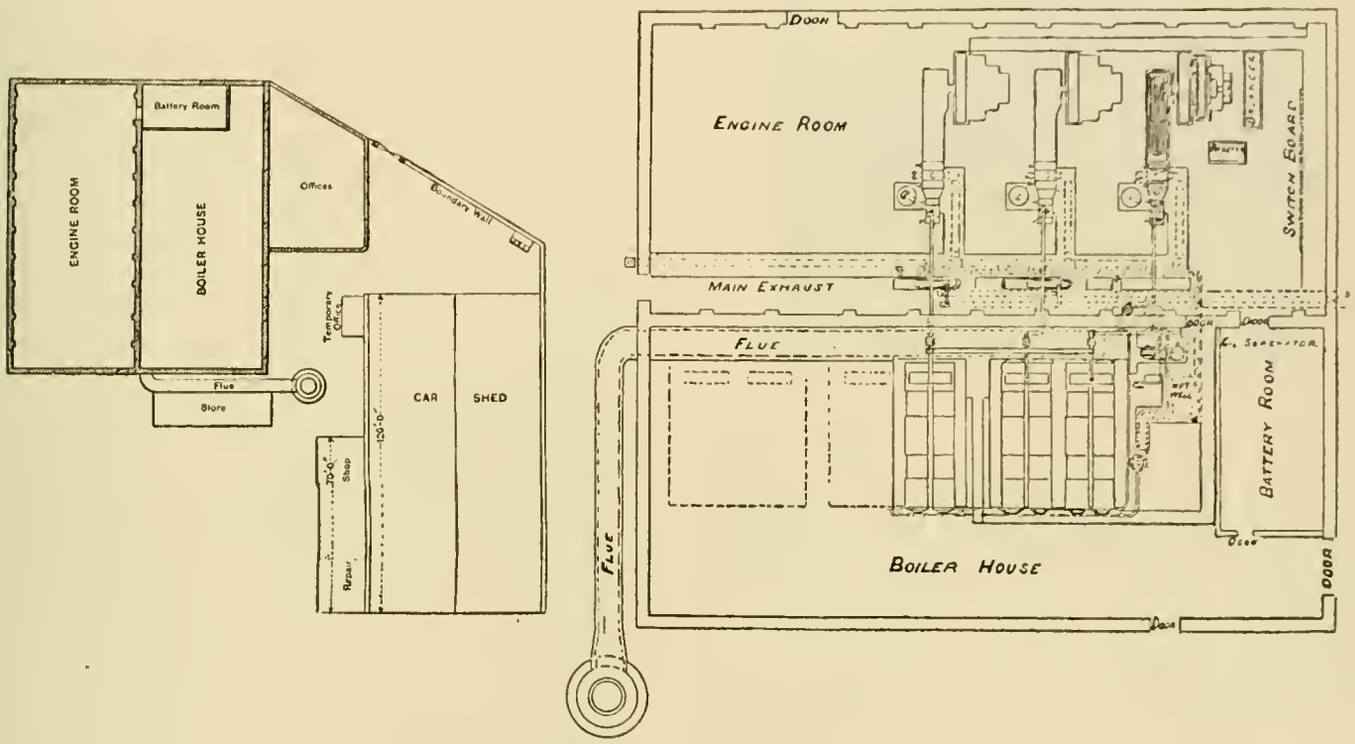


FIG. 8.—PLAN OF POWER HOUSE AND CAR SHEDS.

The arrangement of the switchboard is given in the diagram, Fig. 9. It is situated at the end of the engine room and contains three generator panels, fitted with automatic circuit breakers, with magnetic blow-outs, also the necessary switches, so arranged that the generators can be connected direct to either the lighting or traction bus-bars. The two battery panels are fitted with the necessary regulating switches and magnetic blow-outs, and so arranged that the battery can be either charged from, or discharged to, either the lighting or traction circuits as desired. The two booster panels are so arranged that the booster can, if desired, in the day time be driven direct from the traction bus-bars, or used as an ordinary booster, the two motors being in series across the outside lines of the three-wire circuit and the junction being connected to the neutral wire. In this case, the set is run to give its correct voltage by means of the motor placed in the centre, the electrical connections to which are disconnected after the booster sets are connected to the network. The switchboard is also fitted with a panel containing the necessary instruments required by the Board of Trade for testing purposes.

The battery room contains 256 Tudor cells mounted in three tiers, each cell containing six positive and seven negative plates. The capacity of the battery is 770 ampere hours. The normal rate of discharge is 110 amperes, maximum rate 210. The battery stands are of pitch pine, coated with acid-proof paint and mounted on large oil insulators. This battery can be charged either from the traction or lighting bus-bars as desired, the necessary voltage for charging being supplied by the booster, which can also be driven from the traction or lighting bus bars. The battery booster consists of a 500-volt shunt-wound motor, connected by flanged coupling to a shunt-wound generator and mounted, together with the same, on a combination bed-plate with three bearings. The generator has a rated capacity of 18 k. w., and is adapted to give a range of potential from 40 to 150 volts for running in series with main generators for charging the storage battery.

The boiler room contains three Babcock & Wilcox boilers, each having 2,531 sq. ft. of heating surface and capable of evaporating 8,000 lbs. of water per hour. The normal working pressure is 150 lbs. The feed-water heater was made by the Wheeler Condenser & Engineering Company. The feed water is heated by the exhaust from feed and condenser pumps. The Blake & Knowles feed-pumps are compound, the diameter of high-pressure cylinder being 6 in., low pressure cylinder 9 in., water cylinder 4 in. in diameter, with an 8-in. stroke. The steam cylinders of these pumps are fitted with an improved outside valve gear, so that they can be adjusted to the full length of stroke under all conditions of speed. The steam connections of these pumps are so arranged that, in case of any repairs being required, either pump can be worked independent of the other.

A hot-well is situated in the boiler house. It is fitted with baffle plates, the divisions in which can be filled with coke and straw, if desired, for the purpose of intercepting any oil that may be discharged into the same. It is also fitted with suitable outlets, so arranged that, by opening a valve and filling the tank, the oil, which will be found floating on the surface can be run off. The feed water before entering the boilers can be passed through two Edmiston filters, capable of filtering 16,000 lbs. of water per hour. These filters are arranged on a twin system and fitted with the necessary valves to enable the filters to be used on either range of feed pipes.

The chimney is of steel, and was built by Keeler & Co. of Williamsport, Pa. The height is 130 ft., and the diameter at base is 12 ft., curving in to 7 ft. 6 in. at 12 ft. above ground, and finishing 7 ft. 6 in. at top. The stack is built of riveted plates 4 ft. 6 in. in height, three plates forming a course. They are 7-16 in. thick at bottom, decreasing 1-16 in. for every 32 ft., and finishing ¼ in. thick. The breeching nozzle, 6 ft. wide and 7 ft. high, connecting

the brick flue, is reinforced by the addition of a 2 ft. 6 in. angle iron, forming an arch up the sides and over the top of the nozzle. The stack is lined with 4½ in. radial firebricks, set in fireclay. A water guard is fixed at the top of the chimney, made of 3 in. angle iron turned down to cover the brick lining. The base-plate is of cast iron, 2 in. thick and 15 ft. diameter, in eight parts, strongly ribbed

FIG. 10.—TYPE OF CAR.

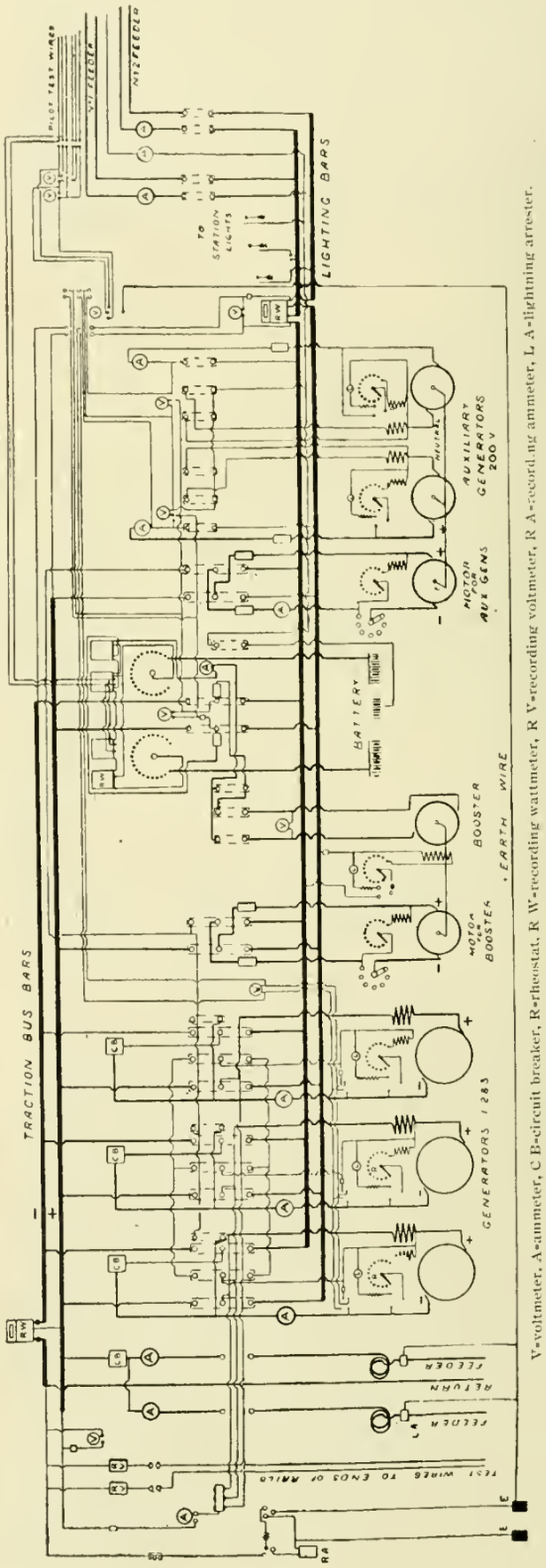
and joined by 1½ in. bolts. The base, 21 ft. sq., is of Portland cement concrete, 6 to 1, and built upon a foundation of 25 pitch-pine piles 12 in. by 12 in., and anchor bolts 14 ft. long by 2½ in. diameter were placed in position before the concreting commenced. The advantages claimed for the steel stack are saving of time in the erection and cost in the structure. The time occupied in erecting was about five weeks, and the brick lining occupied 20 days. The saving in cost over a brick stack was about 25 per cent.

The steam piping is of steel, fitted with heavy screwed steel flanges, so arranged that any engine can be fed direct from the boiler immediately behind it. Necessary valves are inserted to enable any faulty section in the piping to be cut out. This piping is fitted

FIG. 11. END OF CAR SHED.

with an automatic atmospheric valve, which in the event of there being any pressure, due to the failure of the condensing plant, will immediately allow the engines to exhaust direct into the atmosphere; the piping on the atmospheric side of this valve is of thin steel, riveted together in spirals.

The cars, 18 in number, are built to carry 20 passengers inside and 24 outside, and will be electrically lighted. The type of car may be noted from Fig. 10. They were manufactured by the Brush Electrical Engineering Company, Ltd., and are mounted on single Peckham trucks. The motor equipment consists of two G. E. 60 motors with series-parallel controllers; the motors being specially designed for this work on account of the very narrow gage, name-



V-voltmeter, A-ammeter, C B-circuit breaker, R-rheostat, R W-recording wattmeter, R V-recording voltmeter, R A-recording ammeter, L A-lightning arrester.

FIG. 9.—ARRANGEMENT OF SWITCHBOARD.

ly, 2 ft. 11½ in. In other respects the car equipment follows the standard practice.

The car shed, 125 ft. long by 70 ft., is built on ground adjoining the power station, and contains pits for inspecting and cleaning the cars and a repair shop. In Fig. 11 is shown an end view of the shed; its open construction indicates that Cork enjoys a very mild climate. The repair shop is 70 by 18 ft., containing the necessary machines and blacksmith's tools required for the maintenance of the cars and machinery. The entire system was inspected by the Board of Trade on December 8, and the cars are now operating on all the lines on a 10 minute schedule.

DETROIT FORGED TICKET CASE.

The Detroit Citizens' Street Railway Company narrowly escaped having a very serious time with forged tickets which were put in circulation August 10, and it was by the vigilance of some of the officers that the fraud was discovered and run to earth immediately after the tickets appeared. The spurious tickets were hard to distinguish from the originals, but in checking them in the office a young lady clerk noticed a difference in the cardboard and in the strength of some of the lines. Sample tickets were sent to the lithographing company and were pronounced counterfeits.

Detectives were put upon the case and the tickets were readily traced to W. O. Martin, a conductor, and John Cochrane, a motorman. It was discovered that the printing had been done in Chicago and Superintendent John Grant with detectives searched for the printers. J. O. Moore, a State street printer in Chicago, had delivered the tickets to Rufus Johnson, a colored man from Detroit. The engraving was done by Rudolph Lenert, a journeyman engraver, one of the good tickets serving as a model. The engraver was possibly innocent of any intention of wrong doing and the printer claimed that the work was done on an order which apparently came from the company, but he was unable to produce this. Johnson, the colored man, stated that he placed the order for the tickets at the instance of the motorman, John Cochrane.

W. O. Martin, the conductor who was implicated, was convicted and is now serving a three-year term in the penitentiary. Cochrane, who seemed to be the most culpable of all, as well as the negro Johnson and the printer escaped punishment mainly because requisition papers could not be secured. The conductors who sold the counterfeits would give a strip of six of them for a quarter to a passenger and for the fare would turn in a good ticket. In this way the bad tickets were taken up by innocent conductors. Although 36,000 tickets were printed not more than $30 worth were sold. The occurrence cost the company something but it was very fortunate in having discovered that the tickets were being circulated the next day after they appeared. The prompt and vigorous measures taken by Vice-President Hutchins and Superintendent Grant to bring the guilty parties to justice will discourage any future attempts and has had a good effect on the service in general.

STREET RAILWAY LINES FOR VIENNA.

Vienna is one of the largest cities in the world, but up to this time the facilities for local transportation have been very inadequate. The Vienna Tramway Company which holds practically all the valuable franchises in the city depends entirely on horse traction. A contract has now been entered into between the city, the tramway company and a new company, organized by the Siemens & Halske Company of Berlin, which will undertake to reconstruct all the existing lines and build new railways. By the agreement 22½ miles of track must be built in the next two years, 50 miles within four years and after 1903, 21 miles more must be constructed. There will then be a total of 122½ miles of electrically operated railway lines On several of the principal lines a 5-minute service must be maintained and on the rest a 10-minute service. The trolley system has been adopted and Siemens & Halske apparatus will of course be used.

The provisions of the franchise include compensation to the city and municipal supervision in some minor matters, such as the rules regulating employes, etc. Should the dividends for three successive years exceed 7 per cent the city may demand a reduction in fares on the outlying lines. If the city builds electric power stations the company is bound by contract to take current from them. The company is to pay to the city $60,000 for the coming year, $80,000 in 1900, $110,000 in 1901, $140,000 in 1902 and $160,000 in 1903. After five years the annual compensation will be determined by the gross income. If the receipts average $42,000 per mile of track annually 9 per cent shall be paid to the city and for each $800 per mile an additional 1-10 per cent will be added. Then after five years if the profits of the company exceed 7 per cent the surplus will be divided equally between the city and the company. The city reserves the right to construct a subway in the business center for the electric lines and the company must at its own expense erect the necessary plant to operate it.

This provides for a system which is infinitely better than the present horse car traction, but it appears inadequate for a city which is nearly equal to Chicago in population. There is much complaint over the fact that the cost of living in Vienna is greater than any other capital in Europe, especially is this true of house rent. If Vienna were to profit by the experience of American cities more liberal terms would be granted the street railway company, and instead of building 10 to 14 miles of tramway track per year, eight to ten times as much should be constructed which would open up new additions and suburbs where cheap rent and fresh air would prove a great boon to the inhabitants of the overcrowded city.

INDIANAPOLIS STREET RAILROAD LITIGATION.

The Citizens' Street Railroad Company of Indianapolis, Ind., for the last six years has been engaged in litigation with the city of Indianapolis and a would-be rival, the City Railway Company.

In 1893 the city attorney of Indianapolis gave an opinion to the council that the Citizens' Company's franchise expired in 1894 and thereupon the city made a contract with the City Railway Company for a term of 30 years from January 1, 1894. This contract, covered in a general way, the entire existing system and it was the intention, no doubt, to force the company out of the way. The U. S. courts, however, held that the Citizens' franchise was good beyond question until 1901 and granted a permanent injunction restraining the City Railway Company from interfering with its rights. Subsequently the legislature passed an act, the purpose of which was to terminate the franchise, or at least a part thereof, in 1901. This act contemplated the letting of a new franchise for a term of 30 years from that date. For the purpose of clearing up the situation and ascertaining what rights the city had in the premises, a bill was filed in which the city of Indianapolis was the plaintiff and the Citizens' Company and the City Railway Company the defendants. The lower court held that so far as the Citizens' Company was concerned, the rights derived from the original ordinance expired in 1901; it also held that the contract made with the City Railway Company was invalid for the reason that the council of 1893 had not the power to make a contract of the character in question which could not become effective until 1901, as such an act would deprive the council of 1901 of its rights in respect to the street railway question. Upon appeal to the supreme court of Indiana the lower court was reversed by a decision rendered December 16 wherein three of the judges were in favor of a reversal and two against it.

As the three judges who constituted the majority in making this ruling retired from the bench on January 1, there is a possibility that a rehearing may be granted and the decision of the lower court affirmed. To us the recent action of the court appears to be one of political decisions which have not been unknown in Indiana.

The 3-cent fare act of 1897, which has also caused much litigation, was passed in pursuance of a plan to force the Citizens' Company to come to terms after the City Railway had lost its case The history of the 3-cent fare act has been quite fully reported in previous issues of the REVIEW; the case is now pending in the United States supreme court.

The Metropolitan Street Railway of Kansas City, Mo., has experienced some trouble from "tight slots" on its cable lines. The difficulty is due to water entering between the paving blocks between the rails and on freezing the slot rails are forced together.

TRIP AND MILEAGE ACCOUNTS ON THE LYNN & BOSTON.

BY F. E. SMITH, AUDITOR, LYNN & BOSTON RAILROAD.

The following is an explanation of the details of the system used by the Lynn & Boston Railroad Company in keeping an account of the trips run from which the mileage is computed. Conductors are furnished with a book which contains all the trip numbers for all the routes of a division, of which a sample page reads thus:

Routes run from Broadway station—Beachmont and Boston.

From Beachmont.

To Cornhill (Scollay Sq.), via Subway	41
Court and Hanover Sts.,	43
Broadway Station,	45

From Broadway Station.

To Cornhill, via Subway	47
Court and Hanover Sts.,	49
Beachmont,	46

From Scollay Sq., via Subway.

To Beachmont,	42
Broadway Station,	48

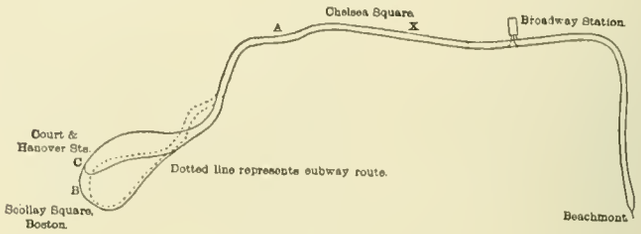
From Court and Hanover Sts., via Hanover St.

To Beachmont,	44
Broadway Station,	50

Use Court-Hanover St. numbers for trips to and from Scollay Sq. on the surface.

As the conductors are frequently sent from one station (which is our name for a car house) to another to help out during a rush, supplying them at the start with numbers covering all the routes on the division, makes it unnecessary to give them this information every time that they are changed.

Form A is the day card in use on the Chelsea division. Conductors are required to send in a separate day card for each of the routes on which they run, for the convenience of the accounting department. This blank is 6¼ by 9 in. The numbers show which route the card covers. The conductors use the column headed "Route Numbers as shown on List of Routes." The numbers given on blank B illustrate a run from the station to Beachmont, then two full round trips to Boston and return to station from Beachmont. Under the system formerly used here, and one which is still in use by many roads, this would have been called two round trips, and the mileage from station to Beachmont on the first half trip, and from Beachmont back to station on the sixth half trip, would not have been counted unless this conductor was relieved at the station by another who continued to Boston with the car, in which case the second conductor would have marked his card as starting from Beachmont. This plan would have covered the mileage of that part of the trip from Beachmont to the station that was run by the first conductor, but neither card showed the actual run



BEACHMONT ROUTE.

of the men. Under the present system, the second conductor starts his card with No. 47. This No. 47 and the No. 45 of the first man equal No. 41, which is a full half trip. When the cards have been checked and assorted into routes, the total of each number run by each conductor is entered on Form B, and this is added and proved. Form B is 8½ in. by 14 in. We prove it in the following manner. Knowing that there must be the same number of trips away from each point as there were to that point (except the starting point or station, and then the rule is reversed), we say the sum of Nos. 41, 43 and 45 should equal the sum of Nos. 42, 44 and 46; the sum of Nos. 42 and 48 should equal the sum of Nos. 41 and 47, etc. If they do not balance, some conductor has given the wrong number for some trip, and it becomes necessary to balance the trips of each conductor until the error is found. We seldom have to resort to this, however, as the clerks who take off the trips become so familiar with the combinations that should go together that they lo-

Form D

LYNN & BOSTON RAILROAD COMPANY Record of Trips during 189

BOSTON TRIPS via CORNHILL | BOSTON TRIPS via HANOVER STREET | On PLEASANT ST MALDEN | On CHELSEA ST., FERRY ST and WINNISIMMET ST.

Washington Avenue | Crescent Beach | Beachmont | Revere Beach | Broadway | Maplewood | Lynn

Form C

LYNN & BOSTON RAILROAD CO., Chelsea Division,

Recapitulation of Trips run on Friday Dec 2 1898

Beachmont Route.

Trip Nos	Trips	Per Cent of Round Trip	Equivalent in Round Trips
41	59	500	29500
2	37	500	18500
3	1	495	495
4	1	495	495
5	6	174	1044
6	28	174	4872
7	7	326	2282
8	29	326	9454
9	-	321	
50		321	
Extra			216
			66858

Form B

LYNN & BOSTON RAILROAD CO. Chelsea DIVISION.

Record of Trips run on Beachmont Route Friday Dec 2 1898

CONDUCTORS	TRIP NUMBERS 41	2	3	4	5	6	7	8	9	50	EXTRA TRIPS Per Cent of Full Trip
Gardner Steele		2	2		1	1					216
do do					1	1					
Total	59	37	1	1	6	28	7	29			216

BLANKS FOR TRIP AND MILEAGE ACCOUNTS

The two forms marked "D" are

cate errors at the time of taking off. They can tell at a glance the number that is wrong and what should be substituted for it from the number that precedes and the one that follows; besides, the time consumed by the trip would indicate whether it was a full half trip or only one to the station, and the nature of the tickets collected on that particular half trip would show whether it was into or out of Boston. We are pretty certain, with all these guides, that the number we substitute is absolutely correct.

The footings of Form B are transferred to Form C and multiplied by the per cent of the round trip, and the sum of the result equals the total trips on that route for that day. Blank C is 8½ in. by 13 in.

The per cents for the Beachmont route are:

No. 41	50.0	No. 46	17.4
No. 42	50.0	No. 47	32.6
No. 43	49.5	No. 48	32.6
No. 44	49.5	No. 49	32.1
No. 45	17.4	No. 50	32.1

The percents are computed from maps prepared by our engineers for each division, which show the distance in feet from one point to both ends of every turnout and cross over, every crossing point and all the termini of the division. This idea was copied from the West End Street Railway Company's system.

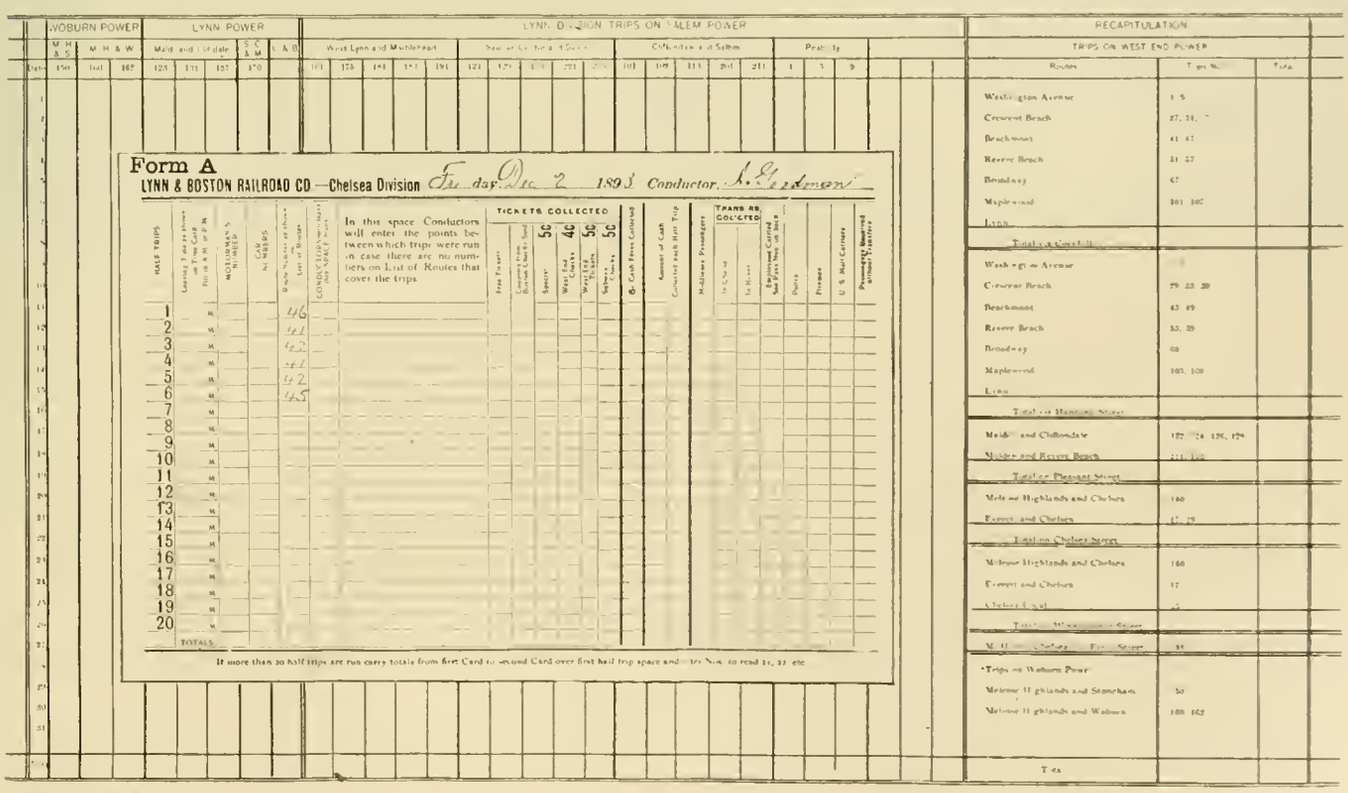
On the Chelsea Division, zero is at the point A shown on the sketch of the Beachmont route, this being the point where the tracks of this company join those of the West End Street Railway Company. We add the distance from A to Beachmont and return to the round trip distance from A around the loop at B and back to A together, which gives us the length of the round trip, 66,024 ft. Half of this we allow to No. 41 and the other half to No. 42, each of which is equal to 50 per cent of the round trip. We subdivide No. 41 into No. 45 and No. 47 and No. 42 into No. 46 and No. 48. Treating the route to Court and Hanover streets in the same manner gives us all the per cents as shown in the table. We find this plan particularly useful when less than a full trip is run, as is illustrated on Form B in the case of Conductor Steele, who went from Broadway Station to Beachmont on No. 46 and started for Boston on No. 41, but getting blockaded at Chelsea Square was sent back to the station. On his day card, in place of putting down No. 41, he would write in the space provided, Beachmont to Chelsea square, and on the next line, Broadway station, there being no numbers to cover this trip. We enter on the card on line after No. 46, No. 45; this brings him back from Beachmont as far as the station, and gives us a number to use to balance the trip No. 46; then we find the distance Broadway station to Chelsea square and back, and find what per cent it is of a full round trip, which is 21.6 per cent; this we enter as an extra trip, but it figures with the rest of the Beachmont trips where it belongs. The trips are transferred to our records and footed at the close of the fifteenth and of the last day of each month and the mileage computed. We do not consider it is of enough advantage to compute the mileage more frequently than twice a month to warrant the expense of doing so.

From blank C the trips run on the tracks of the Boston Elevated Railway Company are transferred to our record, Form D, and at the end of the month a report is rendered them. In making this record we only enter the trip numbers of inward trips as it saves half the labor. We also use this record to keep account of the trips run by one division on power furnished by another division. This same system is used in keeping the trips and mileage of the Beverly & Danvers Street Railway, the accounts of which are kept in this office. This road has but one route, but uses the tracks of the Lynn & Boston Railroad Company at both ends. Some trips stop short, however, of the regular termini and we use letters instead of figures to distinguish the trips. We have found the system is perfectly satisfactory on both roads, and believe it is so simple and inexpensive that any road that is not satisfied with its present methods could well afford to try it. It entirely relieves the foremen from making any report of the trips except of chartered cars.

Checking the registers from start to finish enables us to be sure all trips have been reported. The work required of the conductor is so simple that we can insist upon its being done properly. If we required a conductor who finished his run at midnight, after putting in eight hours on his car, to stay and compute his own mileage, we should expect it would take us longer to correct his errors than to do the work ourselves, besides as stated before we do not see any great advantage in having the mileage daily.

Form D

On Power Leased from other Companies, also furnished by other Divisions



OF THE LYNN & BOSTON RAILROAD.

facing pages of the Record Book.

If any readers of this have any suggestions to offer, looking to an improvement of our system, we should be pleased to have them made through the medium of the Review.

REBUILT STATION OF UNION TRACTION COMPANY.

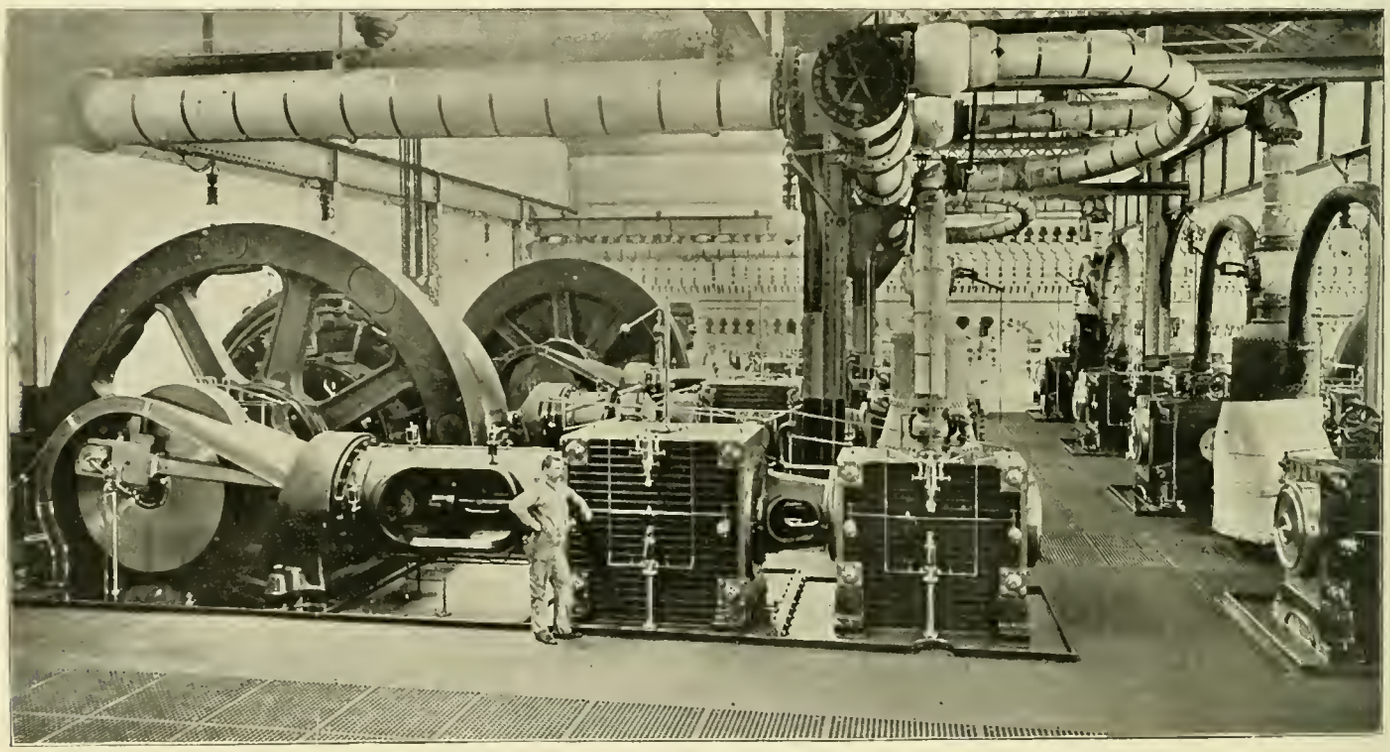
The power station of the Union Traction Company of Philadelphia, located at 13th and Mount Vernon streets, was partially destroyed by fire on March 3, 1897, and the work of reconstruction has been only lately completed. The accompanying illustration is a view of the engine-room as it now is.

The four units consist of compound non-condensing engines, built by Robert Wetherill & Co. of Chester, direct connected to 1,500-k. w. Westinghouse generators. The cylinders are 26 and 40 by 48 in.; the engines take steam at 150 lbs. and run at 80 r. p. m. The engines are not set on foundation capstones as is usually the case, and a large sole-plate forms the base of each engine. The gravity oiling system is used, and the sole-plates serve to collect the waste oil, which is filtered for re-use.

Three of the engines were considerably damaged by the fire and had to be rebuilt; the fourth one was but little injured. Just previous to the fire it had been decided to replace the four generators in the old station, which were of 1,100 k. w. capacity with new 1,500-k. w. machines. The change made necessary new engine shafts, of which but one had been delivered at the time of the fire.

The new shafts were made by the Bethlehem Iron Company of fluid pressed open-hearth steel, and forged in a 5,000-ton hydraulic press. The tensile strength of the material was 85,000 lbs. per sq. in. and the elastic limit 35,000 lbs.; the extension in ½-in. specimens 2 in. long was 25 per cent. Two of these shafts are 20 ft. 5¼ in. long and two 21 ft. 5¼ in.

The boiler-room equipment comprises 19 Babcock & Wilcox boilers of 375 h. p. each. Hoppes open exhaust heaters and Snow steam pumps are installed. The exhaust steam not utilized in heating the feed is carried to a stack connected with the basement of the station, and its high velocity creates a strong draught, thus ventilating the building.



ENGINE ROOM OF REBUILT STATION OF UNION TRACTION COMPANY, PHILADELPHIA.

The Cleveland 4 cent fare case is still pending in the United States court.

EAST SIDE ROAD, KANSAS CITY, TO BUILD.

The East Side Electric Railway Company of Kansas City, Mo., has decided to build four miles of track as soon as possible; it will commence operating the road with 12 cars, and is in the market for materials and equipments. W. O. Hands, who has been appointed manager of the company, advises us that the motive power to be adopted will probably be electricity, although compressed air has been under consideration.

Mr. Hands has been identified with street railway work for over 10 years and has had an experience which well fits him for the position of manager of a company that is building its lines. From 1887 to 1890 he was with the Brush Company at Cleveland and afterwards with the Short Electrical Company. He supervised or assisted in the installation of the roads at Muskegon, Mich.; Rochester, N. Y.; Baltimore and Washington. Mr. Hands has served as superintendent and electrician of the Braddock (Pa.) and Beaver Falls roads; in 1894 he went to Kansas City to become purchasing agent and superintendent of the Northeast Electric Railway Company.

FIFTY-YEAR FRANCHISES.

The town board of Cicero, a suburb of Chicago, met on December 19, and after a session lasting until 1:30 o'clock the next morning passed four ordinances granting 50-year franchises to four of the Yerkes street railways, the Cicero & Proviso, the Cicero & Harlem, the Ogden and the Suburban. The minority of the board attempted to break a quorum by withdrawing, but one member who had not been present because he was suffering from an accident, left his bed when the case was presented to him and attended the meeting. His presence completed the quorum and the ordinances were promptly passed by an unanimous vote. Residents in the districts served by these roads largely gain in the longer ride now given for one fare.

The Carnegie Steel Company has purchased an additional tract of land near Pittsburg, and will erect there a plant for building steel freight cars. A forge for steel car axles will be part of the equipment.

THE NORTHWESTERN ELEVATED, CHICAGO.

Work on the Northwestern Elevated Railroad of Chicago is to be pushed as rapidly as possible, and the prospect is that the northern division of the city by next October will be furnished with an admirable transportation system. It is proposed to provide for express trains which will carry passengers from Wilson avenue to the Union Loop, a distance of six miles, in 18 minutes.

The company was prevented from negotiating a loan early in the year by reason of the war. In November last the matter was again taken up and on December 24 arrangements were closed by which Blair & Co. of New York, Chicago stockholders, and the Illinois Trust & Savings Bank lend $4,500,000 on promissory notes of the company. The notes are secured by the deposit of $5,000,000 of first mortgage 5 per cent gold bonds, and the entire capital stock of the company, $5,000,000, with the Illinois Trust & Savings Bank as trustee.

The company has elected a new board of directors as follows: C. L. Blair and W. W. Miller of New York, and E. L. Brewster, Clarence Buckingham, Bryan Lathrop, D. H. Londerback and John C. Welling of Chicago.

The road was originally organized to operate from Congress street on the south and extending northwest to the city limits. Four branches were provided for, the first commencing at a point on the main line north of Monroe street and running west to a point not more than 100 ft. west of Halsted street, and continuing with two branches, one running northwest, the other north to the city limits. The second branch was to commence at the main line between North avenue and Chicago avenue and extending west to a point between Western and Ashland avenues, thence north to the city limits. The third branch to run from a point on the main line between North avenue and Diversey street north or northwest to the city limits. The fourth branch was to commence at the main line between North avenue and Belmont avenue and extend west to the city limits. One distinctive feature will be a four-track line north of Chicago avenue for 5.52 miles which will accommodate express trains. Plans are contemplated for building inclines by which surface cars of the cross lines may pass to the elevated tracks and be attached to the regular elevated trains.

A power-house of 7,000 h. p. capacity is now building on the corner of Southport and Fullerton avenues. There will be one 1,000-h. p. and three 2,000-h. p. horizontal cross compound Allis engines direct connected to Siemens & Halske generators. The boiler room will contain sixteen 400-h. p. Babcock & Wilcox water tube boilers. The stack will be 16 ft. in diameter and 204 ft. above the street level.

FINE INCREASE IN TOLEDO BUSINESS.

The past three months have shown a most gratifying increase in both the gross and net earnings of the Toledo Traction Company. Operating schedules have been rearranged in a manner at once improving the service and reducing expenses, and with other changes have combined to make the present showing one of the best in the country. Toledo is largely a manufacturing city, and is working hard to secure more industries, hence the city is growing rapidly. The company will at once install an additional 500 h. p. of engines and generators, and General Manager McLean expects even this will be insufficient within a year, if the present rate of increase is maintained.

KINETIC MOTOR NOT RUNNING IN DETROIT.

We have had several inquiries as to the operation of the kinetic motor supposed to be running in Detroit, and find it is not in operation there at the present time. In fact the trial which was made on the Detroit & River St. Clair Railway was anything but satisfactory, and the motor was taken off after two days and a steam locomotive has been used since in its place. The Dodge kinetic motor system was not tried on the Detroit & Mt. Clemens line, as currently reported.

FALK CAST-WELDING ON THE THIRD AVENUE RAILROAD, NEW YORK.

On December 27 the first cast-welded joints on the Third Avenue cable line, New York, were made by the Falk Manufacturing Company and the work of welding is now under way. The joints on this line are made without interrupting the operation of cable trains, which run during the night on a three minute headway and, to quote the foreman in charge of the welding, "Come like shots from a Gatling gun," making the work a matter of more than ordinary difficulty. The track on Third avenue is laid with 7 in. Trilby rails on yokes 5 ft. between centers, and in order to make the joints without interrupting traffic a special mold and clamp was devised by the Falk Company. The clamp is made long enough to reach from

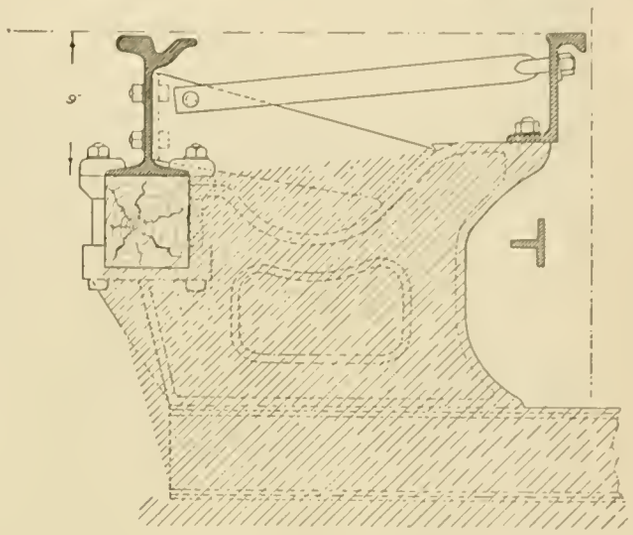


FIG. 1.—CROSS SECTION.

yoke to yoke, thus taking the weight of the car off of the joint itself, and is provided with tapered risers at the ends so that the car can run over it without difficulty.

Superintendent Robertson, who is giving his personal attention to the construction of the road, has carefully inspected the welding and has been well pleased to find that the running of the cars during the progress of the work has not in the least depressed the joint, which it had been feared might result from the incessant operation of loaded cars during the continuance of the work.

All of the new work of the Third Avenue Railroad Company, except that on Third avenue, where the present yokes are being utilized, will be laid with 9-in. Trilby rail, with yokes 5 ft. between cen-

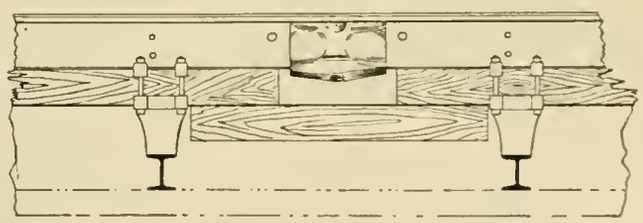


FIG. 2. SIDE ELEVATION.

ters, and the joints will be welded by the Falk process. In order to provide elasticity in the roadbed and consequently smoother running of the cars, Mr. Robertson has designed the construction, of which a cross-section is shown in Fig. 1 and a longitudinal view in Fig. 2. The rail is laid on yellow pine stringers resting on the yokes and supported upon concrete between yokes. The track construction for which the welding contract has been placed embraces about 70 miles of single track, and over 2,000 men are now at work.

An American company is now filling the order for the electrical equipment of the underground Paris terminal of the Orleans railroad. This road was described in the REVIEW for June last, page 400.

LETTER CARRIERS TO WALK IN MONTREAL.

Eighteen months ago President L. J. Forget, of the Montreal Street Railway Company, gave notice to the Canadian postmaster-general that the agreement for carrying the Montreal letter carriers for the lump sum of $200 per month would be terminated on December 31, 1898. The company kept an accurate record of the fares reprsented by the traveling of the letter carriers during both winter and summer months and found that they aggregated from $1,000 to $1,500 per month, and concluded that $200 per month was too little compensation for service worth $1,000 to $1,500.

The postmaster general is reported to have said that the department was indifferent as to whether the contract was terminated or not, as he thought the carriers rode too much anyway, and a satisfactory agreement was not reached. Beginning with the new year the carriers must pay fare or walk.

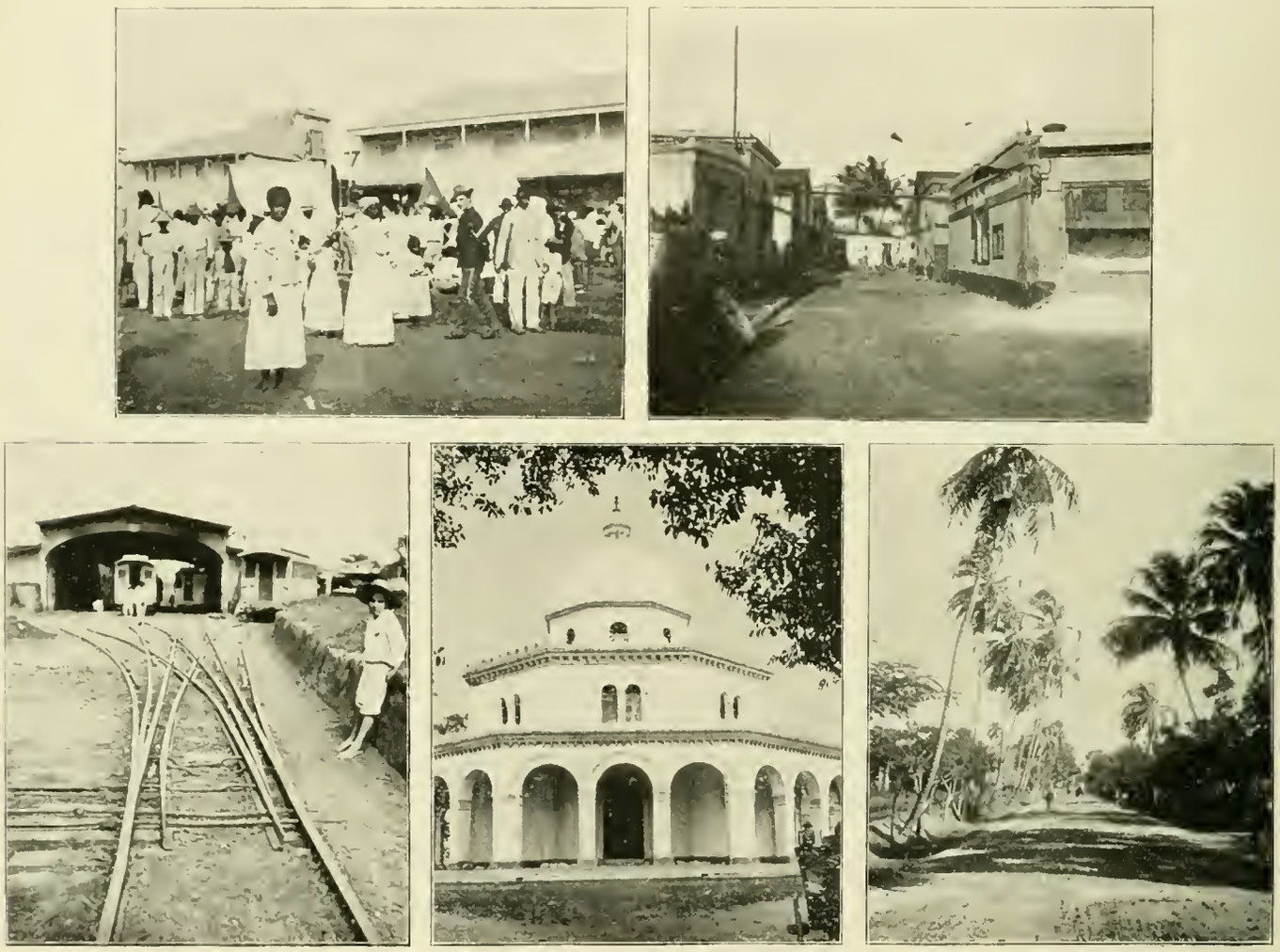
DAYTON, SPRINGFIELD & URBANA ROAD.

Fred Colburn, president of the Dayton, Springfield & Urbana Electric Railway Company, states that his road will be completed by June 1. There are about two miles of track laid and it is the intention to push the work as soon as the season permits. Mr. Appleyard, who has charge of the building, has purchased several cars, one of which has been delivered; it is one that was exhibited at the World's Fair in 1893.

The road when completed will be 42 miles in length, and one may go from Urbana to Cincinnati, over 100 miles, by electric cars. The steam railroads are making preparations to fight the new line.

TROLLEY ROAD IN PORTO RICO.

A syndicate formed by J. G. White, of New York, has purchased from the owners the San Juan & Rio Piedras Railroad in San Juan, Porto Rico, and the San Juan & Rio Piedras Railroad Company has been incorporated in New York, with a capital of $300,000, with Geo. H. Walbridge and H. H. Harrison among the incorporators. The new company will equip the San Juan road with electricity; at present the road is operated by steam and has a gage of 30 in.; it has 20 passenger cars, 20 freight cars and seven Baldwin locomotives. The new company has not yet decided in regard to cars, and possibly the passenger cars will be converted so that they can be used for electric service. The gage will be changed to 4ft. 8½in.



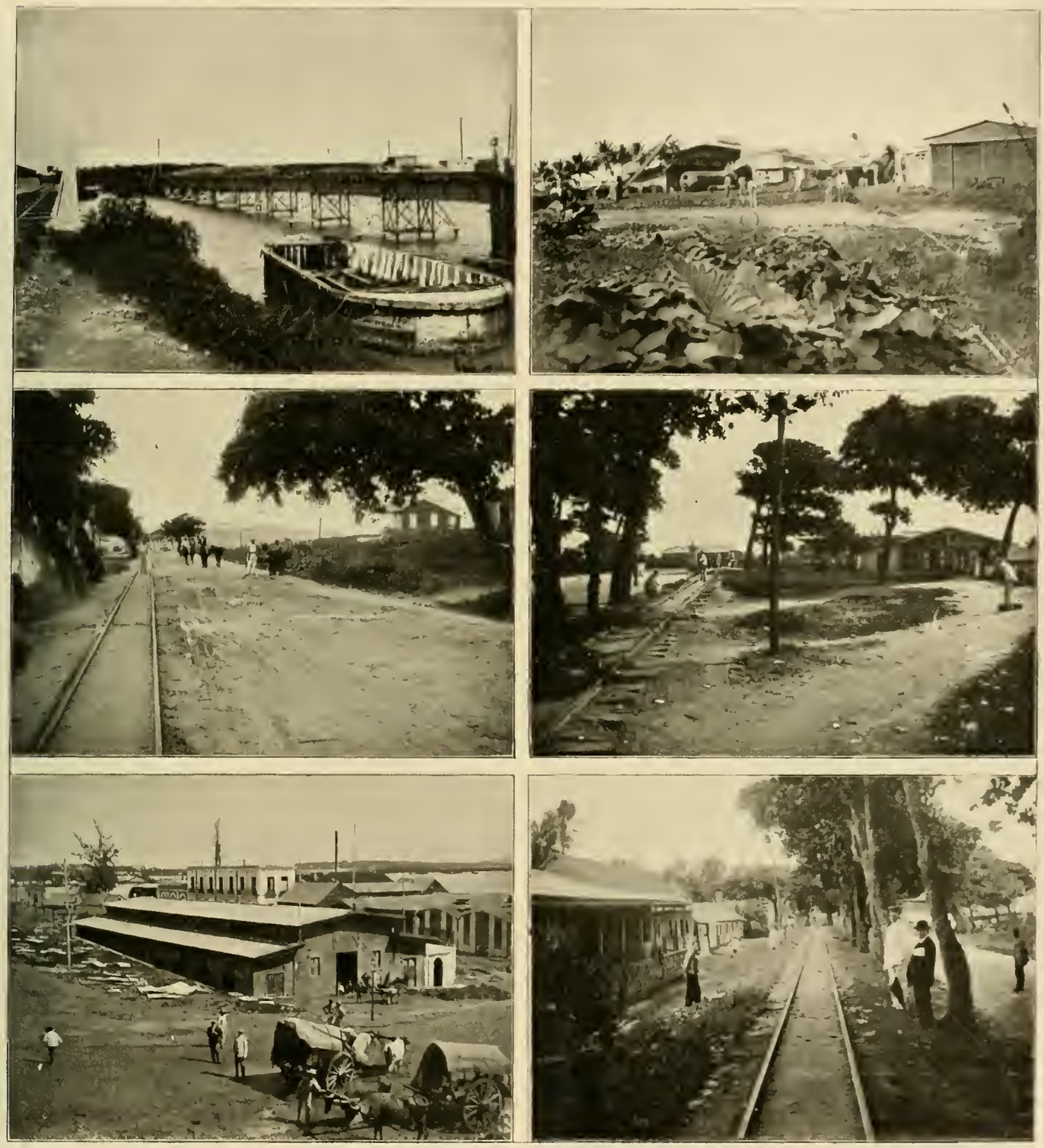
SCENES IN PORTO RICO.

The road at present is about seven miles long; it starts in the center of San Juan, and runs out through a beautiful country which has a population of about 20,000, consisting mostly of persons that live in the suburban villages and do business in San Juan.

San Juan has a population of 35,000 and is situated on an island about a mile and a half long; the road has its own bridge to the mainland. The city is paved, has sewers, and in February the city waterworks will be opened. It is said that the water is very pure and the works will be one of the most complete waterworks ever built. The new company, among other things, contemplates building an amusement park on the line where theatrical and band concerts will be given. Mr. Wilson, who has been with J. G. White & Co. for a number of years, is now in charge of the road and is operating it by steam. Without doubt the new company will also do an electric lighting business, and in building its power house will have it of sufficient capacity for that purpose.

Through the courtesy of Messrs. White & Co. we have received a number of photographs of scenes in San Juan and along the line of the road, some of which are here reproduced. Since the announcement of the purchase of this road, White & Co. have been flooded with letters and calls from people who wish to go to Porto Rico, but there are no positions in connection with the railway now open, nor is there any prospect that there will be.

Our fellow-citizens in San Juan are to be congratulated on the excellent system of street railway in store for them, for the long experience and high standing of J. G. White & Co. is a guarantee of the most satisfactory results possible.



SCENES IN PORTO RICO.

NEW MEMBERS OF THE ACCOUNTANTS' ASSOCIATION.

In addition to the Metropolitan Street Railway Company, of Kansas City, Mo., announced in our last issue as having joined the Street Railway Accountants' Association, Secretary Brockway advised us that the United Traction Company, of Philadelphia; the Syracuse Rapid Transit Company, of Syracuse, N. Y., and the Quebec, Montmorency & Charlevoix Railway, of Quebec, Can., joined the association on December 12, the information reaching us too late for that issue. This makes the membership 80.

PAINT SHOP WASTE.

BY J. L. JOHNSON.

It has been said that "willful waste makes woeful want." The old saying may not be strictly true in every particular, but in the main we think it is. As this has reference to paint shops of either street or steam railroads it certainly should receive careful consideration from the foreman of painters whoever he may be or under whatever management he may be employed. It should be understood that waste in this instance is not intended to be applied to what may be called legitimate loss. For instance, there may be a loss when a thread is cut on a bolt or a skim may form on paint that it is positively necessary to leave after it has been mixed. But the loss that can to any extent be avoided by care or thought on the part of the foreman is what we wish to define in this case as "paint shop waste."

Probably it will be good policy to mention a few instances to illustrate more plainly what is meant by waste. A very common practice in some shops is taking an excess of varnish out of the can, or more than can be used on the job which is to be varnished. This is a loss from any standpoint, as it can be only used afterward for inferior work, very often where a lower priced varnish would do equally as well. There can be no excuse offered for a repetition of this bad practice except carelessness or a direct indifference to all interests of the employer. When a painter varnishes one job he must know how much stuff it takes to do it; and he must consequently know just how much varnish it will take for any jobs of the same kind that he may have to do. What can be plainer?

Notwithstanding this it is not an uncommon thing to find a large can used for (and it is generally full) "slush" or "dump" varnish. This "slush" varnish is also used for every conceivable purpose to "use it up." And on almost every place where slush is used raw linseed oil would serve the purpose just as well were it not for the "using up" process. It is quite right and necessary to have a dump varnish can, but it should be kept strictly clean and a one gallon can is as large as should ever be needed in any ordinary street railway shop. Eight years of continuous service proves this to be the case in our shop, and during that time not once has the "slush" been used with the intent to use it up in order to keep it from accumulating. The varnish account is no small item in the shop expenses and care should be shown in the handling of it.

Now a word on mixing and matching colors. It is a recognized fact that all colors must be kept a uniform shade. This can easily be done by using any regular line of colors and weighing out the regular proportions, or by having all colors ground in bulk form. We have adopted the latter plan and find it a great saving in time. It also insures absolute uniformity of shade. Without this plan it requires extreme care, and much valuable time is taken from the foreman painter, as it is understood that he alone should mix all colors except where the shop is so large that his time will not allow it.

A few words may be allowed as to the matching of colors on cars that have been shoped to be touched up and revarnished. This is a part of the trade where a skilled workman must be employed, and even then he must be an expert on colors to be a success. It is supposed that this is the case, and that a fully competent man is employed, as unless it is so, it can be easily seen that a very great waste is made in every attempt at matching color. Still, in how many cases do we find matched color dried and useless, having stood long after the car for which it was matched was turned out of the shop as finished. This should not be so. Again, why should it be thought so necessary to always start with fresh color in matching? Why not use up color that has been matched for a car that has gone by changing the shade to suit instead of "dumping it," as the saying is, and making fresh? If used as promptly as possible these colors will not have become fatty and much valuable time and material can be saved as compared with the "mix it fresh" process. These examples might be multiplied indifinitely, but we think these should be enough to encourage thoughtful men in trying to save the materials and time that are entrusted to their care. The foreman is entirely and essentially the party who is to be censured for any or all waste that occurs in the shop; even if the shop is so large that a foreman can not do his own mixing, it is his duty to know not only how all paints are mixed but just how much is mixed for each job which is to be done. The loss of paint is only nominal until it has been taken from the keg and mixed and there can be no reasonable excuse for paint mixed in excess of what is needed to do the job. Loss of stuff wasted is as great from a financial standpoint as if it were stolen, and aside from the sentiment it is the same thing. A man may mean well but a lack of thought may entail a loss of many dollars in the course of a year.

Probably the most disastrous waste that can be found in a paint shop is a foreman who is incapable from a practical standpoint. It is in this case that the most costly colors are lavishly wasted. It will be found that an inexperienced person will use the most expensive colors to produce shades and then be compelled to kill their brilliancy by dumping part and waste more stuff to cover the first blunder; a waste of time and waste of material. The writer well remembers a case of this kind in which the dump kegs got so large that they were becoming a "give away," so the paint shop "kid" was told to dig a hole in the ground and over 40 gallons of expensive colors were dumped and the earth never gave up her dead. If a foreman be fully competent his employers have the benefit of what he knows, but if incompetent they have the full benefit of what he does not know in a ten-fold ratio. Alas! that all should be hidden so effectually in most cases from the eyes of those who foot the bill. We cannot conclude this without remembering the old song:

"Waste not, want not, is a maxim I would teach;
Let your watchword be dispatch and practice what you preach.
Never let your chances like sunbeams pass you by,
You'll never miss the water till the well runs dry."

CLEVELAND CIVIL ENGINEERS' CLUB.

W. H. Searles, secretary, advises us that at the regular December meeting of the Civil Engineers' club of Cleveland Edwin L. Thurston, associate member of the club, read an instructive paper on "The Nature and History of Patent Rights." He defined the origin and limitation of the rights enjoyed by a holder of letters patent, showing them to be only such as the statute confers and nothing by natural right or common law. The only right secured by a patent to the patentee is the right to exclude or prevent others from exercising their natural right to make out of their own materials the particular invention which the patent covers. Frequently the patentee of an improvement is excluded from the use of his own invention by some prior patent covering the thing improved.

Two theories were discussed as to the nature of a patent right, the one regarding it as a monopoly, the other as a contract between the inventor and the government representing the public. The latter view has been generally accepted by the courts and by congress in this country. As a contract its language should be liberally construed so as to give the inventor as complete protection as may be. Considered as a monopoly, a patent is such in form only. It is not an illegal or oppressive monopoly. It deprives no one of any right previously enjoyed, because a patented invention must be new. The author described the progress of patent law since the reign of James I of England in 1623 to the present time. The first patent statute in America went into effect April 10, 1790, and was entitled "An act to promote the progress of useful arts." The first patent granted was dated July 31, 1790, and was issued to Samuel Hopkins for making pot and pearl ashes. This act was replaced by another on February 21, 1793. Other acts were passed in 1819 and 1832; but in 1836 all preceding acts were repealed and the present system was inaugurated. The new act created the patent office, with a commissioner of patents. It provided for the registration of patents, thus affording security to the patentee's title. It also provided for an examination to be made by the commissioner as to the novelty of an invention and for the establishment of a library of scientific books. This library now contains nearly 60,000 volumes. In 1870 the term of a patent was changed from 14 to 17 years. A new law which went into effect January 1, 1898, provides for the length of time an invention may be known to the public before the inventor loses the right to claim a patent. This law also relates to the effect of a foreign patent upon a United States patent. More than 15 bills are now under consideration by the two patent committees of Congress.

An interesting discussion followed, after which the meeting adjourned for conversation and lunch.

BOYCOTTING CIRCULARS.

The supreme court of Michigan on November 16, 1898, rendered a decision in the case of Beck and others against the Railway Teamsters' Protection Union and others, of Detroit, familiarly known as the "boycott case." The firm of Beck & Sons was engaged in the milling business, and in the fall of 1897 became involved in a controversy with the teamsters' union because it refused to sign the latter's scale. The firm ceased to use its own teams for a time but later the men it had formerly employed left the union of their own accord and returned to work for the Becks.

The union then interfered with them on the street, hooting and throwing missiles. It also intimidated customers on their way to the mill, and distributed boycotting circulars to the firm's customers and others. Beck & Sons at this point obtained from the Wayne circuit court an injunction restraining the union from further interfering with its employes or business. This decree sanctioned, however, the distribution of the boycott circulars to customers and the public generally, except in front of the mill premises, and any form of boycott to the firm or its customers, without the actual use of violence, and also sanctioned threats to injure and ruin the firm's business, when unaccompanied by violence or threats of violence. From this portion of the decree an appeal was taken.

The supreme court in considering the threats made by the union says that the law abhors subterfuges and that threats in language are not the only threats recognized by law. Covert and unspoken threats may be just as effective as spoken threats. Courts have held that the display of banners in front of one's premises warning workmen to keep away is part of a scheme unlawfully entered into.

So when the Detroit union distributed, on the streets and in stores, circulars advising the public to boycott Beck & Sons, the court declares they intended to convey to the latter's customers that they would be treated in a like manner unless they ceased trading with the Becks.

"The distance that this was done from the mill of the complainants," says the court, "does not detract from its character and harmfulness. It was just as effective and as wrong when 1,000 ft. from the mill as when done 10 ft. from it. The act itself, not the distance, determines the character."

After saying that the circular was false in stating that the Becks had violated their agreement or had discharged union men, and in conveying the impression that they were not paying living wages or treating their teamsters fairly, the opinion continues:

"It would be idle to argue that these circulars were not intended as a menace, intimidation and coercion. They were so used and were a standing menace to everybody who wished to work for or trade with the complainants. They constituted a part of an unlawful scheme and their circulation should have been enjoined."

The court furthermore holds that to picket the Becks' premises in order to intercept their teamsters or persons going there to trade is unlawful. "It is an act of intimidation and an unwarrantable interference with the right of free trade. The highways and public streets must be free to all for the purposes of trade, commerce and labor. The law protects the buyer, the seller, the merchant, the manufacturer and the laborer in his right to walk the streets unmolested. It is no respector of persons. And it makes no difference in effect whether the picketing is done ten or a thousand feet away. It will not do to say that these pickets are thrown out for the purpose of peaceable arguments and persuasion. They are intended to intimidate and coerce."

As to that portion of the decree of the lower court which permits "boycotting by peaceful means," it is said: "If these defendants had threatened complainants' teamsters that, unless they ceased to work for them and joined the union, they had the power and would use it to induce all merchants not to sell them any goods by which they might support themselves and families, and had carried out this threat by issuing boycotting circulars and notifying merchants personally and by committees that they must cease to sell goods to these men, there would have been no act or threat of violence, but would the boycott or conspiracy have been lawful?

"May these powerful organizations thus trample with impunity upon the right of every citizen to buy and sell his goods or labor as he chooses? This is not a question of competition, but rather an attempt to stifle competition. It is a question of the right to exist.

"If there be no redress from such wrongs, then the government is impotent indeed. But such a combination is a criminal conspiracy at the common law, and in some states, in order to remove all doubt, is made so by statute."

The opinion concludes: "The decree must be modified so as to enjoin picketing, the distribution of the boycotting circulars, and all acts of intimidation and coercion."

TROLLEY LINES APPRECIATED IN PHILADELPHIA.

Even the best citizens and business men in our large cities do not always know what is to their own interests. Instances without number might be cited where trolley lines into desirable residence districts have been bitterly opposed by the property owners in the vicinity. After the service has been regularly established and the growling citizen reluctantly steps aboard the electric car he has to admit that it is superior to anything that preceded it. After a time it would be recognized as a calamity to any community to lose such transportation facilities.

The "Philadelphia Telegraph" makes the following comments, which not only are true of Germantown but many another large district or suburb of our cities: "The advent and development of the trolley system, after four years of successful test, has demonstrated to Germantown residents that 'the overhead trolley system, with its unsightly poles and wires,' was in reality a blessing in disguise. Germantown has been for many years peculiar in its obstinate adherence to established customs and for its opposition to innovations, no matter what ulterior benefit might accrue from their introduction.

"The opposition was so strong that a committee of citizens of recognized intelligence and ability was organized for the express purpose of fighting the scheme to the bitter end. Literature was widely circulated, wherein it was asserted that the trolleys would not only be a daily menace to the lives of men, women and children along the routes, but it was pointed out that a great depreciation in property values in the neighborhood of the street car lines would follow, as the dangers resulting from the overhead wires and the electrical current would deter people from occupying or renting houses on streets along which the trolley cars would pass.

"The fallacy of this argument, although its supporters included men of deep learning in business and scientific lines, is easily shown in the wonderful advance in property values during the past eight years. The total value of property in Germantown in 1890 was $31,373,625, and in 1894 it increased to $37,998,781; in 1896 it was $40,118,830; in 1897, it was $44,490,970, and for the present year it will easily reach $50,000,000.

"A study of these figures shows that the advance in values since 1894, when the trolleys began running, exceeds in great proportion the increase before their introduction. Another advantage shared by Germantown with other suburbs is that of increased mail facilities. Before the days of trolley postal cars the railroads carried all postal matter intended for this suburb. The mail matter was conveyed in wagons to the stations and there were often long intermissions between trains. Now the railway postoffice makes the trip between the main postoffice and the Germantown branch in less than three-quarters of an hour, resulting in returns both in the quantity of mail delivered and received greatly in excess of former years.

"The inhabitants of the little borough along the old Germantown roads have long pursued the solitary tenor of their way and been content to follow rigidly the footsteps of their forefathers, but the clanging of the trolley bell and the hurry and bustle of the swiftly moving car have awakened them to a realization of their ability and the possibilities of home development. The last few years have been productive of great progress in Germantown real estate, and the residents do not hesitate to give the credit for the revolution to the one-time abused, but now eagerly welcomed, trolley car."

It is announced that the fare between Lorain and Elyria, O., on the electric road has been raised from 5 to 10 cents.

VIADUCT CONSTRUCTION IN CHICAGO.

The most complicated network of tracks in the world is probably along the Chicago river for some distance on either side of 16th street, in Chicago. The track elevation department of the city collected statistics regarding the traffic at this point. During the 18 hours between 6 a. m. and midnight 743 trains, with 3,952 cars, passed across Clark street; also 827 street cars, containing 16,540 passengers; 2,232 wagons, trucks, etc. The enormous movement at this point made it one of exceptional

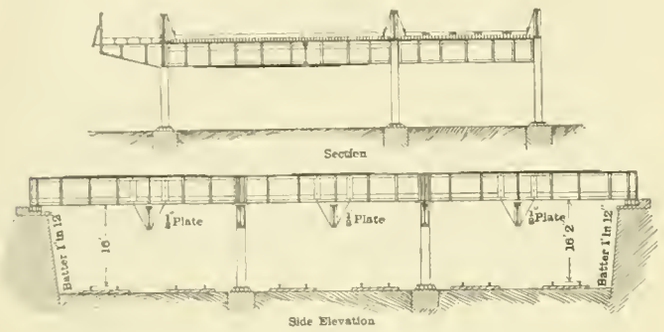


FIG. 1. SIDE VIEW AND SECTION OF CLARK STREET VIADUCT.

danger. Elaborate plans were made for elevating and depressing the railroad tracks, and a viaduct was designed for the car lines and traffic on Clark street.

The grade on Clark street was raised to pass over the depressed railroad tracks and lowered beneath the elevated tracks of the St. Charles Air Line. This latter elevation necessitated the raising of the structure of the South Side Elevated Railroad Company, 2½ squares east of Clark street. On Clark street a 4½ per cent grade begins about 15th street and extends to the viaduct over an open cut through which six railroad tracks pass. Beyond the viaduct the roadway descends at a grade of 5 per cent and passes under the St. Charles Air Line bridge, a clearance of 13½ ft. being left for the electric cars.

FIG. 2. VIEW OF VIADUCT.

In Fig. 1 is a side view of the structure and a cross section of the viaduct, showing the relative space given to the roadway, car tracks and walk for pedestrians. The structure is of steel and is 80 ft. wide. On the west side, separated from the roadway by a concrete wall, is the right of way of the street car company, 26 ft. wide. In the center is a 42-ft. roadway and on the east side is a 12-ft. sidewalk.

The street car tracks are laid with a grooved girder rail with granite paving between, but on the approaches to the viaduct broken stone is filled in between the tracks to prevent the right of way being used for teaming purposes.

About two years ago the Chicago City Railway Company paid $85,000 into the city treasury, after securing a franchise on Clark street, with the understanding that this sum should go towards building a viaduct at 16th street. The city ordinance providing for the elevation of the tracks was passed May 17, 1898, and work was commenced April 24 of this year. For six months the Clark street line has been closed and the Wentworth avenue, Wallace, Halsted and Clark street cars were switched east on 22nd street to the Wabash avenue and State street cable lines. Street cars began to use the viaduct November 20, 1898.

POWER TRANSMISSION AND DISTRIBUTION FOR RAILWAY WORK.

A valuable paper was read by Ernst J. Berg before the American Institute of Electrical Engineers dealing mathematically with some of the troublesome problems which arise in alternating current transmission and in converting the same to a direct current for the trolley circuit. Some practical suggestions are here given from the paper without taking up the formulæ and their derivations

When electric power was first applied to railway work, the distances of transmission were comparatively short, so that one generating station usually located in the center of distribution was sufficient to furnish all power at a reasonable loss.

As the plants were extended it was soon evident that even disregarding the question of efficiency, the distances were very limited for commercial and practical reasons, and boosters connected in series with the line so as to raise the voltage proportional to the load were introduced. By their use it was possible to cover considerable distance and yet keep the potential up without too excessive an amount of copper. Since, however, any booster system must be very inefficient, such installations are not very common, and their field of usefulness limited to cases where considerable power is taken and at the end of a long line for a short time only. The next step towards extension was the introduction of power stations located in various places in the network, but the complication and inefficiency of such an arrangement was apparent, and the possibility of transmitting the power by alternating currents was brought out.

The first suggestion was to generate alternating current power in one station and transmit it at a reasonably high voltage to various sub-stations placed where the steam stations would have been located under former conditions, and there convert it to direct current by means of synchronous motors driving direct current generators. This method of transmitting and converting electrical power was applied in a few cases but was soon superseded by the rotary converters which not only gave a simpler means of converting alternating current to direct current, but which are more efficient and permit of perfect automatic potential control. Thus in 1894 large and representative converter systems were installed.

Since, with the introduction of long distance transmission the generators were placed far away from the converters and connected to them by lines of considerable resistance and self-induction, it was apparent that potential control could hardly be effected in the power station, at least a control of sufficient sensitiveness to follow the greatly fluctuating loads in a railway circuit, the more so as the voltage does not vary in the same proportion as the load.

To illustrate the variation in voltage at the receiving end of a line of considerable resistance and reactance as a function of the phase relation in the current, in Fig. 1 is plotted a curve giving as abscissæ the power factor of the load, that is cos W and as ordinates the voltage at the receiving end. The line current is the same in all cases, the generator voltage is constant and assumed as unity, the resistance is 10 per cent and reactance 40 per cent. The upper part of the curve gives the voltage with leading current, the lower with lagging current.

It is readily seen from this diagram how impossible it would be to control the potential at the generating station under these conditions, as, for instance, with a load of 90 per cent power factor the voltage at the receiving end would be 69 per cent of the generator voltage with lagging current, and the same as at the generator with leading current. Thus, if the generator should be controlled by the amount of current taken, it is evident that no in-

dications whatever would be made by the current itself, since it is the same under these two conditions.

But even if a wattmeter were in the circuit at the power station, this would not help matters, since under the conditions referred to the watts, that is the power, is the same, and yet the voltage so widely different.

In Fig. 2 this is demonstrated in a slightly different way. It is assumed that the voltage impressed upon the converter shall be constant at all loads, and shows how the generator voltage has to be varied in order to keep this constant at rated output with different power factors, and consequently at a variable line current. It is equally evident from this curve how unfeasible voltage control from the generating station would be.

It was therefore necessary to develop some means by which the potential could be controlled, not at the generator station, as is done in direct current railway circuits, but in the converter station. This means of regulating the potential was found in changing the phase relation of the current taken by the converter by means of a change of field excitation, raising or lowering the impressed alternating voltage, and consequently the direct current voltage by means of this current passing through lines of considerable self-induction, or through special reactive coils inserted in the circuit.

In the following I shall endeavor to explain this method of control, and discuss its effects on the operation in general.

In a synchronous converter system we have to distinguish between three e. m. f's.; the impressed e. m. f., that is, the e. m. f. at the collector rings of the rotary converter; the counter e. m. f., which is the e. m. f. induced in the rotary converter by the armature revolving in the magnetic field, and consequently proportional to the field excitation; and the e. m. f. of impedance or the e. m. f. consumed by impedance, which is that caused by the current flowing through the reactance and resistance of the converter.

The first mentioned e. m. f., that is the impressed e. m. f., is entirely dependent upon the generator voltage; the counter

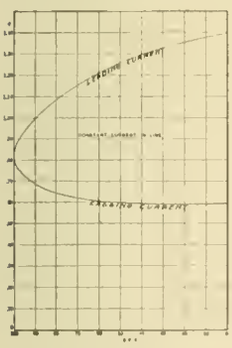


FIG. 1.

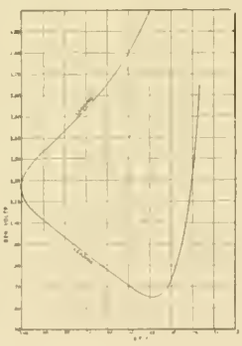


FIG. 2.

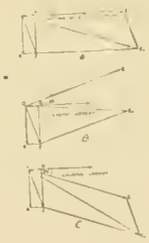


FIG. 3.

e. m. f. is entirely dependent upon the field excitation of the converter, and is constant regardless of the load on a machine, and the e. m. f. consumed by the impedance changes with the load and is proportional to the current.

To explain the phase relations between these e. m. f.'s let us for the sake of simplicity consider the converter running light or doing no work. Since the work done by a synchronous converter rotary is the product of the current taken by the rotary and the projection of the counter e. m. f. on this current at no load the current must be in quadrature that is, at right angles to the counter e. m. f. Since, furthermore, the input of a rotary converter is expressed by the product of the impressed e. m. f. and the projection of the current on the impressed e. m. f. under the assumption that no energy is consumed, the current is also in quadrature or at right angles to the impressed e. m. f. Consequently the impressed e. m. f. and the counter e. m. f. must be in phase and in opposition to each other. Let, then, the field excitation of the converter be reduced, so that the counter e. m. f. is less than the impressed. Since only three e. m. f.'s are acting in the system and their sum must always be zero, that is, the impressed e. m. f. must at any time be equal to the counter e. m. f., plus the e. m. f. consumed by impedance or neglecting the resistance, the e. m. f. consumed by the reactance. The counter e. m. f. is assumed to be less than the impressed, therefore, the e. m. f. consumed by reactance must be in phase with the counter e. m. f. and add itself thereto. But since the current is always 90° ahead of the e. m. f. of self-induction it must be 90° behind the impressed e. m. f. and consequently be lagging.

If, on the contrary, the field excitation of the converter is increased so that its counter e. m. f. is higher than the impressed, it is evident that the e. m. f. consumed by reactance must be in phase with the impressed e. m. f. and add itself thereto. Consequently since the current is 90° ahead of the e. m. f. of self-induction it must be also ahead of the impressed e. m. f., in other words, the current is leading. By a similar discussion it is readily seen that the same argument is true, if the converter is loaded. That is, in this case the wattless lagging or leading current due to the difference between counter e. m. f. and impressed e. m. f., merely adds itself in his proper phase relation to the energy current representing the load.

It is thus seen how by means of converter, leading or lagging currents are caused to flow in the lines. It is readily shown how the voltage at the receiving end of the system can be changed by causing a leading or lagging current to flow over a line with some self-induction.

Graphically this is done in Fig. 3. Let $O\ I$ denote the current which is assumed to be in phase with the e. m. f. in diagram A. The e. m. f. consumed by resistance $O\ R$ is in phase with this current and the e. m. f. consumed by reactance $O\ X$ is 90° ahead of the current. Thus, the e. m. f. consumed by the impedance of the system is represented by $O\ Z$ and is the resultant of $O\ R$ and $O\ X$. The generator voltage is the resultant of this e. m. f. $O\ Z$ and the e. m. f. at the receiving end is thus represented by $O\ E_0$, which is larger than $O\ E$ and larger than $O\ E + O\ R$.

In diagram B, Fig. 3, is assumed the same current flowing over the same line, but the current is made to lead by a certain angle. It is readily seen in this diagram that the e. m. f. which has to be generated is less than the e. m. f. desired at the receiving end, and of course much less than that in the first mentioned case, where the current was in phase with the voltage at the receiving end.

In diagram C Fig. 3, is shown the same condition with lagging current, and demonstrated plainly how the generator e. m. f. is still higher than the generator voltage for non-inductive load.

Usually it is required that the converter voltage shall remain constant or increase with the load, when the generator voltage or excitation is kept constant. If each converter is operated from its own generator, it is preferable to leave the generator field excitation constant and thereby use the generator reactance for phase control and avoid any necessity of regulation in the generating station. If, however, many converters are operated from one generator, or if all generators in the power station are operated in multiple, it is preferable to keep the generator terminal voltage constant, and control the converter voltage by outside reactances in a low reactance transmission, or by the line reactance in a highly inductive transmission.

Since a converter can be made to take leading or lagging current by changing its field excitation and thus its counter e. m. f., such an installation gives the most favorable opportunity to study the fundamental principles of alternating current.

It may perhaps seem as if it would be rather a delicate operation to accomplish this potential control in commercial circuits where available instruments, etc., would prohibit the determination of leading or lagging currents necessary for the control with any degree of accuracy, yet the problem is perfectly simple and resolves itself to adjusting the shunt excitation for a given running light current which is predetermined by calculation, and afterwards to adjust the series field so that the converter takes minimum current, that is, runs non-inductively at the desired load. It will then follow that the potential control for all intermediate loads is perfect, at least within very close limits.

To obtain the maximum possible output with a given line impedance, the converter should run non-inductively at higher outputs as the generator voltage increases, so that for instance, if the system has 10 per cent energy loss and 40 per cent re-

actance and the generator voltage is kept 12½ per cent above the converter voltage, the maximum output is 2.12 times rated output and the converter should run non-inductively at ¾ of rated load. If the generator voltage were 18 per cent higher than the converter voltage, the output would have been 2¼ times the rated, and the converter would run non-inductive at full load and finally, if the generator voltage were 30 per cent higher than the converter voltage the maximum output would be 2.55 times the normal output but the non-inductive load would have been 1½ times full load. In other words the converter should run with lagging current up to 50 per cent overload.

In commercial installations, however, where there is always a limit to the generator voltage, which limit is caused by saturation of the machine, or outside conditions which do not permit of excessive voltage in the power station, the output of a converter is by no means unlimited, and thus some care has to be taken, to get the proper reactance, since with a given difference in generator and converter potential, the output changes as we change the reactance and resistance.

In practice the shunt field is so adjusted that the converter takes the required lagging current running light, and the series field is made to increase the excitation so as to give the required field strength at non-inductive load. Since, however, the series excitation is proportional to the load, it is evident that without hand adjustment, it would be theoretically impossible to accomplish perfect phase control; or rather, it would be impossible to have constant voltage at the rotary converter with constant voltage at the generator. The difference, however, is exceedingly small, the series field being slightly too strong at light loads and too weak at overload, in other words the voltage will be slightly increased at the converter up to non-inductive load and will drop slightly at overloads

Before closing the paper it might be well to discuss the conditions which govern the amount of reactance, etc., in the machines. As stated in the beginning of the paper, in plants where one converter is operated from one generator it is convenient, to use the generator reactance for phase control. Since, however, as seen, it requires considerable self-induction to do this at high power factors, it means a generator of high armature reaction and self-induction, in other words a generator with rather limited output with constant field excitation. This is not objectionable, since by leading or lagging currents the output can really be made as high as desired, even if the armature reaction is high. Yet when considering that it is often desirable to start the rotaries from the generator and therefore its voltage may be reduced greatly at the starting moment when the converter necessarily takes a large lagging current, it may not always be the best policy to use the generator reactance alone for phase control.

Often, however, converters are started from the direct current side and sometimes by auxiliary motors. Under these conditions the generator might conveniently be made with very high armature reaction.

In plants where several converters are operated from one generator, or from a number of generators in parallel, control by generator reactance is not to be recommended, since it involves the change of series field adjustments with the change of generator capacity. The generators may be made of any armature reaction since several of them are used in parallel in starting, yet it must of course be borne in mind even then, that if the armature reaction is too high, the large current taken in starting a converter from the alternating current side, may cause the voltage to drop so far as to seriously disturb the system in general.

Regarding converters themselves, it is obvious from the preceding discussion that they must be of composite type, that is, they must have shunt and series excitation

Shunt wound converters do not permit of automatic phase control, but at constant adjustment of the field will always run at the same wattless current at all loads, so that, for instance, if the field is adjusted for non-inductive load at one load, the converter will run non-inductively at all loads, and therefore the drop in voltage at full load will correspond to the energy loss in the system, and the converter voltage will be higher at lighter loads than at heavier loads, therefore will vary as the load varies, and phase control is thus feasible only by hand regulation, that is, in systems where the load varies only slowly as in lighting circuits.

Reaction converters take lagging currents at all loads and thus are in general objectionable, the more so as they do not allow any automatic potential control

DECORATED CARS IN AUSTIN, TEX.

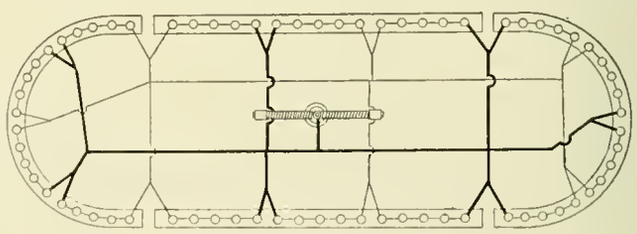
During the past summer a plan of decorating four of the cars of the Austin Rapid Transit Railway Company was devised by Frank E. Scovill, superintendent. The cars were prepared to order for a lawn party and it was considered good policy to so design the decorations that they could be easily removed and replaced for another like occasion.

The diagram of wiring for exterior illumination is here given.

DECORATED CARS, AUSTIN.

the heavy lines indicating the trolley circuit and the lighter ones, the ground wire. The incandescent lamps were fixed to four strips, two of which are semi-circular, and the connections are made for five lamps in series. There were 250 lamps in red, white and blue used in the illumination. A star and crescent of lamps adorned the front dash. The bunting was easily attached by tieing with twine and tacking it to the wood work where it would not show.

The first party was given by Dr. Morse, clerk of the supreme



EXTERIOR LIGHTING CIRCUIT.

court of Texas, in honor of his daughter and 200 guests were invited. An orchestra was stationed in the front end of the first motor car. Two motor cars and two trailers accommodated the party. After a trip over the company's lines the party enjoyed dancing and other amusements. This train of decorated cars has proven to be a very attractive feature and brought considerable revenue to the company.

It is reported that the Italian Mendonial Railroad Company has decided to construct an electric railway between Mandela and Sublaco, in the province of Rome, and it proposed to utilize the water power of the Anniera River for the production of the motive power.

FIGHTING SNOW.

The street railways of Denver are favorably situated with reference to fighting snow, for, as a rule, the winters are exceedingly mild with few cold days. Occasionally there comes a storm which requires a snow equipment. The blizzard in November, which swept from the Rocky Mountains eastward to the Atlantic, was more severe in Denver than in Chicago and other cities in the central states. There was one storm last winter during which 18 inches of snow fell.

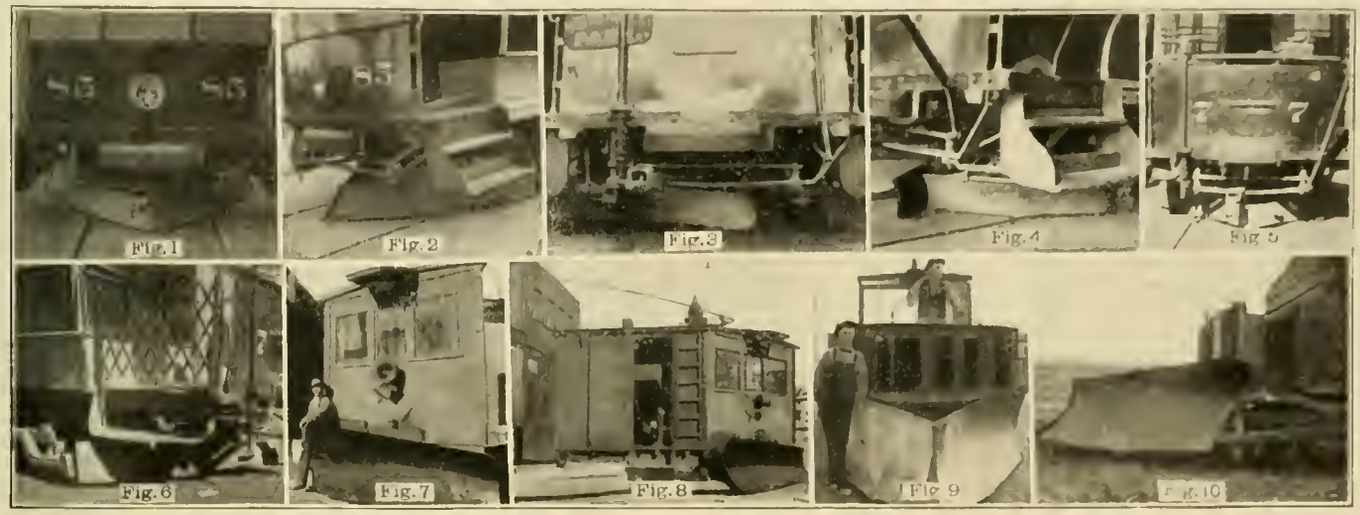
The Denver Consolidated Tramway Company has three distinct types of plows which are mounted on car trucks. Superintendent C. K. Durbin states that each of these plows has done good service. The type shown in Fig. 1 and Fig. 2 is especially suited for the heaviest snows that come to Denver. The plow shears are raised and lowered by means of a lever on the platform, as shown in Fig. 2. The plows, shown in Figs. 3, 4 and 5, are somewhat different in construction. The wings of these are so arranged with springs that they will turn under in case any obstruction is encountered, such as a paving block or high plank.

In Fig. 6 may be seen another style of plow which has done excellent work, handling six inches of snow without difficulty. The great objection to the V-shaped plow is that it piles up snow between the tracks which has to be removed by a plow similar to the one shown in Figs. 7 and 8. The company has six plows of this kind of its own design and construction. The plow, shown in Figs. 9 and 10, is used on the suburban lines and in high drifts. With this equipment the Consolidated Company is well prepared to successfully cope with any storm which may come.

The obstacles to be overcome in Montreal in the winter are much greater than in many cities in the United States. The snow equipment of the Montreal Park & Island Railway Company is very complete and intended for clearing the tracks of snow drifts of any depth. In Fig. 11 may be seen a small plow which is pushed by a sweeper, clearing the track on the "Mountain" line of the company. Fig. 12 is from a photograph of the sweeper and plow as they are returning after cleaning the track on the Outremont branch. Mount Royal Park is in the background. The work is evidently very thoroughly done, as the rails show clean and free from snow.

The view represented in Fig. 13 speaks volumes for the effective work of this equipment. At this point the track was covered by snow drifts 7 ft. deep. The plow and sweeper has cut a road through these piles of snow and cleaned the rails.

For the past four years the Gallatin Light, Power & Railway Company, of Bozeman, Montana, has been able to keep its cars running all winter long without delay. The appliances for keeping the tracks clear of snow were designed by W. W. Livingston, electrician of the company. The plow shears are made of ½ by 5 in. steel and No. 18 sheet steel. Two of these are suspended at the end of the car truck by 1½ in. bolts. These extend through the point of the heavy iron on the plow to the V-shaped irons fastened to the guard board irons, and throw the points of the plows well forward and dropping the bottom of the plow at the center to within 3 in. of the rails. To the sills of the platforms are angle irons from which elbows extend to a handle on each platform. When the handles are released the plows drop of their own weight.



SNOW PLOWS AND SCRAPERS—DENVER CONSOLIDATED TRAMWAY COMPANY.

SNOW PLOW AND SWEEPER—MONTREAL PARK & ISLAND RAILWAY COMPANY.

SHEARS ATTACHED TO TRUCK—BOZEMAN, MONT.

For cleaning the snow farther away from the sides of the track a plank, 18 in. wide and 3 ft. long, shod with iron, is suspended from the truck in an upright position, the outer end being held by a stout chain. One car only is fitted with these plows and it has always kept the tracks clear, even when the snow was 2½ ft. on a level and no thaws for weeks at a time.

Fig. 14 shows a car and with plows running into snow 10 in. deep at a speed of 12 miles an hour. In Fig. 15 the picture was taken on the second trip. Here the track is higher than the adjoining surface and a speed of 20 miles an hour can be attained.

One of the cars of the Milwaukee, Racine & Kenosha Electric Railway Company is represented in Fig. 16 after a blizzard. These cars pass through long stretches of sparsely settled country and have many heavy snow drifts with which to contend. Fig. 17 is

Three motors are used, two for propulsion of the car and one for driving the brooms. Those employed for driving the plow are usually of the heaviest description, while a 30 h. p. motor is sufficient for the brooms. This motor is set diagonally in the cab so that a straight lead is obtained for the sprocket chains. In the matter of chains a great improvement has been made. The Brill Company has introduced solid forgings to take the place of the malleable iron chains which have been heretofore employed. The brooms are raised and lowered by powerful levers within the cab, and are hung on radial guides so that the chains are always taut and do not slip on the sprocket wheels. They are always under perfect control and are readily adjusted for wear. They are easily taken down and taken apart for the replacement of the rattan when worn out. Sweepers are arranged to run in either direction and are fitted with two headlights or one shifting

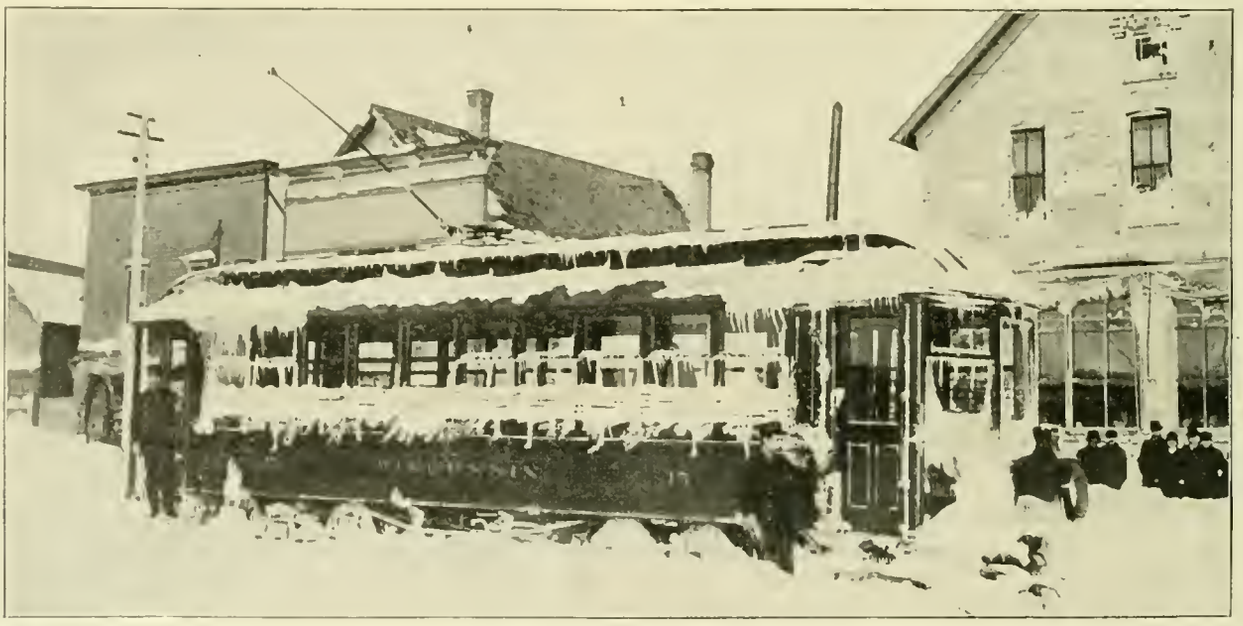


FIG. 16.—MILWAUKEE, RACINE & KENOSHA CAR AFTER A BLIZZARD.

from a photograph of a well-equipped sweeper in service on the lines of the Cincinnati, Newport & Covington Railway Company.

The Brill snow sweepers are unusually effective on account of several improvements of design and details. These improvements have been made in order to overcome the defects which have heretofore made the operation of snow sweepers both troublesome and uncertain. The standard form has a length of 21 ft. with a width of 6 ft. 10 ins. The height is varied to suit conditions when necessary.

headlight for this purpose. Two roof gongs are fitted on the sweeper, and a 6 ft. wheel base is generally adopted. There are two sliding doors in the cab, one on each side. There are two sand boxes, and it is a common plan to fit four sand spouts, one for each wheel, thus giving ample adhesion when it is needed. Both sand boxes are worked from either end of the car. Sweepers are intended for use over paved streets, but are not recommended for unpaved or macadamized street, because the sweeper is liable to pick up stones and throw them with great force.

Aprons are fitted over the brooms to obviate the throwing of snow, etc., as much as possible. Mould boards at the sides clear away the snow which is beyond the reach of the brooms.

For the successful operation of sweepers, they should be started as soon as a storm begins, and be kept at work continuously until it ceases. When a lines does not operate at night it is too expensive to keep a line in operation for a sweeper alone, hence the best practice combines the plow with the sweeper. The Brill plows are designed for operation in deep snow and can easily attack and clear away the accumulation of a night.

For suburban use and upon unpaved streets the plow alone is always recommended. In our southern cities, where there is but

FIG. 17.—SWEEPER—CINCINNATI, NEWPORT & COVINGTON RAILWAY.

small use for a snow plow, the Littell track scraper is often applied to cars, which are then enabled to run in snows which would stall a car or at least render operation extremely wasteful. These scrapers act as small plows and can handle either wet or dry snow of considerable depth.

The snow plow illustrated in Fig. 18 is intended to be to the electric railways what the great rotary snow plows used in the northwest are to the steam railroads. Snow 10 ft. deep will not stop it and it will go through 3 ft. of snow about as fast as a car will follow behind it. It was one of eight recently built by the Peckham

FIG. 18.—PECKHAM ROTARY PLOW.

Company and this one is now in service on the Chicago & Milwaukee Railway which passes through some narrow cuts and suffers from drifting snow. The plow weighs 15 tons and is equipped with three 50-h. p. motors, two for traction and one for propelling the fans. It has a double equipment and can be run either way, having four controllers. At each end of the shaft passing through the car is a fan with four blades of $\frac{3}{8}$-in. sheet steel and a wheel with buckets on the periphery. The fan blades of this plow are 5 ft. 6 in. across. The steel hood about the fan, which are made as wide as the largest car on the line, come within 3 in. of the track. The snow beneath the fan is taken care of by the track scrapers and ice diggers. The snow is cut by the blades and deposited in the buckets which throw it against a deflector door near the top. The bucket wheel going at full speed will throw the snow 125 ft. away from the plow but by arranging the deflector it can be deposited beside the track. The blades of the fan are so turned that they tend to draw the plow into the snow and it is claimed that this plow takes at least 50 per cent less power to do the work than any other type.

STEEL TIES.

There are a number of street railway systems on which the traffic is sufficiently heavy to permit the management to practice economy by using the "best" of everything, even if the first cost is higher, and doubtless some of these fortunate ones have looked upon the steel tie as perhaps being desirable.

The subject of metal ties has been much discussed by the civil engineers of steam railroads and to their experiments we owe the greater part of our knowledge of the subject. There are practically no metal ties in use in the steam railroads of the United States, which have over 10 per cent of the total number of ties laid; in a few instances American roads have laid short and isolated stretches of track with metal ties for trial or for special purposes.

Such was the track laid by the New York Central in 1895, from 106th to 110th street. The ties used were of pressed steel, trough shaped in cross section and bent longitudinally so that only the rail seats were above the ballast, which covered the tie in the middle and at both ends. These ties weighed about 100 lbs. and cost $2.50 each

The disadvantages of steel ties are that they are quickly corroded in a soil impregnated with saline matter; the cost of tamping in soft soils is greater than with wood ties; the ballast tends to work out from under the tie; in case of derailment the steel ties are usually so strained as to be worthless. The advantages are the longer life, and the fact that they are impervious to the attacks of insects

Metal ties have been extensively used in India, and in 1895 the "Indian Engineer" thus compares the economy of cast iron, steel and wood ties. The cast iron ties are two bowl-shaped castings joined by a rod; they cost 55 per cent more than wood ties and have a life of 30 years. The steel ties referred to were of trough section; they cost 30 per cent more than wood ties and have a life of 15 years. The life of the wood ties is taken at $7\frac{1}{2}$ years. At the end of 30 years the total cost (interest included) is estimated to be in the following ratio: Cast iron, 100; steel, 212; wood, 225

If metal ties are preferable any place they would be in India, both because wood is scarce and because it is there subject to the ravages of insects, which quickly destroy it. But even there many of the railroad engineers are of the belief that it would be better to use wood if it is possible to get it. On the Sindh Sagar District of the Northwestern Railway of India, having some 300 miles of track, it was decided in 1893 that renewals of ties should in the future be made with wood. A test showed that in four years steel ties on this road lost 61 lbs. in weight, the original weight being 148 lbs

After an experience of five years on the Belgian State Railroads, steel ties were pronounced unsatisfactory and wood substituted, but this result it is claimed by the advocates of steel ties was because of too light structure and poor rail fastenings. On the other hand the saving by the use of steel ties on the Austrian railroads is placed at about 14 per cent, and at an International Congress in St. Petersburg in 1893, the average results on 17 lines of railway in Europe showed a gain of 30 per cent in the maintenance of steel ties as compared with wood.

Steel ties are much used in Switzerland; in 1894 the percentage of steel ties used on five roads was given at from 60 to 18 per cent, the larger roads having the greater proportion of steel ties.

In Mexico steel ties are used to some extent, the number imported being placed in 1894 at 50,000 annually.

Some foreign street railways have used steel ties in the construction of their track; among these are the street railway systems of Aix-la-Chapelle and Budapest. In the United States very little has been done with steel ties in street railway track construction, the situation being about the same as on the steam railroads.

Probably the most extensive experiment was that of the Citizens' Street Railway Company, of Detroit, which in 1895 adopted steel ties for its new track. The ties in this case were of channel section, 7 in. wide, with flanges 1½ in. deep, and were 7 ft. long. They were spaced 5 ft. between centers, and as the rails and ties were bedded in concrete it is evident that the ties were merely substitutes for rods to keep the gage; they were neither close enough together nor stiff enough to properly support the rails.

The Cincinnati Street Railway Company laid some steel ties in 1895, which are still in service, and have given no trouble. While the steel ties require less excavation and less concrete to properly bed them it is a question as to whether they will last longer than oak, as oak laid in cement concrete seems to be "cured" to some extent and decays less rapidly than when laid in macadam. Bert L. Baldwin, mechanical engineer for the company, states that when some of these steel ties were uncovered after one year it was found that many of them were somewhat rusted. The hot tar coating which was given them when laid had failed to entirely prevent corrosion.

In 1893 the Los Angeles Consolidated Electric Railway Company conceived the idea of utilizing old T-rails for cross ties when the track was relaid with girder rails. The old rails, cut to suitable lengths, were laid head down, with two short sections of Z-bar riveted to each for rail chairs to which the track rails were bolted. At the joints two of these ties were used, one under the end of each rail. The ties were tamped with rich concrete

All of this work has since been torn out and replaced by the ordinary wood tie construction, as it was found that the joints went down just as much as with wood and that it was practically impossible to make any track repairs without tearing up the T-rail tie and cement in which it was bedded.

Steel ties have been laid as an experiment by other street railways in this country, but so far as we know they have not been adopted as standard on any of the large systems. The Rochester (N. Y.) Railway has adopted steel ties in its new work as described in the REVIEW for November, using old rails for this purpose for the most part. The Boston Elevated, in its sub-way track work, used preserved wood ties in preference to metal, and in general the same views obtain in street railway as in steam road practice in this country.

CARE AND CONSTRUCTION OF COMMUTATORS.

In an article in the "Electrical Review," of London, F. J. A. Matthews gives some notes on commutator design which are instructive.

Considering that many makes of direct current dynamos and motors can now be bought with an efficiency of from 85 to 94 per cent, and that by the expenditure of so many more pounds a higher degree of efficiency can easily be obtained, designers have now only two problems to consider, first, to cheapen the cost of production, and, secondly, to improve the general running and life of dynamos. It is of the very greatest importance that the machine, when set to work, should run with the minimum of attention and absolutely no sparking.

The causes of sparking may be classified as follows:

1. Faults inherent to the dynamo design.
2. Faults due to bad setting of the brushes.
3. Causes entirely outside the machine.
4. Faulty construction of the commutator.
5. Bad connections.
6. Commutator too small.

In the present article we are more concerned with the three latter causes, and so may briefly dismiss the first three.

1. These faults are, broadly speaking, two-fold:

(a) Unsymmetrical winding; (b) too weak a field, and each denotes lack of experience and bad designing.

2. These faults are again two-fold: (a) brushes not being diametrically opposite, and not on the neutral plane; in either case this is more a matter for the dynamo attendant, although the designer should contrive to secure such a degree of fixity of lead, that the lead of the brushes does not require to be altered with every slight fluctuation in the load; (b) the brushes not bearing on sufficient width of the commutator, the brushes should be set to cover one and a half sections, plus one and a half pieces of mica. Referring to Fig. 1, where the brush covers one section only, the coil c, just coming under the brush, is carrying current in a right-hand direction; but when it reaches the position of the coil, b, it will have to carry current in a left-hand direction, as it will have passed from the y series into the x series of coils; therefore, while short-circuited under the

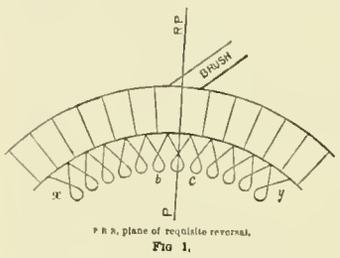


Fig 1.

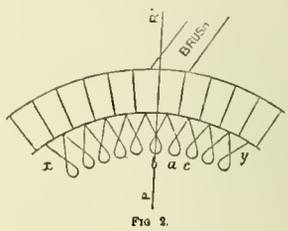


Fig 2.

brush, the current must first die away, and in order to obtain sparkless commutation, a reverse current of the same strength as that carried by the x series of coils must be generated in it. Take the case of a commutator built up with 60 sections, and running at 1,200 r. p. m., the time each section is under the brush is 1-1200 part of a second, and we know that, in accordance with Lenz's laws, there will be a force opposing the dying away of the current, and then a force opposing the generating of a current in the opposite direction, in addition to which the coil must be exactly in the plane of requisite reversal; the time for all these forces to act is very short. It is not impossible to get sparkless commutation with a brush covering only one section. The condition for sparkless commutation in such a case is, that the plane of requisite reversal must be exactly through the center of the coil, and the slightest variation in the load will have a tendency to shift this plane and thus cause sparking. In Fig. 2 the brush is shown covering one and a half sections; here two coils are short-circuited in place of one, as before, with the result that the total time under the brush is very considerably longer; the plane of requisite reversal will now lie through the center of coil c, so that the current in any coil coming up under the brush will have time to die away,

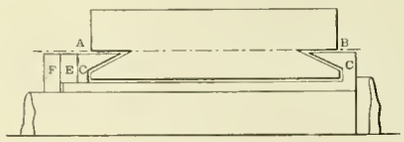
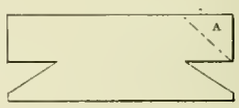


Fig 3



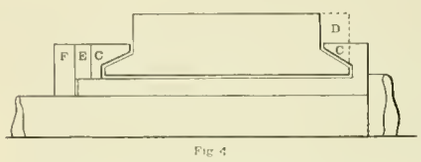


Fig 4

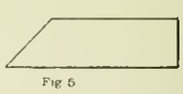


Fig 5

and even a slight reverse short circuit current may be generated in the coil before arriving at the plane of requisite reversal. Should, now, this plane vary owing to a fluctuation in the load, the sparking will in no case be as heavy as it would with a similar fluctuation were the brushes covering one section only.

3. These faults are caused either by (a) vibration of the dynamo, (b) bad joint on the belt causing the brushes to be continually lifted up and down, (c) leakage on the outer circuit. They have, in reality, nothing to do with the design, but attention should be paid to these points by whoever puts down the dynamo.

Having glanced thus briefly at these preceding causes of

sparking which are not due to the design and construction of the commutator itself, we will now deal more fully with faults which can, and ought to, be guarded against when the commutator is either designed or in process of being built.

4. The conditions for a sound commutator are, that it shall be absolutely rigid, evenly balanced, truly turned axially with the shaft, and that the metal shall be homogeneous. Another condition is, that each segment shall be thoroughly insulated from its neighbors and from the sleeve.

Absolute rigidity can only be attained by the exercise of the utmost care, not only in the design, but also in the building up of the commutator, for in all commutators the method of holding various segments together is very far removed from being a sound mechanical construction. This is caused by the fundamental condition that the segments may not be directly held by metal, whilst at the same time they are acted upon by various strong forces, such as centrifugal force due to rotation, friction due to the brushes, and expansion due to the rise of temperature in the commutator during a run. Except in commutators of large size, there are practically only two ways of holding the segments together, represented in Figs. 3 and 4. Various makers differ slightly from these two methods, but they are only variations of the same principle. Each of these two methods has its advantages and its disadvantages. For the type shown in Fig. 3 there can be claimed that less length is required on the shaft for nuts and rings, with a consequent saving in length of the sleeve and bed plate, and also that with rolled copper bars the sections can be cut for connecting lugs from the inductors before the commutator ends are turned up. On the other hand, the life of the commutator is short, for as soon as it has worn down to A B, the brushes will rest on the rings, C C; while with the type shown in Fig. 4 the great advantage is the longer life of the commutator, which can now be worn down to the very bottom; the disadvantages being, first, the longer length required on the shaft, and secondly, and more important, the greater amount of time in building up the commutator when made of hard rolled copper bars, as the various segments have first of all to be put together, and the dotted part, D, Fig. 4, must be turned off, and the whole taken in pieces again before the commutator lugs can be attached, the time of this building up and undoing being saved if the type of Fig. 3 be adopted. Each manufacturer must decide for himself which of these methods is the best, as neither of them has any real advantage as regards the solidity of the commutator; what is of real importance is that the rings, C C, should well cover the V's of the segments so as to secure a good grip.

In a commutator with bars 1½ in. deep, 6 in. long, 8 in. external and 5 in. internal diameters, running at 1,200 r. p. m., the centrifugal force tending to throw the bars outwards is equal to 2,700 lbs., or with 60 sections in the commutator to 45 lbs. per section. Between the collar, C, and the V of the sections some insulating material must be placed, and even today many of the smaller makers use for this purpose fibre washers, one of the very worst materials possible, as not only is it hygroscopic with consequent varying degrees of hardness and rigidity, but it also, under the action of heat, rapidly deteriorates in other ways, and it will be readily seen that if it once only slightly looses its hold the high centrifugal force will cause some of the sections to rise, and the result will be disastrous to the commutator, rapid wearing away and oscillation of the brushes, and development of flats owing to the sharp edges and unevenness of the risen bars. The only substances that up to the present have proved of any serviceable nature for these washers are either pressed mica or micanite. Another fault which may arise, and in many cases has done so, with the use of fibre washers, is for the outer ring to loosen its hold, and the friction of the brushes causes the commutator bars to become inclined at an angle, instead of being parallel with the shaft, with the result that the outer brushes have a forward lead in comparison with the inner brushes; this is a case which the writer has observed in more than one machine which he has been called in to inspect after some months of use. Even employing mica or micanite washers, it is of the highest importance, in order to prevent subsequent slip, to see that the nuts are well tightened up; this can only be done by having the commutator heated after the first tightening up, and upon allowing to cool, again screwing the nuts up in the lathe; further, the nut, E (Fig. 3), securing the commutator to the sleeve, should either be in duplicate, or should slightly overhang the sleeve, so that the nut F, securing the sleeve to the shaft, may act as a check nut.

Another point of vital importance is to see that the commutator segments, washers, sleeve, etc., are entirely free from all dirt, turnings, borings, or filings, as the presence of these in the commutator will cause rings of fire running round the commutator, and although in all probability this dust will soon burn out, and give no further trouble, yet in building such a delicate piece of mechanism as a dynamo, a good manager will leave nothing, that is avoidable by the exercise of a little close attention, to chance.

5. In order to prevent the formation of flats, owing to some bars wearing away faster than others, it is necessary to secure the same degree of hardness in all the bars, by using a perfectly homogeneous metal; but copper being a metal that varies so greatly in the melting pot, the use of cast segments must be abandoned, and hard rolled copper substituted. The worst of this is, that either the bars must be made to the top of the lugs and then turned down along the blade—which would make a thoroughly sound piece of work, but is too costly for any manufacturer to seriously entertain the idea of—or else lugs must be let in. The usual method is to make a saw cut at an angle of 45 degrees and then let in a copper strip lug, as shown in Fig. 5; when this is done, it is most important that the connection at A should be thoroughly sound, as it is owing to bad contacts that a vast amount of heating arises in electrical work. The only method which recommends itself to the writer is to have a saw cut through the center of the bar and solder, or preferably braze, the lug in, and then to drill and rivet it.

6. Above all, the commutator should not be too small for its work; it is frequently stated in dynamo specifications, "no part of the machine to rise more than 70 degrees F. above the surrounding atmosphere at the end of six hours' run with full load;" this, as regards the commutator, is far too high. Take the case of the commutator referred to above; if this rises 70 degrees F. it would tend to lengthen .0005 in., and if the insulating ring is not thoroughly rigid it would give, and upon cooling the commutator would be slack, and the troubles enumerated before would rise upon the next run. If the insulating washers are absolutely rigid, then they and the sleeve, nuts and end rings, C C (Fig. 3), would have to withstand a stress of something like a ton to the sq. in., and the consequences might be very serious, for while the whole might stand firmly together, still the danger, with innumerable successive runs, would be very great, of either the sleeve giving way and breaking, or else of the bars buckling in the center, when we should have the old sequence of events, rapid wearing away of the brushes, owing to the sharp edges and the development of flats. Here, again, the good designer will leave nothing to chance, but will do away with all fear of danger by making a commutator of such ample section that the heating effects shall not cause any such rise in temperature. Even with a considerably less rise there will always be a strain on the sleeve, and hence is seen the necessity of making this of gun-metal of ample section.

As we saw at the first, a commutator is a most unmechanical construction, judged from an ordinary engineer's point of view; yet with careful designing and supervision during construction, and in the hands of an attentive dynamo tender, there is no reason why this, which has always been the weak part of direct current machines, should not thoroughly retrieve its character, which a little time ago it was fast losing.

A plan has been submitted to the Italian government asking for the right of way to construct an electric railway over the Great St. Bernard, a total distance of 43 miles. According to report the scheme is being promoted by an English company recently incorporated under the name of the Great St. Bernard Concessionary Company. It is proposed to adopt a third rail on the rack system, as used on the Mont Cenis line. The cost of the construction and equipment of the railway is estimated at $3,000,000. J. B. Fell, engineer, Turin, Italy.

A PEACE PROPOSITION IN DETROIT.

On December 12, J. C. Hutchins, vice-president of the Detroit Citizens' Street Railway and of the Detroit Electric Railway, made a proposition to the Detroit council involving the following provisions:

A new franchise covering all lines to run 30 years.

The abolition of the eight-for-a-quarter tickets save between the hours of 5:30 and 7 a. m. and 5 and 6:30 p. m.

Six-for-a-quarter tickets with universal transfers for continuous rides.

In lieu of present paving regulations the company to pave between the tracks.

The Detroit Electric Railway to pay 2 per cent of its gross earnings to the city as do now the Citizens' and the Detroit, Fort Wayne & Belle Isle.

Lines within the city limits, operated under original township grants, to be considered extensions of the system.

Sundry extensions of lines to be built.

In case of the widening of a street to lay double tracks the company to bear the expense.

In presenting the ordinance Mr. Hutchins said:

"I will try to be brief. It has been asked in behalf of the city that we shall submit a proposition extending further advantages to the public in street railway matters. I feel the weight of some responsibility in now endeavoring to comply. Your wishes are met in the form of a draft of an ordinance. This draft has been carefully prepared and is in legal form. In it we burn all bridges behind us. It wipes out all indefinite and perpetual rights, and fixes one definite date upon which all franchises shall expire; cancels all authority to charge a straight 5-cent fare, as in other American cities; requires universal transfers where no transfers are now required; extends the hours for workingmen's tickets and compels the giving of transfers on such tickets; it provides for the expenditure of many thousands of dollars in new extensions. It requires the Detroit Electric Railway to pay 2 per cent of its gross earnings into the city treasury, as the other companies do, and while righting a wrong under which that company now labors, requires it to assume the same heavy burdens for street paving as are borne by the other companies.

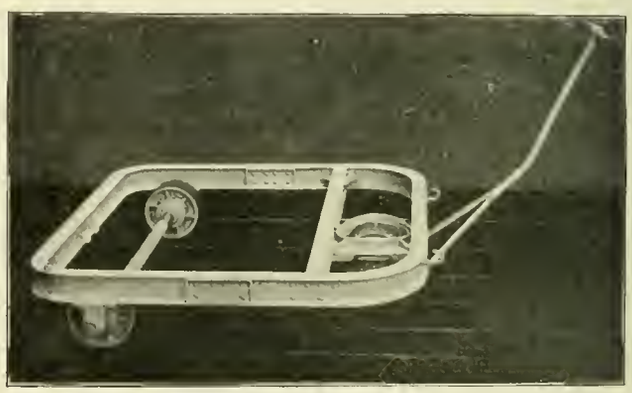
"It makes all tickets and all transfers good on all lines in Detroit. The rates of fare are 25 per cent or 30 per cent below those in effect in any other American city. No other railway management in the world would probably consider such a proposition. We may be able to live under it. I spoke at the commencement of responsibility. Three or four years ago it was largely on my advice that my associates in and out of Detroit were induced to stake their fortunes on Detroit. That advice was predicated on my unswerving belief that in this American city we could count on ultimate fair play. If this ordinance is adopted, it will be on my advice that it may be accepted. Four years ago the bicycle cloud was no larger than a man's hand. Today there is a cloud of more than 50,000 bicycles in this city. No man may foretell what the evolution of city transportation may be. The risk is ours. We may be making a great mistake in proposing to surrender terms which would protect the property under all changing conditions; but we are moved by a desire that the people of this day and generation may have every advantage and facility that now seem possible. The people 20 years hence will be able to take care of themselves.

"There is a phase of this matter to which I wish specially to allude. The records show that no measure introduced in the common council antagonistic to the interests I represent has ever failed of passage by a practically unanimous vote, and none of any other tenor has ever been introduced. The people are doubtless willing that right shall prevail, but have been led to believe that their interests may suffer through the dishonesty of their own servants. It is said that some of these very servants are dishonest in a mercenary sense, and that others are dishonest in the sense that they would annoy us for political advantage. I attack no man's integrity, but trust that all may now be honest. We shall do nothing that is not open and above board. Not one dollar shall be paid to any man, either directly or indirectly, in any way to influence his action in this connection. This matter shall be put upon an altogether higher plane. I have simply complied with the city's wishes in submitting this proposition.

"The common council may be in doubt as to the proper course to pursue. If advice is needed, why not ask it of a high commission composed, if you please, of the governor of Michigan, of the mayor of Detroit, of members of the faculty of our great university, of members of the Michigan supreme court, of members of the circuit court bench, and of the leaders in our great commercial, industrial, labor and religious organizations? or, if you please, submit the whole matter to a vote of the people. If the people of Detroit desire an adjustment along these lines, we shall bow to their will, though the sacrifice seems great on our part. I confess I am sorry this matter is up at this time. If you think best, drop it and let us wait. It now becomes your duty to determine what is best to be done. My duty is discharged. Your responsibility begins. And now, gentlemen, I hand you the proposition and beg leave to retire."

HAND TRUCK FOR BUENOS AYRES SLAUGHTER HOUSES.

In the Review for October, 1898, page 745, was described the method by which meat is handled in the city of Buenos Ayres between the slaughter houses and the markets and the cars furnished by the Brill Company for that purpose. At that time we alluded to the trucks upon which the meat boxes were handled on arrival at destination. The accompanying illustration shows one of these trucks. They are mounted practically upon three wheels although the forward wheel is doubled to facilitate turning. This forward



HAND TRUCK FOR BUENOS AYRES.

wheel is set in a turn table carried in ball bearings and the whole truck can be turned in its own length. While it is intended that these trucks should be handled by hand, a large portion of the work done with them is performed by means of mules and the trucks themselves are arranged so they can be hauled in trains. The handle of one truck is made of sufficient length to drop into the hooks at the rear end of the truck in front of it. The handles of the forward truck can be turned up against the meat box or can be unshipped and then attached to two hooks seen in front of the trucks. The construction is exceedingly simple and at the same time of the greatest strength. Roller bearings for each journal reduces the friction to a minimum.

There is a small truck that might be used to advantage at repair shops, depots and other places where heavy weights are to be moved and where the roads do not have overhead trolleys for the purpose. The trucks illustrated are made of 6,000 lbs. capacity but they can be built for any desired load from 1,000 lbs. up.

The Altoona & Logan Valley Electric Railway Company of Altoona, Pa., has built an addition to its power-house and installed two new 300-h. p. Heine boilers.

The engineer of the proposed elevated freight road for Detroit has prepared drawings showing the construction. It is to be a double-track structure with the posts set along the curb at intervals of 30 feet.

NOTES ON AUSTRALIA.

BY FRANK X. CICOTT.

Australia is 2,400 miles long from east to west and 1,971 miles wide, and is divided into five colonies, New South Wales, Victoria, Queensland, Western Australia and South Australia. The island of Tasmania, which lies just south of Victoria, might also be included when speaking of Australia generally. The population is 5,000,000, about the same as metropolitan London, or 20 per cent less than the state of New York. The governments of the several

PANORAMA OF SYDNEY HARBOR.

colonies of Australia are as distinct from each other as is that of the Dominion of Canada from South Africa, although all are British possessions. Both free trade and protective tariff systems exist. New South Wales has free trade and its next neighbor, Victoria, a high tariff which discriminates against New South Wales as a commercial rival. There is a duty of about $15 per head on live stock crossing the Victorian border, but there is no tariff on cattle entering from any other colony. This state of affairs will doubtless be ended before long by the formation of an Australian federation, which will include Tasmania; this is now being formulated.

Sheep-farming is the pre-eminent industry of Australia, which is of great importance as a wool-producing country. There are in the aggregate about 90,000,000 sheep in Australia. The gold coinage (sovereigns) of the Melbourne mint is about $23,000,000 and of the Sydney mint about $14,000,000 per annum. These mints are under the jurisdiction of the Royal Mint of London. A third Australia mint is now nearing completion at Perth in Western Australia.

Sydney, the largest city and seat of government of New South Wales, was founded January 26, 1788. Port Jackson, the harbor, which is claimed to be one of the most picturesque as well as one

KING STREET, SYDNEY, N. S. W.

of the most secure ports of the world, has many beautiful suburban towns in the numerous indentations of the bay, which has the general outline of a human hand. The railways and tramways of the colony are owned by the government, and the latter are under the management of P. Bedford Elwell, electrical engineer, and Gustav Fischer, chief assistant engineer for tramways. Both of these gentlemen are members of the Institute of Civil Engineers, and Mr. Elwell is a member of the Institute of Electrical Engineers also. The cable and steam tramways are now undergoing a transformation for electric traction. Nearly all of the equipment has been contracted for in the United States; it includes steel rails, Allis cross-compound condensing engines and Peckham standard cantilever trucks. The commissioner, W. M. Fehon, has awarded the contract for cars to Henry Hudson of Sydney, and they are all to be equipped with the Standard air brake. The trolley hangers are of the writer's design. The trolley wire is ordered from John A. Roebling's Sons Company. The feeder cables are being laid underground, and a novel point in the system is the laying of two submarine cables in the bottom of the harbor to carry the power for the north shore lines. These cables have a cross-section of 500,000 c. m. each and are insulated and armored. At the cable crossing the distance is about 1,500 ft. and the water nine fathoms deep. The introduction of electric traction in Sydney and environments will have a tendency to encourage smaller towns in New South Wales to do likewise. Being under the same administration of the railway commissioners as Sydney, these towns will certainly follow Sydney and its suburbs have a population of about 500,000.

COLLINS STREET, MELBOURNE.

Melbourne (Victoria) has also a population as large as Sydney; both cities claim to be the metropolis of Australia, and the census of 1900 will decide the question. However, to visit either one or both of these beautiful cities an American will soon discover that the advance agent of progression has already established an alliance between America and Australia. The characteristics of the people are democratic to a degree; the streets are similar; the Equitable Life and the Mutual Life Insurance Companies of New York have erected large office buildings here which are a credit to American architecture. Even the school children sided with us during the Spanish-American war.

One cannot but admire the liberal way in which the Australians improve property and spend money upon public works, such as legislative buildings, town halls, postoffices and botanical gardens.

The Melbourne Tramway & Omnibus Company, Ltd., of which F. B. Clapp is chairman and general manager, operates about 44 miles of cable and three miles of horse lines. It is contemplated that suburban extensions will be made soon and electricity will be employed. The merits of the construction and favorable results of this cable system have been the subject of many articles published in America and Europe. However, the possibilities for the installation of electric traction in other places in the colony of Victoria is fast approaching; in Ballarat with a population of 45,326, Bendi-

go with 42,380, Geelong with 24,575, and in other smaller towns, the favorable conditions would justify the construction.

The population of Brisbane in the colony of Queensland, is about 130,000. This is one of the most prosperous colonies in Australia; the broad plains afford the richest pasturage. Live stock, tropical fruit and sugar cane are the leading products in this section. The colony has 460,000 horses, 6,500,000 cattle and 20,000,000 sheep.

Brisbane has a modern municipal tramway operated by the overhead trolley system, recently constructed by Mr. Badger, formerly connected with the General Electric Company of Schenectady. Mr. Badger has been retained at Brisbane as general manager, and the tramway is proving profitable. The equipment is nearly all of American manufacture.

From Western Australia, street and steam railway sleepers and piles for bridges and harbor work are largely exported to India and Europe for construction purposes. These jarrah forests cover immense tracks of land in Western Australia; this wood is extraordinarily durable and as it resists both the teredos and white sand ants it is admirably suited for the purposes mentioned. This colony is a great timber country; sandal wood is found and also the karri, which tree attains a height of 300 ft. and is considered to be equal to the jarrah for many purposes.

There are four flourishing towns in this colony, Fremantle with a population of 13,000, Perth with 16,000, Coolgardie with 15,500, and Southern Cross with 15,000. At Coolgardie and vicinity there are rich gold mines. As mentioned a mint has been recently built at Perth to coin the local production of bullion. The rich resources, the permanency of the institutions and rapid growth of these towns will have a tendency to invite electricity for traction purposes.

AN AUSTRALIAN CHIEF.

Adelaide, the capital of South Australia, has a population of 102,000. The municipal conditions are modern; here are broad straight streets, well paved, and planted with beautiful trees; electric lights, public buildings of fine architectural appearance and botanical and zoological gardens of 124 acres within the city limits. The local press is demanding electricity to supersede the present horse tramways. The city authorities are about to arrange the legal preliminaries to make the change. Adelaide is an ideal city in which to operate an electric tramway economically; the gradients are easy, the people are a riding community and the climate is delightful. There is no doubt but that the change of the present tramways will be electrically installed within the period of a few months.

Hobart, Tasmania, is where a penal settlement was established by the British in 1803; transportation of criminals was abolished in 1853, and the name changed from Van Diemen's Land to Tasmania after Captain Tasman.

HOBART FROM THE BAY.
Mt. Wellington, 4,464 ft.

Tasmania is a very productive colony; coal, wool, copper, tin and apples are exported direct to England, via both Cape Horn and the Suez canal.

The first electric tramway constructed in Australasia was installed in Hobart by Messrs. Siemens Brothers & Co., Ltd., electrical engineers of London, in 1891 for an English company. The system gives most satisfactory results, both electrically and commercially.

The prospects for an electric tramway in Launceston, Tasmania, are encouraging; there is water power of great capacity already installed for lighting and power purposes.

There is a rapidly growing field in Australasia for business in electrical appliances, and there are many enterprises under way that will be carried out in the near future.

TO READ AND PONDER.

The following aphorisms conclude the rules and regulations to be observed by the motormen and conductors operating the cars of Lindell Railway Company, of St. Louis:

Politeness is the expression of social virtues.
An honest endeavor is worth ten promises.
Constant occupation prevents temptation.
Good examples are very convincing teachers.
Silence sometimes speaks more than words.
Quarrels require two; both are to blame.
Write injuries in dust, kindness in marble.
Unskilled workmen will blame their tools.
Ease and honor are seldom companions.
Labor well directed will achieve all things.
It is not how much we do, but how well.
He that knows not when to be silent, knows not when to speak.
Better be alone than in bad company.
Trifles often lead to serious results.
A little neglect may breed great mischief.
Many value character less than reputation.
To excel in art you must excel in patience.
Odd moments are the gold dust of life.
He who conquers self is the greatest victor.
Form plans with care, to execute with vigor.
Yield always to reason, but never to passion.
Whatever is worth doing is worth doing well.

The Cambridge (Mass.) board of health has secured its first conviction under an anti-spitting ordinance. An attorney named Zarrelli was fined $1 and costs.

ROTARY CONVERTERS.

Read by Prof. Silvanus P. Thompson before the Institute of Electrical Engineers, England.

So much interest is concentrated at the present time upon the transmission and distribution of electric energy for motive and locomotive power, as well as for lighting, that attention may profitably be directed to a class of machines which hitherto have been little discussed—namely, rotary converters.

In general a rotary converter may be described as a machine having something in common both with a dynamo and with a motor so far as its structure goes, and of which the function performed by its rotation is to transform the electric energy which is imparted to it in one form into an output of electric energy of some other form. Of such converters there are many varieties, subserving many different uses. For example, one sort of rotary converter will change continuous currents at one voltage into continuous currents at a different voltage. Another will change two-phase alternating current into three-phase alternating current. Another will change three-phase alternating current into continuous current. Yet another will change an alternating current of a certain frequency into an alternating current of a different frequency.

In the following table of the principal conversions which may thus be accomplished, C stands for continuous current, A_1 for alternate current of single-phase, A_2 for two-phase, A_3 for three-phase:

TABLE I.

1. C to C at higher or lower voltage.	7. C to A_3, or A_3 to C.
2. A_1 to A_1 " "	8. A_1 to A_2, or A_2 to A_1.
3. A_2 to A_2 " "	9. A_1 to A_3, or A_3 to A_1.
4. A_3 to A_3 " "	10. A_2 to A_3, or A_3 to A_2.
5. C to A_1, or A_1 to C.	11. A_1 to A_1 of different phase.
6. C to A_2, or A_2 to C.	12. A_1 to A_1 of different frequency.

Any one of these conversions might be accomplished by selecting an appropriate motor to receive and be driven by the primary current, and coupling it to a generator to give out a secondary current of the species desired. It will be noted that of these conversions No. 2 is the ordinary alternate-current transformation, and is better accomplished by ordinary stationary transformers; as also are Nos. 3 and 4. By a suitable combination of stationary transformers No. 10 can also be effected, whilst Nos. 8 and 9 may be more or less satisfactorily effected by the use of auxiliary choking coils and condensers. But all of them may, and all the others must, be effected by means of rotatory apparatus. From the above list there have been omitted several possible cases of conversion, as, for example, that of a current supplied at fixed voltage but of varying amperage, to a current of fixed amperage but delivered at varying voltage.

It is not proposed here to deal, save incidentally, with the continuous-current transformer (No. 1), nor with phase transformers (Nos. 8, 9, 10 and 11); nor with frequency transformers (No. 12); nor with any stationary kind of transformer. This paper will be directed to the machines devoted to the purpose of converting continuous currents into alternating currents of one, two, or three phases, or vice versa. The importance which such machines have now assumed in the electrical industry arises from several causes. Long-distance transmission, with its corollary of the employment of high voltages, has demanded for this service alternating currents. The development of the electric tramway with continuous-current motors has called for methods of feeding at distant points. For this service rotary converters are required. Also for charging accumulators in cases where the public supply is an alternating one, and for factory driving with three-phase motors in cases where the public supply is one with continuous currents, rotary converters are wanted. All these cases might, of course, be met by the use of coupled machines, motor and generator. An early example of this method was afforded by the lighting station at Cassel, where the high voltage alternating transmission was effected by the use of synchronous single-phase alternators, and the town distribution by continuous current dynamos coupled to the shaft of the synchronous motors. Even now, in the case of a three-phase transmission and a continuous-current distribution, some engineers recommend the use of a group converter, consisting of a non-synchronous three phase motor coupled to a continuous current dynamo. But in all such cases the efficiency of the group is necessarily lower than that of either of its component parts. If a motor having, say, a 90 per cent efficiency is coupled to a dynamo, also of 90 per cent efficiency, the efficiency of the group cannot possibly exceed 81 per cent.

Two other solutions to the general problem are possible. One is to wind the revolving armature with two sets of windings—one to receive the primary current and revolve as a motor, the other to generate the secondary current. As only one field magnet and one pair of bearings are required, there is an obvious economy of material, though no great saving in efficiency. Another solution—not, it is true, of universal application, but having the advantage of effecting a considerable increase of efficiency as well as an economy in material—is to wind the armature with but one set of windings, furnished at one end with a commutator, and at the other with appropriate contact rings, the same winding serving both to receive the incoming primary current and to generate the secondary current. It is this specialized type of machine which is the main subject of the present discussion, and which is called par excellence a rotary converter.

At this point it may be convenient to drop the adjective "rotary," and speak simply of converters, leaving the term "transformer" to denote the stationary apparatus.

Converters of a simple kind have been known for many years. Ever since 1885 there has been one at the Technical College, Finsbury, consisting of a bipolar Gramme machine with the ordinary commutator, with the addition of two insulated contact rings at the other end of the armature, these rings being connected to two points on the winding at opposite ends of a diameter. It, therefore, belongs to the species C A_1 (No. 5). The addition of three contact rings connected to three symmetrical points on the winding would constitute a machine of the species C A_3 (No. 7).

It may be convenient here to point out the relation between the number of contact rings (called for brevity slip rings) that are applied in any alternate current generator, and the uses to which such generator may be put with respect to the phasal relations of the currents that may be drawn from it. For brevity these are enumerated in the following table. The figures in the second column relate to the angles between the points on the winding at which the slip rings are connected for the simple case of a bipolar machine.

TABLE II.

No. of slip-rings.	Angle.	Possible service.
2	180°	Single phase.
3	120°	3 single-phase in ternature = "three-phase."
4	90°	2 single-phase in quadrature = "two-phase," or 4 single-phase in successive quadrature = "four-phase."
5	72°	5 single-phase in quinature = "five-phase."
6	60°	3 single-phase in ternature = three-phase with separate leads, or 6 single-phase in successive sexature = "six-phase," or 2 three-phase in sexature.
7	51⅔°	7 single-phase in septature = "seven-phase."
8	45°	4 single-phase in successive octature = "four-phase" with separate leads, or 8 single-phase in successive octature = "eight-phase," or 2 two-phase in octature.
9	40°	3 three-phase in nonature, or 9 single-phase in successive nonature = "nine-phase."

The general principles of conversion from polyphase to continuous currents, or vice versa, are well known. The relation between the respective voltages on the alternating current side and the continuous current side have long ago been investigated, and expressions for their values in the several instances that may arise have been given for those cases in which it is assumed (a) that the alternating currents are simple sine functions of the time, and (b) that the magnetic flux is distributed as a sine function in space with respect to the periphery of the armature. Calculations for the voltages of two-phase and three-phase converters were given by Prof. Ayrton in the "Journal of the Institution of Electrical Engineers," vol. xxii., p. 340, in a discussion on April 27, 1893. For the purpose of studying such machines they may be considered either as used to convert continuous currents into alternating, or

as converting alternating into continuous. The latter function is of more frequent occurrence in practice; the former is rather more easy to follow out in thought. Taking, then, the instance of the converters as used to change continuous currents into alternating, and applying Prof. Ayrton's results to the several cases, we obtain the following numerical values. If we take the continuous currents as being supplied at a constant pressure of 100 volts, the voltmeter readings at the alternate current side will be as follows:

TABLE III.

No. of slip-rings	Angle between connections to rings.	Nature of service generated.	Voltage ratio.	Voltage (virtual volts).
2	180°	Single-phase ...	$\frac{1}{\sqrt{2}}$	70·71
3	120°	Three-phase ...	$\frac{1}{2}\frac{\sqrt{3}}{\sqrt{2}}$	61·23
4	90°	As two-phase..	$\frac{1}{\sqrt{2}}$	70·71
4	90°	As four-phase	$\frac{1}{2}$	50·00
6	60°	As three-phase	$\frac{1}{2}\frac{\sqrt{3}}{\sqrt{2}}$	61·23
6	60°	As six-phase ...	$\frac{1}{2\sqrt{2}}$	35·35

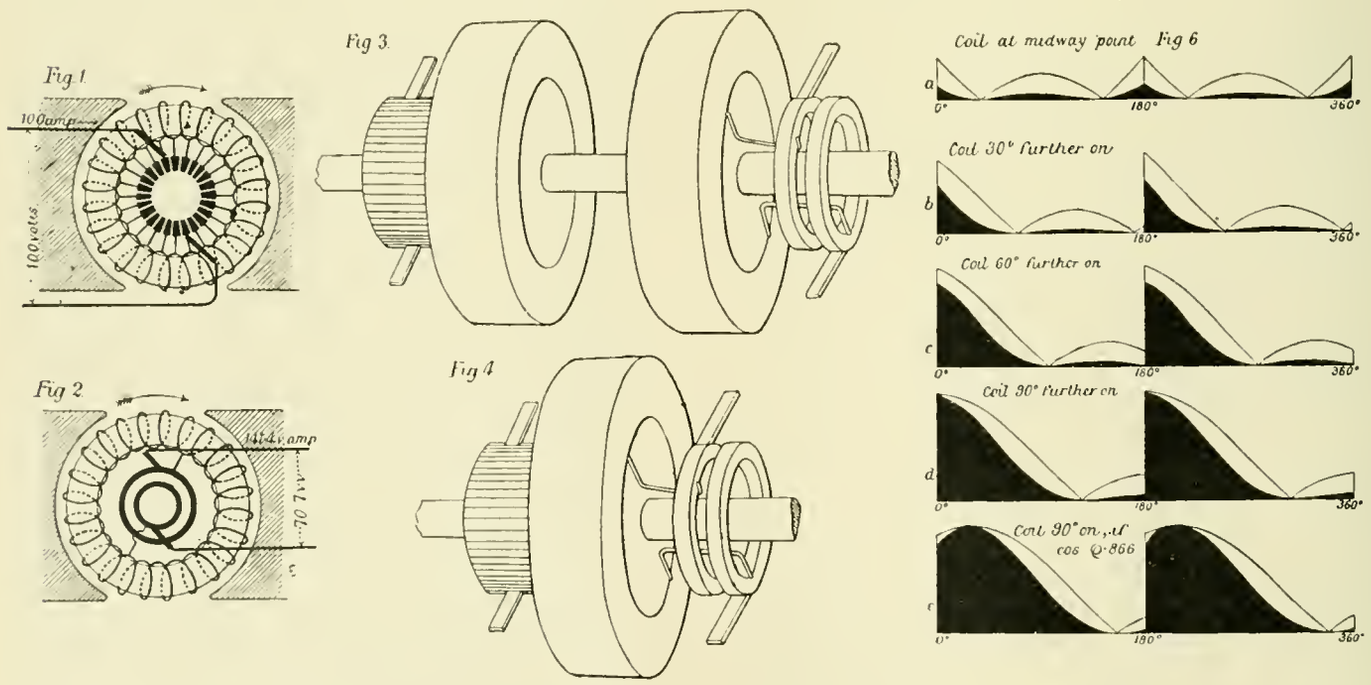
A very complete discussion of the voltage relations, with formulae applicable to the cases of open-coil windings as well as of closed-coil windings, was given by Herr R. M. Friese in the "Elektrotechnische Zeitschrift" of February 15, 1894. Throughout the series of articles he assumes the sine values of the distribution of the magnetic flux around the periphery of the armature. More recently Mr. Steinmetz has reconsidered the same problem in the same journal in articles which appeared on March 3 and 10, 1898. From these theoretical considerations it is easy to write down not only the voltages in the several cases, but also to calculate the corresponding relative values of the working currents in the armature and in the line wires. Similar calculations, down to a certain point, have to be made by every designer of polyphase motors. If we assume the above values for the voltages, and proceed to calculate the corresponding currents for an output of 10 k. w., we find the values of the currents generated to be as follows, the circuits being supposed non-inductive. Maximum as well as virtual values are given. Columns 4 and 5 refer to currents in the armatures, and columns 6 and 7 to currents in the lines. Star groupings are out of the question here, as they cannot be applied in armatures of converters. The only two-phase case that is possible is really a four-phase.

TABLE IV.

No. of slip-rings.	Angle between connections to rings.	Nature of service.	Armature current.		Line current.	
			Virtual.	Maximum.	Virtual.	Maximum.
2	180°	Single-phase	70·7	100·0	141·4	200·0
3	120°	Three-phase	54·5	77·0	94·3	133·3
4	90°	Two-phase [4 wires]	50·0	70·7	70·7	100·0
6	60°	Six-phase	47·2	66·7	47·2	66·7

If the circuits are inductive, there will be a lag of phase in the currents, and wattless currents as well as working currents. For an equal output of power the numbers in columns 4 to 7 of the above table will need to be increased by dividing them by the cosine of the angle of lag.

Let us return to the problems presented by a converter, in which an armature, furnished with slip rings at one end and a commutator at the other, is wound with but one set of windings, receiving current as a motor and delivering it as a generator. The question for consideration is how the current in the act of being transformed from alternating to continuous, or vice versa, flows through the windings of the armature. This is a matter that has not hitherto been considered in detail in any publication. Consider the general case of a revolving armature which is at the same time being traversed by continuous currents to drive it as motor, and by alternating currents which it is putting forth as generator. It is self-evident that the currents which it receives as motor must be flowing in general against e. m. f.'s induced internally by its rotation, while the currents which it gives out as generator must be flowing with those e. m. f.'s. Further, since at every instant (under steady conditions of operation) the value of the continuous current is (by hypothesis) unvarying, whilst the instantaneous value of the alternating current is continually changing, it is clear that at some instants the motor current must be in excess of the generating current, whilst at other instants the reverse must be the case. Whilst the average speed of rotation remains uniform it is certain that dur-



ing each period, or revolution, there will at times be a positive acceleration, and at other times a negative acceleration. Further, it is clear that if there are any irreversible sources of loss of energy, such as friction, hysteresis, or eddy-currents, the motor current must, on the whole, be greater than would otherwise be requisite, the power supplied at the motor side being greater than the output of power at the generator side, the difference being equal to the sum of the various items of power wasted in the machine.

To make this clear, as well as to exhibit the way in which the circulation of current in the windings is effected, it is well to take some concrete case. All cannot follow an analytical argument; and therefore, though the analytical treatment has many advantages, I have deliberately preferred, for the purposes of the present paper, to avoid formulae (though they have been used in its preparation), and instead, to exhibit the arguments numerically by taking specific cases that are readily followed.

Let us consider a 10-k. w. bipolar ring armature, having at its periphery 96 conductors, connected symmetrically down to a 48-part commutator, running at 1200 r. p. m., or 20 revolutions p. s. There will be two turns of the winding between each commutator bar and the bar next adjacent. (Or the armature might be wound as a lap-wound drum, with two conductors to constitute each element of the winding.) That it may run as a 100-volt continuous current machine the magnetic flux through the armature core must be 5,208,333 lines, or a little over five megalines. Fig. 1 will serve to represent diagramatically this armature when receiving 100 amperes at 100 volts, and running as a motor. The flow of current in the armature winding will, of course, be 50 amperes in each half of the ring.

Now, suppose a precisely similar armature to be revolving in a precisely similar field, but let its windings be connected at two diametrically opposite points to two slip rings on the axis (Fig. 2). If driven by power it will generate an alternating current. As the maximum voltage between the points that are connected to the slip rings will be 100 volts, and the virtual volts (as measured by a voltmeter) between the rings will be 70.7 ($=100 \div 1.414$), if the power applied in turning this armature (Fig. 2) be 10 k. w., and if the circuit is non-inductive, the output in virtual amperes will be $10{,}000 \div 70.7 = 141.4$. If the resistance of each of the armatures is negligibly small, and if there are no frictional or other losses, the power given out by the armature which serves as a motor will just suffice to drive the armature which serves as generator. Accordingly, let us suppose them both mounted upon the same shaft, as in Fig. 3, and placed so that each lies in a similar and equal bipolar magnetic field. We have here the well-known combination of a motor dynamo. In every actual case there are, of course, losses (a) by friction, hysteresis, and eddy currents; (b) by heating of the resistance in the armatures. The former have to be paid for by an increase in the motor current. Suppose them in the present case to amount to 4 per cent for each armature, then 108 amperes, instead of 100, must flow in from the supply circuit. The heat losses manifest themselves electrically by a fall of potential at the terminals of the generator, and by a fall of speed in the motor if the primary voltage is not raised. Let the primary voltage be supposed to be raised the requisite small percentage to keep up the speed and to maintain the secondary voltage at 70.7 on the generator side; the output of the generator will then be 10 k. w., the input at the motor 10 k. w. plus the number of watts required to make up all the various items of lost power. Though the armatures are of equal resistance, and are respectively receiving and giving out (approximately) equal amounts of electric energy, the armature of the alternate current side (whether used as generator or motor) will heat more than that of the continuous current side; for it carries 1.414 times as large a current, and the ohmic heat will be proportional to the square of this, or twice that produced in the continuous current armature by the 100 amperes of working current. In each armature the heat will be developed equally in all the separate coils around the ring. As the armatures are alike, and as the similarly placed windings in each are passing through identical magnetic fields, there is no reason why one winding should not answer for both purposes. Fig. 4 shows the case in which this change has been made. One armature only is used; it is connected at one end to the commutator, at the other to the two slip rings, and the machine now becomes a simple rotary converter. The total hysteresis and eddy-current losses will obviously be now one half of their former amount. The total heating due to resistance will be also reduced, because now the single winding has to carry only the differences of the two currents—a point presently to be considered—and the ohmic losses will be less. The waste of power, in fact, is approximately halved. How far this economy of losses can be carried depends on the number of phases of the alternating current. But there is another consideration involved—the question of armature reactions and sparkless collection of current. In the combined pair of machines called a motor-dynamo the brushes on the continuous current side must be set, exact as in any continuous current machine, with a lead, negative or positive, according as whether it is operating as motor or dynamo. In the rotary converter no lead in either sense need be given to the brushes; for the armature reactions of the motor part being, in general, opposed by those in the dynamo part, they cancel one another to a large extent. This property, which is common to all those motor-generators in which there is used, whether with one winding or two, a common core in a common field, was pointed out by the author in 1888, when giving the theory of continuous current transformers.

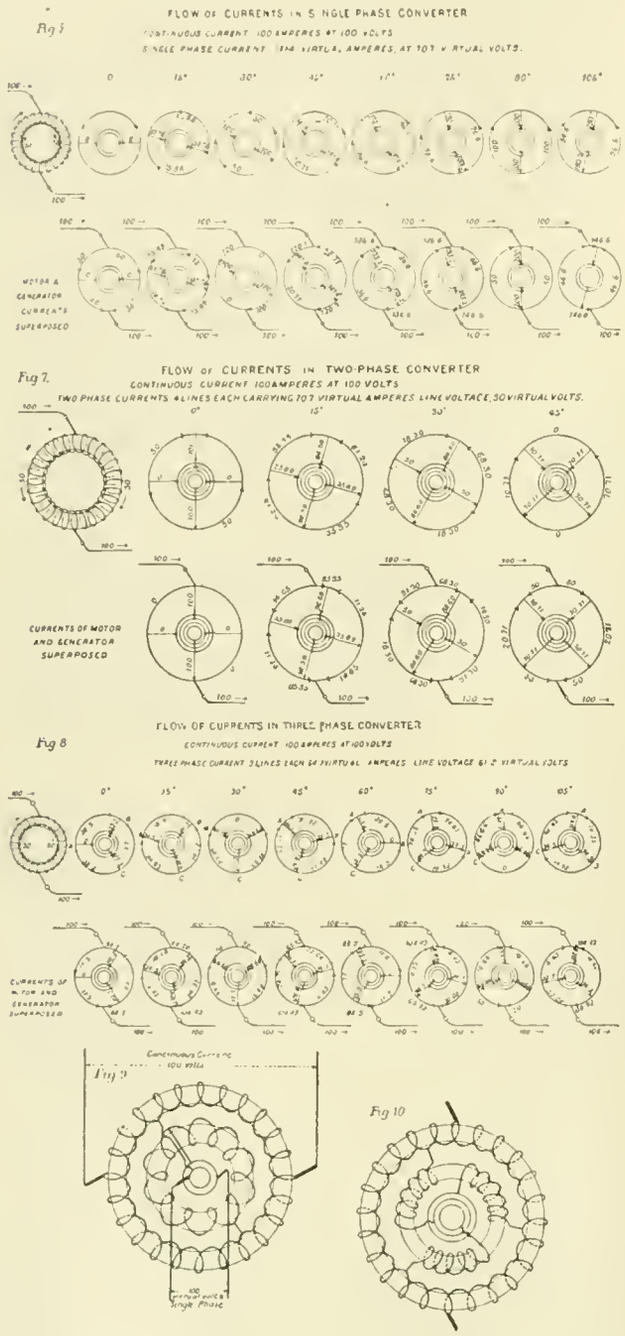
The relations between speed and field are peculiar. In the case of those grouped machines, or motor-dynamos (Fig. 3) in which each armature revolves in its own field, the conditions differ from those of the converter (Fig. 4), where there is only one field. If in either case the continuous current side is the primary (i. e., motor) side, the speed of revolution will depend on the field magnet, the weakening of which will increase the speed. The frequency of the secondary or alternating current will in that case also vary. But the ratio of the primary and secondary voltages will be independent of speed if the speeds are alike, or if only one common field is used. The secondary voltage cannot be varied, while the primary voltage is kept constant, unless separate fields and separate windings are employed, as in Fig. 3.

If, on the other hand, the alternating current side is used as primary, then the machine, whether motor-dynamo or converter, runs as a synchronous motor with a fixed speed. In that case the voltage ratio remains also nearly a constant, even though the excitation of the field is increased or diminished, owing to the peculiar phase relations which take place, as is known, in the currents of synchronous motors when under-excited or over-excited. This question, and the expediency of exciting in series or in shunt from the continuous current side, or of running without excitation, has been discussed by E. J. Berg, in the "American Electrician," for February, 1897.

Returning to the question how the current in the armature of the converter gets through the windings, it will be found that a simple means of answering it is afforded by the principle of the superposition of instantaneous values of currents. Still taking as a concrete case the 10-k. w. converter of Fig. 3, we may calculate out the instantaneous values of the currents in its windings at different epochs in its period of rotation. If we do this for the motor currents and for the generator currents separately, and then superpose them, we shall obtain a number of instantaneous values for the combined armature as converter. This has been done in the series of drawings in Fig. 5. If the continuous current acts as motor taking 100 amperes, there will be 50 amperes flowing in each half of the winding at every instant—qua motor—in a direction opposing the e. m. f. in the winding. This is shown in the first diagram in the upper row of Fig. 5. As single-phase generator the armature is working, as already described, with a virtual voltage of 70.7 volts, and an output (supposing the power-factor = 1) of 141.4 virtual amperes. The maximum current will be $141.4 \times 1.414 = 200$ amperes: and this will be attained at the instant when the two conductors which lead down the winding to the slip rings are turned to the position of 90° to the axis joining the middles of the pole-faces. The eight diagrams which follow in the top row of Fig. 5 exhibit the successive values of the currents flowing in the armature in positions differing successively by 15°. By supposing these eight diagrams successively superposed upon the motor diagram which precedes them, we obtain the eight diagrams of the lower row, which exhibit the currents actually flowing in the different parts at the particular times when the armature has the position shown.

Examination of these diagrams shows several interesting points. At the instant when the alternating current is reversing, and has

zero value (at position 0°), the armature is operating simply as a motor with 50 amperes in each half of the winding, and is being accelerated. At the 90° position, when the alternating current is at its maximum (200 amperes), the armature is operating wholly as a generator, and with an equal current of 50 amperes in each half of the winding, and the acceleration is negative. The armature is thus adding 100 amperes to the 100 amperes coming in from the primary mains. Nothing has here been allowed for the extra power needed to make up for the frictional and other losses. Suppose that an additional 4 amperes were needed for this, making 104 amperes as the motor current; in position 0° the two downward currents would be 52 each instead of 50, increasing the positive acceleration;



in position 90° the upward currents would be 48 instead of 50, decreasing the negative acceleration. The output current at that instant would still be 200, being made up of 104 incoming plus 96 generated in the windings.

On further examining these diagrams it will be seen that the currents in the armature windings consist of a set of four currents, each in position 0° being 50 amperes. But as the armature turns these change. They increase in the two arcs that are shortening as the points where the slip-ring connectors approach toward the positions occupied by the commutating brushes. But in the two other arcs that are lengthening, the currents first decrease to zero, then increase again to 50. Further, the individual coils in different parts of the ring winding have very different currents to carry. A coil that is midway along the winding between the two connectors has to carry never more than 50 amperes. Four times in each revolution it carries 50, and four times it carries 0 amperes, with values intermediate in intermediate positions. (This will obviously set up four armature reactions in each period.) But a coil that is situated next to either of the two connectors has to carry a current which, when it is closed to the brush position, rises to a maximum of 150 amperes, and changes abruptly to 50 in passing the brush; rising thus gradually twice to 150, or else rising twice abruptly from 50 to 150, and being zero twice in one revolution. The necessary consequence of this is that the coils which are close to the slip-ring connectors are much more heated than those which lie midway along the periphery beween the connectors. The distribution of the heating is here quite different from that which would obtain in either armature of the motor-dynamo machine (Fig. 3). This unequally distributed heating effect is in total somewhat greater than that in the same armature if used purely as a continuous motor or generator, but is less than the total heating effect (if equal power) is used purely as single phase generator or motor; the ratios of the heating being as 1 : 1.366 : 2 in the three cases. Or, if we consider the output of an armature to be limited by equal heating effects, the several outputs which would give equal total heating in the same armature would be: As continuous current generator or motor only, 100 k. w.; as single-phase generator or motor only, 50; as single-phase converter, 85 k. w. Fig. 6 exhibits this unequal heating effect in the case of a single-phase converter. The first line represents graphically by the outline diagram the varying current (irrespective of direction) which a coil midway between the connectors will carry in one revolution; and the outline curve of the darkened area within it is drawn with ordinates squared so as to be proportional to the heating effect at different instants. The total area blackened represents the total heating effect in that coil. The second line represents similarly the current and heating for a coil 30° farther towards the connector. The third line represents current and heating for a coil 60° farther; whilst the fourth line represents similarly the current and heating in a coil that is next to the connector. The relative heatings in these four coils are about in the proportions 10, 21, 50, 86. The curves in the fifth line depict the case of one of the coils next to a connector when there is, in consequence of self-induction in the circuit, a lag of 30° in the phase of the current. The result of such phase-difference is an increase of heating for the whole armature, but an extra increase for those coils which are near the connectors.

We may now pause to consider what differences will be made in the preceding considerations if the distribution of the magnetic flux around the periphery of the armature does not follow a sine law. It will be noticed that when any arc of the winding (and this applies to two-phase and three-phase cases) lying between two slip-ring connectors is acting as generator, it produces its greatest e. m. f. when its mid-point is passing the mid-point of any pole. Hence, if the poles are narrowed so as to concentrate the field, even though the average e. m. f. for continuous current purposes remains unchanged, the root mean square value of the e. m. f. will be increased, and the curve of induced e. m. f.'s will be more peaked than a sine curve. If the machine is being used to convert continuous current into alternating, the effect will be to raise the relative alternating voltage and lower the relative alternating current, and on a non-inductive circuit the current also will have a more peaked curve. If the machine is being used to convert alternating into continuous currents the converse result takes place, the relative value of the alternating voltage being lowered. An eight-pole conconverter at the Technical College, Finsbury, constructed in 1891 by the Allgemeine Elektricitats, of Berlin, has a curve of induction which is remarkably close to a sine curve, and its relative voltage ready referred to, gives the following tabular comparison for three for continuous and three-phase currents is practically identical with the theoretical value. Herr Friese, in the article already referred to, gives a tabular comparison (see Table V.) for three machines with ring armatures constructed by Messrs. Schuckert.

M. Hanappe has published a careful analysis of a Schuckert converter, capable of yielding alternating currents in one, two, three, four, or six phases, and suitable for laboratory experiments.

If the machine is being used to convert a single-phase current into a continuous one, the form of the impressed voltage curve, and the distribution of the flux around the periphery, are of even greater importance. The current delivered, though certainly continuous, will not be uniform, but will have a periodic fluctuation superimposed upon it by departures from the sine law. Armature reactions will, as we have seen above, impose fluctuations of a frequency double that of the primary current. Indeed, in any case the single-phase converter is a less satisfactory apparatus from several points of view than the two-phase or the three-phase converter. It has more considerable variations of armature reaction, a greater and more unequal heating, and requires a more accurate setting of the commutator brushes than the polyphase converters. Moreover, it is not self-starting from the alternate current side. Notwithstanding these disadvantages, single-phase converters are in satisfactory use—for example, several constructed by the Elektrizitats-Aktiengesellschaft (Schuckert & Co.) are in operation on the city circuit at Cologne.

TABLE V.

Nature of service.	Voltages as measured — Machine No. 1.	Machine No. 2.	Machine No. 3.	Voltage calculated.
Continuous current	100	100	100	(100)
Single-phase	71·0	71·8	—	70·7
Three-phase	61·3	62·0	61·8	61·2
Two-phase	71·0	71·8	—	70·7
Four-phase	49·8	50·7	—	50·0
Six-phase	35·0	35·8	—	35·4

A single-phase converter when standing still can act partly as a mere stationary transformer. When running at a certain speed in a field with a given number of poles it will act as a converter, converting into continuous current those currents only which come to it with a frequency corresponding to the frequency of the movement of revolving conductors past the poles. Any alternating currents or components of alternating current of any other frequency that may be superposed can affect the continuous-current output at the other side by producing superposed fluctuations.

Passing on then to the case of the two-phase converter, we may at once apply the same principle of superposition of instantaneous currents to study the flow of current through the windings. Fig. 7, which gives the corresponding series of diagrams, requires no further explanation. The generator action during one-eighth of a revolution is illustrated by the four figures on the right of the upper line. The superposed action is exhibited in the lower line. Inductive reactions and energy losses are, as before, supposed to be absent. In position 0° the converter is acting neither as motor nor as generator, the current at that instant simply running through from the commutator to the slip-rings. In the position 15° it is observed that the currents in the armature windings consist of six sets. Two short portions are carrying a motor current of 85.35 amperes each; two others of somewhat longer arc are carrying a motor current of 14.65 amperes; whilst two quadrantal parts are delivering generator currents of 11.24 amperes. On the whole, in this position the armature is acting as motor, increasing the acceleration. In the next position, at 30° the motor action has decreased. In the position at 45° the action is chiefly generator, the current in that part of the field which is strongest being at its maximum and flowing with the e. m. f. It will again be noted that the currents in those coils of the armature which lie close to any of the four connectors will be more heated than those midway along the intervening quadrants; the maximum current for the former being 100, for the latter 50. The inequality of the heating is much less, however, than in the single-phase armature. Also armature reactions are more nearly balanced throughout, and there is much less tendency to impart a periodic fluctuation to the continuous current. Such machines will be self-starting, and will give little trouble from sparking at the commutator.

Fig. 8 exhibits the flow of currents in the armature of a three-phase converter. Comparison of the successive positions will bring out several points. The current in any one of the three lines is at its maximum (on a non-inductive circuit, when generator, or when, as motor, the field has normal excitation) when the connector for that line is just passing a commutator brush; and its maximum is 1·1·3 times the continuous current. In certain positions of symmetry—for example, in position 30°—the motor and generator actions resulting from the flow are bilaterally similar. In other positions—for example, in position 0°—one side (the left here) is acting wholly as motor, the other side partly as generator and partly as motor. A coil which lies midway between two connecter ends will carry a current that has a maximum of 27 in one part of its revolution, and another maximum of 50 in another part of its revolution; there being two of each of these maxima in one revolution. A coil situated close to a connector has 133.3 as its maximum twice in each revolution, with an abrupt change to or from 16.66 just as it passes the brush. The inequality of heating of coils is less in a three-phase converter than in a single-phase, but it is greater than in a two-phase converter. The inequality of heating in the case of two-phase converters has recently been examined analytically by Messrs. Woodbridge and Child in recent numbers of the "Electrical World" (January 1 and February 12, 1898). Their paper, which is one of great skill, concludes with the interesting deduction that, assuming a power factor of unity, if such a converter is driven mechanically so as to be generating both a continuous and a two-phase current at the same time, the heating of the armature will be less than would be the case if with same output it were used as either a continuous-current generator alone or a two-phase generator alone.

Amongst Continental firms Messrs. Alioth, of Basle, have been prominent in the application of rotary converters, which they designate as "commutatrices." R. B. Ritter, one of their engineers, has kindly furnished many particulars of these machines and of their application. Articles by him on this subject have appeared in "L'Industrie Electrique" for 1896. He points out that in the application of these machines to charge accumulators from an alternating current supply, means are necessary for changing the voltage as between charge and discharge. There are several ways of meeting this need—by the use of choking coils, or of auto-transformers of variable ratio in the alternating side of the circuit, or by throwing in or out of circuit of a supplementary armature. The solution preferred by M. Ritter is the latter, a small auxiliary continuous current machine in series with the continuous current side being either mounted on the same shaft or driven by a pulley from it. The desired variations of voltage can be obtained by varying the excitation of the separate field magnet provided for this auxiliary machine.

A large 100-k. w. two-phase converter, constructed by Messrs. Alioth for Geneva, is described in the "Electrician" of January 8, 1897, with sectional drawings. This is a 14-pole ring armature machine, having an armature 1 meter in diameter, running at 385 r.p. m. As it is designed to supply continuous currents to a three-wire distribution, it is wound with two independent converter windings, each capable of supplying 450 amperes at 110 volts; and is furnished with four slip-rings, and with a commutator at each end. It has an efficiency of 90 per cent.

The problem of changing into convenient simple ratios the awkward percentage numbers which subsist between the voltages at the two sides of a converter has engaged the attention of several engineers. Mr. Heldt has described an ingenious method of obtaining any desired ratio by the device of including on the alternating current side additional windings between the slip-rings and the points where these rings are connected up to the armature winding proper. Fig. 9 illustrates the case of a single-phase converter. Here auxiliary windings (in two parallel circuits) are joined in so as to bring up the 70.7 volts on the alternating side to 100 volts, so as to make the voltages alike at both sides of the machine. To adapt this suggestion to the case of a three-phase converter, three sets of auxiliary windings must be intercalated between the three slip rings and the points of connection to the ring winding; these auxiliary windings being chosen, as to number and position, so as to add the desired supplementary voltage. It will be seen that this is equivalent to using a mixed star and delta winding; the delta part being that which alone constitutes the true converter winding. It is uniformly distributed around the core, and is symmetrically connected to the commutator.

(To be continued.)

IN THE POWER HOUSE

This department is devoted to the construction and operation of electric railway power houses. Correspondence from practical men is specially invited. Both the users and makers of power house appliances are expected to give their views and experiences on subjects within the range of the department.

In the REVIEW for October last was a brief description of the chimney of the Omaha & Grant Smelter, at Denver, Col., the highest chimney in America. This chimney is 352 ft. 7 in. from the stone table at the ground to the cap at the top; it is 33 ft. square at the base, with a 16-ft. flue. This chimney must now take second place, yielding the first to the stack of the power house of the Metropolitan Street Railway Company of New York.

The Metropolitan chimney has recently been completed and is 353 ft. high. At the base it is 55 ft. square; 80 ft. from the ground it is 38 ft. 10 in. in diameter and at the base of the neck 26 ft. 10 in. The flue is of the uniform diameter of 22 ft. The cap is of cast iron in 40 segments. On the outer edge of the cap are erected 10 lighting rods which are connected with two rods carried down the north and south sides of the chimney.

There were 3,400,000 brick used in the construction. The estimated weight is 8,540 tons. The foundations rest on 1,300 wooden piles driven to an average depth of 37 ft.

* * *

In discussing mechanical draft and its advantages an engineer recently made the following estimates as to what might be saved in a plant that with chimney draft would require 1,600 nominal boiler horse-power:

By omission of chimney and damper regulation, ...	$5,800
By reducing the boilers necessary from 8 to 7,.....	4,125
By saving in space occupied by chimney, ...	990
By saving in space occupied by boiler omitted, ...	960
Total	$11,875

This would make a reduction in the fixed charges of $831 or $890 per annum, according as the aggregate of interest, taxes and insurance is taken at 7 or 7½ per cent per annum.

Doubtless there are many plants so situated that this estimate of the saving effected by induced draft would be considered high. If the cost of land is low, $1,950 is too much to credit to the space that would be occupied by an extra boiler and a chimney. And for various reasons it might not be desirable to reduce the number of boilers, which reduces the estimated saving of the induced draft to the first item only, $5,800. This is $406 per annum at 7 per cent and $435 at 7½ per cent.

The Cincinnati Street Railway Company has recently made some important changes in its Depot street power station, and one of them has been the substitution of natural for induced draft, as it was found that the coal required to drive the fan engines for the latter system would pay for the chimney in a short time. The new stack is of steel, 175 ft. high, with a 12-ft. flue.

The company has installed a new 26 and 42 by 42-in. McIntosh & Seymour non-condensing engine, which is directly connected to an 850-k. w., 12-pole G. E. generator. The engine is similar to one which has been in service several years driving an 800-k. w. generator.

* * *

INGENIOUS PATCH FOR A LEAKY TUBE.

Charles J. Mason of Brooklyn, N. Y., described in a recent number of "Home Study" the method employed by him to make tight a leaky boiler tube. The boiler was rated at 250 h. p. and carried a working pressure of about 90 lbs. per sq. in. The leak was at the back end in a tube in the fifth row from the bottom, marked A in Fig. 1. The tube was 4 in. in diameter, and the leak proved to be due to a hole about as large as a needle point near the sectional box in which the tube ends were expanded. As it was not wished to condemn the tube for this small leak, a section 6 in. long was cut from an old tube and split in two lengthwise. The two pieces were bent slightly to conform to the curvature of the inside of the tubs and the edges filed to a taper of ⅜ in. to the foot. After smearing the tube with a thick paste made of red lead and boiled linseed oil,

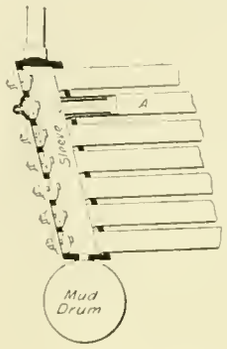


FIG. 1.

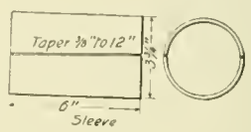


FIG. 2.

FIG. 3.

the lower tapered piece was put in place and the upper one driven home with a hand hammer. The boiler proved tight when tested under 150 lbs. hydraulic pressure and has remained tight ever since.

* * *

SOME COOLING TOWER DATA.

At the last meeting of the American Society of Mechanical Engineers, J. H. Vail presented a paper in which he described a cooling tower and condenser installation made under his direction. The power plant was an electric light station equipped with 27 boilers, 48 in. in diameter, 20 ft. long, with 22 5-in. tubes. These boilers were set in pairs to furnaces having grates 8 ft. 6 in. by 5 ft.; the odd boiler was set to a single furnace. The engine capacity and the station load already taxed the boilers to the limit of their capacity. The author made tests which showed the boilers to be each able to make 4,281 lbs. of steam per hour from a feed water temperature of 206.5° F. and at a steam pressure of 97.4 lbs.

After making tests it was recommended that one 18½ by 30 in. Buckeye simple engine be transformed into a 14½ and 25 by 30 in. tandem compound condensing engine; that an additional 750-h. p. tandem compound condensing engine be installed; that a cooling tower and the necessary condensing apparatus be installed, and that no change be made in the boilers save to raise the working pressure.

After investigation the Barnard type of cooling tower was selected as desirable to best meet the conditions existing at this plant, which were, minimum floor space and minimum weight, and a considerable elevation above floor level of engine room.

The cooling tower is of the twin type, having two chambers, with a pair of fans supplying a strong draft of air to each chamber. The interior dimensions are 12 ft. 3 in. by 18 ft. by 29 ft. 6 in. high. The shell of the tower is of steel, 3-16 and ¼ in. plates, reinforced with angle and channel irons.

The hot water from the condenser discharge is delivered through a 10-in. wrought-iron pipe, extending the whole length of each chamber, slotted on top and perforated at the bottom, giving equal distribution to a series of 96 distributing pipes extending across the tower, each pipe being slotted and perforated, thus insuring a very uniform distribution of water.

Means are provided for cleaning these pipes, which is found necessary in cold weather, when the cylinder oil from the exhaust

COST OF POWER FOR ELECTRIC RAILWAYS.

Output Measured by Wattmeter in Each Case.

Station.	Month.	Monthly Output, Kilowatt-Hours.	Cost of Electrical Output per Kilowatt-Hour Cents. Fuel.	Labor	Supplies, Oil, Waste, etc.	Water.	Repairs.	Total.	Gals. Cylinder Oil per 10,000 k. w. h.	Gals. Lubric't-ing Oil per 10,000 k. w. h.	Lbs. Water per Lb. Coal.	Lbs. Fuel per k.w.h.	Price of Fuel per Ton of 2,000 Lbs.	Kind of Fuel
1.	Sept.	1,338,306	.301	.168	.038	.029	.018	.554	4.39	1.22	9.40	2.87	2.10	Bituminous
3.	"	188,587	.479	.301	.053	.009	.010	.852	5.79	2.66	.....	.	2.13	"
4.	"	277,120	.387	.228	.034	.007	.054	710	4.4	4.3	.....	3.58	2.16	"
5. Metropolitan Elevated, Chicago.	"	1,538,109	.280	.150	.020	.020	.020	.490	5.5	1.8	5.6	3.3	1.70	"
8.	"	931,804	.394	.224	.066	.....	.029	.703	.....	.....	.....	...	...	
9.	"	271,995	.457	.353	.090	.....	.074	.974	.....	.....	.....	...	...	
10 Central Av., Metropolitan, Kansas City, Mo.	"	330,797	.310	.135	.003	.004	.029	.486*	1.52	3.21	.....	5.0	1.24	Bituminous slack.

*Miscellaneous, .005.

steam is liable to clog the pipes and interfere with uniform and free distribution of the water.

The hot water falls from the distributing pipes over 42 galvanized wire mats, made of No. 19 steel wire, woven to No. 5 mesh. Each mat is 12 ft. by 15 ft. 6 in., affording a total of 8,064 sq. ft. of cooling surface. Each mat is suspended by galvanized iron hooks and is easily removed for cleaning or repairs. In actual service it is found that the water is uniformly distributed.

The circulation of air is furnished by two pairs of 8-ft. diameter fans, each pair of fans being mounted right and left on a 2 15-16-in. shaft, and the four fans being capable of delivering 360,000 cu. ft. of air per minute when driven at a speed of 150 r. p. m. The air entering the tower chambers at the lower section is deflected vertically from each fan, thus avoiding cross currents, and affording a uniform blast through and between the mats.

The rated capacity of each section of this cooling tower is to cool the circulating water needed to condense 12,500 lbs. of exhaust steam, from an initial temperature of 132° F. to 80° F. when the atmospheric temperature does not exceed 75° F., nor the humidity 85 per cent.

The circulating water is handled by a Blake vertical twin air pump and jet condenser.

In an equipment of this kind it is important to have facilities for driving the fans at variable speeds; this requisite flexibility has been obtained by using a small vertical engine without a governor direct connected to the shaft of each pair of fans.

From the log book the following data as to the performance of the tower were given:

	1898. Jan. 31.	Feb.	June 29	July.	Aug 26	Nov 4.
Time	9 P M	8 P.M.	8 P M	8 P M	8 P M	5 35
Temperature atmosphere	30	36	78	96°	85	59
" condenser discharge to cooling tower	110°	110	120°	130°	118°	129°
Temperature condenser suction returned from tower to tank	65°	84°	81°	93°	88°	92°
Degrees of heat extracted through tower	45°	26	36°	37°	30°	37°
Speed of fans at tower, R. P. M.	36	0	145	162	150	148
Vacuum at condenser	25¼	26	25	24¾	25¼	25
Strokes of condenser pump	30	30	37	44	43	28
Lbs. boiler pressure	110	110	120	120	120	112
Temperature boiler feed	212°	212°	210°	211°	213°	213°

The Buckeye engine when converted showed the following output:

Revolutions, 137; steam pressure, 113 lbs.; mean effective pressure, 50.16 lbs.; vacuum per gage, 26 in.; h. p. developed in high pressure cylinder, 163.42; h. p. developed in low-pressure cylinder, 168.48—total, 331.9 h. p., and of this 90.52 h. p. was below atmospheric line. The work was divided almost equally between the high-pressure and low-pressure cylinders; all cards showed similar results.

The usual work required from the cooling tower and condenser varies from 7 to 17 hours per day. A notable record was made on August 2, 1898, when the run was from 7 a. m. till 12 midnight, and from the daily records, the following data are extracted:

	Maximum	Minimum.
Temperature atmosphere	103	83
Temperature, condenser discharge to tower	128	106°
Temperature, condenser suction	98°	91°
Degrees of heat extracted, through tower	32	21
Speed of fans, r. p. m.	160	140
Vacuum at condenser	26	20
Strokes of condenser pump	50	38
Pounds boiler pressure	121	100
Temperature, boiler feed	212°	200
Engine, h. p. developed	900	400

A continuous heavy load was carried during the entire 17 hours' run. This was not a test record, but simply daily service.

Indicator diagrams, November 5, 1898, from the 20 and 36x42 tandem compound condensing Corliss engine, gave the following:

Engine revolutions	120 p. m.
Steam pressure	112 lbs.
Vacuum at condenser	25 in.
Work done in high-pressure cylinder	311.8 h. p.
And in low-pressure cylinder	31.5 h. p.
	643.3 h. p.
Work done in low-pressure cylinder below atmospheric line	185.1 h. p.

Simultaneously with the engine, the pump and fan engines were indicated. The cards showed:

Work done by the pump	13.75 h. p.
Work done by the fan engines	13.5 h. p.
Total external work	27.25 h.p.

which if deducted from the work done below atmospheric line in low-pressure cylinder 185.1 h. p. leaves a net gain of 157.85 h. p. from the use of the condenser and cooling tower.

It will be noticed from the previous data that the feed water shows a temperature above 200° F. There are two feed-water heaters in connection with the condensing plant. First, an intermediate tubular heater in the line of exhaust between low-pressure cylinders and condenser. Second, an auxiliary feed-water heater was also attached, receiving the exhaust from the condenser and boiler feed pumps, and any other auxiliaries.

The feed water is first heated in a tank that receives the exhaust from the general line of high-pressure engines. The feed water then passes through the intermediate heater, and thence through the auxiliary heater, and reaches the boiler at a temperature of upwards 200° F.

The condensing plant has increased the station capacity about 1,000 h. p. with the aid of a condensing system, using the same water in continuous circulation, while the boiler plant, previously stated to be fully loaded, supplies steam for this additional work with boilers to spare.

SCHLICHT PROCESS OF COMBUSTION.

In a paper recently read before the Franklin Institute, Paul J. Schlicht described the method which he has invented for supplying air to furnaces by drawing it down the chimney. A brief mention of the advantages claimed for this process was made in the REVIEW for April, 1898, page 222. Mr. Schlicht said in part: "The invention is based upon the fact, which I have discovered, that if a current of air is properly introduced into a chimney or flue through which hot products of combustion are escaping, the air current will flow in a direction contrary thereto, and, becoming heated in its contact therewith, will reach the sphere of combustion in a condition highly favorable to the union of its oxygen with all the combustible elements of the fuel.

"In stoves, house furnaces and other slow combustion apparatus, all of the air for combustion is supplied on the top of the bed of fuel. In industrial furnaces the desired rate of combustion determines the quantity of air to be admitted below the bed of fuel in addition to air supply on top.

"In some instances the best results are obtained by closing, or nearly closing, the ash pit door. In other instances, when a high rate of combustion is necessary, the resistance offered by the bed of fuel and the air pressure downward through the chimney or flue so reduces the air pressure ordinarily exerted through the open ash pit doors that no appreciably large air supply is furnished upward through the bed of fuel, but it is given a double air supply most favorable to high efficiencies.

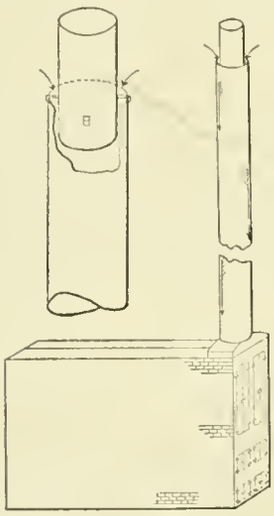


FIG. 1.

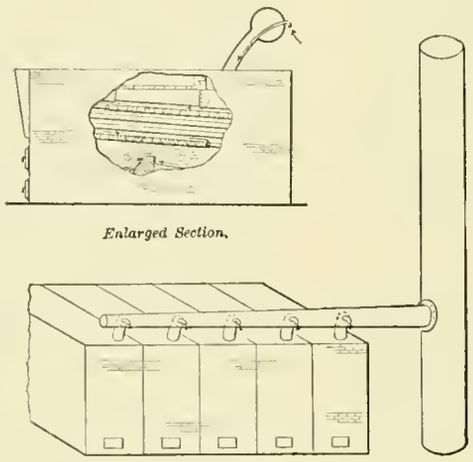


FIG. 2.

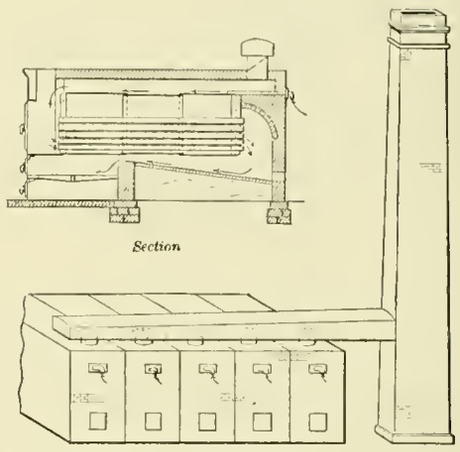


FIG. 3.

"In the ordinary process, combustion is most active over the grate bars, but its uniformity is constantly interfered with by the varying thickness of the bed of fuel and the gradual accumulation of ashes. In stoves and house-furnaces the losses from the escape of carbon-monoxide and other combustible gases up the chimney, in very large quantities, is the result of feeding the air for combustion upward under the grate bars, and through the bed of fuel. In industrial furnaces this upward draft generally results in the feeding of an excessive air supply, the losses due to which are known to those who have made a special study of the subject, and are now beginning to receive the attention they deserve by engineers generally. I will not refer to the breaking up of carbon-dioxide, about which much might be said.

"I believe that the most common sources of waste in industrial furnaces when the fuel is high in fixed carbon, are those due to excessive air supply and to the non-transmission of a portion of the heat of the gases through the boiler plates, the rate of flow of the gases being more rapid than the rate of transmission through such plates. I effectually prevent such wastes in plants favorable to the proper application of my invention, besides bringing back waste heat to the combustion chamber. When the fuel is high in volatile matter, the additional gains by my system are very large. I have realized gains as high as 40 per cent in well-designed plants burning such fuels. This latter gain was made at a plant where evaporative tests of two weeks' duration were confirmed by months of subsequent use of the system.

"In industrial furnaces, where the draft has been insufficient to economically burn the smaller sizes of anthracite coals, I have realized large gains with my process in the burning of these cheaper fuels, burning them either alone or mixed with soft coal. I am well aware that with high chimneys and forced draft this can be done successfully, but I maintain that it can, in most cases, be done on a smaller investment and with a less deterioration of the boiler-plant and greater economy by my system. Another great source of gain that has been realized with my process of combustion is the less frequent cleaning of boiler-furnace fires. At one large plant which had been run with the closest regard to economy, the services of two men were easily dispensed with.

"One of the boiler-plants of the Barber Asphalt Paving Company, of Long Island City (See Fig. 1) typifies the conditions most favorable to the application of my invention at the top of the chimney of industrial boiler furnaces. Here the combustion products enter the chimney immediately after leaving the sphere of useful work, and its height and diameter are properly proportioned to the grate surface and to the quantity of coal burned per sq. ft. of grate. If there were a separate chimney to each furnace, the results would be even more favorable, as the current of the combustion products from one boiler interferes somewhat with the current of combustion products from the other. If a less quantity of coal be burned per sq. ft. of grate in one furnace than in the other, the quantity of air flowing into the combustion chamber will be proportionate to the combustion taking place therein. For example, if twice the amount of coal is being burned in one furnace than in the other, approximately twice the quantity of air will automatically flow to the combustion chamber of that furnace.

"These two boilers are return tubular. For a part of the day the plant is run below and for the other portion, far beyond its rated capacity. It is while burning the largest amount of coal per sq. ft. of grate surface that the largest economy is effected. Evaporative tests with these boilers show the following results with "Sonman" bituminous coal:

	Without Schlicht Process.	With Schlicht Process.
Pounds water from and at 212° per pound	10.79	12.96 and 12.68
Horse-power developed	166	188 and 172

"A test made to determine the efficiency of process with reference to time required to melt 250,000 lbs. of crude asphalt showed: without Schlicht process, 20 hours; with Schlicht process, 17 hours, and requiring a consumption of 8¾ per cent less coal. The amount of work done at this plant was greatly in excess of that done in previous evaporative tests. There are also Babcock & Wilcox's boilers at this plant, the equipment of which is at top of chimney.

"Evaporative tests were made at a brewery where this process

is in use, and showed variations with the rate of combustion. My compensation for the application of the process was determined by the lower cost for coal of each barrel of beer. From returns made by the brewing company, the cost of coal per barrel of beer up to June 1, 1898, for the previous year was $0.0695, while previous to installation of the invention the cost of coal per barrel of beer was $0.0855. This difference represents a saving of $0.016 per barrel of beer. In these calculations the price of coal was made the same for both years, although the market price was less for the last year.

"About this time the German Patent Office, doubting the statement in my application for a patent that I could cause air to flow down a chimney in contact with products of combustion escaping therefrom, requested me to furnish affidavits of reliable experts in corroboration of this fact. Accompanied by Professor Greenleaf, formerly of Columbia College, and John J. Powers, I secured evidence of this fact in a very simple manner. Pieces of tissue paper were strung upon a string with a piece of wood fastened at its lower end. The string was let down the chimney close to its side and the papers strung upon it were drawn down in the manner that pieces of paper on a kite string are carried to the kite, known to boys as telegraphing to the kite.

Fig. 2 shows the application of the device to the boiler plant of Fleischman & Co. at Blissville, Long Island, and Fig. 3 to the plant of the New York Quinine & Chemical Works. At the former plant the evaporation was increased from 11.08 to 12.19 lbs. of water from and at 212° per lb. of coal.

THIRD AVENUE, NEW YORK, CONTRACT.

It is announced that the contract for equipping the underground conduit system of the Third Avenue Railroad, of New York, was let December 15, to the Westinghouse Electric & Manufacturing Company. The Westinghouse Company is to furnish the power-house equipment as well as the motors and controllers. The plans call for a power-house, to be located at 216th street, with a capacity of 64,000 h. p. It is understood that of the electrical apparatus one-half will be made in Pittsburg and the other half at the works of the Walker company in Cleveland. The engines are to be built in Pittsburg. This is a $5,000,000 contract and the Westinghouse Company has our heartiest congratulation on securing it. The Third Avenue Railroad will have no reason for regret as "the name of Westinghouse is a guarantee."

The breaking of a shaft in the power house of the Chippewa Electric Railway Company, Eau Claire, Wis., on December 16, caused a delay on that line and also on the Eau Claire-Chippewa Falls interurban.

A heavy overload caused an armature in the power house of the South Bend (Ind.) Electric Company, to burn out on December 14. A new Westinghouse machine recently ordered was in the freight yard, so that only a short delay ensued.

STREET RAILWAYS IN ATCHISON, KANSAS.

The Atchison Railway, Light & Power Company furnishes gas and electricity for lighting, transportation and power purposes in that city. In addition the company will put in a steam heating plant this coming year to utilize the exhaust steam. The corporation is a progressive one and lets no opportunity slip to enlarge its field of usefulness.

The company has been operating its cars for a little more than four years, the first car having been started on Thanksgiving day, 1894. From this time on Atchison has been a wide-awake, progressive city. While the electric line was talked about for years, it was really built and equipped in a very short time; the work was practically done in six weeks. The power house had been constructed and the boilers set in position nearly a year before. Then came the panic, and it was not until October 14, 1894, that Messrs. Waggener and Hetherington, local capitalists, decided to back the enterprise with their own money, and ordered J. A. Bendure, then superintendent of construction, to proceed in all possible haste with the work. They were incredulous when he said he would have the work completed by Thanksgiving, but he did. The haste was due to certain contracts for electric lighting conditional upon the completion and operation of six miles of electric railway by December, 1. From October 14 to November 29 all the material and the cars were purchased, the track laid, the engines and dynamos placed in position and the overhead wiring completed, to say nothing of the work done on the lighting plant, which was to be operated in connection with the railway.

FIG. 1. POWER STATION AND CAR BARN AT ATCHISON, KAS. FIG. 2.

FIG. 3. ENGINE ROOM.

At the start the enterprise was pretty much of a speculation, for then Atchison had a population no greater than 15,000, and there

was sharp competition in the lighting business with an older company. Rates were cut to such an extent that there were no profits left and then a consolidation was effected. Low rates prevailed even after the combination and as a consequence there are more than 16,000 incandescent lamps in use in the city. The plants of the two companies were combined. The exterior views of the new power-house and car barn are shown in Figs. 1 and 2. The company operates 16 cars, eight of which are trailers, on 8½ miles of

FIG. 4. PIT IN CAR BARN.

track. Two of the motor cars are 10-bench open cars, 27 ft. long; two are 18-ft. closed cars with vestibules, and four are 16-ft. closed vestibuled cars. Each car is equipped with two 25-h. p. motors, the closed cars having steel motors, made by the Johnson Company, with series-parallel steel controllers. These motors have been in service for four years without a single one having burnt out, which in part is due to the excellent system of inspection and shop practice of the general manager, J. A. Bendure. Electric heaters, made by the Consolidated Car Heating Company, keep the cars comfortable in winter.

The traffic not being especially heavy, 45-lb. rails in 30-ft. lengths are used. They are laid on 5x7 in. by 7 ft. oak ties spaced 2 ft. between centers. On the different lines of the company there are nine grades, the maximum being 10 per cent; 18 curves, with radii

FIG. 5. MACHINE SHOP.

ranging from 80 to 90 ft., and five switches. No. 0 trolley wire has been strung and is reinforced by one mile of No. 0000 and half mile of No. 00 feeders. The poles are spaced at intervals of 100 to 125 ft., 500 of them being cedar poles, 7-in. tops, for side suspension, and 30 are iron poles.

The power station occupies a site 90x100 ft. and contains electrical machinery for supplying current to the street railways, arc and incandescent lamps and for motor power. There are two generators for street railway purposes, one of 100 k. w. and the other of 200 k. w. capacity, and one 90-k. w. dynamo is run for commercial power. The three arc light machines are capable of lighting 225 lamps.

FIG. 6. WHEEL PRESS.

The four incandescent machines have a combined capacity of 385 k. w. On the left in Fig. 3 may be seen one of the engines driving several lighting machines, and on the right is an engine driving several railway generators.

The boiler plant consists of two 80-h. p. and four 125-h. p. Freeman boilers furnishing steam at 100 lbs. pressure. The feed water passes through Hoppes and Excelsior feed water heaters before being pumped into the boilers. The engines comprise one 100-h. p. Ball automatic speed engine, one 300-h. p. Hamilton Corliss, one 300 and one 350-h. p. Sioux City Corliss.

The car barns and shops are combined in one brick building 130 ft. long, the shop occupying a space 40x40 ft. The facilities for repairs and construction work are unusually good for so small a road. All the frogs and switches are made in the shops, the Bryant cold metal saw, made by the Q & C Company, being used for this purpose. A Shafer wheel press of 125 tons capacity, a McCabe double lathe, with 24 and 40-in. clutch, and a Barnes 30-in. back geared drill press are the other large tools in the shop. A Buffalo forge furnishes air for the blacksmith shop. The next three illustrations are views of the repair shop in the car barn. In Fig. 4 is shown a motor car truck over the pit for repairs. The armature

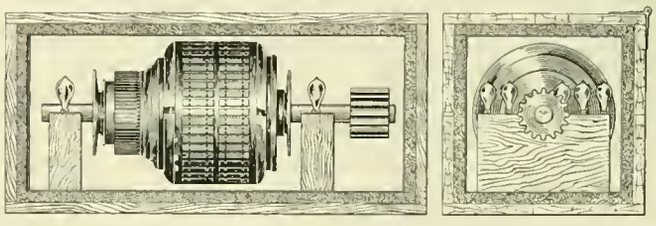


FIG. 7.—ARMATURE BAKING OVEN.

from one of the motors is being lifted from the case. The machine tools and wheel press are illustrated in Figs. 5 and 6.

General Superintendent Bendure has constructed an armature baking oven which is simple and inexpensive in construction, but serves the purpose very well. The end and side views of the interior of the oven give a good idea of its construction. The oven consists of a box in which one of the car motors was shipped, lined

with tin and about 1 in. thickness of asbestos between the wood and tin. The box is 17 in. wide, 17 in. deep and 3 ft. 3 in. long inside.

The armature rests on two end bearings. On each of the wooden blocks is a five-lamp circuit, and these furnish the heat for drying. After the armature is in place the oven is closed so that it is practically air tight and all the incandescent lamps are turned on. When the interior of the box is thoroughly heated one circuit is cut out, the other being sufficient to dry the armature. The oven does its work quickly and at small expense.

It is generally conceded that Atchison has an unusually good street railway system for so small a city. The Atchison Railway, Light & Power Company has not only given an impetus to the growth of the town, but has paid out for labor, so far this year, the sum of $28,951.26, and has employed an average of 72 persons. The company uses 250 cars of coal annually. Another item of interest is that the company has 100,000 lbs. of copper wire in the streets of Atchison, all of which cost at least 14 cents a pound.

The Atchison Railway, Light & Power Company has a capital stock of $300,000. Its officers are J. P. Pomeroy, president; W. P. Waggener, vice president; C. S. Hetherington, treasurer; J. A. Bendure, superintendent; J. P. Brown, George Storch and B. P. Waggener, directors.

THE RELATION OF THE STREET RAILWAY TO THE PUBLIC.

BY JAMES F. LARDNER.

The following is extracted from a paper on "Transportation in Cities," read before the Contemporary Club by Mr. Lardner, secretary, treasurer and general manager of the Tri-City Railway Company of Davenport, Ia. The first portion of the paper was devoted to a brief history of street railways, then followed the discussion of the relation to the public, and the concluding portion was upon the municipalization of street railways.

In considering the wonderful and rapid growth of the street railway since its first introduction to the public, let us examine into it in the light of its relation to the public. The great successes achieved by the promoters and owners of street railway enterprises, and the immense amounts of capital invested in these properties, have attracted the attention of the public to them at this time, when they have reached what might be termed the acme of their success in meeting the demand of the people for rapid transit. Much of the private capital invested in street railways has yielded fair returns, some of it large returns; but many millions have been entirely lost to the investors, in costly experiments in endeavoring to arrive at the solution of the problem of rapid transit. The time is now at hand when the original franchises of the street railway companies in America are beginning to expire, and considerable discussion is indulged in as to the conditions under which renewals of franchises shall be granted. There are many and varied shades of opinion on this question. It must be borne in mind, in considering this matter, that the street car is no more of an intruder on a public street, and has no less legal right to use a street than a wagon or private carriage; and should not, on account of any wear or detriment it may cause the public streets, be subject to any special taxation any more than these vehicles; for the fact presents itself that, instead of wearing out paving or roadway, by the constant tramp of horses over a given surface, as in the case of the horse car, the modern car actually preserves the street from wear and tear, by transporting a large percentage of the population over its steel rails, that would otherwise be necessitated to make use of the public highways to transport themselves about, and subject such highways to consequent wear and tear.

There seems to be a grave popular misapprehension also, as to the value of street railway franchises, and the extent of street railway profits, that is not warranted by the facts. There is a general impression in some quarters that street railway corporations are receiving from municipalities exclusive rights and privileges of enormous value, for which they pay absolutely no money consideration; that in exchange for these rights they are rendering a very inadequate and unsatisfactory public service, and that their profits are consequently inordinately large, as compared with returns on other investments; and that, by a vicious system of financiering, and still more vicious method of bookkeeping, they have managed to keep their enormous profits concealed from the public. The facts do not seem to bear out these ideas. A careful investigation will show that the real value of public franchises is greatly exaggerated, and that the equivalent of money value is paid for the franchises in the shape of tax on capital stock, paving and maintenance of streets, licenses for cars, transportation of city employes and other direct expenses, in addition to regular taxes levied on real and personal property; and, as will be seen hereafter, a careful investigation does not disclose that profits on street railway investments in general are as great as they are generally supposed to be.

It is contended by some that in addition to the present requirements, in the shape of direct and indirect taxation mentioned above, there should be exacted a reduction in carrying charges, and a 3-cent fare is urged on the ground of the reduction in price of labor and all other products and commodities, with which street car fare should be made to keep in step. There are others still who urge that the profits of the street railway companies, which are so generally supposed to be fabulous, should be divided with the municipality, either in the shape of a fixed charge or a percentage of receipts or profits. There are others again who argue that the tracks and roadbed, conduits and overhead lines, should belong to the municipality, and should be leased to the railway companies, so as to put the streets, and everything in connection with or appertaining to them, under the absolute control and ownership of the city. And there are still others who go to the limit and assert that we should, in imitation of some experiments that have been made with indifferent success in Europe, secure for the municipality not only the control and ownership of all street railways, but that the municipality shall operate the street railways as well. There is a great deal to be said on all these different ideas, but let us briefly run over them in the order of their standing.

Much has been said and written in support of the statement that, "Everything has been cheapened in price, but street car fares alone remain the same." By a careful analysis of the following facts I will endeavor to show that this statement is not correct, in the light that more than twice as much accommodation and benefit is given for the 5-cent fare than formerly, and hence street car fares have actually been cheapened by more than 50 per cent. That which constitutes a ride in a street car today is certainly of twice the value as the ride of ten years ago, and the cost of operating railway companies twice as much as under the old methods and system. We have only to recall the bob-tailed horse car that dragged along wearily, badly lighted and heated, if heated at all; the rough and rocky roadway, and the short distances traversed for a 5-cent fare. Is not the public receiving more for 5 cents in the service of today than formerly, when we consider the increased facilities in the shape of extended lines, rapid transit, large and comfortable cars, well lighted and heated, more frequent service and improved roadway, and the long haul in the large cities where systems of transfer have been in operation? (Here the author quoted at some length from the data published in the REVIEW for February, 1897, showing the 5-cent street car ride of 1896, average for 28 cities, was over 3 1-3 times the 5-cent ride of 1886.)

It cannot be denied that the price of a street car ride has been reduced by giving more for the money, when above facts are taken into consideration. There can be no other reason alleged, therefore, for a reduction in fares, unless it can be shown that the profits of street railways are far beyond a reasonable interest on money invested. In connection with this matter we must bear in mind the enormous amount of capital expended in the last 10 years in changing over the method of operation from horse to electric power, and the accompanying necessary changes in roadbed and rolling stock; the building of large power houses; the substitution of newer and improved motors, as they were introduced from time to time, (one road I know of having changed five times in eight years); the general extension of railway systems in America to meet the demands of the public, and the consequent building up of the suburbs, which before were inaccessible, and the immense wealth added thereby to the entire city, as well as to separate individuals, who actually profited by street railway enterprise. The investment in experiment and experience in the power stations, motors, roadbed and extensions ought, in all fairness, to be entitled to a profit in view of the developments that resulted. In order to form

an idea as to the possibility of a reduction in street car fares, I secured statistics, showing the cost of hauling each passenger, including interest on bonded indebtedness, on 17 of the principal street railways of the United States.

From this table we learn that the average total cost of carrying each passenger on 17 different roads is about 3.8 cents for each person carried.

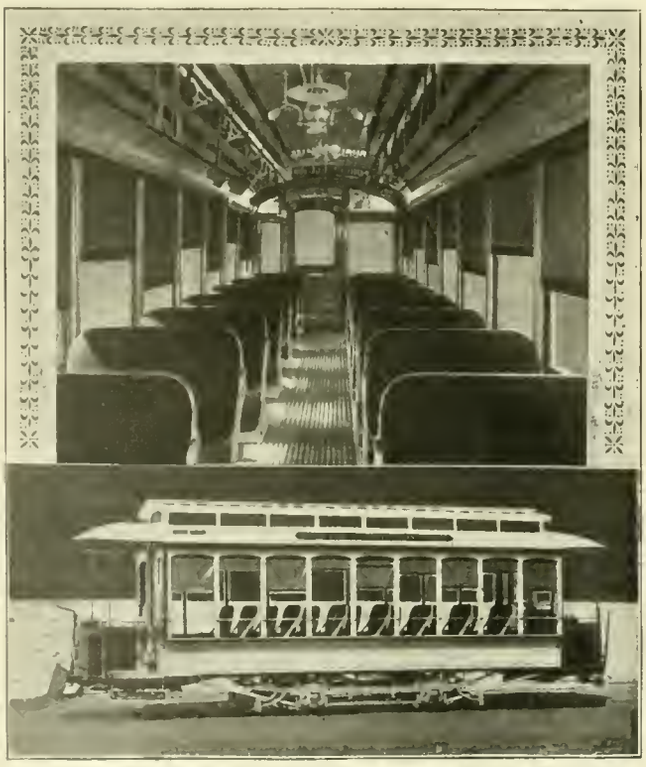
These 17 railways are among the most profitable railways in the country, and the average cost of carrying passengers is, perhaps lower, on account of the volume of business done than on most other railway systems in the country.

When we deduct from the 1.2 cents per passenger remaining, the amount required to make extensions and improvements, and the amount set aside for depreciation of property, it does not, I think, leave an excessive amount for distribution among the stockholders for interest on money invested.

From this we can easily see that the adoption of the 3-cent fare is absolutely out of the question, unless it is intended that the street railway corporations shall absolutely pay more for the privilege of hauling the public than this privilege earns; as the cost of carrying each passenger is considerably more than 3 cents, and from the above figures it is hard to see how the American public can expect to reduce the 5-cent fare and allow a fair profit to the companies operating street railways. No comparison can be made between rates of fare or carrying charges in Europe with those in this country, on account of the entirely different conditions existing here.

CAR FOR CONSOLIDATED, BALTIMORE.

The Consolidated Railway Company of Baltimore has recently purchased a large number of combination cars of the pattern shown in the accompanying illustrations. They were built by the J. G. Brill Company and are intended to give all the advantages of both open and closed cars. They have cross seats with aisles in the center and the seats are so low that when the upper panels and sash are removed, they are practically as open as any cars with side entrances, and since they are provided with longitudinal panels upon



BRILL CAR FOR CONSOLIDATED, BALTIMORE.

the sides, they possess nearly as much strength as an ordinary box car. The upper view shows the interior of the car with the sash in place, that is as the car appears for winter service; below is a view of the exterior with the sash removed for summer use.

The design is one which has given great satisfaction and is extensively used. These cars have bodies 22 ft. 11 in. long, 7 ft. wide at the sills and 7 ft. 10 in. wide at the belt rail. The length over the dasher is 30 ft. 11 in., the platforms being 4 ft. each. They were mounted on trucks furnished by the company and the under sides of the sills stand 28¼ in. from the rail: with a 12 in. riser this gives a step about 16 in. from the head of rail. The gauge of the road is 5 ft. 4½ in. The wheel base is 7 ft. and the wheels are 33 in. in diameter. There are two No. 49 Westinghouse motors used. The weight of the car complete is 18,470 lbs.; the truck without motors weighed a little more than 5,000 lbs.

There are 16 "walkover" seats 34½ in. long; at the ends of the car there are two 19 in. seats. This gives a seating capacity for 34 persons. The seats are upholstered with dark maroon plush similar to that employed on first-class steam railroads. The ceiling is of three-ply birch veneer neatly decorated; the interior finish of the cars is of cherry with cherry hand poles. The height of the car at the center inside is 8 ft. 2 in. and the height over the trolley board is 11 ft. 7 in. All the glass is set in cast rubber and held in position by moldings screwed on from the outside. The dasher is closed on one side and open on the right hand side as the car goes forward. The outside platform knee is strengthened by an angle iron bent to the shape of the knee. The trolley board extends the full length of the body. The fittings throughout are of solid bronze. There is one center lamp with sockets for three electric lights and a beveled plate glass mirror is placed at each end of the car. The buffers are of malleable iron of the company's own pattern, and the cards are fitted with the Baltimore Consolidated Railway Company's fender. Electric push buttons are provided on each post, the dry batteries for operating the platform bells being placed underneath one of the seats.

The window guards, which are a very necessary feature in a car of this type, are of ⅞ in. pipe arranged along both sides of the car. The panels and sash for closing the sides of the car are of cherry finished in the natural color of the wood; as the cars are painted a very light cream color this produces an exceedingly fine effect and the cars are among the handsomest that we have seen. It should be noticed that the doors of these cars are placed at diagonally opposite corners. When the first of this lot of cars reached Baltimore, they were very favorably commented upon by the local newspapers and apparently gave great satisfaction.

LITIGATION IN ATLANTA, GA.

The Atlanta Railway Company not long since secured franchises for a number of streets in Atlanta, including a portion of Mitchell street leading to a new viaduct. Mitchell street is already occupied by tracks of the Atlanta Consolidated Railway Company and as the Atlanta Railway Company had served notice that it would institute condemnation proceedings against the Mitchell street tracks, the Old Colony Trust Company, as trustee for some $2,000,000 of the Consolidated bonds, filed a bill in the United States circuit court praying for an injunction.

The Atlanta Railway in its answer to the bill alleges that the Old Colony Trust Company has no interest in the condemnation proceedings which authorizes it to sue, and further that the existence of the Atlanta Consolidated Railway Company is illegal, the consolidation having been effected in violation of state statutes on the subject.

COLLISION AT WORCESTER, MASS.

December 21, a collision occurred on the Worcester & Suburban Street Railway, Leicester division, that resulted in the death of two persons and the slight injury of a number of others. One car passed the switch where it should have waited to meet the car coming in the opposite direction and the two cars met at the foot of a descending grade. One car was telescoped while the other was but little injured. A fog hung over the valley, otherwise the two cars would have been in view of each other and the collision been avoided. Prior to a month before the accident a different switch had been the passing point, and the motorman at fault doubtless had the old turnout in mind when running past the proper one.

RECENT STREET RAILWAY DECISIONS.

EDITED BY J. L. ROSENBERGER, ATTORNEY AT LAW, CHICAGO.

Sufficient Designation of Company.

Sprigfield Consolidated Railway Company v. Hoeffner (Ill.), 51 N. E. Rep., 884. Oct. 24, 1898.

One of the defenses sought to be made in this case was that the party suing the street railway company for personal injuries was not shown by the testimony to have been riding upon one of its cars. This contention was based upon the fact that the plaintiff in the lower court spoke of the company as the "Consolidated Street Railway Company," and her brother-in-law spoke of it as the "Springfield Consolidated Railway," whereas its real name was the "Springfield Consolidated Railway Company." But technical accuracy as to the proof of the name of a corporation, the supreme court of Illinois holds, is not required. It says that it was a question of fact whether or not the plaintiff was a passenger upon a car of the defendant, which question was expressly submitted to the jury.

No Recovery for Breaking of Trolley Pole While Being Replaced.

Broderick v. St. Paul City Railway Company (Minn.), 77 N. W. Rep., 28. November 10, 1898.

As a general rule, a servant cannot recover damages for an injury caused by the very defect which he was employed to repair. This rule the supreme court of Minnesota applies here to a case wherein an employe, who had been engaged in helping replace certain wooden trolley poles with iron ones, and while on a ladder resting against one of the wooden poles where he had gone to fasten a block and tackle to be used in raising one of the iron poles, sustained personal injuries by reason of the wooden pole breaking off on account of its rotten condition, throwing him to the ground. The court thinks that this is a case where the servant was injured by reason of the very defect which he was employed to repair. It required no superior skill to inspect the pole and discover the defect. The employe was as well able to discover the danger, and protect himself from it, as was the foreman or the company to discover it, and protect him from it. So says the court, which adds that, in its opinion, the old wooden pole was not, as was contended, an instrumentality furnished by the master for the purpose of raising the iron pole, and of such a character that the master was liable for failure to repair that instrumentality. And for these reasons it holds that the employe was not entitled to recover damages.

No Special Consent or Authority Necessary to Construct Connecting Curve.

Kunz v. Brooklyn Heights Railroad Company (N. Y.), 54 N. Y. Supp., 187. February, 1898.

That two companies have the right to connect their tracks by a curve by agreement, Judge W. M. Smith, sitting at a special term of the supreme court of New York, Kings county, says in this just reported case, is not open to serious question, and he considers it the same where the curve is to be erected by a third company under a contract with the other two companies, a part of the consideration for which is the right for the third company to operate its cars at times over the curve and the operation of the tracks of the two companies whose tracks are thereby connected.

As the judge looks at it, if the tracks of the two companies were lawfully constructed, the curve is a necessary incident thereto, and no further consent or authority is necessary for its construction.

And the constitutional provision that "no law shall authorize the construction or operation of a street railroad except upon the condition that consents of the owners of one-half in value of the property bounded on, and the consent also of the local authorities having the control of that portion of a street or highway upon which it is proposed to construct or operate such railroad, be first obtained," which is substantially re-enacted in section 91 of the railroad law, he does not consider makes necessary new consents in the case of traffic contracts, so long as section 78 of the railroad law, a re-enactment of an enactment of 1839, makes it lawful for any railroad corporation to contract with any other railroad corporation for the use of their respective roads, and thereafter to use the same in such manner as may be prescribed by said contract

Duty Owed Person Attempting to Get on Car in Wrong Way or at Wrong Place.

Kelly v. Consolidated Traction Company (N. J.), 41 Atl. Rep., 686 November 7, 1898.

It cannot be that a carrier owes an intending passenger no duty merely because that passenger is attempting to enter the vehicle in a wrong way or at a wrong place. Such an entrance need not be anticipated; but, if seen, proper care must be exercised for the safety of the passenger, and the more precarious the situation, the greater should be the care. So says the supreme court of New Jersey.

In this case a boy 12 years of age was about to take passage on an open electric street car, having a bar across the side next to an adjoining track. Under the conductor's eye he stepped upon the foot-board at the barred side, and before he was fairly on the car was started on the conductor's signal, and the boy thrown down and injured.

Under the circumstances the court holds that the questions of the conductor's negligence and of contributory negligence in the boy were for the jury, and that a nonsuit was wrong.

It declares that it cannot say, as matter of law, that the attempt to enter an electric street car at a place where it may be seen, because of barrier or other conditions that entrance is not invited, must necessarily be negligent, even though the car is held for passengers and the attempt to enter is under the conductor's eye. It is not a reasonable anticipation that under such conditions the car will suddenly be started by the conductor's order. If in this particular case the foot-board was on edge, the boy's position on it, the court further insists, called loudly for care in the starting of the car.

In Favor of Same Crossing Rights for Electric as Steam Railways.

Stewart v. Wisconsin Central Company (U. S. C. C.), 89 Fed. Rep., 617. September 30 1898.

Here the Chippewa Valley & Electric Railway Company petitioned for an order authorizing it to construct its electric railway across the track of the Chippewa Falls & Western Railway Company, operated apparently by the receivers of the Wisconsin Central Company, which desired order the United States circuit court grants.

It was conceded at the argument that the court, having possession through its receivers of the steam railway in question, could in its discretion exercise the rights of an owner of the property, and grant to the Electric Railway Company the right to cross upon proper conditions, so that the court states that it had no need to stop to consider the interesting legal question whether the petitioner had statutory power to procure by condemnation the right to cross tracks of a railway.

While it is unquestionably true that the crossing of one railway by another at grade is necessarily accompanied with great danger to the public, to life and to property, and that crossings, at least in populous communities, should be required by law to be above or below grade, the court points out that such has not yet become the established policy of the state of Wisconsin. Nor does the court (Judges Jenkins and Bunn) perceive why that policy should be adopted with respect to electric railways when not applied to steam railways, for in the latter case the danger is much greater than in the former. The electric car can be much more speedily brought to

a stop than can cars propelled by steam; and, the court declares, that it can see no reason for enforcing so stringent a rule with respect to cars propelled by electricity, when the authorities of the state do not deem it necessary to apply it to cars propelled by steam.

Electric Railways not "Electric Power Lines."

McDermott v. Warren, Brookfield & Spencer Street Railway Company (Mass.), 51 N. E. Rep., 972. November 28, 1898.

By an amendment made in 1884, section 4 of chapter 109 of the Public Statutes of Massachusetts, which prior thereto related only to "companies for the transmission of intelligence by electricity," was extended so that its provisions allowing the assessment of damages by the selectmen in certain cases were also applied to "electric light and electric power lines." This, it was contended in this case, would take in electric street railways. But the supreme judicial court of Massachusetts holds that the legislature did not intend by the amendment of 1884 to abridge the rights of street railway companies or to affect them in any way. It says that it seems rather that companies for the production and sale of electric power or of electric light were intended to be brought within the provisions of the statute amended.

While electric railways use electric power, the court insists, they are not properly called electric power companies. Their use of power is only in their own business of maintaining and operating railways for the transportation of passengers or freight. In the same way they use electric light for the illumination of their cars, but they are not for either of these reasons electric power companies or electric light companies. They are not in the business of manufacturing or furnishing electric power or electric light for others.

For these reasons the court holds that the action of the selectmen in assessing damages, on the plaintiff's petition, against the defendant corporation, for the construction of an electric railway in the usual manner along and upon the highway opposite the plaintiff's land, was without warrant in law, and that their award was void.

Not Always Duty to Stop Car on Approaching Frightened Horse.

Terre Haute Electric Railway Company v. Yant (Ind.), 51 N. E. Rep., 732. November 2, 1898.

Upon examination of the many decisions in which railway companies have been held liable for damages occasioned by frightening horses, the appellate court of Indiana says that it will appear that the liability was held to attach on the ground of negligence when the fright has been caused by the running of the train or car in an unusual, unnecessary or improper manner, or when those in charge, seeing the injured party in imminent peril, have acted in a manner attributable only to a wanton disregard for the safety of those in peril.

Averments that a car was being run at a high rate of speed and making a great noise, and that it was run carelessly and negligently, it does not consider averments of facts showing negligence.

This will help to explain why it reverses a judgment for damages obtained in this case, on the ground that the complaint was fatally defective. It says in its criticism of the complaint that it did not appear from the averments therein that the injured party would have been able, because of the gentleness of the horse, or from any other reason ,to have controlled it, and prevented the injury, had the car been stopped before its near approach, nor that the motorman had reason to apprehend the accident that occurred. Neither did they show that he manifested a wanton disregard for the safety of the injured party, nor that he had reason to believe that such party, who was in the position which he believed the best to manage his horse, would not be able to do so.

To hold the complaint in this case sufficient, the court continues, would be to declare it to be the duty of a motorman operating a car in a lawful manner to at once stop or slacken its speed at the sight of a frightened horse on the public highway adjacent to the track, although held by his owner in a manner from which it might fairly be supposed he would be able to control him. To so hold, the court believes, would be error.

Limitations Attaching to Power to Construct a Street Railroad.

South & North Alabama Railroad Company v. Highland Avenue & Belt Railroad Company (Ala.), 24 So. Rep., 114. Decided June 16; rehearing denied November 5, 1898.

The Elyton Land Company, from and through which the Belt Railroad Company claimed to have acquired certain rights, was originally a land corporation, and had no power, prior to the act of the legislature, adopted in 1885, enlarging its powers and franchises, to construct or operate a railroad of any kind. By this act it was given the power "to build, own and operate street railroads, and use thereon cars propelled by horse, steam or other motive powers; . . . but no street railroads shall be constructed on the streets of the city of Birmingham without the consent and authority of the city council." No other powers with respect to street railroads or railroads of any kind were conferred by the act, and no express power was given to construct such railroad except upon the public streets or highways, or to condemn the property of other railroads or of individuals.

After making these explanations, the supreme court of Alabama says that the term "street railroad" is applied to "a railway passenger carrier whose road lies along and upon the streets of a city, town or village."

From this power given to a land corporation (which previously had no power to construct a railroad of any kind) to construct a street railroad, the court holds no authority can be derived to construct a freight belt railroad in and around the city, for the sole purpose of transferring freight cars to and from factories and other railroads.

If the Elyton Land Company had any power of condemnation at all, continues the court, it was certainly such only as was incident to street railroad companies, and only as to such lands as were necessary for a right of way and structures necessary and incident to its business.

Indeed, the court declares, it may be doubted whether a street railroad company, having no express power to construct its railroad elsewhere than on the public streets and highways, has any authority to either condemn or receive, for a right of way or other purposes, property not located on such public streets or highways, since its charter does not contemplate the necessity or use of such property.

The right of way of the South & North Alabama Railroad Company, upon which the Elyton Land Company contracted for the right to build its track, the court further insists, was not a public street or highway in this sense, it being a broad avenue running through the city, the property of the railroad company, donated to it by the Elyton Land Company for railroad purposes, when it founded and laid out the city.

But it cannot be doubted, says the court in concluding its discussion on this point, that this corporation had no authority to take or receive, either by condemnation or by grant, property for the use of a freight belt railroad which it had no power to construct or operate.

However, the court recognizes it as a principle of universal application that if a corporation has acquired the title and possession of real property, its right to hold it cannot be questioned by a private citizen, this question being one between the corporation and the government, the state alone having the power to question the right in a direct proceeding for this purpose. Still it says that if it is necessary for the corporation to seek the aid of a court of equity to perfect its title, an interested individual may contest its claim, and the court will, in case it has no right to hold property of the particular kind in controversy, refuse a decree in its favor.

Riding on Running Board of Trolley Car.

Hassen v. Nassau Electric Railroad Company (N. Y.), 53 N. Y. Supp., 1069. November 1, 1898.

An open trolley car, with seats running across and a running board upon the side, had from 70 to 90 passengers, all of the seats being filled, and people standing in the space between the seats and also upon the running board. A man got on it. He could have occupied some of the still unoccupied space within the car between

the seats, but remained upon the running board. While riding in this position, and when the car was running at about six or eight miles an hour, it gave a sudden violent jerk, causing him to break his hold with the left hand upon the stanchion of the car, swinging his body outward, in which position his head was brought into contact with a trolley pole, inflicting injuries, to recover damages for which he sued the electric railroad company.

The company contended that the man was guilty of negligence as matter of law; that if he could, with slight inconvenience to himself, have procured standing room between the seats of the car, he was bound so to do; and that, as it was conceded that there was such space, the man must be deemed to have voluntarily remained in a place of danger, which defeated his right to recover damages.

But conceding that a person would be chargeable with contributory negligence, in the ordinary operation of a car, if he stood upon a running board when he might obtain a safe place within the body of the car, the second appellate division of the supreme court of New York declares that, under the circumstances of this case, it does not think that such proposition may be affirmed as matter of law.

The court says that it is well known that the space between these seats, when the latter are occupied, is quite narrow. With small people upon a seat, the space left might be occupied, with more or less inconvenience. With large people it may become a matter of extreme difficulty to stand in the space, and with some an impossibility. In all cases it is a place of discomfort, and disagreeable both to the person standing and to those sitting.

Nor does the court stop with this generalization. It goes on to say that the cars running from Coney Island to Brooklyn, on one of which this man was injured, at most times are crowded within and without in all available space. The company expects that this will be so; and if it does not invite, it makes little effort, if any, to prevent such condition, and collects and receives fares from those sitting and those standing, indifferent as to the place where the passenger secures his foothold.

Under such circumstances, the court says that it thinks the question of contributory negligence becomes one of fact to be determined by the jury, having regard to particular conditions.

The trial court charged the jury in accordance with this view of the law, and, upon the evidence, the appellate division thinks the submission was proper.

Besides this, the court holds that the company was properly found guilty of negligence upon the testimony. It says that such finding was warranted by the evidence with regard to the sudden and violent starting of the car, which was shown to have disturbed the equilibrium of other passengers as well as of this particular one. It says that the company had accepted him for carriage. It collected his fare, and knew the place he occupied upon the car. It was bound to know that the application of motive power in such manner as to cause the car to give a violent jerk was extremely hazardous, in view of the position of many of the passengers upon the car, and might result in injury. The jury were therefore authorized to say that it was a negligent act, it holds. And judgment against the company is, upon these considerations, affirmed.

Street Railway Cannot be Double Tracked Under Guise of Building Switches.

Willis v. Erie City Passenger Railway Company (Pa.), 41 Atl. Rep., 307. October 17, 1898.

This was a suit brought by certain township road commissioners to restrain the extension of a street railway side-track along a highway, and they obtained a permanent injunction. Among the findings of fact was one stating that the road commissioners had duly passed a resolution granting to said company and its lessees the right of extending the street railway in question along the highway, provided that the railway should be constructed south of the center of the road, except at points where crossovers, switches, and turnouts were required, the poles to be set as near to the south fence as practicable, almost all of the owners of abutting property having previously granted the right to occupy and extend the line of railway, and the necessary turnouts, and to operate the same through and along said highway.

As a conclusion of law it was held that by virtue of the consent given by the road commissioners and landowners, and by the fact that the railway had been constructed in said highway, that the defendants had the right to maintain and operate a single track street passenger railway, with such switches or turnouts as are necessary for the proper operation of single track street railway, but that the defendants had no right to construct a double-track railway in said highway.

It was further adjudged that the location of switches prior to the commencement of the suit, did not, under the facts of the case, exhaust the power to build necessary turnouts, or to relocate the same permanently, so as to equalize the distance, etc., and that, while ordinarily the length of switches, etc., might be a matter in the discretion of the railway company, yet where, as in this case, the defendants, under the guise of building switches, were manifestly attempting to double-track their railway or at least a large portion of it, it then became the duty of the court to find from the evidence the number of switches and of what length were necessary turnouts to which the defendants were entitled.

The supreme court of Pennsylvania states that the case was tried with such painstaking care and ability that little, if anything, would be profitably added to the opinion embodying the findings of fact, conclusions of law, etc., of the court below, and affirms its decree, dismissing the appeal.

"Any Railroad" Held to Include Street Railways.

Bammel v. Kirby (Tex. Civ. App.), 47 S. W. Rep., 392. June 23, 1898.

A general demurrer was sustained to the petition, and the suit was dismissed, in this case, in the district court, on the ground that the Texas statutes give no cause of action against the receiver of a street railway for the death of a person caused by the negligence of his servants.

Whether or not this ruling was correct, the court of civil appeals of Texas says, depends upon the construction to be given that portion of article 3017 of the Revised Statutes of Texas of 1895, which gives rights of action as follows: "When the death of any person is caused by the negligence or carelessness of the proprietor, owner, charterer, hirer of any railroad, steamboat, stage coach, or other vehicle for the conveyance of goods or passengers, or by the unfitness, negligence or carelessness of their servants or agents; when the death of any person is caused by the negligence or carelessness of the receiver or receivers or other person or persons in charge or control of any railroad, their servants or agents, and the liabilities of receivers shall extend to cases in which the death may be caused by reason of the bad or unsafe condition of the railroad or machinery or other reason or cause by which an action may be brought for damages on account of injuries, the same as if said railroad were being operated by the railroad company."

The court says that it believes that it has not been questioned in the state that street railroads themselves, when operating their roads, are liable under this statute for damages for deaths caused by the negligence of their servants. If they are generally liable, their liability is created by the inclusion of them within the words "any railroad" used in the first clause of said article 3017. And if that language embraces street railroads, the court holds, it must necessarily follow that the same language in the second clause, with reference to the receiver of "any railroad," must also include receivers of street railways, because it is impossible to hold that the words are used in different senses in the two relations.

And so the court holds that the language "any railroad," in the statute under consideration, includes street railroads, and therefore gives an action against receivers of such roads for the death of a person caused by the negligence of their servants, and that the action of the district court in dismissing the suit against the receiver was erroneous.

A rehearing was denied.

But this case should not be passed by without it being further noted that the court suggested that it might be urged that liability would attach to a street railway company as the owner of "vehicles for the conveyance of passengers," thus spoiling the above argument. But the court thinks that it is hardly to be supposed that the legislature, if intending to make them liable at

all, would express its intention by referring to them as the owners of vehicles, while at the same time declaring generally the liability of railroads. The words "other vehicles," it says, follow naturally after "stage coach," and include such instruments of conveyance as are not embraced in the preceding language. They might include street cars, but the court says that it thinks the more natural construction of the statute is to hold that those operating street railways are included among the owners of "any railroad."

Legal Propriety of Making Due Allowances for Temporary Breakdowns.

Illinois Trust & Savings Bank v. Ottumwa Electric Railway (U. S. C. C.), 89 Fed. Rep., 235. September 8, 1898.

This action was brought to foreclose a trust deed. A third party filed a petition of intervention for the purpose of establishing a preferential claim, over the trust deed, for money he had furnished the defendant company, which was engaged in operating an electric railway system, in operating an electric lighting plant, and in operating a steam heating plant.

One point that the United States circuit court makes, in this connection, is that the payment of an installment of interest on bonds under the trust deed in question, though it possibly prevented a foreclosure of the trust deed at that time, did not make or keep the railway a "going concern," because such foreclosure would doubtless then, as has now, been attended with others providing for operation of the railway enterprises meanwhile.

But all of the rest of the money the intervener furnished, beyond a certain sum that was diverted from use in making additions to the plant was applied on the payment of interest, was expended in building a new power house, and providing additional engine, boiler, etc., facilities. The court is convinced that this was an imperative necessity at the time. But objection was urged that the expenditure was unnecessarily large, and that a smaller one might have been sufficient. The answer of the court is that, while it may be true, under the evidence as applied to past facts, that a smaller expenditure might have sufficed, yet we must not forget that what are now to us known facts then lay wholly in the future. There was the necessity of making proper allowances for temporary breakdowns in machinery, boilers, etc., and the necessity of some provision to meet same.

The railway could not shut down for repairs, like a private corporation operating a sawmill or a factory, continues the court. What would justify this shutting down in the sawmill or factory might fall far short of justifying it in the railway. Its public and private lighting, the operation of its street railway lines, and the furnishing of its heating facilities, demanded whatever precautions were reasonably necessary as to reserve ability to supply the same or provide for accidents reasonably to be anticipated.

In conclusion, the court rules against the allowance as a preferential claim of the amount applied to payment of interest, but it allows as a preferential claim the amount furnished the railway and applied to erection of building and procuring machinery, etc., for power supply.

Doing Some Freight and Express Business Does Not Alter Nature of Railway.

Cedar Rapids & M. C. Railway Company v. City of Cedar Rapids (Ia.), 76 N. W. Rep., 728. Oct. 20, 1898.

Here is a case where a railway company that was assessed as a street railway company contended that it was a "railway corporation," within the meaning of Section 1317 of the Iowa Code of 1873, which provides that, "On the first Monday of March in each year, the executive council shall assess all the property of each railway corporation in this state, excepting lands, lots, and other real estate belonging thereto not used in the operation of any railway."

The railway owned and operated by the company extended from a point within the limits of Cedar Rapids, through the incorporated town of Kenwood, and over certain unincorporated territory, into the incorporated city of Marion. It also owned and operated in connection therewith certain other lines or branches entirely within the limits of the city of Cedar Rapids. These tracks were laid upon and at the grade of the streets of these municipalities, and upon and at the grade of the public highway connecting said cities, over the unincorporated territory, including certain county bridges in said highway.

Originally, the line to Marion started at what was then the boundary street of Cedar Rapids, and was operated by steam engines, under chapter 32, Acts 18th General Assembly, authorizing any street railway company extending its lines beyond the limits of the city to build and operate its road over and along any portion of a highway of a width of 100 feet or more. Later, the tracks within the city of Cedar Rapids and that to Marion were operated together; electricity, applied by the overhead or trolley system, being used as the motive power, one or more of the steam engines formerly used being kept in a motor house near a certain creek, for use in case of deep snows or other emergency rendering their use desirable. Cars were operated on these tracks mainly for the carriage of passengers in the manner practiced by street railways, but the company had four cars which it used in carrying freight between said cities, and it also carried such express matter as was offered at either end of the line or at any point between.

Conceding that the company is a "railway corporation," in the broadest signification of that term, the supreme court of Iowa says that the fact that the line between Cedar Rapids and Marion was laid and operated along the highway as authorized by the act stated, relating exclusively to street railway, seems to it conclusive that the company is a street railway corporation, and not a railway corporation, within the meaning of said section 1317, Code 1873. The fact that the company's street railway was authorized to be extended and laid and operated along a highway, it says, precludes the conclusion that it was intended to be other than a street railway.

Moreover, while ordinarily it is true that a distinctive and essential feature of a street railway in relation to other railroads is that it is exclusively for the transportation of passengers, and not for goods, the supreme court declares that surely the mere fact that this company carried goods and express matter did not take it out of the class of railways where the statute under which it was built and operated put it.

Thus it is, that the court holds that this company is not a "railway corporation," as contemplated in said section 1317, but a street railway, and is therefore subject to assessment by the local assessors.

All Care and Vigilance That Human Foresight May Suggest Must be Exercised.

Keegan v. Third Avenue Railroad Company (N. Y.), 54 N. Y. Supp., 391. November 11, 1898.

The injuries for which damages were awarded in this case were sustained by a passenger who was sitting on the side, near the rear, of an open car on a cable road, and were caused by a collision with a heavy wagon that the driver was attempting to get out of the way of another car that had come up behind it on the other track.

First of all, the first appellate division of the supreme court of New York says, that the gripman was not absolved from blame for not observing this attempt and slackening his speed, because the wagon struck the car, instead of the car's striking the wagon. A defendant company has often been held liable, although its own car was the one struck in the collision.

But the main question of law presented upon this appeal was as to the correctness of the trial judge's charge to the effect that, while the company was not to be considered as an insurer of its passengers' safety against all possible injury, yet it was bound to use a high degree of skill and vigilance to guard against accidents from which its passengers might suffer injuries, and that it had not fulfilled this duty unless it had used the utmost care and diligence which human skill and foresight would suggest. And this was subsequently accentuated by his specifically charging further that the responsibility of a common carrier of passengers is such as to require a high degree of care for their safety, and the discharge of this duty requires of such a carrier the exercise of all the care and vigilance that human foresight may suggest to secure the safety of its passengers, and that if it was possible by exercising of great care and vigilance, all that human foresight might suggest, for the gripman

to have avoided the collision and consequent injury to the plaintiff, and he failed to use such care and vigilance, then he was negligent, and the railroad was responsible for the consequence to the plaintiff.

This charge, the court holds, was correct, and in accordance with what it understands to be the settled rule of law in the state applicable to the facts here presented to the jury. Nor does it agree with the contention that the rule in question is not applicable to street cars drawn by horses or propelled by a cable.

Referring to the case of Stierle v. Union Railway Company, reported on page 568 of the STREET RAILWAY REVIEW for August, and commented on in a decision reported on page 741 of the STREET RAILWAY REVIEW for October, 1898, the court says that what it understands to have been decided in that case was simply that the general rule to which it has adverted was not applicable to its particular facts, that case presenting no situation of danger and calling for no special exercise of extreme vigilance.

Every act of the driver of a car, however simple and ordinary, continues the court, calls for reasonable care. Where, however, there is nothing whatever in the surroundings to evoke the slightest sense of danger, the decree of care required is simply that which is commensurate to the existing conditions. A rule which called upon every driver or motorman, at all times and under all circumstances, to keep himself keyed up to the highest pitch of vigilance, would be senseless. He should never, it is true, be heedless or forgetful of his duty. He should, in fact, at all times be watchful and prepared for emergencies. When, however, the law imposes upon him a still higher degree of care—namely, the exercise of all the vigilance that human foresight can suggest—it naturally refers to conditions calling for that extreme degree of vigilance. It is not so unreasonable, for example, as to demand constantly strained eyes from the lookout over a perfectly clear horizon.

Finally, the court directs attention to the fact that in the general charge the trial judge explicitly confined the propositions quoted to the particular situation "immediately prior to the happening of the accident," and spoke of the gripman's duty commencing when the driver of the wagon began to swing it across the track the gripman was on. Judgment for plaintiff affirmed.

Not Necessarily Negligence for Woman to Prepare to Alight Before Cars Stop.

Springfield Consolidated Railway Company v. Hoeffner (Ill.), 51 N. E. Rep., 884. October 24, 1898.

The supreme court of Illinois recalls here that it has held that it is not negligence in itself for a passenger to board or alight from a street car operated by horse power while it is in motion; that it is not negligence in itself for a passenger to board or alight from a street car propelled by electricity while it is in motion; and also that it is not negligence in itself for a passenger to get on or off a moving street car, whose motive power is a cable. In all such cases of getting on or off street cars while they are in motion, whether such cars are propelled by horse power, electricity or cable, continues the court, the question whether or not the passenger has used due care for his safety, or whether or not he has been guilty of contributory negligence, is a question of fact to be submitted to the jury, and to be determined by them from the circumstances surrounding the case.

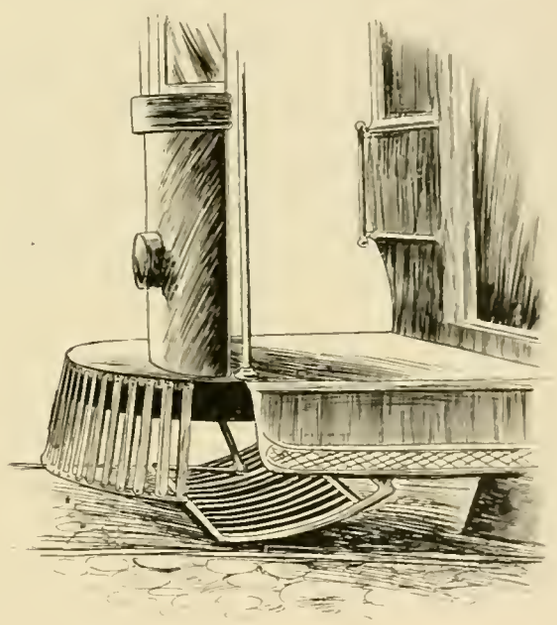
In this instance it was a woman who, according to one expression of the court, might be deemed to have attempted the feat of alighting from a moving electric street car, and the court says that it was for the jury to determine whether,in making such an attempt on her part, she was exercising due care for her own safety. But, it seems from the evidence, that this was more of a case where the woman notified the conductor of the street crossing at which she wanted to alight, and as the speed of the car was slackened at that point, prepared to alight when the car should stop on the other side of the crossing. She stood with one foot on the car and the other on the foot-board, and was holding on to the brass arm of the seat. While she was in this position, and while it seemed that the car was about to stop and she was about to alight, the car, without stopping, started forward with a sudden and violent jerk, breaking her hold and throwing her upon her back, so as to cause the injuries complained of, the most serious of which was to her spine. The trial judge told the jury that they must believe from all the evidence that the company ran its car to the corner of the intersecting street in question and was then and there in the act of slacking up or stopping said car, and that the woman passenger was then and there exercising all due care and caution for her own safety, and that, while so exercising said care and caution, she was preparing to alight from said car when it should come to a stop, and that such act or acts by her of preparing to alight at the time, under all the circumstances, and in the manner shown by the evidence, were not negligence or carelessness on her part.

This instruction, the supreme court holds, stated the law with substantial correctness. It says, furthermore, that street car companies are obliged to stop a reasonable time to allow passengers to get on or off the car, and the question of what is a reasonable time is in every case a question for the jury. If the manager of a car sees, or ought, in the exercise of reasonable care, to see, that a passenger is in the act of getting on or off the car, it is negligence on the part of the company if he starts the car suddenly.

The supreme court also points out that the jury were required in this case to find that the passenger gave to the conductor reasonable notice of her desire to get off, which left the jury to determine whether the notice was reasonable or not. Judgment for the woman affirmed.

A NEW FENDER.

The fender illustrated is now being tried on a Western road but has not yet passed the experimental stage. When anything is struck by the guard, fastened to the bumper by means of a pivoted lever, the fender beneath the platform is forced down against the



track, and is supposed to scoop up the fallen person. As now constructed the guard in front of the bumper extends down too close to the track and serious injury is liable to be done a person before the fender proper comes into play.

EXCLUSIVE UNIFORM HOUSE.

An extensive establishment has recently been opened in Chicago, at 192 and 194 Market street, for the exclusive manufacture of uniforms. While uniforms of every description will be made and also carried in stock, particular attention will be given to conductors' and motormen's garments. The concern is composed of men who have had extensive experience in uniforming, and the firm name is James H. Hirsch & Co. The manager is H. H. Crocker, also an experienced uniform maker, who has furnished some of the largest steam roads running out of Chicago. Samples and prices will be sent on application. Special attention will be given to street railways in cities of 50,000 or less.

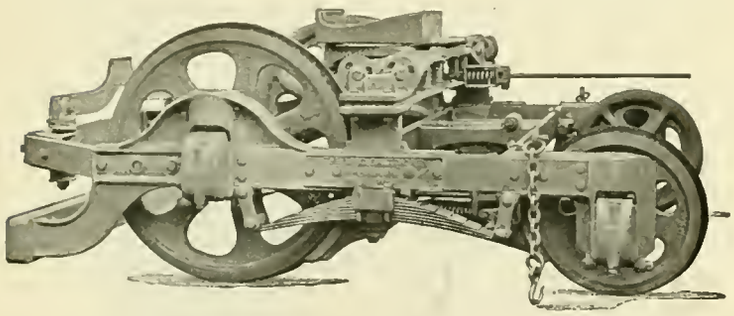
LORD BALTIMORE MAXIMUM TRACTION TRUCK.

The accompanying illustration shows the maximum traction truck made by the Baltimore Car Wheel Company of Baltimore, Md., and like the other well-known trucks made by the company it is called the Lord Baltimore. The design conforms to that of the Lord Baltimore single and center-bearing trucks.

The pedestals are of steel and form part of the side frames; they are provided with housings to receive graduated coil springs, which rest on the axle boxes and carry the entire weight, thoroughly cushioning all. The car body and load ride upon four half-elliptic springs, two to each truck, suspended from below the side frames by links and connected by posts to the truck bolsters. The posts are held in place between and guided by the bars forming part of side frames and connecting the pedestals.

They are of bolster construction, to which bolster pivotal centers, located at or near the centers of driving axles, are fastened; the weight of the entire structure is so proportioned that 66 per cent rests upon the driving wheels and is applied to the wheels through the bolsters and distributed upon the centers of the bolsters and self-oiling roller side bearings which revolve upon steel thimbles. These roller side bearings, upon which car body chafe plates bear, are placed directly above centers of half-elliptic body springs. The axle boxes are of the most improved dust and oil tight pattern and provided with either felt or waste feed as may be desired.

The driver end cross frames are bolted directly to the main pedestals and are of such form that they will never be outside of track



LORD BALTIMORE MAXIMUM TRACTION TRUCK.

line in curving; the only function they perform is to carry bars supporting the motors upon outer ends, the motors being placed outside of the drivers. These end cross frames form stiff end ties for the side frames, which are also securely braced diagonally between the wheels. The frames, taken as a whole, are as securely built as the best locomotive trucks and have all the advantages of stiffness and stability claimed for center bearing trucks of the most approved design.

The brakes are applied between wheels and so constructed with proportioned levers that 70 per cent of the braking power is applied to the drivers, they are operated by levers acting from the pivotal points of trucks, avoiding the use of objectionable quadrants in applying brakes upon curves; all the working parts of the brake mechanism have large bearings provided with oil holes, work upon steel thimbles, are placed at center lines of trucks, and not liable to receive mud or dust thrown up by the wheels. The brakes are extremely powerful and this power is equalized between the trucks by interposing springs in such a manner that it will be divided equally between the trucks and each wheel will receive its proper proportion of the braking power.

These trucks are thoroughly and carefully built in every particular, the construction is such that there are no shearing stresses upon the bolts. All parts are of steel and malleable iron, no cast iron being used except for wheels and brakeshoes.

The Employes' Mutual Benefit Association of the Rapid Transit Railway Company of Syracuse, N. Y., was organized last month. Applicants for membership must be between the ages of 21 and 45; the initiation fee is $1 and the monthly dues 50 cents. Death benefits of $150 and sick benefits of $1 per day, with a maximum of $90 in any one year.

PERJURY IN NEW YORK DAMAGE SUITS.

It is stated by Louis Julian, of the claim department of the Metropolitan Street Railway Company of New York, that about a year ago he was informed of a conspiracy to commit wholesale perjury in suits for damages pending in the supreme court against this company and other corporations. A general investigation was made and a number of confessions secured after which the matter was laid before the district attorney. In December last an indictment was secured against five persons alleged to be concerned in the conspiracy. Charles Gallaher, an adjuster, and William Rapp, a janitor, were arrested, and on December 28 Michael P. O'Connor, a lawyer, gave himself up and was admitted to bail.

O'Connor was the ringleader and one of his schemes was to educate young children, tell them what to testify to and place them on the witness stand. In order to thoroughly drill them he had in his office models of cars and rails, wagons and trucks, which were used for the purposes of illustration.

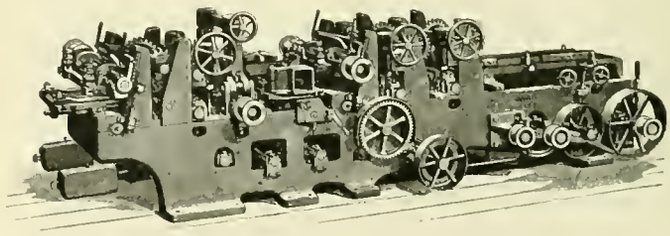
The confessions on which the indictments were based showed the existence of an organized band of swindlers, whose business it was to commit perjury and furnish perjured testimony against street railway companies in this and other cities and any and all corporations and private individuals against whom damage suits might be brought. The Third Avenue Railroad Company, the Casualty Company and other business concerns and reputable lawyers have assisted the Metropolitan Street Railway Company in the pursuit of these inquiries.

Another source of revenue of this band was to furnish straw bondsmen. Most of the men used by O'Connor as witnesses to swear his cases through the courts had been used by him and others as bondsmen.

The affidavits on file show that perjured testimony is cheap in New York. One witness, who was put through a course of study so that he might know the story by heart when he appeared in court, is said to have got $10 to commit perjury. Another got $5. They did not always remember the stories when on the witness stand, and one man who was in Oklahoma when the accident to which he testified occurred aroused the suspicion of Justice Freedman by the manner of telling his story.

FAY & CO.'S NEW FLOORING MACHINE.

J. A. Fay & Co. of West Front street, Cincinnati, have had a corps of expert mechanics and draftsmen at work for over a year designing and perfecting new and improved wood-working machinery, and one of these machines which has just been placed on the market is shown in the accompanying illustration. It is known as the No. 17 new six-roll, triple-cylinder, "Lightning" flooring machine, and combines a number of important improvements not be-



J. A. FAY & CO.'S NO. 17 "LIGHTNING" FLOORING MACHINE.

fore assembled in one machine. The framing is massive and all parts are well braced; by a system of interchangeable parts and adhering to exact standard sizes the highest degree of perfection has been reached.

There are three cylinders made of solid steel forgings, with four faces slotted to receive two or four knives, and chip-breaking lips for cross-grained lumber; all three are provided with long self-oiling bearings. The matching works are heavy; the bearings are adjustable horizontally and vertically, and rigidly locked by means of a lever conveniently located outside the frame. Stock as narrow as 1½ in. may be matched on this machine. The feed works comprise six 8-in. rolls driven by a train of powerful gearing. There are

three speeds of feed, 30, 45 and 60 ft. per minute; the feed is under instant and positive control of the operator by means of a lever engaging a friction ring. The various pressure bars are adjustable to and from the cut.

New and improved belt tightening apparatus for both cylinder and side head belts, which is quickly adjustable while the machine is running, permits the use of endless belts that run smoothly and do not have to be cut to take up the stretch.

PRIZES FOR CARE OF CARS.

The Birmingham (Ala.) Railway & Electric Company has recently added 11 new cars to its equipment. They were built by the St. Louis Car Company, and are 42 ft. long with 20 cross seats. They are divided into two compartments accommodating white and colored passengers. The cars are finished in green, white and gold.

Having made this addition to the equipment General Manager J. B. McClary thought the time had arrived to put in operation a plan for keeping the cars in the best possible condition and at the same time ascertaining which of the men have the interests of the company at heart. Accordingly street records are to be kept and awards made on July 1 and December 31 of each year.

Conductors of electric trains and motormen of fare box cars who have kept the neatest cars will be awarded $10.

Those who have habitually kept dirty cars will be discharged.

All motormen who have not cost the company anything for damages or break-downs will be awarded $20.

All who have not cost over $5 for collisions or break-downs will get $5.

All who have cost over $5 and under $25 will get nothing.

All who have cost over $25 will be discharged unless they can prove themselves innocent of carelessness.

DENVER STREET RAILWAYS IN 1898.

The Denver Consolidated Tramway Company during 1898 expended over $150,000 in improvements and expects to spend an equal amount in 1899. The tracks from Lawrence and 15th streets to the terminus of the Colfax avenue line have been relaid with 60-ft., 72-lb. rails on creosoted ties. General Superintendent Durbin gives the cost, including paving between the rails, as $27,000 per mile of single track. The company's shops are at present busy rebuilding cars, making combination cars by joining open and closed cars as described in the REVIEW for November.

What is known as the Montclair line, running to that suburb, has been acquired by the company, bringing its mileage up to 110 miles. This addition makes the longest 5-cent ride offered by the company 13½ miles.

A new transfer station is under construction and is to be completed by February 1. A contract was recently let for 104 new 35 h. p. motors and the improvement of the equipment is to be continued.

During the first 10 months of 1898, 18,000,000 passengers were carried, an increase of 5 per cent over the same period in 1897.

No change of importance has been made in the lines of the Denver City Railroad Company. An ordinance was recently passed by the council, after very extensive discussion, granting the company the right to change the motive power of its cable lines to electricity, but this was vetoed by the mayor and failed on its second passage.

A RAILWAY LOOP AT NIAGARA.

A new suspension bridge which is now building at Lewiston, N. Y., will be the connecting link in a loop including the lines of the Niagara Falls Park & River Railway and the Gorge Route. A continuous trip can then be made on the trolley cars along the gorge on the American side, crossing the new bridge to Canada, returning on the Canadian bank and recrossing the river on the bridge at Niagara Falls. The bridge will be completed in time for the opening of the season and will enable visitors and tourists to make a most delightful circuit on the electric cars. The location of the bridge is on the site of the old suspension bridge which was built in 1850 just above the village of Lewiston and destroyed by a storm in February, 1864. The structure will be 1,040 ft. between towers and have a clear passageway of 25 ft., affording ample space for a railway track and a roadway for teams on either side.

NEW YORK APPROACH TO NEW SUSPENSION BRIDGE AT LEWISTON, N. Y.

The cables are those removed from the old upper suspension bridge at Niagara, recently replaced by a steel arch. The metal in the bridge weighs about 800 tons, 200 tons of which is in the cables. The height of the bridge above the water will be 65 ft. On both sides of the river long approaches have been constructed so that the trolley cars may have an easy run on and off the bridge, the approach on the New York side being 800 ft. long. Double tracks will be laid on them to increase the facilities for handling the cars. The two illustrations are views of the New York approach. The face wall, which has been built to prevent the shale disintegrating and falling on the tracks, is 800 ft. long and 19 ft. high at the highest point.

A. N. Sicard, secretary of the Ft. Smith (Ark.) Street Railway Company, announced that construction work would begin by January 1. The line is to be six miles long.

The Helena (Mont.) Power & Light Company reports its receipts for the fiscal year ending November 30, 1898, at $36,147, and its expenditures at $37,008, of which $3,200 went for improvements.

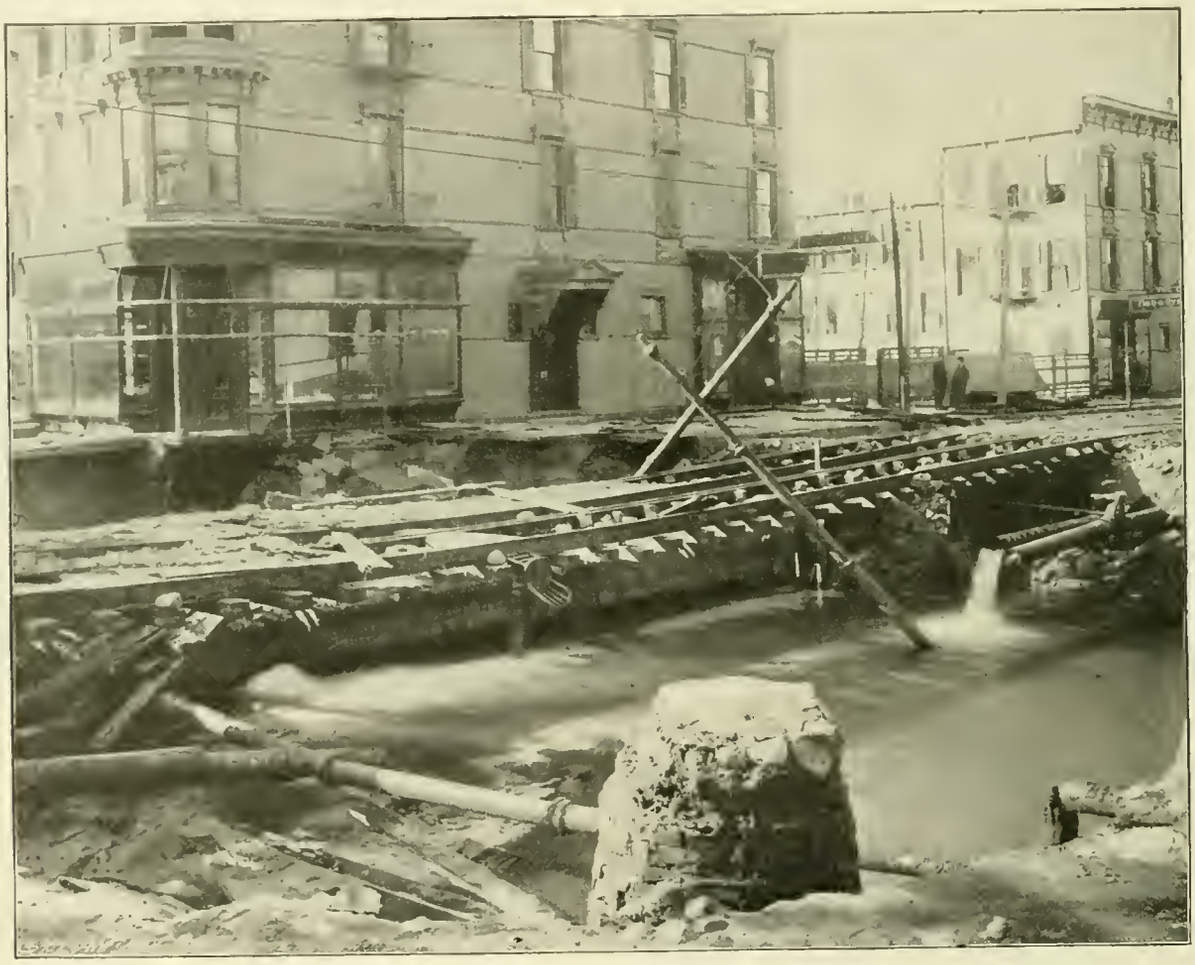
BURSTING OF A WATER MAIN IN BROOKLYN, N. Y.

The accompanying illustration, for which we are indebted to the "Scientific American," shows the corner of Central avenue and Covert street in Brooklyn as washed out by the breaking of a 48-in. cast iron water pipe on December 11. The pipe was laid about eight years ago and extended from the Ridgewood reservoir to the Prospect Hill pumping station.

The soil about the point of the break is sandy, and the street was undermined before the effect of the break showed on the surface. When the street caved in the gas mains were broken. The foundations of many of the buildings in the neighborhood were undermined, making them unsafe.

As near as could be ascertained the break occurred about 5 a. m. As soon as it was discovered firemen were detailed to render assistance. When they arrived the street car tracks on Central avenue were submerged and the poles down, as shown in the illustration. Adjacent basements were flooded to the depth of 6 ft. The supply was cut off at the reservoir as soon as possible, but the water in the pipe still caused trouble. After several hours the water receded, and it was found that the hole at the street crossing was 100 ft. in diameter and 20 ft. deep. The sewer in Central avenue was also badly damaged.

The break in the pipe was near the bottom and was 3 ft. long by 12 or 13 in. wide. It is stated that the break was due to structural weakness in the casting. The loss of water is estimated at 4,000,000 gallons.



BREAK IN A 48-IN. WATER MAIN IN BROOKLYN, N. Y.

Richard Croker, in a recent interview, announced that the underground rapid transit scheme would be put through during the administration of the present mayor of New York. The tunnel is to be wide enough for four tracks.

STREET RAILWAY ASSOCIATION OF VIRGINIA.

The organization of the Street Railway & Electric Association of Virginia was announced in the December REVIEW. A copy of the constitution has been sent us by E. A. Williams, president of the Richmond Traction Company and vice-president of the association. Active members of the association comprise street railway companies or lessees, or individual owners of street railways, electric light and power companies, and associate members include manufacturers and dealers in street railway and electric supplies, and engineers and contractors engaged in electric railway construction. The meetings are to be held on the third Tuesday in May each year. A membership fee of $10 is charged and the yearly dues are $10. The first meeting of the association gave promise of a useful and prosperous future.

PROSPERITY AT BUTTE, MONT.

The year just passed has been a very good one for the Butte (Mont.) Consolidated Railway Company, the increase in business being in excess of 20 per cent when compared with 1897. This increase was largely due to extensions and improvements in the system. When the present manager, J. R. Wharton, took charge of the system, in 1891, the business was easily handled by nine cars; at the present time there are 24 passenger and nine freight cars in use.

This company handles a great deal of ore, transporting it from the mines to the smelters, but during the year ending October 1, 1898, the number of passengers carried was 1,615,000. About 5¾ miles of new track have been laid, the most important of the additions being a line to the Parrot smelter.

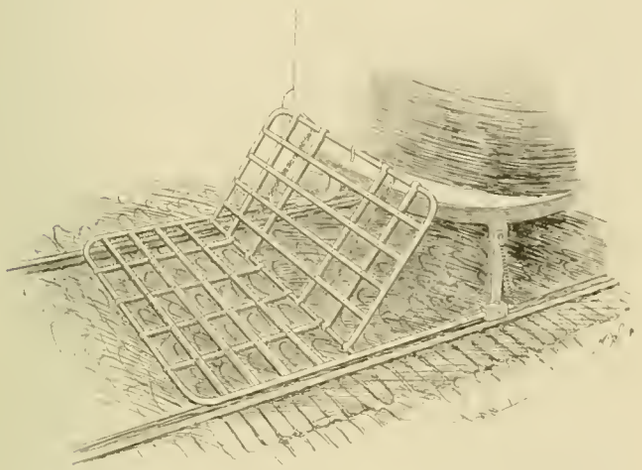
In the REVIEW for March, 1898, page 171, was published an illustration showing an electric locomotive with a train of ore cars on the Butte line.

SAFETY DEVICES ON CHICAGO CARS.

The fender which was adopted for the North and West Chicago cable cars was described in the REVIEW for October, page 771. Another fender has been designed by V. T. Lynch, master mechanic of the North Chicago Street Railroad Company, for applying to the electric cars. The frame of the fender is of ¾ in. pipe, and in this frame are wooden slats 3 in. square held lengthwise by four steel bands each 1 in. wide and 1 16 in. thick. The wooden strips are rounded on the top corners and are held in place by 3-16-in. bolts.

The characteristic feature of the fender is in its suspension. On either side of the platform is bolted a knee made of angle iron ½ by 3 in. In each knee there are three bolt holes so that the fender may be suspended at different heights from the track, or to provide for cars whose platforms are not at the same heights as the standard. A curved link is held in the knee by an iron dowel and is loose riveted to the extension of the frame of the fender, as may be seen in the cut. Between the fender frame and the knee is a spring 1½ in. in diameter and 7 in. long having a tension of 7 lbs. to the inch. A dowel in the curved link holds the frame in place.

The portion of the fender covering the bumper is joined to the cradle beneath and in front of the bumper. This portion is held in place by two clips and a loose bolt in the bumper. The fender is normally 5 to 6 in. above the rails. When the fender strikes anything in front the link work of the suspension throws the fender down close to the tracks. Beneath the frame and on



FENDER FOR NORTH CHICAGO ELECTRIC CARS.

each side is a U-shaped piece of pipe fastened at the ends and riveted to the frame. These prevent the fender striking the ground and hold it an inch or more from the rails. The spring suspension cushions the blow which may be struck by the fender. The fender can be folded up and changed from one car to another in five minutes.

The outer frame is about 30 in. in front of the bumper and is 6 ft. across. All the work is done in the repair shops and by turning them out in large numbers the cost is small. By the last of this month 400 fenders will have been finished and put on the cars of the North Chicago Street Railroad Company. The West Chicago Street Railroad Company has adopted the same type of fender for its motor cars.

The cars have also been fitted with another safety device which is simple and effective in accomplishing its purpose. Beneath the car body and in front of the wheels a V-shaped wooden fender is carried by the truck. On this fender and immediately in front of each wheel is bolted a clip of ¼ by 4 in. steel which holds a piece of 2-in. four-ply hose about 12 in. long. When the car is loaded the hose just touches the rails. Should the hand or foot of a fallen person be in front of any wheel of the car and in danger of being crushed this piece of hose will push it off the track.

A large percentage of serious and fatal accidents on the cable trains is to passengers who, in jumping on or off the cars while in motion, either slip or lose their hold in some way and are caught by the trail cars. J. M. Roach, general manager of the North Chicago Street Railroad Company, has patented a guard which effectually prevents such accidents. Its principal feature is a row of five coil springs connecting the cars at the dash. These springs are 36 in.

SPRING GUARD BETWEEN CARS.

long and 1¾ in. in outside diameter and made of No. 5 wire. At each end of the coil is a hook made of ⅜ in. iron, with a loop on the inner end about which the spring is tightly coiled. On each side of the dash of each car is a ⅜ by 2 in. steel strip in which five holes are drilled. This is held at the bottom by a piece of steel ⅜ by 2 by 6 in. which is bolted to the sill under the platform, and at the top there is a clip of ⅛ by 1 in. iron which is bolted to the dash by 5-16-in. bolts. The strip is free to move so that the springs are drawn out straight when the cars are rounding curves. All parts of the guard except the springs were made in the repair shop. Not an accident of this class has happened since these guards have been put in place.

A NEW ORLEANS FOLDER.

The New Orleans City & Lake Railroad Company has distributed a 12-page folder which is very useful to one visiting or touring the city. The folder has not only been published entirely at the company's expense, but it has been advertised by placards, 10½ by 13½ in. printed in red and black ink, a reproduction of which is shown in the cut. In the folder is a map of New Orleans and vicinity showing the 64 miles of track operated by the company. A brief directory of the railroad stations, hotels, churches, etc., is given and also a condensed description of the parks, pleasure resorts, monuments, places of amusement and points of historic interest. The folder is pocket size, and is not only very attractive, but is full of information concerning "New Orleans, What to See and How to See It."

WORK ON BOSTON ELEVATED.

Most of the material for the Boston Elevated structure has been contracted for, and the contracts for the rolling stock and equipment are soon to be placed. The exact construction for the stations has not been determined upon. The route is shown on the map of the Boston lines, published in the REVIEW for August, 1898. At the corner of Harrison and Beach streets it is proposed to erect an eight-story building, through the second floor of which the trains will pass. At Dudley street and the Sullivan square loops the stations are to be three-story buildings. Elevated cars will have two routes, one over the elevated structure and one through the subway. The third rail system will be used and some nice problems are involved in making the connections at the inclines to the subway. The cars it is proposed to use are to be 45 ft. in length, with entrances at each end and at the center. They are to comfortably seat 48 persons and this means accommodation for at least 100 in rush hours.

THE CINCINNATI AND HAMILTON INTERURBAN.

One of the best recent examples of quick and thorough work in building electric railways is that of the interurban between Hamilton, O., and Cincinnati, connecting with the Cincinnati Street Railway lines. In March, 1898, F. J. J. Sloat, then superintendent of the Akron, Bedford & Cleveland Railroad Company, went to Hamilton to look over the proposed route of the Cincinnati & Hamilton Electric Street Railway Company. In November of the same year the cars were running on schedule time from Hamilton to College Hill. The entire construction and equipment of the road indicate that it has been in the hands of experienced men. Only first-class material and the best of equipment have been used.

The line is 15 miles in length and extends from Hamilton through Symmes and Mt. Healthy, making connection at College Hill with the lines of the Cincinnati Street Railway Company. At the Hamilton terminus it joins with the Miami Valley Electric Railway, thus a continuous trip can be made from Dayton to the heart of Cincinnati on electric cars. The power station is located five miles south of Hamilton. The water for the boilers is pumped from two 60-ft. wells and stored in a large cistern. The power house occupies a site 49 by 143 ft. and is built of brick with a slate roof and cement floors. The engines are 600-h. p. Hamilton-Corliss, built by the Hooven, Owens & Rentschler Company, of Hamilton. The cylinders 24 by 48 in. and the speed of 88 r. p. m. The fly-wheel is 20 ft. in diameter and weighs 27 tons. The engines are belted to two 400-k. w. Westinghouse generators running at 425 r. p. m. and giving an output of 600 amperes at 650 volts. At times an overload reaching 1,000 amperes is carried by one unit. There are four 250-h. p. Stirling watertube boilers. The fuel consists of a mixture of nut and slack coal. The feed pumps were made by Laidlaw, Dunn & Gordon Company. A Hoppes purifier and Berryman hot water heaters are employed. The pumps occupy a separate room, 13 by 27 ft.

VIEWS IN THE POWER STATION OF THE CINCINNATI & HAMILTON ELECTRIC STREET RAILWAY.

FIRE AT ST. LOUIS.

A fire, the origin of which is doubtful, broke out in the Lami street power station of the St. Louis (Mo.) Railroad Company between 3 and 4 a. m. on December 29. The building is of brick with a slate roof. The slate is laid on wood and underneath is a false roof of wood. The fire broke out between the roof and false roof of the boiler room, and quickly burned out all the wood, the slates falling into the boiler room.

The Broadway cable line was stopped when the fire was discovered, but cars were again running at 6:30 a. m. The coal handling and stoking machinery was deranged and hand labor was needed in the boiler room until repairs could be made. The damage was estimated at $10,000, covered by insurance.

The building was erected in 1890, and is a two-story brick structure, valued with the equipment at $200,000. General Manager McCulloch considers it fortunate that the loss was so little.

Eight 42-ft. cars, made by G. C. Kuhlman & Co., of Cleveland, are now running. The cars are mounted on Peckham No. 14 double trucks and equipped with four 50-h. p. motors. The controllers are G. E. No. P 8. The cars are fitted both with hand brakes and with G. E. electric brakes. The electric heaters were furnished by the Consolidated Car Heating Company and the fare registers by the New Haven Car Register Company. Each car has a smoking compartment and at the end of each seat provision is made for a card table such as are used in steam passenger coaches.

The system by which the car schedule is regulated is worthy of mention. At each switch is a telephone booth and at intervals of 1,000 ft. along the entire line are plug-in boxes to which a portable telephone box may be attached. Each car carries a portable telephone so that if any accident should happen between switches the conductor has only to go with his instrument to the nearest plug-in box to be in communication with the office and shop. In this manner all the cars are directed from the office. A speed of from 40 to 45 miles an hour is attained along the greater part of the route.

The trolley wire consists of two No. 0000 copper wires and in this way all overhead frogs and switches are avoided. There are three No. 000000 feeders 22 miles in length south of the power station and two of the same size four miles in length north of the station. Cedar poles 35 ft. long with 15-in. butts and 6-in. tops are spaced at intervals of 90 ft. and the trolley wire is suspended from Christy brackets.

TERMINAL STATION AT COLLEGE HILL.

POWER HOUSE AND CAR BARN.

TRACK AND LINE WORK.

The main line is laid with 70-lb. T-rails and in the towns 73-lb. T-rails and 83-lb. girder rails. For 13 miles of track rails 30 ft. in length are laid and for the remaining two miles 60-ft. rails are used. Oak ties of standard size, 6 by 8 in. by 8 ft. are spaced 2 ft. between centers. Crown bonds of the Washburn & Moen Manufacturing Company are used. All special track work was made by the Johnson Company. There are some 35-ft. curves in Hamilton but very few on the main line. The maximum grade is 8 per cent.

The car barns are located five miles from Hamilton and occupy a site 55 by 153 ft. The structure is of brick with a patent paper roof. The shops are 41 ft. by 69 ft.

The officers of the company are as follows: President, Will Christy, Akron, O.; vice-president, D. Kimberly, Cleveland, treasurer, F. T. Pomeroy, Cleveland; secretary, C. E. Hoover, Hamilton, and general manager, F. J. J. Sloat, Hamilton. General Manager Sloat, who is a large stockholder also, has long been prominent in interurban work in northern Ohio.

F. T. Pomeroy, treasurer of the company and also a member of the executive committee, took an active part in projecting and constructing the railway. Mr. Pomeroy is general manager and treasurer of the Cleveland, Berea, Elyria & Oberlin Electric Railway Company, one of the most successful interurban roads in the country. He has made the building and operating of interurban railways a study and is an enthusiastic advocate of them, having been one of the projectors and builders of the Cleveland & Berea line, which was constructed in 1894. The Cleveland & Elyria and the Elyria & Oberlin lines followed in quick succession the building of the Cleveland & Berea road. From the date of the completion of the Cleveland & Berea line, in 1894, to the present time he has been actively interested in interurban railway business and has been very successful in this line of work.

F. T. POMEROY.

A PROPOSED CHICAGO CONSOLIDATION.

A highly desirable consolidation of a number of companies, now having nominally separate existence, but in fact operated in connection with the larger Yerkes companies of Chicago, was recommended by Mr. Yerkes at the annual meeting of the North Chicago Electric Railway Company. There are nine of these companies: North Chicago Electric Railway, Cicero & Proviso Street Railway, Chicago North Shore Street Railway, Chicago Electric Transit, North Side Electric Street Railway, Evanston Electric Railway, Chicago & Jefferson Urban Transit, Ogden Street Railroad and Suburban Railroad. The aggregate capital is $13,900,000, and the bonds $8,061,000. These nine companies have over 260 miles of track.

December 26, a car of the Euclid avenue line in Cleveland ran into the rear end of a Cleveland, Painesville & Eastern car because of a failure of the brakes to work properly. The passengers in the Euclid avenue car were badly shaken up, and the motorman seriously, but not fatally, injured.

TERMINAL STATION OF THE CALUMET RAILWAY.

The great problem for the managers of suburban roads is to stimulate traffic and offer inducements which will attract patronage. The manager of the large city railway turns his attention to providing accommodation for enormous traffic, and schedules must be arranged for a large movement of cars at certain intervals in the day. As a rule the cars of suburban roads are not so burdened with passengers and the ingenuity of the manager must be exercised to stimulate travel. The Calumet Electric Street Railway Company has 90 miles of track and all of this is in the suburban districts in the southern part of Chicago. About 70 per cent of the patronage on its lines is what is known as through traffic, i. e., passengers use the Calumet lines to reach the South Side Elevated and the Chicago City lines to go to the business districts.

There are three suburban systems in the southern part of the city, the Calumet, the South Chicago City and the Chicago Traction (the storage battery road), and the Chicago City runs as far south as 79th street. One northern terminal of the suburban lines is at 63d street and South Park avenue, connection being made with the Alley L. At 63d and Stony Island avenue is the other northern terminal of the Calumet and South Chicago City lines, and connection is made at this point with the Alley L and the Chicago City lines. Three of the Calumet lines center at this point, the Pullman, the Robey and the Grand Crossing, and during each day of 18 hours there are from 250 cars in winter to 350 in summer brought to this terminal. There is sharp competition in this portion of the city, for besides the electric lines, the Illinois Central Railroad gives an excellent service with its local and express suburban trains, but higher rates are charged than on the electric cars.

FIG. 1—CALUMET TERMINAL STATION.

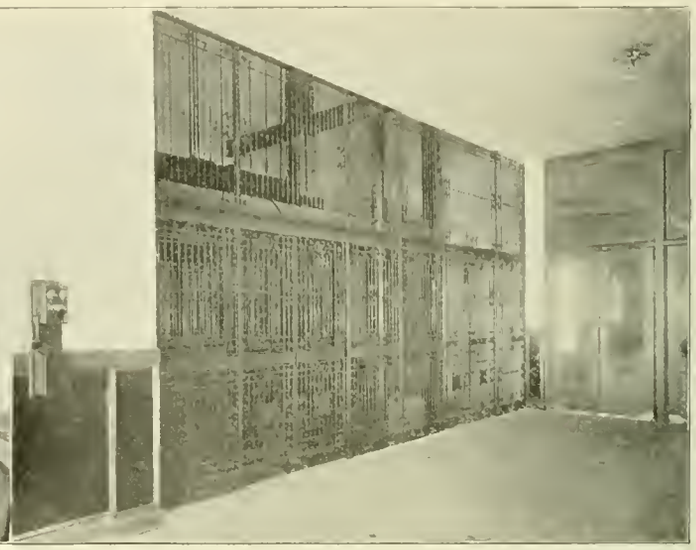


FIG. 3—ELEVATORS IN WAITING ROOM.

Where the Alley L crosses the elevated tracks of the Illinois Central at 63d street it was necessary to raise the structure to 30 ft above the street grade, and this makes a station of unusual height at Stony Island avenue. H. M. Sloan, general manager of the Calumet Electric Street Railway Company, decided that a terminal station at 63d street would be a great convenience to the patrons of his road and would induce a corresponding increase in traffic. Plans were carefully made for a station and it is now nearing completion.

The desired terminal being across the street from the site of the

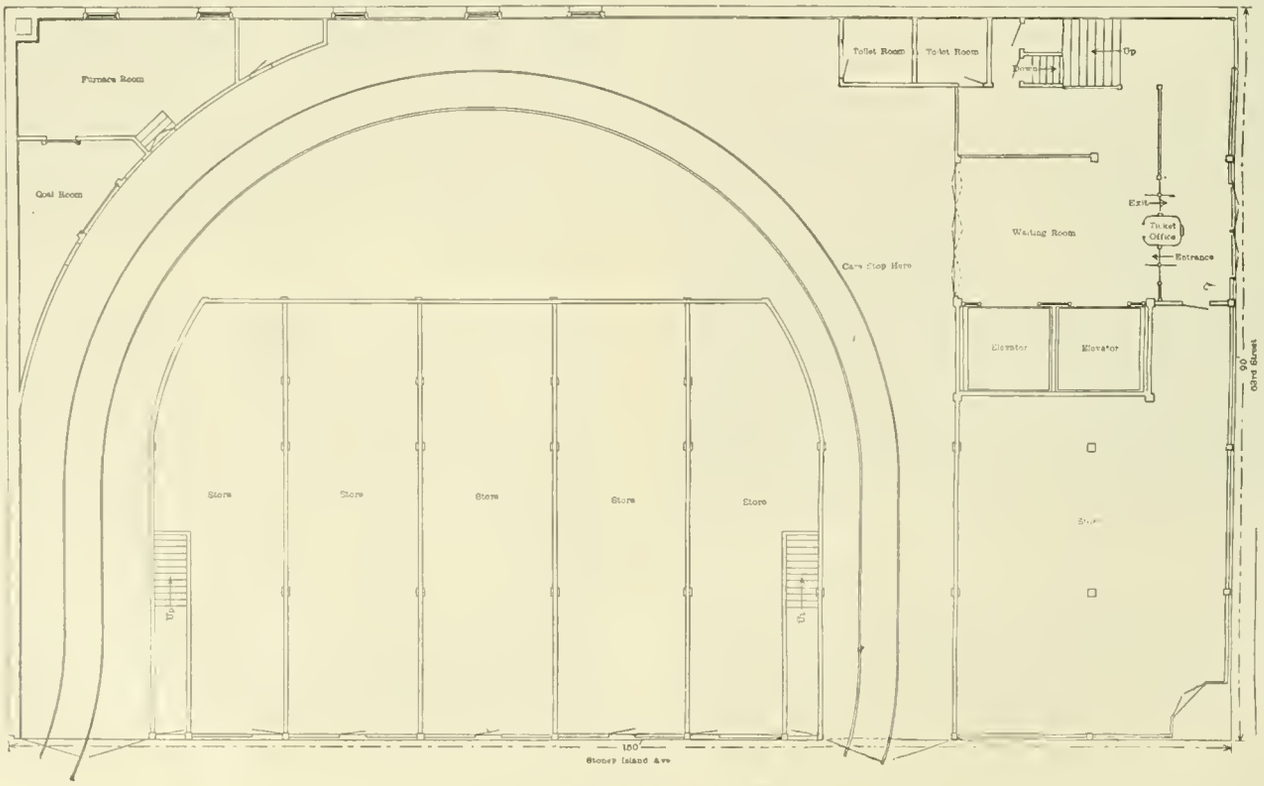


FIG. 2—FIRST FLOOR PLAN.

World's Fair, the locality is filled with large buildings, and to get to the station it was necessary to purchase a three-story brick building with a frontage of 90 ft. on 63d street and 150 ft. on Stony Island avenue, a general view of which is given in Fig. 1. On the ground floor a passageway was cut through the building and a loop constructed, as may be seen in the first floor plan, Fig. 2. The loop is entirely under cover and occupies the space shown up to the second floor. All cars stop and discharge passengers in front of the swinging doors leading into the large waiting room. This is a handsome, commodious apartment, a view of the interior being shown in Fig. 3. The trolley above the loop, instead of being fastened to the trough on the ceiling by hangers, was suspended by span wires, which effectually prevents the noise of the running trolley from being transmitted to other parts of the building.

In the waiting room are the entrances to the two elevators which run to the third floor. These are the largest passenger elevators in Chicago, each one having a capacity for 55 persons and capable of lifting 7,000 lbs. In Fig. 4 is given the plan of the third floor showing the arrangement of the stairways, elevator entrances and halls leading to the station platform of the Alley L. The arduous climb up the stairs to the elevated station is thus avoided.

The elevators were installed by the Crane Company, of Chicago, and are very complete in every detail. In the basement is a large steel tank half filled with water and the rest with air, which acts as a cushion in running the elevators. The hydraulic piston cases are sunk 30 ft. into the ground. The two pumps are worked by 10 and 20-h. p. motors, the smaller being in reserve. Current for the motors is taken through a switchboard from the Calumet trolley wire and connection is also made with the feeder system of the Alley L for cases of emergency. A rotary transformer reduces the voltage from 500 to 110 for lighting the building. The heating plant will occupy a triangular space in the southwest corner of the ground floor, as shown.

The building is being remodeled, attractive storerooms occupying the ground floor on the Stony Island avenue front, and the second and third floors largely devoted to flats or apartments. On the second floor has been constructed a small but well appointed theater with a seating capacity of 500. Aside from letting it for theatrical performances the company will rent it for lodges, dances, banquets and entertainments of various kinds. The arrangement of the theater, stage, banquet room overlooking the hall, the kitchen, dressing rooms, lavatories, etc., may be seen from the plan of the third floor. The entire building has been modernized and now it is one of the most valuable terminal stations in the possession of any electric railway company. Although the investment is large, there is every indication that it will be very profitable, and the largely increased traffic will justify General Manager Sloan's course in providing such facilities.

ELECTRIC RAILWAYS IN GREAT BRITAIN.

In a special report which was made last month by James Boyle, United States consul at Liverpool, some interesting information is given concerning the street railway situation in England. The following extracts are taken from it.

"Heretofore the cities of Great Britain have been among the most backward of any cities of the world in the matter of street railroads. A great change is taking place, however. Undertakings are in progress in the principal cities of the kingdom for the establishment of the most improved systems. Attention is here drawn to this newly awakened spirit of enterprise, so general on the part of British municipalities, in the hope that American contractors and manufacturers may secure some of the work of supplying the plants. The recommendation is made that American firms who manufacture and deal in street railway and electrical appliances put themselves in communication with the municipal authorities here. This can be done by addressing the city engineer. As nearly every city and town of importance in Great Britain has such work under progress or in contemplation, it is unnecessary to give a list, and those interested can hardly go astray by addressing the city engineer of any large city in England or Scotland; and the same suggestion holds good, to a limited extent, for Irish and Welsh municipalities. The further suggestion is made that American contractors and manufacturers who desire to bid for such work should have an agent, say in London, who could keep them informed of the undertakings determined upon, so that bids could be promptly made.

"There is a general belief, both in the United States and England, that contracts for these public undertakings must be advertised for in the newspapers and must be let to the lowest bidder. I learn, however, from official sources that this is not necessarily so. It is not the case so far as Liverpool is concerned, and I understand that it is not so as regards most of the cities. These great municipal enterprises are undertaken by authority of act of Parliament. First, certain powers are granted by general acts. Then specific authority to meet local conditions is obtained in one of two ways, viz., (1) either by special local act passed by Parliament, or (2) by provisional order of the Government Board of Trade, which subsequently has its permissive authority or grant of power confirmed by act of Parliament, a number of such grants being 'omnibused' in

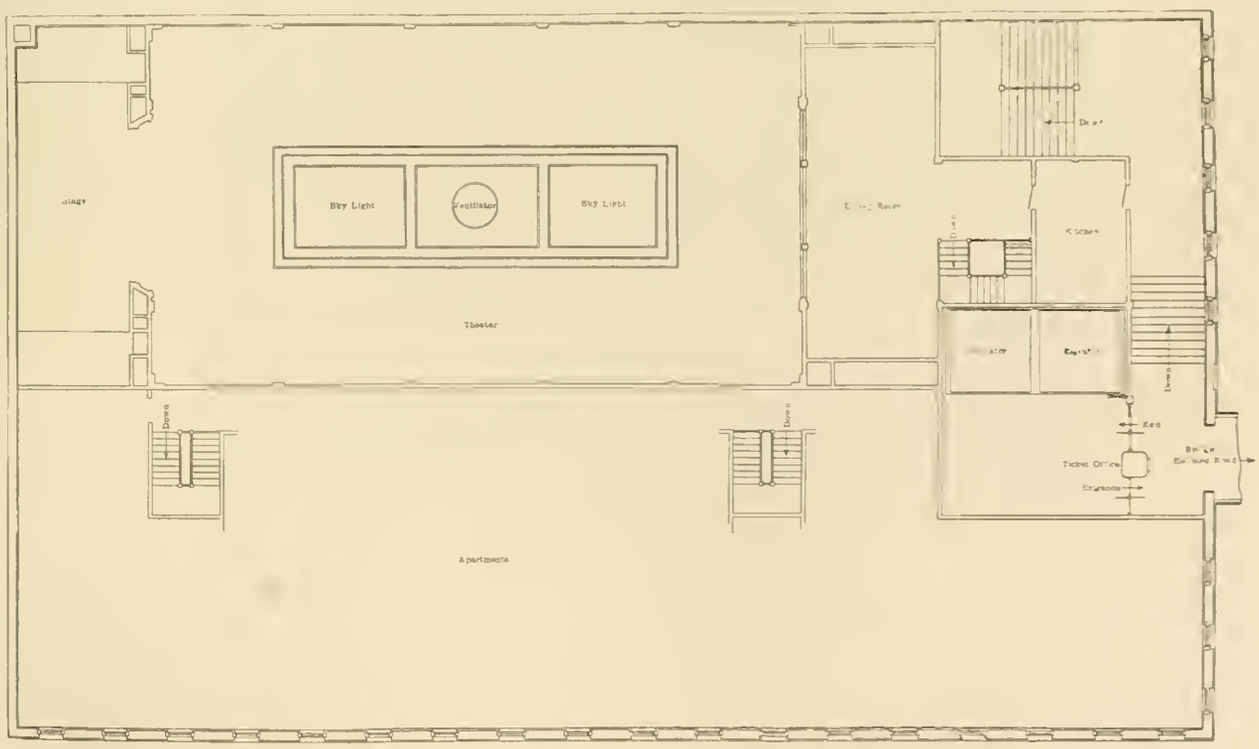


FIG. 4—THIRD FLOOR PLAN.

one act. The general public understanding has been that in the parliamentary acts there is a proviso necessitating advertising in the newspapers and the awarding of the contracts to the lowest bidder. On inquiry I learn that these details are left to the municipal authorities. After the plans and specifications are drawn up, the rule is for the council committee, through the city engineer, to write to concerns inviting bids. On application, the engineer will supply forms, plans and specifications.

"Within the last two years there has been a widespread agitation in Great Britain against the awarding of public contracts to foreign concerns. This sentiment has been particularly aroused by the bringing over of workmen from the United States to perform public contracts. Were it not for the fact that, for the last 18 months, labor generally has been plentiful here, with fair wages, this opposition would probably have made itself even more manifest. Certain industries, particularly those relating to iron and steel, are very busy in Great Britain now, as there is an accumulation of orders which had to be postponed because of the recent engineers' strike.

"The result was that the British manufacturers were placed at a great disadvantage when it came to making bids for these public contracts, and this applied both to prices and the time in which the work could be turned out. Some municipalities issued advertisements for tenders and gave the contracts to the lowest bidders, even though they were foreign concerns, and a number of American contractors and manufacturers reaped the advantage.

"I have inquired with particularity from those in authority whether, in the extension of the electric street railroad system, foreign competition will be invited and accepted if the bids are the lowest and the best. I am informed that, owing to the protests of their constituents, the city council of Liverpool will not go abroad for any more of the work where it can possibly be done in England, and this will include the furnishing of rails, electric plant and cars. It is better that American contractors and manufacturers should understand the situation as it really exists, and yet I believe it is worth their while to make an attempt to secure some of the work, not only in Liverpool, but in other British municipalities. Within the next few years there will be a great many million dollars spent by the municipalities in street railroad and electric light improvements. 'King's Manual of Electrical Undertakings' gives the aggregate capital of the electrical companies in Great Britain and Ireland for 1898 as $426,426,120. In Liverpool alone, from $5,000,000 to $7,000,000 will be spent for steel rails, electrical plant and cars within the next two or three years. The length of the contemplated street railway extensions is about 100 miles.

"The directors of the Metropolitan and Metropolitan District Railway Companies of London have decided to undertake, at their joint cost, a series of experiments prior to the introduction of electric traction on the Inner Circle underground lines. For this purpose it is proposed to lay down between Earl's court and High street, Kensington, an electric installation adequate for the hauling of a train which shall be fully as heavy as those now running at the busiest times of the day on the Metropolitan railway. This section of the company's line has been chosen for two special reasons: First, because the ordinary service thereon is not so frequent as that on other sections; and, in the second place, because it contains some steep gradients—as sharp as 2½ per cent—which will enable the new electrical system to be tested under the severest conditions that would be experienced in regular working.

"Each company has agreed to put down the sum of $50,000 to defray the cost of experiments, and these will be carried on without any interruption of the present steam locomotive traffic for eight or ten months—a period sufficiently long to demonstrate the practicability of the principle thereafter to be introduced generally on the lines of the Metropolitan and Metropolitan District railways. The contract for the experimental work has been let, and it will be executed forthwith, under the direction of Sir John Wolfe Barry, the consulting engineer to the Metropolitan Company, with whom is associated Mr. W. H. Preece, the engineer-in-chief and electrician to the general post office. Owing to the enormous volume of traffic, the undertaking will probably be the largest enterprise of any kind in the world in which electricity is the motive power.

"The extraordinary awakening in England in the use of electricity extends in a still further direction than that here outlined. There is a scheme under way for connecting Liverpool with the manufacturing towns within a radius of 17 miles, by light suburban electric street railroads, which in the daytime will carry passengers and at night will carry freight. Electric light and power will also be supplied to the towns. There will be a huge generating station at St. Helens. The company has a capital of $5,000,000."

In connection with this report it is of interest to give a partial list of electric railway schemes which will be presented for the approval of Parliament during the session of 1899. The information is taken from "Lightning," of London. Summary of applications for session 1899:

	Loc. Author.	Companies.	Total.
Tramway Provisional Orders	14	9	23
Tramway Bills	28	13	41
Electric Railway Bills	—	9	9
Light Railway (Electric) Provisional Orders	4	28	32
	46	59	105

Statistics regarding the following applications are given.

Name.	No. of miles.	Estimated cost. £	Promoters.
Aldershot and Farnborough	5¼	64,093	Power and Traction Ltd.
Ayr, Prestwick, and Monkton	4¾	31,787	Drake & Gorham Electric Traction Co. Ltd.
Barnsley and District	3¼	22,351	British Electric Traction Co. Ltd.
Camborne, Redruth, and District	10	41,887	Camborne, etc., Light Railway Co. Ltd.
Cheltenham and District	5¾	46,587	T. Nevins.
Colchester	5	33,827	British Electric Traction Co. Ltd.
Colne and District ...	5½	81,614	Colne Town Council.
Crystal Palace ...	9¼	45,417	Crystal Palace Light Railways and Tramways Co. Ltd.
Doncaster and District	5½	37,324	British Electric Traction Co. Ltd.
Doncaster Corporation	7½	34,500	Doncaster Corporation.
Dudley and District (Extensions)	3¼	27,277	British Electric Traction Co. Ltd.
East Anglian	13¾	98,912	Drake & Gorham Electric Traction Co. Ltd.
Finchley, Hendon, and District	10¼	111,185	Finchley District Electric Traction Co. Ltd.
Hamilton, Motherwell, and Wishaw	8¾	79,582	Hamilton, etc., Light Railway Co. Ltd.
Hampstead, Finchley, etc.	14½	75,615	Metropolitan Tramways Co. Ltd.
Hastings, Bexhill, and District	13½	63,524	Hastings, etc., Light Railway Co. Ltd.
Highgate, Finchley, and Wood Green	10¾	54,559	Metropolitan Tramways Co. Ltd.
Hounslow and Twickenham	6¾	47,259	Drake & Gorham Electric Traction Co. Ltd.
Isle of Thanet (Extensions)	5¼	23,224	Isle of Thanet Light Railway Co.
London United Tramways, Ltd., Light Railway Extensions	16¾	199,015	London United Tramways, Ltd.
Middlesbrough, etc. ...	7	56,340	Imperial Tramways Co. Ltd.
Middleton (Extension)	2	15,108	British Electric Traction Co. Ltd.
Musselburgh	4¼	37,303	Drake & Gorham Electric Traction Co. Ltd.
Nelson and District ...	1½	15,000	Nelson Corporation.
Nelson, Colne, etc. ...	6¾	87,860	Greenwood & Batley, Ltd.
Rhyl and Prestatyn ...	3¾	26,458	Rhyl and Prestatyn Light Railway Co. Ltd.
St. Helens, Leigh, and Bolton	24	102,090	Lancashire Light Railway Co. Ltd.
Southend-on-Sea and District	6½	40,474	Southend Corporation
South Staffordshire ...	4¼	28,767	British Electric Traction Co. Ltd.
Spen Valley	7½	55,631	British Electric Traction Co. Ltd.
Swansea	7½	55,172	Swansea Improvements, etc., Co. Ltd.
Waltham Cross and Enfield	5¾	27,923	Metropolitan Trams, etc., Co. Ltd.

PENNSYLVANIA CAR WHEEL COMPANY.

The Pennsylvania Car Wheel Company, although a comparatively new concern, has already made giant strides and has established a most enviable reputation for its product. Starting in the early part of 1898, it has been compelled to make two large additions to the works in order to keep pace with the growing demand for its wheels, and it is now melting iron at the rate of 30,000 tons per annum and expects to largely increase this during the present year.

The accompanying illustration, Fig. 1, shows a view of the company's works at 499 to 539 Preble avenue, Pittsburg. In Fig. 2 is shown a view of the interior of the main foundry. The company has a complete equipment, and is prepared to meet the requirements of every kind of service; the sizes vary from 14-in. wheels for turntables to 36-in. wheels for snow-plows and street sprinklers, and 42-in. coach wheels.

FIG. 1.—WORKS OF PENNSYLVANIA CAR WHEEL COMPANY.

The wheels are all made from specially selected grades of metal and are properly annealed and carefully tested—in fact, the testing of both the material and wheels after being finished is most thorough. The raw material is carefully inspected and only the higher grades of charcoal iron with a percentage of selected old wheels are used in the mixtures. The metal is tested frequently; at stated intervals during the melt, test bars are poured from which to ascertain the transverse strength, and test pieces made from which to ascertain the hardness and wearing quality of the metal and to determine the depth of chill. All the wheels are carefully annealed; this process requires a number of days, depending on the weight and diameter of wheels, and every individual wheel is thoroughly tested and examined by competent inspectors before shipment can be made. The testing and inspecting are so carefully done that it is almost impossible for an imperfect or defective wheel to be sent from the foundry.

The company guarantees its standard quality of wheel to meet all the requirements of ordinary service either for steam or electric cars; but for specially severe service, such as heavy grades, and consequent severe application of brakes, or for unusually high speed, it strongly recommends its "Duquesne extra quality." The "Duquesne" wheels are made under exactly the same thorough system of tests and inspection as the standard wheels, but owing to the use of more expensive metals in the mixtures they have greater strength and increased wearing quality, giving a corresponding increase in mileage. These wheels are recommended for absolute safety. This company's wheels have been adopted by a number of roads and are largely used under cars of 100,000 lbs. capacity, which require a wheel that will stand severe service.

The quality of wheels furnished electric railways is shown in a letter the company received recently from E. W. Davis, superintendent of the Versailles Traction Company, McKeesport, Pa., in which he says: "I am returning two pairs of wheels on axles. One axle was bent in a wreck which we had a few days ago and has on it the wheels you recently sold us. As I can find no damage to the wheels, please have the axle straightened and replace the same wheels on it, and return it as soon as possible. The wheels were subjected to very severe stresses and the result speaks well for your product."

FIG. 2. INTERIOR OF MAIN FOUNDRY.

The officers of the Pennsylvania Car Wheel Company are all men of wide business experience. Joshua W. Rhodes, of J. W. Rhodes & Co., of Pittsburg, is president, and his all-around business ability

and enterprise have had not a little to do with the remarkable success achieved. W. L. Elkins, the vice-president, is one of the celebrated Elkins family of Widener & Elkins fame, and has been largely instrumental in securing the very considerable street car business which the company is doing. The burden of actual management rests on the shoulders of Charles V. Slocum, secretary and treasurer, who is equipped for the arduous duties by 20 years' experience in a similar position. J. D. Rhodes looks after the sales in the western part of the territory. The eastern section is taken care of by John Howard Yardley, with headquarters in the Girard building, Philadelphia. Mr. Yardley is one of the best known men in the railway business, having in the last few years developed a large trade with both steam and electric railways. Connected and interested with the company are C. L. Magee, state senator from the Pittsburg district and proprietor of the "Pittsburg Times;" W. B. Rhodes, general manager of the Pennsylvania Tube Works, and J. D. Callery, president of the United Traction Company, of Pittsburg. The company will be pleased to submit designs of wheels for any special service, and any inquiries addressed either to Pittsburg or Philadelphia will receive prompt attention.

REPORT OF BOSTON ELEVATED.

Under date of December 19, 1898, President William A. Gaston presented to the stockholders of the Boston Elevated Railway the first annual written report of the company, covering the operations of the fiscal year ending September 30, 1898. We extract the following from the report:

The company was chartered by special act of the Massachusetts legislature in 1894 and organized immediately thereafter. The property of the West End Street Railway Company was leased December 9, 1897, for 24 years, 8 months and 9 days from October 1, 1897. The lease was approved by the Railroad Commissioners on December 15, 1897.

For the year ending September 30, 1898, the business was as follows:

Gross earnings from operation		$9,179,096.35
Operating expenses		6,566,584.16
Net earnings from leased lines		2,612,512.19
Subway rental	$ 106,134.35	
Interest on debt of and dividends on stock of lessor companies	1,655,730.00	
Taxes on West End Company	435,860.44	
Total payments under lease		2,197,724.79
		414,787.40
Add interest on special deposits		78,156.59
		492,943.99
Taxes		166,366.83
		326,577.16
Interest to holders of Boston Elevated Railway Company, 2¼ per cent on amount paid in		112,500.00
Surplus for year		214,077.16

Compared with the business done by the company's lessors in the year October 1, 1896, to September 30, 1897, the business done the past year on the leased roads shows a satisfactory and substantial increase, and this in spite of unfavorable weather and disappointing financial conditions. The company has maintained the leased property fully up to the solid and excellent condition in which it took it. With a view of increasing the business and of meeting and satisfying reasonable public demand, the company has built new track, established new lines, and enlarged the general equipment to the extent necessary to accomplish that result. The cost of these improvements and additions are charged to the West End Street Railway Company under provisions of the lease. Among some of the more important track work finished or in process of completion, may be mentioned the new line from Waverley to Mount Auburn, the extension of the track on Blue Hill avenue to Walk Hill street, and the double tracking of Main and Salem streets, Medford, from the Somerville line to the Malden line; 13.21 miles of old tram or T-rail track have been relaid with the best 9-in. girder rail; 128 open and 140 box cars have been purchased, with all their necessary adjuncts and electrical equipment, 57 cars taking the place of 57 cars burned in the fire that occurred December 24, 1897, in which the Everett car-house was completely destroyed, the loss, however, being covered by insurance; 13 additional snow-plows have been bought, five having been destroyed by fire. The company has purchased on Dorchester avenue, Dorchester, a lot of land, and built a large, fine, commodious car-house, with opportunity for the storage of 60 cars, and has built at Everett another new car-house, of a capacity of 60 cars, to take the place of the one destroyed by fire. The total number of miles of new track laid and equipped with all necessary electrical apparatus, including new track in subway, has been 16.44.

In connection with the business of the leased line, a few words of interest may perhaps be said concerning one of the largest and most important public works that has been recently experimented, the Boston subway. Up to September 3, 1898, the portion of the subway south of Park street was operated by this company, although previous thereto, while the public work was still uncompleted, it had equipped the remainder of the subway with the very best road-bed, track and electrical apparatus known. On September 3, 1898, the completed subway was open to the public, and since that date has been operated under the contract made and entered into by the city of Boston and the West End Street Railway Company, which contract has been assumed by the Elevated Company. Up to the end of the fiscal year which this report covers, and since that time, the company has been endeavoring to make the subway a success and a pleasure to the public, and endeavoring to make the largest and most advantageous use of that leased property. In this, it has had the assistance of the Transit Commissioners, who have made many valuable suggestions as to the operation of the subway and as to the conduct of the business therein. Whether any means can be devised which will increase the present carrying capacity of the subway is a problem upon which the operating department has given, and is giving, the best thought in its power; and the officers feel confident that, if any solution to that problem is possible, it will be made.

While the fiscal year ended on September 30, it may be of interest to learn of the use of the subway for the month of October, 1898 as at the end of the fiscal year the largest use of the subway had not taken place.

Average daily number of cars running through subway in October, 1898, was		3,518
Total number of subway checks sold October, 1898:—		
At Boylston Street	138,523	
At Mason Street	171,726	
At Park Street	818,708	
At Scollay Square	485,941	
At Brattle Square	136,032	
At Adams Square	85,698	
At Haymarket Square	161,851	
		1,998,479
Average number of subway checks sold per day in whole subway in October		64,467
Free transfers in October, 1898, in subway		749,687
Average number of free subway transfers given per day in October		24,183
Total free transfers issued in October, 1898		3,622,279
Average number of free transfers given per day in October		116,847

VOLUME OF BUSINESS FOR YEAR.

Total revenue passengers carried during year	181,321,295
Increase over business of lessor's previous year	8,766,782
Or an increase of about 5.1 per cent.	
Total free transfer passengers carried during year	28,239,880
An increase over business of lessor's previous year of	4,462,154
Or an increase of about 18.8 per cent.	

The present free transfer facilities now in effect point to an enormous increase of free transfer passengers in the present fiscal year.

Under the provisions of law, no work could be begun on the elevated structure until the plans thereof had been approved by the mayor of Boston as to architectural appearance and obstruction to

and safety of the structure, as to the convenience and comfort of the public, and as to certain other particulars. The plans were approved by the mayor on April 29, 1898. The plans were approved by the Railroad Commissioners, after several long public hearings, on July 11, 1898. Since that time the company has been busily engaged with a large force of men, making the surveys and examinations of the streets and adjacent properties necessary to make contracts and specifications for the erection of the elevated structure. In anticipation of a favorable decision on the plans, some necessary work was done on the new Charlestown bridge prior to July, 1898, in connection with the building of that bridge by the Transit Commission, so that it was able on September 27, 1898, to make a contract with the Carnegie Steel Company, Limited, to erect the section of the structure upon that bridge, completion of the work to be prior to January 1, 1899.

Within a short time it is expected to have under contract a large proportion of the structure upon the route upon which the company has been authorized to build by the Boston city government. Foundations to receive the structure will be begun at the opening of the spring of 1899. Much of the structure will be completed by the following fall. The plans for the terminal stations at Roxbury and Charlestown have been completed, and a large part of the land required for the same has been taken by eminent domain or purchased.

The traffic statistics for the year are as follows:

Round trips run by electric passenger cars	3,088,473
Round trips run by horse passenger cars	52,588
Round trips run by U. S. mail cars	15,363
Total	3,156,424
Revenue car-miles, electric passenger	31,933,624
Revenue car-miles, horse passenger	275,526
Revenue car-miles, U. S. mail	170,295
Total	32,379,445
Revenue passengers on electric cars	180,178,908
Revenue passengers on horse cars	1,142,387
Free transfer passengers on electric cars	28,239,880
Passenger receipts, electric cars	$8,911,080.94
Passenger receipts, horse cars	56,506.62
Receipts, U. S. mail cars	20,097.31
Average receipts per revenue passenger	4.945 cents.
Average receipts per total passenger	4.270 cents.

The company operated a total of 316.05 miles of track on September 30, 1898, of which over 306 miles are equipped on the overhead trolley system.

The company owns 274 horse cars, 2, 566 electric cars (passenger), 13 mail cars, 437 horses, 3,370 electric motors, 78 horse snow plows, 158 electric snow plows, 419 snow sleds, and 501 miscellaneous vehicles.

NOTES FROM COLUMBUS, OHIO.

The street railway companies of Columbus, O., have been furnishing their patrons with weather reports during the past six weeks and the service has proved to be very popular. The United States weather bureau furnishes neat cards, with forecast printed on them, each morning, and one of these is placed in each car by the conductor.

Columbus has no public parks suitable for picnics, and the street railway companies are fortunate in each having a park of its own. All of them are beautiful and are well patronized by the public. Last year was the most successful one in the history of the roads and largely because of the parks.

One of the roads recently settled a claim against it for $162.50 arising out of an accident at its park casino. There was a small rent in a piece of carpet in which a lady caught her toe, and in falling sprained a finger.

The Columbus Central Railway Company runs a freight car which is proving very popular and is more lucrative than any passenger car on its lines.

NEW PUBLICATIONS.

The address of Charles Wallace Hunt, as president of the American Society of Mechanical Engineers, delivered at the meeting of the society in November last, has been reprinted in pamphlet form. A short extract of this address was published in the REVIEW for December, 1898.

"Graphite," Vol. 1, No. 1, appeared in December. It is a four page monthly issued by the Joseph Dixon Crucible Company in the interest of its graphite products. The first number is filled with interesting information, and we may expect to find in this publication the cream of the writings on this subject.

The "Wisconsin Engineer" for January is a number very creditable to the technical department of the University of Wisconsin. Many valuable contributions on electrical, mechanical and civil engineering subjects were made by the professors and alumni of the school. The introductory article is on "Technical Education at the University of Wisconsin."

The 20th annual number of "The Tradesman," published at Chattanooga, Tenn., is a volume, including advertisements, of 248 pages. There are over 100 pages of reading matter, principally descriptive of the industries and resources of the south, and the book will be valuable for reference. There are a large number of signed articles by able writers and every business man will find something in it to interest him. There are numerous handsome illustrations and the typography is above reproach.

Our New York contemporary, "Locomotive Engineering," which had its offices on the 15th floor of the Home Life Insurance building, suffered severely when that building was burned out on December 5. Only the contents of the safe escaped destruction, and the papers and books in it were badly scorched. The loss included the office furniture, reference library, books kept for sale, copy for the January issue and the mailing list. Notwithstanding that the fire left the paper without cuts or copy, the January issue appeared on time with a complete new dress, and it appears that the difficulties encountered by Mr. Sinclair only served as a tonic. The whole number is fully up to the high standard of previous issues.

The National Association of Manufacturers, which has its general offices at 48-51 The Bourse, Philadelphia, has just prepared its "American Trade Index," a volume of over 300 pages, forming a descriptive and classified membership directory of the National Association of Manufacturers of the United States, arranged for the convenience of foreign buyers. The first 125 pages is an alphabetical list of American firms and companies doing an export business, with a brief statement of the line of goods made by them. The second part, of 130 pages, is an index of products, names of makers being given under each. Part III is a list of the registered cable addresses of members of the association, and Part IV comprises a number of displayed announcements. The index is a handsome volume strongly bound in cloth.

The first edition of 5,000 copies, in the English language, is to be distributed free to the principal merchants in English-speaking countries. A second edition, in the Spanish language, is now in preparation. The work is done without cost to the firms indexed. As the index is intended for foreign circulation, a charge of $3 per copy is made to those desiring the book in the United States.

CONDUIT CARS BLOCKED BY RAIN.

It is reported from New York that the cars on the Sixth avenue conduit electric line were compelled to stop at 11:15 p. m. January 6, the blockade continuing until morning. The blockade was at first only between 23rd and 59th streets, but within a short time the entire line was involved. A heavy rain commenced on the night of January 5 and continued for so long a time that the drainage system proved inadequate to keep the water level in the conduit below the level of the conductory rails. When installed the drainage system was thought to be ample.

THE LATEST IN AIR BRAKES.

Supply is Carried in Reservoirs—No Charging on the Car—300 Stops With One Supply.

For more than a year past the G. P. Magann Air Brake Company has conducted exhaustive experiments at Detroit on a new type of air brake, the purpose being to avoid the use of electric or axle-driven compressors, and provide a brake cylinder that would act more sensitively in instantaneous release of brakes, and eliminating noise and vibration. Through the hands of the company's inventor these results have been attained. Widely departing from present methods of air brake application, stored air is used confined in res-

CAR WITH MAGANN AIR BRAKE.

ervoirs fixed to the car and filled by a half minute charge from a stationary steam or electric driven air compressor in the power station, or on the line at sufficient pressure to allow a car an average of 300 stops to be made. By this system the care and expense incident to air brake machinery is reduced to a minimum, for there is very little mechanism on the car. The broad claims of the company for its storage air system are supported by an examination of the working of the brake on the Detroit & Pontiac Railway, which has had 12 cars thus equipped and in successful operation for the past eight months.

The system is extremely simple, the air being first compressed at the power station to 225 lbs. per sq. in. by means of a reciprocating air pump located in the engine room, and driven directly by steam. From the compressor the air is conducted to a large stor-

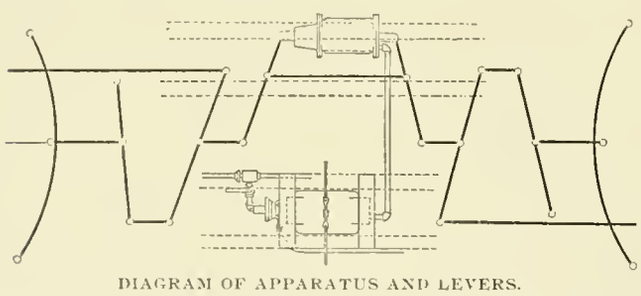


DIAGRAM OF APPARATUS AND LEVERS.

age reservoir, thence through underground pipes to convenient points along the track in front of the station, and to the car barn when near by. Connection to the cars is by means of automatic adjustable couplings quite similar to the air brake train connection on steam roads. Each passenger car carries two storage tanks made of riveted sheet steel tested to double the ordinary storage pressure of 225 lbs. Each cylinder has a capacity of 36 cu. ft. The time required for making connection, charging and breaking connection is less than 30 seconds, and on the D. & P. line all this is done while the conductor is filing his trip report. The storage tanks on the car are piped through a reducing valve to a small auxiliary reservoir which carries 40 lbs. pressure. The usual connections are then made to the brake or jam cylinder through a 3-way controlling valve on the platform. The jam cylinder is of the differential type, air being admitted on both sides of the piston, which moves in two cylinders of different sizes. To stop the car the large sized cylinder is exhausted, allowing the air pressure in the smaller cylinder to force the brake on. To release, the air is admitted to the large side, forcing the brake off and making a positive release. This also allows the motorman to put on only the requisite braking pressure, any undue pressure being immediately relieved by air cushioning in the large cylinder. With car reservoirs stored to original pressure of 200 lbs. a large double truck interurban car on the Pontiac line ran six hours and 20 minutes, or a total of 96 miles, in a hilly country and made 228 stops. When the car was then brought into the car house there was still enough pressure to handle the car with ease, the gage showing 40 lbs. Where a greater or less number of stops than 300 are desired, it is regulated by the initial pressure carried. The system will meet its first and large introduction on interurban and elevated lines, but it is highly probable that city surface lines will be able to adopt it with equal success in large cities, where headways are short, or on very long lines, where it is desirable to have the charging stations either scattered or increased, to avoid bunching cars at a few points, compressors can easily be installed wherever desired; in basements for instance, and operated by current from the trolley wire. The rapidly increasing uses to which compressed air may be put around a power station will also make the presence of a compressor in a station useful in many ways. The Pontiac officials report no repairs or delays in the operation of the brake, and their requirements are severe, the running time of the 30 miles being 90 minutes, while over a portion of the route a speed of fully 50 miles an hour is attained.

The general offices of the company are at 47 Campau building, Detroit, and F. D. Ray, well known to street railway men, has assumed position of general manager. Mr. Ray has had a long and wide experience in matters electrical, and as manager of electric lines, and is fully qualified to determine just the requirements for any kind of service.

CAST-WELD PATENT DECISION.

In the case of the Falk Manufacturing Company vs. the Missouri Railroad Company, of St. Louis, and the American Improved Rail Joint Company, of Chicago, which has been pending since July, 1897, an opinion was filed on January 10 by Judges Adams and Sanborn of the United States circuit court at St. Louis. In this opinion the court finds that while the Falk Company's patent sued upon (No. 545,040) has five claims, yet each of them might be said to be practically based upon the following steps, viz.: 1. Cleaning the abutting rails for a short distance from the ends. 2. Heating such cleaned rail ends. 3. Adjusting a mold around such rail ends. 4. Pouring molten metal into the molds.

After commenting upon the result obtained, in the way of securing what are known as continuous rails, the court says: "In our opinion, without entering into any detailed analysis of the evidence bearing on the state of the art, consisting generally of publications, technical works, mechanical operations, individual experiences, common knowledge, and divers patents—all of which have been carefully considered—the efforts of the patentee, as disclosed by this patent, belong to the domain of mechanical skill and not to the domain of invention."

The opinion then calls attention to the fact that "the proof shows and common knowledge confirms" that every step in the process is something that was known in the general art of casting and founding "long before the application for the patent in suit was made."

Answering the argument that the patent should be sustained notwithstanding all that was known of cast-welding in other arts the court says: "It is an old and familiar method applied to a condition which is brought about by the needs of the recent changes and improvements in street railway propulsion." It is then pointed out that such improvements are the heavy electric cars, and heavy rails, such rails being "required to be so sunk into the ground and fortified by retaining walls of stone or cement so that only the upper surface of the head and running flange are exposed." These conditions the court observes are not of the creation of Mr. Falk, and he "is not entitled to a monopoly of the supposed invention because the well known old process of his patent fell into a use

made available by the adaptation of new conditions to new needs, with which the patentee had no concern."

After thus disposing of the Falk patent in general terms the court considers specifically some of the English patents put in evidence by the defense. It says: "Again, in our opinion the complainant's patent is clearly anticipated by other patents pleaded by the defendants in their answer. The Norris English patent of 1851 shows the rail sections united so as to form a continuous rail; shows also a divided mold adapted to be placed around the abutting ends of two rail sections; shows also the process of pouring in the molten metal so as to surround the ends of the rail sections."

This Norris patent (which was issued in 1851) is then quoted from at length, and as to the point raised by the complainant that it was silent on the points of preliminary heating and cleaning, the court says: "We agree with counsel for defendant that these steps were so well known to the founder's art, both in practice and prior patents, long before the Norris patent, as to be necessarily read into it."

The patent of 1831 to George Stephenson, the eminent English engineer, was also quoted to show that at that early day everything set forth in the Falk patent in the way of doing cast-welding was well known.

The opinion concludes: "It seems to us that any practical mechanic familiar with the founder's business cannot read these two English patents, to say nothing of several others in the case almost equally suggestive, without seeing the applicability of the process there taught, to any and all the uses contemplated by complainant's patent. We therefore hold that complainant's invention was anticipated at least by the Norris and Stephenson patents above alluded to. It results that the complainant's bill must be dismissed."

WRECK ON THE ALLEY "L," CHICAGO.

A read end collision occurred on the South Side Elevated Railroad, Chicago, about 7 p. m. on January 13, in which four persons were seriously injured. The two trains met at Monroe avenue, one square west of the Madison avenue station, on the heavy up grade leading to the bridge over the Illinois Central at 63rd street. The rear of the train struck was at Monroe avenue and 63rd streets. The two cars were telescoped, the motor car being driven into the other for a distance of 10 ft. or more. As stated four persons were seriously injured; the motorman was not hurt.

Who or what is to blame for the accident is not known at this writing, but one lesson to be drawn from it is that elevated cars should have steel platforms and vestibuled ends.

At the municipal election held in Ottawa, Canada, January 2, the question of whether street cars should run on Sundays was voted upon; there was a large majority in favor of Sunday cars.

The Worthington, Clintonville & Columbus (O.) Street Railway Company, December 31, elected officers as follows: George H. Worthington, president; F. D. Simons, vice-president; T. A. Simons, secretary and treasurer; R. M. Weaver, auditor.

The Westerville & Worthington Street Railway Company, of Delaware, O., is at work securing grants for a right of way between Delaware and Flint, preparatory to asking the county commissioners for a franchise. The company promises to complete the line by July, 1900, if the franchises and consents are secured.

The first trip of a 5,000-gallon street sprinkling car recently put in service by the San Diego (Cal.) Electric Railway Company, was witnessed by a party comprising the mayor, city council and other guests. We understand that the company is willing to take the city contract for sprinkling the streets in which its tracks are laid.

The passenger earnings of the Brooklyn Rapid Transit Company's system for December, 1898, were $472,500, an increase of 10 per cent over December, 1897, and 14.3 per cent over December, 1896. For the year 1898 the total passenger earnings were $5,847,568, an increase of 12.8 per cent over 1897 and 15.4 per cent over 1896.

A franchise for an interurban road between Mattoon and Charleston, the county seat of Coles county, Illinois, is being sought by W. H. Patterson, president of the Bloomington City Railway Company. There will be a mile of track in Charleston, 2½ miles in Mattoon and 10 miles between the two towns. Charleston has a population of 7,000, which will soon be increased on account of the recent completion of a normal school for 1,000 students. The shops of the Big Four and the Peoria, Decatur & Evansville Railroads are located at Mattoon, which is a city of 11,000 inhabitants. Prospects are very good for franchises being granted for this line, and in such a case Mr. Patterson will be in the market for 500 h. p. of engines and generators and eight to ten cars.

The Rock River Valley Electric Railway Co., which wishes to build between Rockford and Oregon, Ill., is seeking to place $50,000 of its bonds in Rockford.

The Tama & Toledo (Ia.) Electric Railway & Light Company has been reorganized with W. C. Walters, president; H. A. Shanklin, secretary and treasurer, and Wm. McDaniel, superintendent.

The East Liverpool (O.) Railway Company refused to reinstate a discharged motorman and dispense with the services of one of the officers of the company at the demand of the local motormen's union, and a strike resulted.

A Monongahela electric car left the track and went over a 25-ft. embankment near Duquesne, Pa., on January 9. The stove was upset and several passengers burned. Four passengers and the conductor were injured, but all will recover.

It is announced that a decree has been entered in the case of the city of Lincoln, Neb., against the receiver of the Lincoln Street Railway Company, making the city's claims for paving taxes some $80,000, a first lien on the system, taking precedence of two mortgages.

H. C. Scott and S. W. Fordyce of St. Louis are making oil experiments at Waco, Tex., with a view to sinking wells and developing oil fields. Mr. Scott is president and general manager of the Citizens' Railway Company of Waco, and both are large stockholders in the Waco Gas Company.

The town of Gray's Lake, Ill., has granted a 50-year franchise to the Chicago & Fox Lake Electric Railway Company for a free right of way through the village. It is the intention to start the road at Lake Bluff and build it to the Fox Lake district. Cars will be operating by July 1 according to the plans of the promoters.

Among the 4,500 uniformed employes of the Boston Elevated Railway Company there are three men, Christopher Brady, Benjamin F. Jacobs and John Byrnes who are entitled to wear eight service stripes, indicating that they have been with the road for over 40 years. Six men wear seven and 22 wear six stripes. About 1,500 are entitled to one stripe.

The new board of directors of the Zanesville (O.) Electric Railway Company was elected as follows: T. Robinson and John M. Graham, of Boston, Wm. B. Cosgrave and Charles W. Foote, Zanesville, and Wm. Cristy, Akron. The board selected the following officers of the company: Thomas T. Robinson, president; John M. Graham, vice-president; W. B. Cosgrave, treasurer, and Charles W. Foote, secretary and general manager. Frank A. Durban will act as chief counsel for the company.

David Young was chosen president of the North Hudson County Railway, of Hoboken, N. J., on January 5, which is taken to indicate that stockholders of the North Jersey Street Railway Company, of which Mr. Young is vice-president and general manager, have acquired control of the former company. One of Mr. Young's first orders was to connect the wires of the two companies, and North Hudson electric cars at once began running to the Jersey City ferry terminal over the North Jersey tracks, where only horse cars of the North Hudson Company have been allowed heretofore.

NEW DOUBLE TRUCK CARS.

We present herewith illustrations of two very handsome cars built by J. M. Jones' Sons, of West Troy, N. Y., which cannot fail to be of interest to our readers as showing the latest types of double truck cars built by a firm having a most enviable reputation for excellent work.

The closed vestibule car for interurban service has a length over all of 39 ft. 6 in.; the length of the body is 30 ft. 6 in., and the width over the windows 8 ft. The bottom framing is extra heavy, with inside steel plates; there are inside and outside iron trusses. The car is equipped with spring buffers and air brakes. The car is wired for two trolleys. The vestibules are the Jones standard round and bent type; drop sash are in both the body and the vestibules. The vestibules have folding doors and double steps are placed at each end of the car. The car is divided into two compartments, one of which is for smokers.

The view of the interior of this car shows the partition separating the smoking compartment from the other part of the car; plate glass is used in this partition. The door in the end, to the left, is the regular entrance for this end of the car, and the entrance to the smoking compartment is at the platform, at the side of the regular entrance. The passageway from the entrance to the main passenger compartment is along one side of the car, as shown in the illustration, and by this arrangement there is no need for persons entering or leaving the car to pass through the smoking room, as would be the case were the partition separating the two parts simply a transverse one. The entrance at the opposite end of the car is at one side of the center, the two main entrances being at diagonally opposite corners.

JONES CLOSED INTERURBAN CAR.

The interior of the car is beautiful, being natural cherry throughout, with decorated ceiling. There are upholstered "walkover" seats for 28 persons in the large compartment and longitudinal rattan seats for 12 persons in the smoker. The cars are wired for 25 lamps. The windows have spring roller curtains. There are adjustable ventilators; push buttons are placed at each seat.

This car is one of a number built for the Stillwater & Mechanicville Street Railway Company, of Stillwater, N. Y., and Jones' Sons are now building 10 cars for the Albany Railway, which are the same in all respects save that there are no vestibules and plate glass is used throughout.

The second illustration shows one of the Jones standard 15-bench open cars built for the Commonwealth Avenue Street Railway

JONES 15-BENCH OPEN CAR.

Company, of Boston. This car is 41 ft. 3½ in. long over all; the length of the body over the panels is 32 ft. 9½ in. The width at the bottom is 7 ft. 3 in.; over the seats 7 ft. 9 in.; over all, with steps folded, 8 ft. 1½ in.; over all, with steps down, 9 ft. ¾ in. The distance from center to center of trucks is 25 ft. This car has seats for 90 persons. The seats are placed 2 ft. 6 in. from center to center, except at the ends, where the distance is 3 ft. 9 in., to give sufficient room between the facing seats. There are folding steps and guard bars on each side. At the sides are spring roller curtains; at the ends there are drop sash. The car has iron plate sills. It is wired for double trolleys. The interior finish is in maple and ash, and solid bronze trimmings are used throughout.

NEW ELECTRIC ROAD IN KANSAS CITY.

The work of changing the Brooklyn Avenue Railway, Kansas City, Mo., from a cable to an electric line is to be commenced at an early date. A number of changes will be made in the grade and the roadbed reconstructed. The company has applied for franchises which will enable it to make much needed extensions and reach a better paying territory.

The plans for the substitution of electricity and the rebuilding of the line have been prepared for some time, but the letting of contracts was delayed on account of the litigation concerning the Julian law providing for the sale of franchises to the highest bidder. The supreme court finally decided that this law has no application to Kansas City.

The present officers of the company are: John Lucas, president; James Blair, of New York, vice-president; W. H. Lucas, general manager.

GENERAL ELECTRIC RAILWAY LITIGATION.

As noted in the Review for November, 1898, when the General Electric Railway, of Chicago, began the construction of its tracks in Plymouth place it was stopped by injunction issued on the petition of the Chicago & Western Indiana Railroad Company. Later the injunction was dissolved and the bill dismissed, and the Chicago & Western Indiana carried the case to the appellate court, which a few days since reversed the ruling of the lower court, and held that the Chicago & Western Indiana Railroad, by virtue of its right of way across the street, could sue in equity to restrain the injury to its property which would be inflicted were the crossing permitted. The case will of course be carried to the supreme court.

FOREIGN FACTS.

Hastings has decided by a large majority of its voters that the city should be provided with electric traction. A committee has been appointed to inspect the various tramway systems in English cities.

In the latter part of November the Compagnie Generale Parisienne de Tramways put in operation its Bastille-Charenton line. This has a total length of 4⅜ miles, partly conduit and partly overhead trolley.

The experimental trolley line in Glasgow has given satisfaction, and instead of equipping the Govanhill route, connecting the line to Coplawhill for operation by the conduit system, as was intended, the council directed that a trolley line be built.

The accident at Bradford of an electric car slipping down hill and causing a loss of life has turned the attention of the tramway committee of Sheffield to investigate the question of safety brakes, for there are steep grades and sharp curves on the Walkley line.

The council of Newcastle is hesitating as to the system of tramway traction to be adopted in that city, for there are some steep grades. A committee is now visiting the cable roads in Edinburgh and Brixton, and the electric lines of Middlesbrough, Leeds and other cities.

In the construction of the cable tramways of Edinburgh some difficulties have arisen; among others, narrow streets on the Edinburgh and Portobello suburban line prove to be a hindrance. It was considered in the council that a trolley line might be desirable along this route.

The results from the Dingle experimental trolley line in Liverpool have been gratifying. On the first day the cars carried 20,000 passengers and on the succeeding 23 days 265,000 were carried. The increase in traffic has been 170 per cent since the horse cars have been replaced by the electric.

The conduit system of Blackpool, which has been in service for 12 or 13 years, is now being converted to a trolley line. This change was brought about by investigating the power consumption. Under favorable conditions not less than 45 per cent of the current leaked into the ground. This caused a yearly loss of $11,000, which in two years will pay for the cost of the necessary changes.

Japan is to have a second electric street railway system connecting the seaport of Oita with the town of Beppu, on the island of Kyushu. The construction is now in progress and much of the equipment has been ordered. The Brill Company has shipped 10 car trucks; McIntosh & Seymour one 160-h. p. high speed engine; the General Electric Company one six-pole 160-k. w. generator and 20 25-h. p. car motors.

Sometime since a laborer on one of the motor cars of the Dublin United Tramways Company jumped from the car while in motion, and in falling was run over and killed by the trailer. Although the jury found that no blame was to be attached to the company or its employes for the accident, objection was raised to the use of trailers. The company has consented to discontinue the trail cars except on special occasions when traffic is excessive.

The development of water powers in Switzerland, particularly those on the Rhine, promise to bring a great boom to the industries in the country. Electric railways are being planned and built between cities and villages, and in some cases these lines connect towns of insignificant population. Not far from Aarau, power stations are being erected to give an output of 16,000 h. p. An electric railway is now being constructed between Aarau, a city of 7,000 population, and Frich, a village of 1,000 inhabitants.

The United States consul at Lourenco Marquez, or as better known, Delagoa Bay, in Portuguese Free State of East Africa, reports that the government has given a 50 year concession to a Belgian syndicate to build and operate an electric railway. Surveys are made for four miles of tracy with overhead trolley. The frdanchise provides that work must begin by July of this year. He further reports that the council of Durban, Natal, is seeking reports of electric railway systems in the United States and Europe with the intention of planning a system for that city, which has a population of over 25,000.

Carlisle, England, has been given power by an act of Parliament to build a system of electric railways. The mayor and council have been investigating the different methods of traction and are very favorably disposed toward the trolley as operated in Dover. The American manufacturers who furnished the apparatus at the latter place will do well to foster this impression by plans and estimates.

The power station for the Sheffield tramways, which has been building since last July, is nearing completion. The first installation will be three 300-h. p. E. P. Allis engines direct connected to 225-k. w. generators.

Further investigation into the transportation needs of Porto Rico leaves no doubt but that electric railways are best suited to the needs of the island. The few railroad lines that are now in operation charge exorbitant rates, over 5 cents per mile for passengers and even higher rates for freight. There are a great number of streams of considerable magnitude which rise in the mountains and make a rapid descent into the sea. These streams provide abundant water power at all times during the year. The island is so small and symmetrical that current could be rtansmitted to all parts when these water powers are developed. In every way the trolley lines would be best fitted to meet the needs of the island, and it is only a qustion of a short time when they will be constructed.

The Dusseldorf & Crefeld Light Electric Railway has been completed and opened for traffic. This interurban line is about 20 miles in length and connects Dusseldorf, a city of 150,000 population, with Crefeld, a city of 110,000, in one of the Rhenish provinces of Germany. For 11 miles between the cities the company owns its right-of-way. The overhead trolley wire is employed throughout the entire length; this together with the other portions of the electrical work was constructed by Siemens & Halske Company. The interurban cars are each equipped with two 35-h. p. motors, and the cars used for local traffic with two 20-h. p. motors. This line comes in competition with the state steam road, and it is necessary to maintain a speed of 26 miles an hour to meet the schedule of the steam road. The construction of the power station and roadbed was commenced in July, 1897, and the rails were laid early in 1898. The electric railway crosses the Rhine on a steel bridge 555 ft. long, which has just been completed at a cost of over $1,000,000.

The history of electric railway projects in Italy was recently given in a well written paper by an electrical engineer named Minarini. The first trolley road in Italy was opened for traffic in Florence in September, 1890, and was a little less than five miles long. In 1892 1½ miles or road were put in operation in Genoa, and in the following year a trolley line was constructed in Milan. The electric railways in Rome were put in service on September 19, 1895, and have grown to be 10 miles in length, but will soon be enlarged to 25 miles. In the same year two systems of railways were built in Turin, one of which uses a mixed system of trolley and storage battery, and the other the trolley and conduit, overhead wires being forbidden in the business districts. Each of these systems is being extended and interurban connections constructed. These lines will be 62 miles long when completed. Suburban lines are now building about Florence under a 50-year franchise. There will be 33 miles of track. Concessions have been granted for 42 miles of electric railways about Genoa and on the Riviera, the franchises extending for 40, 55 and 90 years. It appears from this that the railway companies receive more liberal concessions in Italian cities than elsewhere on the continent, and as a consequence there is great activity although the industrial conditions are not as favorable as in other countries.

REPORT OF THE YERKES ROADS, CHICAGO.

The annual meetings of the North Chicago Street Railroad, the West Chicago Street Railroad, and the Lake Street Elevated Railroad Companies were held on January 10, and the following extracts are taken from the reports submitted for the consideration of the stockholders:

NORTH CHICAGO.

	1897.	1898.
Capital	$6,600,000.00	$7,920,000.00
Passenger receipts	2,818,398.90	2,921,425.10
Other sources	93,153.51	93,897.91
Total	$2,911,552.41	$3,015,323.01
Operating expenses	1,319,926.63	1,390,680.93
Net earnings	$1,591,625.78	$1,624,642.08
Charges, including railway rental, taxes, insurance and interest	636,462.73	543,665.24
Net on stock	$ 955,163.05	$1,080,976.84
Regular dividends paid	791,943.00	870,957.00
Balance	$ 163,220.05	$ 210,019.84
Percentage earned on stock	14.47	13.65
Percentage Operating expenses	46.83	47.60
Passengers carried	56,354,147	58,422,071
Transfers	.....	19,972,589
Total passengers	.....	78,394,660
Miles run	10,644,270	10,916,737
Passengers per mile	5 30-100	5 35-100
Receipts per car-mile, cents	26.5	26.8
Total cars run	677	767
RECEIPTS.		
Cable lines	$1,141,248.78	$1,448,652.50
Electric lines	1,375,638.57	1,456,907.75
Horse lines	20,911.55	15,864.85
PERCENTAGE OF OPERATING EXPENSES.		
Cable lines	47.67	48.00
Electric lines	44.92	46.90
Horse lines	115.26	76.36
COST PER CAR-MILE, CENTS—		
Cable	13.4	13.5
Electric	11.4	11.9
Horse	20.6	25.9

In his report President Yerkes said: "During the last year we have not added any miles to our trackage and have made few improvements, except in the office building, which has been enlarged. There have also been some cars added to our complement. This has been owing to the fact that the management did not feel warranted in spending money for that purpose at the present time. The road, buildings and rolling stock are in first class condition, as has always been the case, it being a matter of pride with our company to have the North Chicago Street Railroad in the best condition possible.

"There are many improvements which could be made to facilitate the carrying of passengers if the city would acquiesce in our suggestions, such as giving us the right to run continuous trolley cars over the cable tracks and places where it is necessary. We are in hopes that they will in time understand the matter more fully and consent to our making these improvements.

"The general business of the country is good and when that condition exists, street railways always partake of their share of the prosperity."

The directors, Messrs. Yerkes, Winston, Lamb, Furbeck and Moore, were unanimously re-elected. During the counting of the ballots Mr. Yerkes made the following statement to the stockholders:

"Recently there has been considerable talk about the crowding of cars. Strange as it may seem, the newspapers have given circulation to the criticisms against the company, but have failed to give our reply. In answer to the complaints by the city and to the communication of Mr. McGann we sent out a reply, although the charge was made that we neglected to do so. That reply, in which we gave the reasons for the crowding of the cars, was not given circulation by the newspapers. In that reply we show that if the city were willing to give the public the same facilities this company provides there would be no crowding.

"The case presented is just like this: On the one hand the city finds fault with the facilities afforded the public, while on the other hand the city authorities are not willing to extend the means to make these advantages possible. I suggested in that reply the extension of the electric lines on Clark and also on State street, so as to permit of continuous connection with the limits. Various other recommendations are made to do away with the crowding, and we could have given more reasons, but we thought those sufficient for the purpose. Nevertheless, I hope the city authorities will soon realize the need of these things and grant them. This road offers more to its passengers for 5 cents than any other line in the world, and the generosity of the roads in Chicago to their patrons is a matter of world-wide knowledge."

WEST CHICAGO.

The president's report contained the following statements: "The total receipts from passengers and all other sources were $4,031,903, which is an increase over the year previous of $131,983. The total operating expenses were $2,017,946, being an increase of $88,282 The total profit from operating was $2,013,957, an increase of $43,703. From that are to be deducted the fixed charges, which include interest, taxes and rentals of leased roads, of $1,198,000, leaving $815,956 as profit for the 12 months. From this amount there were dividends paid amounting to $791,340, leaving a balance to the credit of income account of $24,616. There were carried on all the lines, including full fares and transfers, 111,916,319 passengers, showing that the receipts a passenger carried were 3.55 cents.

"The business of the company is increasing, more particularly in the last few months. The competition of the elevated roads is being felt less than at any time in the past. From evidences which we have in regard to the increase of travel, both on the surface and the elevated roads, it would appear that the West Side is keeping well up to the measure of progress that is being made on the other two sides of the city, and it is a matter of regret that the increased demand cannot be met by the street railroad companies owing to insufficient legislation, as business generally is extremely prosperous, and it looks as if we might expect a considerable increase in our receipts for the coming year."

Mr. Yerkes also said: "The addition of capital to the company has not resulted in an increase of our earnings. That is to say, the dividend that we receive on our stock has not been increased by the fact we are running cable and electric cars. We are not making as much money on the amount invested today as we did when we ran horse cars. The reason is that we did not carry the people so far—did not give them so much for their money."

In answer to a question by a stockholder the portion of transfers actually issued which could be demanded by the public as a right was given as 6 per cent. The total number of transfers on the West Side lines was 31,000,000, reducing the receipts per passenger to 3.55 cents.

LAKE STREET ELEVATED.

The report of President Louderback contained the following statement:

	1898.	1897.	Increase
Gross business from passengers	$618,326	$561,370	$56,955
Advertising, etc.	15,077	18,589	*3,512
Totals	$633,403	$579,960	$53,442
Operating expenses	324,947	329,124	*4,177
Extraordinary expense	.....	31,880	.....
Net earnings	$308,456	$218,956	$80,500
Fixed charges, including taxes, interest on floating debt, and loop rental	335,147	291,798	43,349
Deficit	$ 26,691	$ 72,842	*$46,151

*Decrease.

Average passengers a day for 1897, 30,766; for 1898, 33,948.

The operating expense per cent of earnings was 51.27 for 1898,

as against 56.75 for 1897. Having regard to which the following may be of interest:

	1897.	1898.
Loop rental	$15,707	$61,953
Maintenance of track	7,104	9,534
Maintenance of cars and motors	26,552	27,511
Totals	$49,363	$99,000

The entire rolling stock has been painted and given a thorough overhauling during the last two years, and the property of the company has been well maintained throughout.

By a recent ordinance passed by the town board of Cicero, the Lake Street Elevated is to be extended 1,000 ft. west where an incline will be built to the street surface, and necessary surface lines built, so that by April 15, 1899, the company's cars can be run to the west line of Cicero.

BROOKLYN MAIL CARS.

The street railway companies in Brooklyn were among the first to carry mail for the government. After a contract had been awarded to the Brooklyn Heights Railroad Company several special mail cars were built. They had 32 ft. bodies and were divided into two compartments; one for the mail and the other half was closed, with seats on either side of a center aisle for passengers. This arrangement proved unsatisfactory, for patrons had an aversion to this type of car and would wait for one of the regular passenger cars. In many cases these cars were mistaken for mail cars exclusively, and at other times when a car would be behind time with the mail it would have to stop to take on passengers.

President Rossiter decided that the best service would be rendered by cars used for mail exclusively and turned the problem over to D. S. Moffatt, superintendent of the Brooklyn Heights shops The new mail cars were reconstructed from old passenger cars as shown in Fig. 1. They were 16-ft. cars and had been in service for 10 years or more. On each side of the car a part of a panel was cut out and a door put in to receive and discharge the mail sacks. The front door of the old car was removed and a panel put in with one small window. The window on each side of the front door was replaced by a panel bearing the insignia of the government. At the rear end the doors were taken out and a swing door built in. Fig 2 shows the completed mail car as reconstructed. The car is painted white with gold lettering. As may be noticed the car is mounted on a Peckham truck. The trucks so used were among the first put in service under the electric cars in Brooklyn and are now practically as good as new.

Fig. 3 gives an interior view of the front or working end of the car and shows a rack for holding mail sacks, sorting table and pigeon-holes for letters. At the other end of the car there is provision for a wash basin, water cooler, locker and room for chairs. The car is finished in ash throughout and is lighted by three clusters of three lamps each, suspended from the roof of the monitor, and four separate incandescent lamps. The motorman and conductor will have the uniform of the United States postal service. The old combination mail cars are being changed into passenger cars, the side doors have been taken out and paneled, and the mail compartment is furnished the same as the other compartment with seats and an aisle extending the length of the car.

FIG. 3 INTERIOR OF BROOKLYN MAIL CAR.

STREET RAILWAY FRANCHISE IN HAVANA.

After considerable legal difficulty the title to the Urban Ferro Carril lines, of Havana, has been secured by an American syndicate headed by G. B. M. Harvey, the price paid being $1,472,000. Others interested in the deal include H. P. Whitney, F. S. Pearson, Senator James Smith, of New Jersey, Hanson Brothers, of Montreal, J. W. Todd, of London, and the Banque Internacionale, of Paris. Plans are now formed for equipping the lines for electric traction, and F. S. Pearson, chief engineer of the Metropolitan Traction Company, will go to Havana to take charge of the construction work. Percival Farquhar, who was successful in negotiating the deal, will be the manager.

On the Meriden (Conn.) Electric Railroad only one passenger was injured out of nearly 1,500,000 that were carried during the year.

FIG. 1—OLD PASSENGER CAR RECONSTRUCTED FOR A MAIL CAR IN BROOKLYN. FIG. 2.

COAL WAGONS FOR BOILER ROOMS.

Two very convenient forms of wagons are here illustrated for conveying the fuel from the coal pile or bins to the boiler furnaces, and they are designed especially with the view of easy running and convenience in shoveling the coal. The wagon shown in Fig. 1 is made to carry from 1,200 to 2,000 lbs. of coal. The wheels are 19 in. in diameter with wrought iron spokes, and the wagon has a wrought iron fifth wheel, 14 in. in diameter. The wheels are all provided with ball or roller bearings, as may be designated. The underwork is of wrought iron, and the body of the car is made of 3-16 and ¼-in. hard finished steel fastened on the corners with 2-in. angle iron, reinforced around the top edge with a flat bar. The door is hung on hinges, making it convenient to shovel the coal from the wagon into the firebox. All rivets are countersunk on the inside so as to offer no obstruction when removing the coal.

The car shown in Fig. 2 has heavy plate cast iron wheels and the car body is nearer the ground. On account of the radial trucks the cars can be turned in a very small space. The standard capacities are 1,000 lbs., 1,500 lbs. and 2,000 lbs., although they are also made in smaller sizes. These wagons have been used with success in many of the large stations in New York city and Philadelphia. They are made by the Atlas Bolt & Screw Company, of Cleveland, O.

FIG. 1 COAL WAGONS, ATLAS BOLT & SCREW COMPANY, CLEVELAND.—FIG. 2.

CANADIAN NOTES.

The Quebec-Montmorency & Charlevoix Railway Company will apply at the next session of Parliament to change its name to the Quebec Railway Light & Power Company; to ratify and confirm the purchase of the property and franchise of the Quebec District Railway Company and the issue of bonds and stocks made to pay for the purchase of the road; and to authorize the building of a line of railway in the counties of Levis, Bellechasse, Dorchester, Beauce and Lotbiniere; to ratify the purchase of the property and capital stock of the Montmorency Electric Power Company, and for other purposes.

The Sherbrooke Street Railway has been purchased by Frank Thompson & Co., bankers and financial agents of Sherbrooke. They have also acquired the Brompton Falls water power which will enable them to extend the line and increase the number of cars, which could not be done with the present water power. This railroad was opened about a year ago, and the earnings have been very satisfactory, exceeding the expectations of the company. There are now six miles of road in operation, and it is now probable that the line will be extended to North Hatley and other outside points.

The Cataract Power Company has asked Engineer Hillman to survey two direct lines from Hamilton, Ont., to Guelph and Berlin for a fast electric railway service. The proposed lines will run from a point on James street in Hamilton to and along Burlington Heights, thence over the old canal, and will follow in some respects the original radial railway survey to the top of the Flamboro escarpment, and be as straight as possible. Once over the hill the road will fork, one line leading direct to Guelph, through Millgrove Freelton, Aberfoyle, etc., and the other through several villages to Galt, Waterloo and Berlin. No bonuses will be asked for and the most direct lines that can be laid down will be used.

The St. Catharines & Niagara Central Railway has again changed its application to Parliament for permission to change its name to the Niagara Falls, St. Catharines & Toronto Railway Company and to extend its line to Port Dalhousie on Lake Ontario and to the city of Hamilton. The negotiations for its purchase by an American syndicate and converting it into an electric road commenced some time ago. The government inspector on account of the condition of the road prohibited traffic upon it and the bondholders disposed of it to Mr. Neelon of St. Catharines for $35,000 subject to prior liens of $15,000. Ten per cent of the money was paid into court and the time for the payment of the balance extended. This expires next week and a further extension will be asked and in all probability conceded, to allow time for the consummation of the present deal and the amending of its present act which will enable it to make connections at Port Dalhousie with all lines of steamboats to Toronto and all points down the St. Lawrence and at Hamilton with the T. H. & B. and C. P. R. and a number of projected radial lines. The purchasers are Messrs. S. B. Colon, treasurer, of New York, J. A. Powers of Albany, Hon. C. D. Haines of New York and others.

AN EXCLUSIVELY STREET RAILWAY SUPPLY HOUSE.

The firm of McGill & Pomeroy, which is the only exclusively street railway supply house in Chicago, has made every preparation for meeting the heavy demand for such goods that will undoubtedly come as soon as the weather permits the many companies now contemplating building to commence operations. The firm has taken the whole of the store at 317 Dearborn street, Chicago, of which it formerly occupied only a portion, and has ample storage space for carrying a complete line in stock, so that shipments can be promptly made.

A full line of street railway supplies of every description is carried in the Chicago stock. The firm handles the Ohio Brass Company's line material, Cutter Electric & Manufacturing Company's I-T-E circuit breakers, the Bradford Belting Company's "Monarch" insulating paint, and other such standard products.

Both Mr. McGill and Mr. Pomeroy have demonstrated their ability in the railway supply business and we predict continued success for them during 1899. E. R. Mason, who "before the war" was with the Mason Electric Equipment Company, of St. Louis, is now with this firm. Mr. Mason served on the U. S. S. Cincinnati.

THE CHICAGO PLANT OF THE GRIFFIN WHEEL COMPANY.

Chicago can boast of having the largest car-wheel works in the world, that of the Griffin Wheel Company, located at Sacramento avenue and the Chicago & Northwestern Railway. The plant covers over 15 acres of ground and a general idea of the extent of the works can be gleaned from Fig. 1. This is the view presented looking towards the east as one enters from Sacramento avenue. The distance from the extreme left to right is 1,050 ft. In the right-hand corner is shown the company's new office building completed some six months ago. The office is 48 by 62 ft., of red pressed brick with stone trimmings, two stories high and of fire-proof construction. On the first floor are the offices of the local manager, storekeeper, timekeeper and shipping clerk; while on the second floor are the offices of the managers, second vice-president, secretary, consulting engineer and general bookkeepers.

FIG. 1 GRIFFIN WHEEL WORKS, CHICAGO.

The foundry as originally built in 1891 had a capacity of 750 wheels per day. Additions have been built within the past four years until now the daily output is 1,060 wheels per day; this output has been maintained for the past 12 months, and plans are now being perfected to increase this to 1,500 wheels per day.

The main foundry is 400 by 320 ft. directly back of which and connecting therewith is the charging and cupola building which measures 60 by 200 ft. In this building are located three cupolas with a melting capacity of 300 tons daily. All material is handled by elevators from the lower floors and yard to the charging room. The molding room contains 43 floors; all ladles, etc., are moved about by means of overhead tracks, while all the cranes are fitted with penumatic hoists for the handling of molds and wheels.

The annealing pits are located at the west end of the main foundry and take up a space 360 ft. in width. Wheels after being cast are placed in these annealing pits for a specified time and are then taken to the cleaning and shipping room, shown in Fig. 2. Directly south of the cleaning room is located the storage platform for new wheels, Fig. 3. This platform is capable of holding 10,000 wheels; additional storage platforms are located to the west. The yards contain 2½ miles of side track, with direct connections to the Chicago & Northwestern Railway and the Chicago, Milwaukee & St. Paul Railway. The machine shop is 75 by 140 ft., and is equipped with all modern appliances for boring and pressing wheels on axles, improved lathes for turning and key-seating electric motor axles. Adjoining the machine shop is a complete pattern shop, where all wheel patterns are made not only for the Chicago plant, but also the branch plants of the company. The pattern room and laboratory are located in a fire-proof building 36 by 60 ft. directly to the west of the machine shop.

In addition to the above buildings are the engine and boiler house 75 by 60 ft., the core room, where all cores are made; two large sand sheds, coke sheds, carpenter shop, etc. Surrounding the foundry to the north, east and south are extensive storage yards for pig iron, old wheels, etc. In the southeast corner of the grounds is a large pond, furnishing water to the steam plant and affording ample fire protection. A thorough system of water pipes encircles the works and at intervals are located hose houses fitted with Prescott automatic reels. Extensive improvements have been made in all departments during the past year, a great many new tools of special design have been purchased, and every preparation has been made to anticipate the increased business for 1899.

FIG. 2—SHIPPING ROOM.

FIG. 3—STORAGE PLATFORM FOR 10,000 WHEELS.

The Chicago plant is at present casting about 200 wheels per day for electric motor and street railway service. Aside from the Chicago plant, the Griffin Wheel Company owns and operates car wheel foundries at Detroit, St. Paul, Denver and Tacoma.

TOLEDO UNION DISBANDS.

The union of the employes of the Toledo Traction Company has been disbanded and the property of the local association was turned over to W. D. Mahon, president of the Amalgamated Association of Street Railway Employes of America, of which it was a branch. The local union was organized on August 13, 1895.

PERSONAL.

Max Berg, of the Ohio Brass Company, called on the REVIEW on his recent trip to Chicago.

George A. Paul, superintendent of the Southwest Missouri Electric Railway, Webb City, Mo., has resigned.

G. J. Nitsche, who for nine years has been electrician of the City Electric Railway, Decatur, Ill., resigned January 1.

Charles J. Mayer, of Mayer & Englund, Philadelphia, was a REVIEW caller when in Chicago just before the new year.

Albion E. Lang, president of the Toledo Traction Company, was a caller on the REVIEW when in Chicago on Christmas week.

James Partridge, of the Partridge Carbon Company, Sandusky, O., was among the REVIEW callers shortly after the first of the year.

Forbes Holton and W. J. Kenney have been chosen president and secretary respectively of the Charleston-Mattoon (Ill.) Street Railway Company.

Maj. Clay Stacker, who has been superintendent of the Electric Street Railway Company, of Clarksville (Tenn.), since 1896, resigned on January 1.

M. D. Thatcher, president, and the other officers of the Pueblo (Col.) Electric Street Railway Company were re-elected at the annual meeting in December.

President Frank H. Dewey and the other officers of the Consolidated Street Railway Company of Worcester, Mass., were re-elected at the annual meeting in December.

James V. Thompson, who has for 41 years been foreman of the Gilpin County (Col.) Tramway, has resigned, and William S. Wells of Denver has been appointed to succeed him.

Charles A. Wilson, superintendent of the Prospect Heights & Glen Oak Railway Company, Peoria, Ill., was on Christmas presented with a handsome oak chair by the employes.

T. H. Anderson has been elected general manager of the Somerset Traction Company, of Skowhegan, Me. Heretofore the president, Gen. R. B. Shepherd, has held the title of general manager also.

J. C. DeLong, who has been the successful manager of the Sedalia (Mo.) Electric Railway, Light & Power Company since last May, when the present owners acquired the property, has resigned. He was succeeded temporarily by Robert Hamner.

Francis E. Drake has been appointed director of machinery and electricity for the United States commission at the Paris Exposition. Mr. Drake is well known to street railway and electrical men, having been with the Walker Company for several years.

George Barclay, electrician of the Uniontown (Pa.) Electric Railway Company, recently met with a distressing accident. His thumb was caught between the belt and a fly-wheel in the power station and he was thrown to the floor with such force that his leg was broken.

S. G. Coleman, superintendent of the lighting department of the Milwaukee Electric Railway & Light Company, has resigned. This department was in sole charge of Mr. Coleman and it was built up under his direction. O. M. Rau, chief electrician, will fill the vacancy at least for the present.

Edmund Furthmann, who has been attorney for the North Chicago Street Railroad Company for 11 years, resigned on January 1. Mr. Furthmann was assistant prosecuting attorney under the late Julius S. Grinnell, and was retained by the company on leaving that office when Mr. Grinnell was placed on the bench.

Prof. and Mrs. Sidney H. Short of Cleveland sailed for Liverpool on December 13, and will make an extended trip in Europe, returning in April. Prof. Short has seldom taken vacations, and while he is making this trip for recreation he will doubtless address some of the scientific societies which have invited him to deliver papers on subjects connected with electric railways.

Charles Sheldon has resigned the position of general manager and treasurer of the Consolidated Car-Heating Company, of Albany, N. Y., to become manager of the Chihuahua & Pacific Railroad, with headquarters at Chihuahua, Mexico. Frederick W. Kelley, who has been Mr. Sheldon's assistant, has been appointed general manager and treasurer of the Consolidated Car-Heating Company.

In December the Boston Elevated Railway Company made some changes in its department officers; John H. Studley, superintendent of division 6, has been transferred to the legal department, and succeeded by R. T. Laffin, formerly superintendent of employment; Joseph Dee, superintendent of division 7, was transferred to the department of maintenance of way, and succeeded by H. A. Pasho, heretofore superintendent of division 9.

J. L. Willcutt, secretary of the Market Street Railway Company, San Francisco, had a very narrow escape from death recently while crossing on the ferry-boat Bay City. Just as the boat was entering the dock the walking beam of the engine broke, and portions of the beam and the loose connecting rod struck among the passengers to their consternation. Fortunately none were injured, though Mr. Willcutt and several others had very narrow escapes.

Franklin E. Huntress has been chosen to represent the seventh Middlesex district in the Massachusetts house of Representatives for a third term, the first time a representative has secured a second re-election in that city. Mr. Huntress has been active in politics since his graduation at Harvard in 1889 and equally active in business. He is known in street railway circles from having introduced the Neal electric headlight, which is used by the West End, of Boston, the Metropolitan, of New York, and numerous other roads throughout the country.

With an entire change of ownership in the Quincy, Ill., lines comes the customary change in management, and C. C. Rush of Joliet succeeds E. K. Stone, Jr. Mr. Stone has long been identified with the operation of the Quincy property, of which his late father was also for many years manager. Mr. Stone has made an enviable record, and the local papers speak in highest terms of his work. While he has not yet fully decided as to the future, we feel sure he will not remain long out of the service, and if he concludes to go into other business, it certainly will not be for the lack of opportunities to remain in street railway work.

W. J. Clark, who for years has been manager of the railway department of the General Electric Company, has been appointed manager of the company's foreign department, with headquarters in New York. Mr. Clark thoroughly understands the details of the foreign electrical business and has an extensive acquaintance abroad, which specially fits him to make as great a success in his new department as he did in the old one.

N. C. Draper resigned as electrical superintendent and master mechanic of the Central Railway Company, of Peoria, Ill., on December 27, and on January 1 became general manager of the Joliet (Ill.) Railway Company. Mr. Draper will be remembered by many street railway men as having been with the General Electric Company as constructing engineer, when he built and operated the City Electric Railway, of Decatur, Ill.; the Ottumwa (Ia.) Electric Railway, and roads at Revere and Plymouth, Mass. He has also been at various times connected with the railways at Brockton, Mass.; Newton, Mass.; Providence, R. I., and the West End, of Boston.

OBITUARY.

Dr. Wellington Adams of St. Louis, well known as an electrician and inventor, died of pneumonia on December 20.

Col. I. G. Randle, well known in Texas as a capitalist and street railway promoter, was shot and killed at Dallas on December 19 by H. P. Erwin, of Forney, Tex.

Frederick Culver Whitmore, assistant engineer of the underground and third-rail department of the General Electric Company, died December 7 of typhoid fever at the residence of his parents in Hartford, Conn. Mr. Whitmore was 27 years of age.

William C. Crane, for many years connected with the New Albany (Ind.) Street Railway Company as treasurer before the Kentucky & Indiana Bridge Company secured the property, died at his home in New Albany on January 11, at the age of 73.

Michael J. Burns, who was until a few years ago superintendent of the Citizens' Street Railroad of Indianapolis, died December 20 from the effects of a surgical operation. Mr. Burns was prominent in local politics and was school commissioner at the time of his death.

E. K. Stone, Sr., formerly and for many years general manager of the Quincy Horse Railway & Carrying Company, died November 25, 1898, at his residence in Quincy. He attended the Boston convention with his son, E. K. Stone, Jr., and had a wide acquaintance with those in early street railway work.

R. T. McDonald, president of the Ft. Wayne Electric Corporation, died at Dallas, Tex., on December 24, after a short illness. Mr. McDonald was born in Allegheny City, June 24, 1849, and was of Scotch extraction. When a small boy his family moved to Indiana and he has long been identified with many enterprises in Ft. Wayne. He became interested in manufacturing electrical supplies in 1880, and was not only connected with the Ft. Wayne Electric Corporation and the Ft. Wayne Lamp Company, but was interested in lighting and railway companies in St. Louis, New Orleans, Dallas Indianapolis and New York.

Charles F. Orthwein, one of the leading financiers of St. Louis and associated with Corwin H. Spencer in the purchase of the National Railway Company's street railway lines, died at his home on December 28. Mr. Orthwein was a native of Stuttgart, Germany and came to this country over 40 years ago; he was 60 years of age. The firm of Charles F. Orthwein & Sons is widely known in the west.

FIRE AT ROCHESTER.

At 8 o'clock on the morning of January 1, fire was discovered in one of the buildings of the Rochester Railway used for storing cars, and was quickly communicated to other buildings. Many of the men were at the barns and were able to get out all but 20 of the cars. One corner of the building occupied by the machine shop and tool room was somewhat burned, but the greatest damage here was from water. General Manager Nicholl estimated the total loss at $45,000 to $50,000, covered by insurance. Fourteen cars were destroyed, but the service was not seriously interfered with on that account. The origin of the fire is unknown.

The Des Moines (Ia.) City Railway Company contemplates making a number of improvements at Crocker Woods Park which will add to the attractions of that resort. The theatre is to be enlarged, chutes erected and bath houses and diving platforms built.

What is said to be the shortest street railway in existence has been operated for about a year by the Metropolitan Street Railway of Kansas City, Mo.; it is two blocks long and serves to connect two of the company's main lines. The equipment comprises one car, and the trip from one end to the other takes about one minute.

ECHOES FROM THE TRADE

The executive office of the Electrical Exhibition Company is now located at Madison Square Garden, New York, where the electrical show is to be held May next.

The 1899 calendar of the American Electrical Works, of Providence, R. I., bears a handsome steel engraving of S. F. B. Morse, surrounded by the company's name.

The Weber Railway Joint Manufacturing Company, of New York, formerly located in the Cotton Exchange building, has moved its offices to rooms 1813-1816 Empire building, 71 Broadway.

The Okonite Company, of New York, is sending out an extremely pretty calendar, lithographed in colors, which will prove an ornament to any library or office, and the attractions of which are well qualified to more than last the year.

The Van Dorn & Dutton Company, of Cleveland, O., has remembered its friends and customers with a wall calendar for 1899, which also briefly tells of the trucks, gears, pinions, armature lifts track cleaners, etc., made by the company.

L. A. Chase & Co., of Boston, on January 1 became selling agents for the Pawtucket Brass Company, of Pawtucket, R. I. Chase & Co. are well-known supplymen, and are now in a position to figure on all kinds of overhead material.

Mayer & Englund, 10 South 10th street, Philadelphia, have leased the entire five floors of the building they are in, and will use the basement and first floor for store rooms. The rapid increase in their business has made more space absolutely necessary.

The catalog of the Jeffrey Manufacturing Company, of Columbus, O., entitled "Circular No. 15, Jeffrey Electric Locomotive," is a very handsomely illustrated pamphlet of 40 pages, which gives data on the mining and yard switching electric locomotives built by this company.

The R. D. Nuttall Company has distributed a neat calendar to the trade. One of the standard pinions is illustrated and the inscription, "The Gear Cutters," is encircled by a gear rim. This calls attention to the conspicuous position of the company as successful manufacturers of street railway gears and pinions.

Gustave Suckow, manager of the Vose Spring Company, of New York, reports the business of the company as exceptionally good. Mr. Suckow has been 23 years in the spring business, and he states that while December is as a rule the lightest month of the year, December last was the business month of 1898.

Edward Daniell, superintendent, informs us that the Menominee Electric Light & Power Company, Menominee, Mich., contemplates the purchase of one 300-h. p. engine, one 100-k. w. 500-volt generator, 60 ft. of 5½ in. shafting, with sundry clutches, couplings and pillow blocks, and 11 clutch pulleys of various sizes.

The Link-Belt Machinery Company, of Chicago, has published a new edition of its Catalog No. 24, which is entitled "Modern Methods," and is an exposition of modern methods of handling raw and manufactured products and of transmitting power. It is a profusely illustrated book of 300 pages which covers the subject well.

John B. Wallace, general manager of the Wallace Electric Company, 1506 Marquette building, Chicago, January 9 filed a petition in voluntary bankruptcy, declaring his debts to be over $236,000. No assets are mentioned. This company did a large business and was the western representative of a number of large eastern concerns.

Wendell & McDuffie, of New York, have just sold the Metropolitan Street Railway, of New York, 12 Taunton snow plows. The Metropolitan people had been making most of their plows themselves, and thought their type of plow sufficient for all emergencies. The recent severe storm, however, demonstrated the necessity of something better, hence the order for Taunton plows.

The Whitney Car Wheel Works, of Philadelphia, have resumed the manufacture of chilled wheels at 901 Montgomery avenue. James S. Whitney is manager; Asa W. Whitney, superintendent, and H. F. Hannis, treasurer. The firm has on hand all its old patterns, chills, drawings and the records of orders filled in the last 52 years, and will be prepared to duplicate old orders or fill new ones.

The Bates Machine Company, of Joliet, Ill., has recently placed on the market a new wire nail machine which has more than double the capacity of the other nail machines best known to the trade. On 10d. common nails, for instance, the new Bates machine has an output of from 37 to 40 kegs per 10 hours, as against 14 to 16 kegs for other machines. This extraordinary increase in production is due to the peculiar construction of the machine and its great strength.

The Standard Underground Cable Company, of Pittsburg, has sent to its friends a neat foot-rule and wire gage as a Christmas souvenir. We all remember the company's No. XV Pocket Handbook, received about a year since, which has been of constant use for reference, and the rule promises to be equally useful. The company will be pleased to give gratis the benefit of its 16 years of successful experience to those who contemplate any cable or wire installation.

The Lombard Water Wheel Governor Company reports that the demand for its governors is constantly on the increase. During last month orders were received for upwards of 20 governors to regulate 41 water wheels, which will develop 15,750 h. p.. More than half of this machinery will be used in electric stations—principally in power-transmission plants—and electric railway stations, the balance being in textile and other manufacturing plants driven by water power.

The Chisholm & Moore Manufacturing Company, of Cleveland, O., formerly the Moore Manufacturing Company, of Milwaukee has recently published an 8-page illustrated circular descriptive of its anti-friction differential chain pulley blocks, traveling cranes, trolleys and door-hangers. The differential block of this company was illustrated in the REVIEW for November, 1898, page 846. The company has moved into a new building of its own and is prepared to promptly fill all orders.

The most pretentious calendar we have seen is that of the Falk Manufacturing Company, Milwaukee. It is 20 by 28 in. and intended to hang upon the wall or rest on a library bookcase or easel. It contains a set of six superb photogravure reproductions of masterpieces and a page of text describing the pictures. The name of the company occupies a very modest position at the bottom of the sheets, and the calendar is suitable to adorn the library as well as office. The idea is carried out in a manner at once highly artistic and attractive.

The Creaghead Engineering Company, of Cincinnati, has recently furnished the brackets and line material for the Gadsden & Attalia Union Railway Company, of Gadsden, Ala., which has been changed from steam to electric. The company has also furnished the line material for extensions built by the Knoxville Traction Company, the Birmingham (Ala.) Railway & Electric Company and the Chattanooga Rapid Transit Company. It now has on hand a contract for the line work of the Dayton, Springfield & Urbana Electric Railway.

We are gratified to be able to announce that the "Turner" water tube boilers as made by the Turner Engineering Company, of Bucyrus, O., is meeting with a prompt acceptance on the part of some very critical and extensive steam users. These boilers, which were described in the REVIEW for August, 1898, page 576, are made in various sizes from 100 to 500 h. p. and are being installed in various parts of the country. Among the contracts on hand are two 100-h. p. boilers for the Standard Snuff Company, Nashville, Tenn.; two 500-h. p. for the Midland Steel Company, Muncie, Ind.; three 225 h. p. boilers, piping and stack for the Indianapolis (Ind.) Ice & Cold Storage Company.

The sweeper department of the McGuire Manufacturing Company of Chicago closed the year with the shops working day and night. Among the roads ordering sweepers late in 1898 were: Metropolitan, New York; Buffalo Railway; Citizens, Oshkosh, Wis.; Monongahela, Pittsburg; St. Joseph & Benton Harbor, St. Joseph, Mich; Chicago Electric Traction; Milwaukee Electric Railway & Light Company; Meadville Traction, Meadville, Pa.; Ashtabula Rapid Transit, Ashtabula, O.; Rockford Traction Company, Rockford, Ill.; St. Joseph Railway, Light, Heat & Power Company, St. Joseph, Mo.; South Bend Street Railway and Indiana Electric Railway, South Bend, Ind.

The Babcock & Wilcox Company has taken from Westinghouse Church, Kerr & Co. the largest stationary boiler order that has ever been placed. The boilers are for the power plant which the Westinghouse Electric Company has contracted to build for the Third Avenue Railroad Company, New York, at 218th street and Harlem river, and which is to be constructed by Westinghouse, Church Kerr & Co. The order covers 60 Babcock & Wilcox forged steel type boilers of 520 h. p. each, or an aggregate of 31,200 h. p. The boilers are to be capable of carrying 200 lbs. steam pressure. They will supply steam for compound condensing engines of 64,000 nominal horse power in the aggregate.

The J. A. Fay & Egan Company, of Cincinnati, O., under date of December 15, announces that as it is exclusively a maker of woodworking machinery, it has decided to discontinue acting as selling agent for other products. The Chicago branch store of the company has been sold to the firm of Manning, Maxwell & Moore, of New York, and they will be the exclusive agents in the Chicago territory for J. A. Fay & Co. and the Egan Company. The sale is to date from November 1, 1898, and settlements on all business previous to that date should be made with the Fay & Egan Company; after that date with Manning, Maxwell & Moore. The company bespeaks for its new agents the same consideration that has been shown to it.

The Clonbrock Steam Boiler Works, of Brooklyn, N. Y., has recently won an infringement suit against the Columbian Steam Boiler Works, with which were connected former employes of the Clonbrock Works. The Columbian boiler was practically identical with the Climax in construction and the defense was lack of novelty; to support this contention the Rogers & Black and the Hazleton "Porcupine" boilers were cited as anticipatory inventions. The court carefully considered these and other inventions, and the opinion is an interesting discussion of boilers of these general types. The court holds that the Climax boiler was clearly infringed. The Climax boiler comprises a vertical shell surrounded by tiers of looped tubes set obliquely, and the whole set over an annular grate and surrounded by a cylindrical casing. It has given excellent results in practice.

The Q & C Company, of Chicago, has just issued its first catalog on pneumatic tools, which is a pamphlet of 46 pages, uniform in style with the other well-known catalogs of the company. The company announces that it has purchased the entire business and good-will of the Ridgely & Johnson Tool Company, Springfield, Ill., and added a pneumatic tool department to its list of special machinery and railway appliances. When purchasing the business of the Ridgely & Johnson Tool Company, a thorough comparison of the various tools on the market was made, and in presenting this subject the Q & C Company deems it perfectly safe to claim that it has a most complete line of pneumatic tools. The list embraces

the lightest of tools for chipping and calking, as well as hammers powerful enough to drive 1¼-in. rivets, or to do any work usually done with an eight or ten-pound sledge. The great characteristic of these tools, and the main claim for their superiority, is simplicity. They are valveless, have but few parts, and no skill or experience is required to keep them at work—points which will be appreciated by all users of pneumatic tools. All tools of each size are perfectly interchangeable, so that any part of one tool will fit another of the same size.

The Westinghouse Electric & Manufacturing Company has closed a contract for 101 large car motors and 125 controllers for the Hanover (Germany) Street Railway Company. The contract was got in the face of fierce German competition.

The Peckham Truck Company has just received an order from the Third Avenue Railroad Company, of New York, for 100 sets of No. 14 B short wheel base double trucks, and 60 No. 14 D 2 maximum traction trucks. These are to be used on the cars on the conduit lines which are now being reconstructed from cable lines.

Theo. A. H. Weinz, sole agent of the Warrenton Woolen Company, and R. M. Bickerstaff, who looks after the western business of the company, were recent callers at the Review office. These mills make a specialty of uniform cloths, and with constant efforts to improve a long and honorable record for high grade materials, are receiving a constantly increasing patronage. Particular attention is given to the requirements of street railway companies.

Elmer P. Morris, 15 Courtlandt street, New York, reports an excellent business with prospects for the coming year better than at any time since the introduction of the trolley. There is a great demand for iron poles and brackets, in fact the factory of which Mr. Morris is the representative, is working day and night on orders. Contracts for trolley wire were larger during the past 30 days than any month in 1898. Assembled commutators, made from drop forged copper, have been in great demand. On February 1 Mr. Morris will open a branch office in Philadelphia in the Betze building.

The Western Electrical Supply Company, of St. Louis, has of late put on the market a number of railway specialties which have the approval of street railway managers. The company's railway business has grown to such an extent that the facilities have had to be greatly increased. It is now in a most favorable position to care for its patronage in a most satisfactory manner. In St. Louis the company carries a very large and well assorted stock of electric railway supplies of every description, and the many specialties which are now offered are worthy of investigation. A neat and complete catalog, devoted exclusively to railway supplies, has recently been published. A copy of this may be had by writing a line to the company. Additions have been made even since this publication, which is an indication that the company is keeping up with the needs of street railways and is receiving an increasing patronage.

The Michigan Electric Company, of Detroit, has had its place of business at No. 101 Woodward avenue, which was completely burned out September 24, 1898, entirely rebuilt, and has utilized the opportunity to have the building arranged in every particular in the manner best suited to the needs of the business, and has just opened with a complete new stock, fittings, etc., a place which the company claims is the handsomest and best arranged electric house in the country. Their first floor is the electric supply store; second floor, general offices; third floor, jobbing stock room, and fourth floor, shop for electric repairs, etc. The company reports a very satisfactory business for 1898, as ever since the fire, it has done almost its usual amount of business and now with new quarters perfectly arranged, a large and varied stock, and a demand more brisk than at any previous time, it counts on making 1899 a year whose business will excel by far that of any previous year.

The Pennsylvania Car Wheel Company reports an interesting incident in connection with the use of car wheels developed on one of the lines of a large street railway company, as follows: It filled an order for 48 wheels, each 33 in. in diameter, and these were placed in service on axles, while on the opposite end of each axle was the wheel of another manufacturer 33¼ in. in diameter, or ¾ in. larger in circumference than the Pennsylvania wheel. These wheels being pressed rigidly on the axle the larger wheel went ¾ in. each revolution farther than the other, dragging it this difference which aggregated 480 in. in a mile. Many of the cars were making 150 miles a day, so that the smaller wheels were dragged 6,000 ft. per day. The remarkable feature of it is that 80 per cent of these wheels are still in service, having in that time made 18,000 miles, each wheel being dragged over 136 miles. Naturally the master mechanic of the company does not care to have his name published as permitting such a practice. However, these results speak well for the wheels of the Pennsylvania Car Wheel Company.

SALE OF THE METROPOLITAN ELEVATED, CHICAGO.

According to the order of the United States court of the northern district of Illinois, the Metropolitan West Side Elevated Railroad Company was sold in Chicago on January 4. The sale was advertised by the master-in-chancery and an upset price of $6,000,000 put on the property. There was but one bid, that of F. T. Olcott, of New York, chairman of the reorganization committee. It is expected that a reorganization will be effected in the next 30 or 60 days. The improvements which are now in progress will be completed and no change is anticipated in operating officials.

CONSOLIDATION IN BROOKLYN.

There are persistent rumors that the Brooklyn Rapid Transit Company, of Brooklyn, N. Y., through Roswell P. Flower, Anthony N. Brady and others of its stockholders and their friends, has acquired control of the stock of the Nassau Electric Railroad, and that the two systems will be consolidated as soon as the necessary papers can be prepared. The deal is said to include both the elevated roads of Brooklyn, and thus would consolidate the Brooklyn Heights, Nassau and DeKalb avenue surface lines and the Brooklyn and the Kings County elevated roads.

The project of an electric road from Lexington to Richmond, Ky., is growing in favor and probably construction will be begun in a short time. The originators of the project are Dr. David Bennett and W. J. Loughbridge.

A new time card has been arranged for the Tri-City Railway Company of Davenport, Ia., by which the service commences earlier in the morning and is continued later at night than formerly. More men have been put on so that the maximum time on duty is reduced to 11½ hours.

John C. Wegner of Milwaukee last month applied to the Kenosha (Wis.) city council for a franchise for an electric railway. Mr. Wegner also wishes to secure the right of way for a road from Kenosha to Waukegan, which connecting with the Milwaukee, Racine & Kenosha and the Chicago & Milwaukee would give an electric line from Chicago to Milwaukee.

At the regular meeting of the Chicago Electrical Association on December 16 the annual election of officers was held with the following result: President, Thomas G. Grier; vice-president, J. M. Hollister; treasurer, Harold Almert; secretary, Cloyd Marshall; directors, F. S. Hickok, E. W. Jewell and Hayward Cochrane. The address of the secretary is 1310 Monon building.

At the annual meeting of the Albany, Helderburg & Schoharie Electric Railway Company, December 21, officers were chosen as follows: President, H. W. Burgett; vice president, B. M. Secor; secretary, W. H. Irwin; treasurer, Charles E. Bibben. The Albany Construction Company, of which W. H. Schermerhorn of Brooklyn is president, has been incorporated to do the construction work, which will be commenced as soon as the weather permits. The company is now ready to let contracts for materials.

THE Street Railway Review

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We note that "many prominent men have joined the Municipal Ownership League of Illinois," which has for its object the acquisition of street railway properties by municipalities. If the majority of the Chicago council is as corrupt as these "reformers" would have us believe, it would appear that the League is extremely anxious to jump from the frying pan into the fire.

One would scarcely look to Italy for an expression of broad gaged policy among European nations. And yet the Italians are by no means slow, and are granting franchises for electric railways for terms of forty to ninety years. The natural result of this liberal policy has been a marked activity in electric railway construction, entirely out of proportion,—from industrial conditions,—to other continental cities.

At last the Keeley motor fraud has been laid bare. The one solitary feature of his work worthy of mention was the ability of the man to continuously humbug so many people through so long a term of years; and even this cannot be too severely condemned, for it was a deliberate lie without a single redeeming feature. And yet little sympathy can be found for his victims, who thought to get something out of nothing. In the street railway field during the past twenty years there have been many Keeley motors, nor is it probable we are entirely done with them yet. More money has been spent in trying to perfect more such appliances than Keeley ever saw: but it must be said for some of them, their promoters honestly believed in what they had.

The diagrams on the supplement accompanying this issue will be appreciated by street railway men in the operating departments. We have seen similar diagrams in the private note books of electricians, but these have never before been arranged in such a compact and convenient form. All the circuits and connections for each notch of three of the principal types of controllers are graphically shown. They have been developed from car wiring drawings and the paths of the current through the controller contacts, rheostats, motor armatures and fields are indicated as the controller handle is moved and the changes occur in the series and parallel connections. Diagrams can tell a long story in a concise and lucid manner, and so it is in this instance.

In England many cities and towns have undertaken to own and operate their own electric lighting plants and a smaller number to own and operate street railways, and now the authorities seeking permission for similar undertakings apparently wish to enter the electrical supply field. No less than 70 recent notices from local authorities which are going to apply for power to supply electricity ask for permission "to manufacture, purchase, hire, sell, and let meters, lamps, accumulators, dynamos, fittings, plant, machinery, and other matters or things required for the purposes of the order, and to acquire, work, and use patent rights for the producing, storing, controlling, distributing, measuring and using, or otherwise relating to the supply of electricity." The English electrical papers are doing a good work at the present time in calling the attention of the public to the seriousness of thus authorizing municipalities to undertake manufacturing schemes on the credit of the taxpayers.

The extent to which street railways are utilized for transporting United States mails is not so great at the present time as was predicted a few years ago when this service was commenced, but the efficiency of this service shows a remarkable increase. On another page is a statement compiled from the reports for the last three years of the superintendent of the railway mail service of the United States. From this it appears that in 1897 1 street railway mail car with 3.1 clerks made 10.4 trips per day, running 49,086 miles per year, and carried 17,996 pieces of mail and 17.2 closed pouches per day; in 1898, 1 car with 2.8 clerks made 9.7 trips per day, running 43,617 miles per year, and carried 47,227 pieces of mail and 24.3 closed pouches per day. The total miles of cable and electric mail routes having no clerks and handling closed pouches only was 798 in 1897 and 1,304 in 1898; the mileage per annum was slightly less but the number of pouches per day was 40 per cent greater in 1898.

Our friends the daily papers have struck a new lead on us, and as might be supposed in these days of germs, it is what they christen the street car bacilli. The street car family of germs, moreover, is a large and vigorous family including everything from chilblains to consumption. Some of the learned medical men of the east have already found a remedy, if indeed they did not make the remedy first and discover the germs afterwards. All we have to do is to inoculate our cars with the biniodide of mercury, and then fumigate with formaldehyde gas. Managers who really desire to do the work thoroughly will also use a 7,000-volt current on such germs as have survived the two previous treatments. It might also be well to request the passage of an ordinance requiring each passenger on paying his fare to make affidavit he has no germs concealed about his person. All this, with the thorough though old fashioned method still in use of scrubbing with soap and water, should keep the street car what it has always been—a pretty safe place to be in.

A correspondent of one of our English exchanges writes commenting upon the relative danger of German and American competition to British makers. He claims that the Germans maintain low prices because they pay small salaries to their managers and engineers as well as low wages to workmen; it is believed that the salaries of engineers and managers must eventually be increased which will make the cost of manufacture nearer what it is in Great Britain. American competition is regarded with more alarm; he says American makers are now exporting to Germany, machine tools and bicycles in large quantities and are entering the market for iron and steel pipes, fittings, steel rails, bridges, etc., and asks: How can they do it with their high wages and expenses for freight and duty? He further states that he was informed by American firms operating branch factories in Germany which were equipped with the best machine tools and under the direction of their best engineers, but

employing only German labor, that they could not turn out work as cheaply as in their American works.

The reason may be that the American is the best workman, and the best is the cheapest even if the first cost is higher.

The "Electrical Engineer," of London, takes the REVIEW to task for some comments appearing in the December, 1898, issue regarding the comparative safety of trolley circuits of 500 volts and arc lighting circuits of high potential. Had the article in the REVIEW been read with care the criticisms would have been unnecessary, for the statement was not made that lighting circuits of 5,000 volts were carried overhead in American cities. However, it is needless to add that where arc lamps are connected in a circuit there must be some exposure. In the case of the railway electrician who was killed, he was working with the arc lamp and accidentally came in contact with it. The fact that he was not killed at once by such a high voltage is evidence that he would have suffered little danger in coming in contact with a 500-volt trolley circuit, which was the point in our editorial. The expression of thankfulness that England is blessed with Board of Trade regulations, forbidding the nefarious practices of the United States, is amusing, especially in view of the fact that many of the needless and oppressive regulations of the Board of Trade, particularly regarding electric railway construction, have stood as a barrier to progress.

Last month we remarked on the probable scarcity of machinery and construction material for early spring delivery on account of the unusually large amount of new work in sight. During the month copper has strongly advanced, and insulated feeders are likely to go still higher on account of the rise in rubber. Rails are becoming scarce at any price for April and May delivery, and the mills are already talking July and August delivery to inquiring buyers. The car builders are not overbooked now, but another month will undoubtedly see them all full. With a demand equal to or in excess of possible supply buyers will be forced to bid against each other for time delivery, and this will raise prices. The supply houses in all the smaller materials and specialties are doing a land office business, and buyers are already beginning to seek the sellers as they have not done in several years.

New enterprises are being announced every day, and while many of them are the hopes of people who know nothing about electric railways, and are ten years in advance of a paying business, some are legitimate and commendable undertakings which will make good propositions as operating roads. Money is cheap and abundant, and investors are paying more to get into the same deals they turned down less than six months ago, just as was then predicted in these columns.

Roads already built are doing a good business with fine prospects for the largest summer riding ever experienced.

Pleasure resort roads are improving their parks and installing additional mechanical and amusement features. Altogether these are busy days in the street railway field.

The Twin City Rapid Transit Company, of Minneapolis and St. Paul, has begun the substitution of large double-truck cars for the two-car trains, motor and trailer, on its city lines, and has adopted the type of car used on its two interurban lines as the standard. The reasons for this are the economy in operation effected by reducing the item for car service employes, the decrease in accidents which it is expected will result by abolishing trail cars as far as possible, and the preference of passengers for the larger and more comfortable cars.

As brought out in the paper before the Boston convention by Richard McCulloch the use of trailers increases the number of accidents for two reasons; first, because the trailer is another car; and second, the opening between motor and trail car is sometimes a dangerous one for a passenger boarding or alighting from the car. The means of effecting a reduction of the number of accidents to passengers boarding or alighting from cars have been given much attention by the officials of this road, and the radical remedy adopted of at all times restricting the entrance to one end only of the car and protecting that entrance by gates which are open only when the car is at a full stop, has proved an effectual one as shown by statistics published on another page.

The experience of street railway companies in general has been that the use of double truck cars, solely by reason of being larger and easier riding, has created traffic, and this is a good reason for recognizing the preference of passengers in choosing rolling stock.

On the Twin City lines it is found that one of the large cars requires more power than a two-car train, but that the increase of this item is more than balanced by the saving of having only two instead of three men to operate each unit.

In October, 1897, Isaac B. Brown, the secretary of the bureau of railways of the department of internal affairs of the state of Pennsylvania, caused a count to be made of the number of persons passing a given point in the city of Harrisburg in street cars and on bicycles during two days. The figures were published in the Pennsylvania report for 1897, and excited considerable interest as showing that 67.7 per cent of the persons counted were on wheels.

On November 1 and 2, 1898, similar observations were made at the same point and in the report for 1898 these figures for the two years are compared. It is stated that the conditions for riding were about the same in the two years; there was no particular inducement on account of the inclemency of the weather to ride in the cars, and the condition of the streets was such as to make the riding of wheels entirely satisfactory. In 1897 the number in cars was 1,962 or 32.3 per cent of the total; on wheels 4,116 or 67.7 per cent. In 1898 the number in cars was 2,370 or 40.7 per cent; on wheels, 3,449 or 59.3 per cent.

These figures confirm the impression we received last summer that pleasure bicycle riding is on the wane. The number of riders in the Chicago parks was markedly less, so far as a casual observer could judge, than in 1897, and was rather surprising when the rapid and continuous increase in the number of bicycles during previous years was recalled. Two years ago most people were of the opinion that the bicycle had come to stay and that its use would continue to increase as it had for some years. Now it is realized that the high water mark of pleasure riding was probably reached in 1897. The ownership of a bicycle, like the possession of other property, entails care, and more people now think that the care overbalances the pleasure to be got from it.

The bicycle riding of the coming season we think will be for the greater part by those who would otherwise walk, and the loss in fares to street railway companies will be much less.

At a recent dinner of the Chicago Trade Press Association, the largest and most influential organization of its kind in the world, addresses were made by Arthur Woodcock, of the Paris Exposition commission; John W. Ela, of Chicago, and other speakers upon the development of the foreign trade of the United States, in which they strongly urged the necessity of reform in the consular service, and the desirability of having a government department of commerce. The state department has, at the request of this association, secured data from foreign countries as to the governmental departments dealing with commerce, which will soon be published in the consular reports. We have received advance sheets and heartily recommend that our readers and particularly our advertisers secure the report and peruse it carefully.

The remarkable expansion of the foreign trade of the United States within the last two or three years has made a greater number of the American manufacturers and dealers acquainted with the methods pursued by other nations in promoting foreign commerce and in conducting the consular service, and made them more keenly appreciate the shortcomings of our own government in these respects. Consuls are properly business agents pure and simple, charged with assisting their countrymen in conducting business transactions and in collecting statistics on commerce and industries which will be of value in informing home manufacturers and promoting the export trade. The United States consuls are in the majority of instances appointed on the recommendations of ward bosses and county central committeemen; they have neither the ability nor the desire to promote the commercial interests of their country and look to making what they can during a short term of office. The consular reports, which are really good, are not the work of the consuls, but of their clerks, who are generally natives

of the country to which the consul is appointed and hold over from one administration to the next.

No business man would choose his business agents as the United States chooses its consuls and expect satisfactory results. Knowing the conditions, and feeling the results more sharply each year as our export trade grows larger, our exporters should endeavor to secure a remedy. Our congressmen and senators pay greater heed to the business men and manufacturers among their constituents than to any other class, because it is from them the campaign funds must come. Let everyone who has suffered from the viciousness of our consular system make a personal appeal to his representative in congress and the evil will stand a better chance of being soon remedied.

There is a bill now pending in congress which should receive the strong and active support of manufacturers; it provides for an Executive Department of Industries and Commerce. Every nation making any pretensions to civilization, save only our own, has either one or two departments of its government whose scope is industries and commerce. At the present time the work of gathering statistics on commerce properly belonging to such a department, is being carried on by four independent corps under the secretary of state, the secretary of the treasury, the secretary of agriculture, and the commissioner of labor, and notwithstanding these four sets of statistics on the same subjects, it is said that there are none of any practical value.

The electric railway is widening its field, and as each spring time brings its list of projected trolley roads it becomes more and more certain that the electric motor is a competitor of the steam locomotive for traction purposes. During the coming year the prospects are favorable for building more interurban lines than are now in existence, and these frequently parallel or compete with steam railroads. Wherever there are contiguous cities of considerable size there is sure to be a plan for connecting them by a trolley line. Practical railway men who have built roads and are officers of street railway companies are quietly looking over every field and are planning interurban lines which will be quickly constructed and soon become paying properties, and for this reason the new electric railway construction is on a healthy basis.

The return of prosperous times is not the only cause of trolley lines extending in every direction. By experience it has been shown that a trolley line can be constructed, maintained and operated at less cost than a steam line. Steam railroad engineers have been very reluctant to acknowledge that the locomotive could be replaced by the electric motor with greater economy. For elevated railway service they argued that the cost of maintaining the electrical equipment would equal the maintenance of the locomotives, and whatever saving there might be from energy being generated in a central station would be lost in transmission. Whatever may be said pro or con on the subject, the financial report of the South Side Elevated Railway Company, of Chicago, for the past year is the strongest argument which can be set forth in favor of the electric motor. Under practically the same conditions of traffic and operation the percentage of operating expenses to receipts was reduced from 84.7 in January, 1898, when steam locomotives were in service, to 55 per cent in December, 1898, when electricity was the tractive power. Such a record as that cannot be answered by any theoretical arguments against the electric motor. This demonstrates that for heavy, and frequent passenger service over comparatively short distances, the motor has a great advantage over the locomotive.

A case in which the conditions were diametrically opposite is that of the interurban line near Wilkesbarre, Pa., which is described elsewhere in this issue. One terminus of the line is at a town of about 3,000 inhabitants and the other at a popular pleasure resort, the line passing through several villages, the largest of which has only 500 population. At the other terminus connection is made with the street railway system of Wilkesbarre, a city of about 40,000. This line, 12 miles in length, was operated for some time as a steam road, but was a losing venture. Progressive street railway men came in possession of the property and equipped it for electric traction. One item alone is sufficient to set forth the relative merits of steam and electricity. During the past month of steam operation the coal bill for the two locomotives was just five times the cost of coal for the power station during the first month of motor car operation; furthermore, a better and more frequent service was rendered. This line is also an excellent example of the various advantages of high voltage transmission. The power station could be located at one terminus of the 12 mile road, which effected a very great saving in the fuel bill; no feeders were necessary, and the combined cross section of the three alternating current transmission wires is less than a No. 1 wire, making an enormous saving in copper. The transmission is at 8,000 volts, and the drop or loss on the lines is less than on many short city trolley circuits.

The alternating current has successfully passed through service tests and has greatly augmented the possible length of electric interurbans. Between the two extremes described above there are other railway conditions which can be met better by the trolley than by the locomotive. While we are not sanguine enough to say that the best days of the locomotive are over, it is our firm conviction that the greater development in the future will be in the line of electric railway engineering.

CONFISCATION OF PROPERTY.

Under the above caption the Cincinnati "Enquirer" comments on the demand made by some unreasonable citizens of that place for further and impossible performances on the part of the road. The tenor of the article is so unlike the usual newspaper attitude we copy it, as follows:

The Cincinnati Street Railway Company has spent about $12,000,000 in rebuilding its entire lines and in making extensions. A large share of these $12,000,000 went directly into the streets on which the company's tracks were laid. In numerous instances the streets were relaid from curb to curb either with granite or asphalt, thus contributing millions of value to the city, and in no way enhancing the value of the company's property. Extravagant as was this cost the company had to bear it. Moreover, this company has been loaded down with tax burdens, such as the 5 per cent on gross receipts and the $4 per lineal foot on each car, as no other street-car system in the world is loaded. To insist now on its again tearing up the streets and rebuilding its lines by putting its trolley wires under ground, and so spending another $12,000,000, would practically insist on the property being confiscated. If the company were compelled to spend that sum now it would have to issue bonds, and to pay interest on those bonds would leave no money for dividends, which would destroy the value of the stock, and that would be confiscation. But this is not all, and is not the worst of it. Should the company have this burden forced upon it, its enormously increased fixed charges that would follow as a result, it is claimed, would make cutting down the wages of every one of its employes inevitable. It could not pay the wages it now pays, for it would not have the earnings above its fixed charges with which to pay them. Do the people of Cincinnati want this kind of result? Did any city in the world ever profit by the cutting of the wages of its laborers or by the bankruptcy of its most prosperous corporation?

AN ECHO OF THE LONDON, ONT., STRIKE.

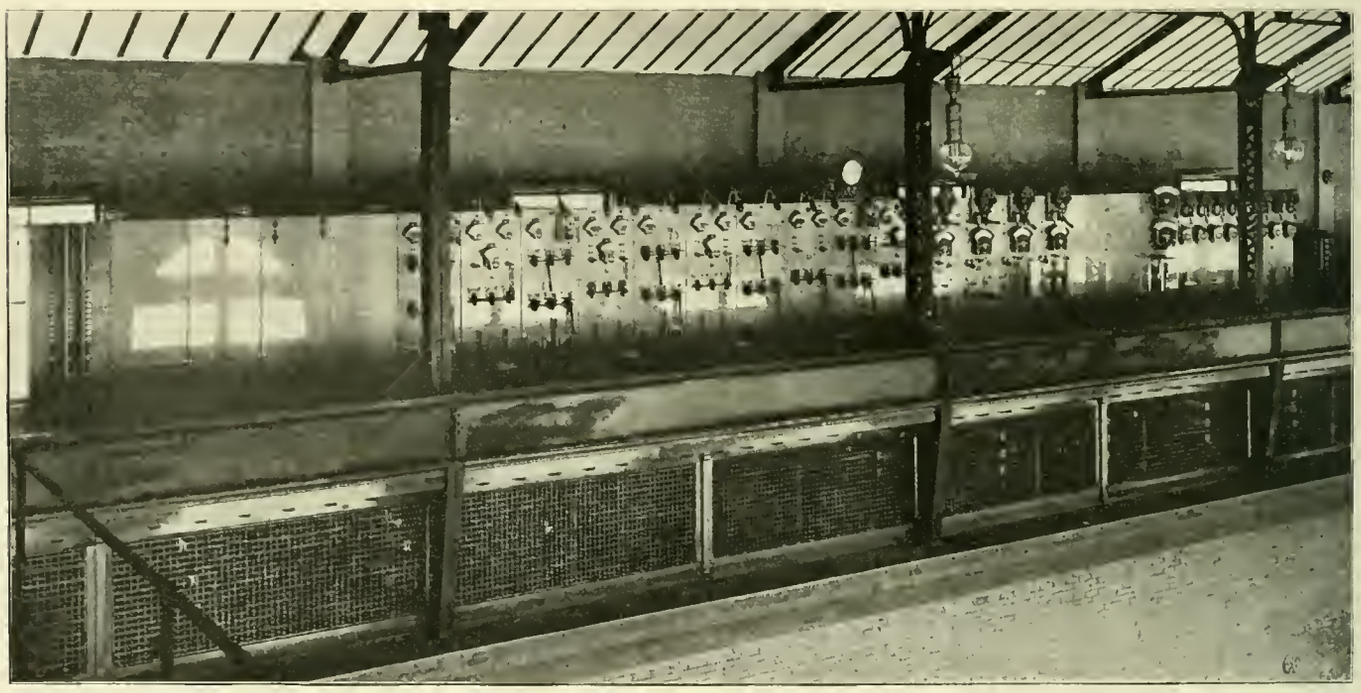
The city of London, Ont., is likely to pay dearly for its passive assistance to the striking employes of the London Street Railway Company. Writs of summons against the corporation of the city have been prepared at the instance of the railway company in a suit for damages arising from the recent strike. The chief grievance of the company was the action of the city council in denouncing the company at one of its meetings and upholding the prospective strikers. The claim is made on the grounds of "inciting riots, causing damage to the plaintiffs and for neglect and breach of duty." The suit is for $20,000 damages.

On January 19, a cable oiler was severely burned as the result of an explosion in a cable pit of the Presidio & Ferries Railroad, San Francisco. He had entered the pit, which is 25 ft. by 50 ft., to oil the pulleys and on striking a match to light a gas jet as usual, the explosion followed. It was found on investigation that the cable had been rubbing against a gas pipe and had cut it about half off.

Power House and Shops of Twin City Rapid Transit Company.

Description of the Water Power Plant at St. Anthony's Falls — Method of Distributing Current — Changes Effected in Old Stations — Description of the General Shops of the Company and of the New Car Shops — Standard Double Truck Car for City Use — How Accidents Have Been Reduced by Gates and Fenders.

The Twin City Rapid Transit Company was chartered in June, 1891, under the laws of New Jersey, but the three companies which it controls, the Minneapolis Street Railway Company, the St. Paul City Railway Company, and the Minneapolis, Lyndale & Minnetonka Railway Company, are much older. The men who are now managing this company were interested in the street railways of the Twin Cities before the motive power was electricity and were pioneers in electrical working. Thomas Lowry, the president, was among the first to recognize the future of electricity in the street railway field, and though he had decided upon a cable system and purchased large quantities of material, did not hesitate to change his plans and use the newer power. C. G. Goodrich, the vice-president, has been connected with this system for over 20 years, and W. J. Hield, the general manager, for nearly 12 years. Both have been untiring in their efforts to develop the business, and the success achieved crowns the work. The auditor of the company, John F. Calderwood, is well known to the street railway men of the country through his connection with the Street Railway Accountants' Association, of which he is president, and as a member of its committee on a standard system of accounts.



VIEW OF SWITCHBOARD.

At the present time the company operates about 240 miles of track. Since acquiring the St. Paul & Suburban road it has all the street railways in and connecting the two cities and their suburbs. The various lines are shown in the map of the system published herewith. The equipment comprises about 1,000 cars, of which over 600 are motor cars. The great majority of the cars are run in one direction only, Y's being provided at all terminals, and hence have but one controller. The exceptions are cars put on intermediate sections of lines where there is a heavy local traffic during portions of the day; on these lines cross-overs are provided and the cars are run back and forth without turning.

Double truck cars are favored because they are more popular with patrons and cheaper to operate under the conditions which obtain, and, it is believed, are also cheaper to maintain. The large cars are heavier and require more power, but the capacity is greater and the increased cost of power is more than compensated by the saving in trainmen's wages. A single large car will replace a small car and trailer, dispensing with the need of one conductor. This reduction of one-third in the item of wages, about 40 per cent of the operating expense, permits a comparatively large increase in the item of power, which is only about 15 per cent of the total. Also by substituting one car for a two-car train the number of safety gates is reduced. As fast as possible the old cars will be superseded by new ones of the standard type.

One year ago the power used by the company was generated at three separate stations, two of which, known as Nos. 1 and 2, were in Minneapolis and one, No. 3, in St. Paul. The aggregate power of the engines then in use was 10,500 h. p. The plant of the St. Anthony Falls Water Power Company was first put in partial operation January 1, 1898, and was in full operation by February 19, 1898, since which time the old No. 1 power station has been run but 11½ hours, and No. 2 has been abandoned. It was not intended to entirely supplant No. 3 station by the water power plant, and this station still carries a portion of the regular St. Paul service.

The power station of the St. Anthony Falls Water Power Company is located on the north side of the Mississippi river, at the end of the company's dam, which is commonly called the lower dam. This company owns all of the St. Anthony's Falls water rights, and years ago built the upper dam and leased power to the various mills located on both sides of the river at this point. The fall at the upper dam is 48 ft., and when the lower dam was built its height was limited by the necessity of not interfering with the water power of the mills above. At the lower dam the available head varies from 16 ft. to 21 ft., depending on the stage of the river; the average available acting head is 19 ft. The location of the plant is shown in the accompanying map.

As seen from this map the building is a part of the dam; it has foundations of cut granite and walls of hollow tiling, with sandstone

trimmings. The building from outside to outside is about 250 ft. long by 100 ft. wide. The northern portion, constituting the wheel pits, has walls extending 20 ft. above the flood level (which is the same for the wheel pits as for the generator room); this portion is 44 ft. wide, inside measurement. The generator room is about 48 ft. wide at the floor, but the north wall of this room is built over the wheel pits so that a gallery 12 ft. wide is formed at one side. In this gallery are placed the switchboard and transformers. The office of the electrical engineer of the Twin City Company, Edward P. Burch, is also located near the front end of the gallery. From the floor of the generator room to the top of the side walls is 34 ft.; to the ridge of the roof, 45 ft. The roof is of slate, supported on steel trusses. A 40,000-lb. crane, built by Pawling & Harnischfeger, of Milwaukee, travels the entire length of the building.

The dam, as shown in the map, extends in a northeasterly direction, almost parallel to the 10th avenue bridge, for a distance of 400 ft., and then turns at an angle and runs parallel to the northern shore for 544 ft.; at the southern end is a log sluice and near the power house are two bear trap waste gates. The dam is built of cut lime stone laid in concrete cement. To protect the shore a retaining wall, also of granite, was built from the east end of the station to a point opposite the angle in the dam.

The so-called bear trap gates consist of two aprons pivoted at their lower edges and inclined toward each other. One, the lower or down-stream apron, is shorter than the other, which is the gate proper, and has rollers along its upper edge against which the upper apron rests. To raise the gate water is admitted to the space between the two aprons, through a by-pass under the up-stream apron, and forces the two gates up. To lower the gates the upper by-pass is closed and a by-pass connecting the space between the aprons with the water below the dam. As the water flows out from under the aprons they fall, and when completely open the two lie flat, one over the other. The gates at the south end of the dam are three vertical gates operated by screws with ball-bearing nuts. These are operated by a small water wheel.

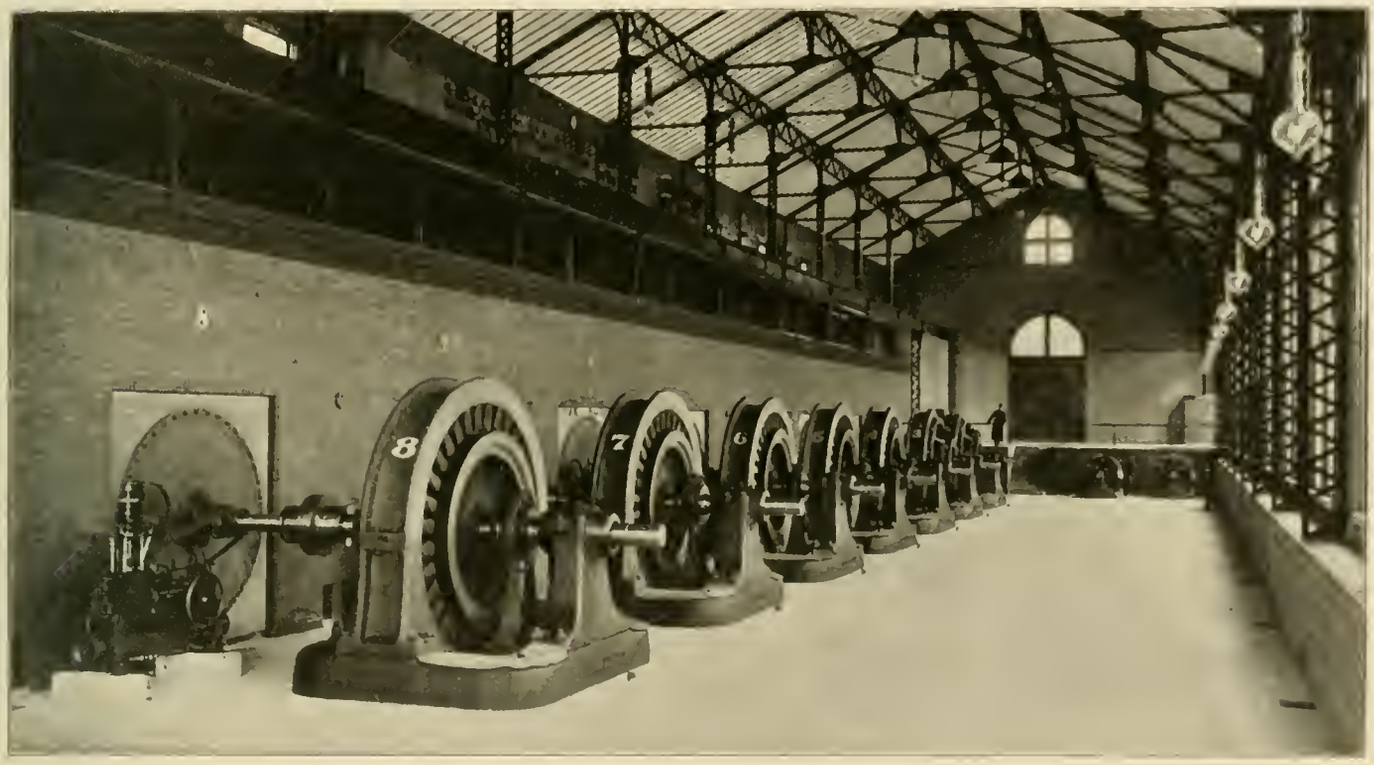
There is also a wing dam extending from the power house side of the bear traps down below the abutment of the Minneapolis Western Railway bridge, which crosses just east of the power house. This wing dam serves to keep the tail-race clear and protect the power house.

In the main wheel chamber are 14 pairs of 42-in. horizontal water wheels, made by the Stilwell Bierce & Smith-Vaile Company; they are of the Victor type. Under the head available these wheels are guaranteed to develop 250 h. p. each. They are mounted in pairs and two pairs coupled, making four 42-in. wheels driving each of the seven generators now installed. At the east end of the power house, in a smaller wheel chamber, are two sets of wheels made by the S. Morgan Smith Water Wheel Company.

The governors were made by the Lombard Water Wheel Governor Company, and seven of them are now installed.

The machines installed now comprise five 700 k. w. three-phase General Electric alternators, with 32 poles, running at 130 r. p. m., giving a frequency of about 35; two 700-k. w. G. E. 8 pole direct current generators, wound for 575 volts at no load and 600 volts at full load; and two 100 k. w. six pole exciters running at 280 r. p. m., giving 575 volts at no load and 600 volts at full load.

The switchboard is of Vermont marble, with 28 panels, six of which are now blank for the machines not yet installed. The plant was built to contain ten 700 k. w. machines. A good idea of the size and extent of the switchboard may be had from the illustration. The station panel is fitted with one 750-volt illuminated dial Weston voltmeter and one 2,500-ampere, 600-volt Thomson recording wattmeter. The alternating current panels are each equipped with one 200-ampere, dead-beat, inclined coil ammeter, one 5,250-volt voltmeter, one generator rheostat, one high-voltage main switch with porcelain chamber, two single-pole field switches, one two-point phase lamp switch, two pilot lamps, one phase lamp, one potential plug, one 700-k. w. single-phase indicating wattmeter and three fuse blocks.



INTERIOR OF POWER HOUSE.

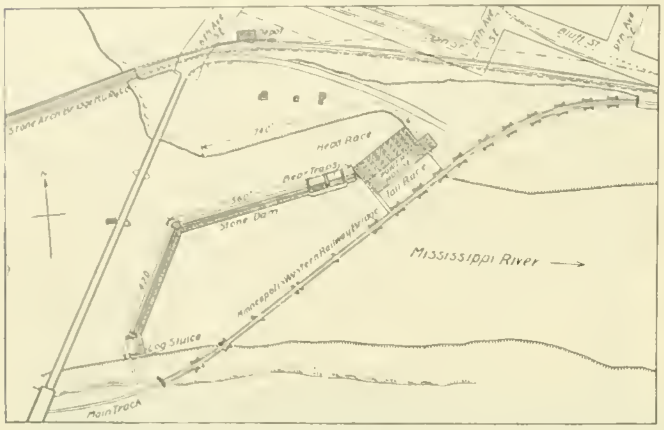
There are five alternating current feeder panels, each fitted with one 200-ampere, 3,500-volt three-phase Thomson recording wattmeter, three porcelain-chamber, high-voltage coupling switches, one pilot lamp, six busbars at the back, one single-phase indicating wattmeter of 700 k. w. capacity, and three fuse blocks.

The panels for the two continuous current generators are each equipped with one 1,200-2,000 circuit breaker, one 2,500-ampere illuminated-dial Weston ammeter, two single-pole, double-throw main switches, one two-way field switch, one potential plug, one pilot lamp, one resistance lamp and two busbars at the back.

The two exciter panels are next the generator panels and have

each one illuminated dial Weston voltmeter, one Weston ammeter of the round pattern, one rheostat, two single-pole, double-throw main switches, two single-pole field switches, one automatic circuit breaker and two busbars at the rear.

Each one of the railway feeder panels has mounted upon it two



MAP OF DAM.

300-500 ampere circuit breakers, two 200-ampere Weston ammeters of the round pattern, one pilot lamp, two single-pole main switches, and there are two busbars at the back.

One panel of the switchboard is designed for the purpose of taking care of static discharges. Two divisions are for the 3,500-volt circuits and the third for the 12,000-volt circuit, the latter having a greater number of discharge gaps and more graphite resistance; otherwise, it is the same as the other two. These are connected to

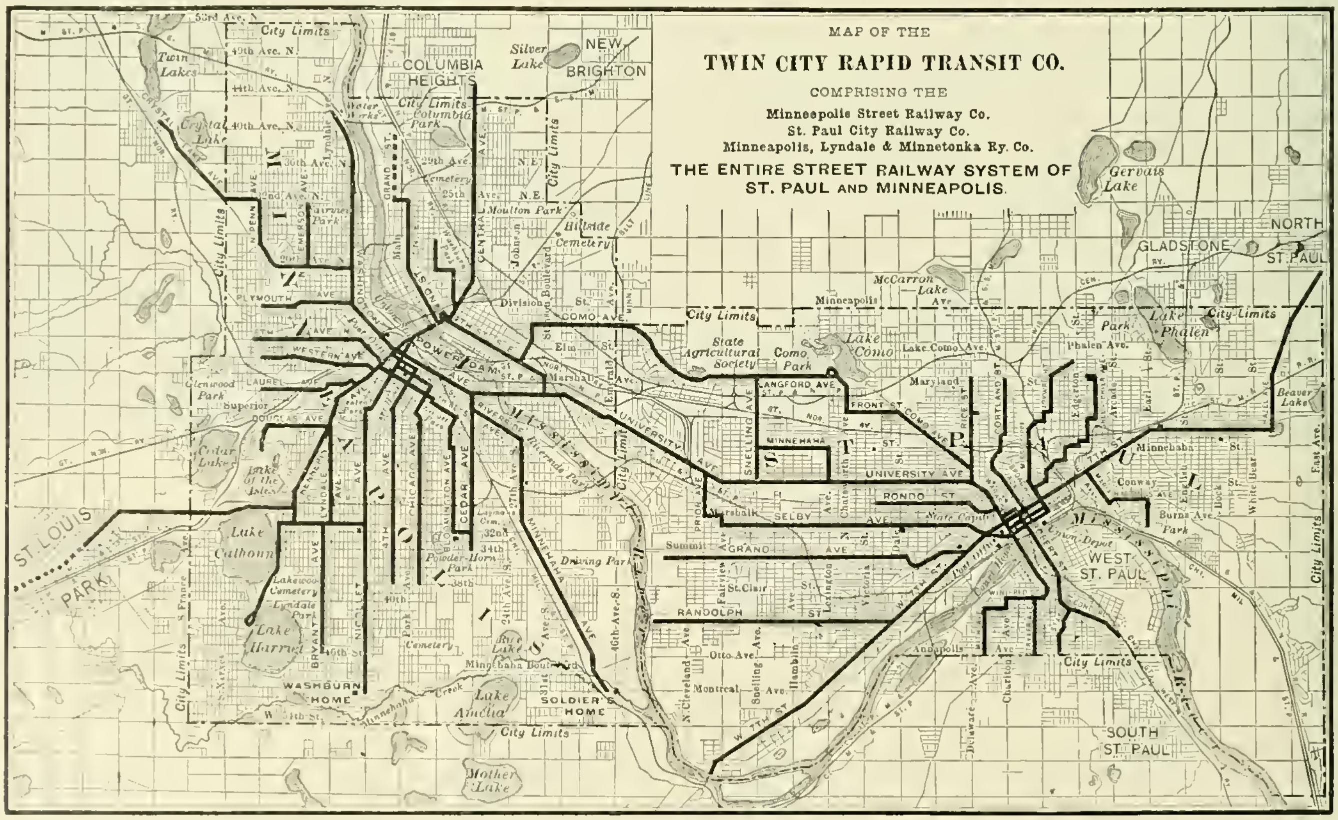
At the west end of the switchboard gallery are six G. E. static transformers of the standard air blast type. They are each of 223-k. w. capacity, and are used to raise the voltage of the generators from 3,450 to 12,000 volts for transmission to St. Paul.

EXTERIOR OF POWER HOUSE.

The building is heated by means of home-made electric heaters and lighted by 13 arc lamps.

The hydraulic work of this plant was in charge of William de la Barre, engineer of the St. Anthony Falls Water Power Company; and the electrical work in charge of Edward P. Burch, electrical engineer of the Twin City Company. Mr. Burch has been with the company for seven years.

The entire output of this plant is leased to the Twin City Rapid



the line through switches and can be opened at any time without interrupting the flow of current in the line. This is for the purpose of cleaning and adjusting the discharge gaps with safety. Surmounting the central panel of the switchboard, as a head piece, is a 12 in. dial. The switchboard, which is in a gallery above the generators, as a whole, is a very handsome piece of work.

Transit Company. Current is transmitted to the three stations of the company in the two cities.

Current is transmitted to station No. 1, which is in the business heart of Minneapolis, through two triple-conductor, paper insulated, lead covered cables, each equivalent to No. 000 B. & S. wire. The distance is 9,000 ft.; voltage, 3,450. In the station are six 215-

k. w. transformers of the General Electric A. B. type, transforming from 3,300 to 360 volts, and two 600-k. w., 8-pole rotary converters running at 520 r. p. m., and giving 580 volts up to full load.

This station formerly contained two triple-expansion Allis-Corliss engines, with cylinders 24, 40¾, and 56 by 60 in., one simple Allis-Corliss of 400 h. p. and one vertical engine of 400 h. p. The two smaller engines have been removed to make place for the converters and transformers. The triple-expansion engines each have flywheels 28 ft. in diameter and 73 in. face, which drive through jack shafts 16 Edison 175 k. w. and two Edison 80-k. w. generators. The old boilers, two Stirling boilers (2,875 sq. ft. of heating surface each) and five Babcock & Wilcox boilers (3,128 sq. ft. of heating surface each) are still in place, though regularly used only for heating the building.

The two triple-expansion engines are available as a reserve. During 1898, after February 19, they were run but 11½ hours, and that was during the severe snow storm of November last, when the water was somewhat low in the river and the demand for power was exceptionally heavy, because the use of snow plows had to be continued during the peak of the railway load.

No. 2 station is in Minneapolis, about 4½ miles from the water power plant, and current is transmitted to it at a voltage of 3,450 over one cable equivalent to a No. 0000 wire. No. 2 contains one 600-k. w. converter and three transformers. This station formerly contained ten 16 and 27 by 16 in. Westinghouse compound engines direct belted to m. p. 270-k. w. T.-H. generators, and seven Stirling boilers of 287 nominal h. p. each. The engines have been removed from this station, but the boilers remain in place and some of them are used for heating the building.

Current is taken to station No. 3, which is in St. Paul, a distance of about 10 miles, over one triple conductor cable of three No. 0 wires. Here are two converters and six transformers. No. 3 formerly contained three triple-expansion Allis-Corliss engines with cylinders 24, 40¾ and 56 by 48 in., and one 400-h. p. engine; the small engine has been discarded. As before stated, No. 3 still carries a part of the regular load.

The cables from the water power station to the three sub-stations are all laid underground in cement lined sheet iron pipe, there being about 100,000 ft. of this conduit laid. The pipe is 4¼ in. outside diameter and inside the cement lining measures 3 in.

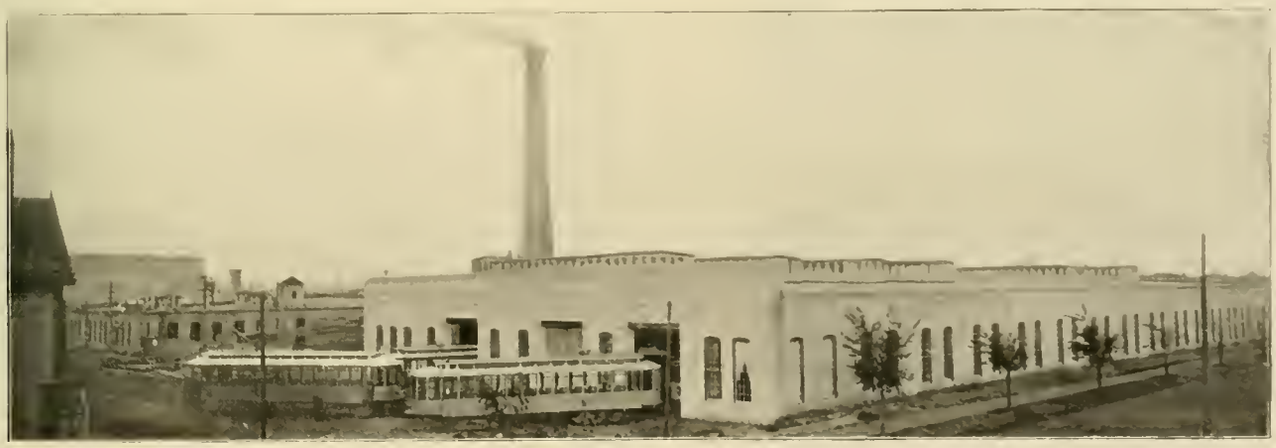
In both Minneapolis and St. Paul are extensive systems of underground low potential feeders which were installed in 1890, when the lines were converted to electricity. These have been supplemented by overhead feeders as extensions were built. The trolley wire is divided into sections of varying length, the length being such that the maximum load on the section is about 300 h. p.

The Twin City Company has recently acquired the St. Paul & Suburban road, which is a line extending from St. Paul to Wildwood, at White Bear Lake, 12 miles northeast. This line is to be extended eight miles farther to Stillwater, giving a 20-mile road. The power station of this road is known as the Wildwood station and is equipped with two Babcock & Wilcox boilers, two 100-h. p. Ideal engines and two m. p. 4 pole, 90-k. w., T.-H. generators. There is a heavy traffic between St. Paul and White Bear Lake, which is cared for by this station.

The Twin City Rapid Transit Company does a great deal of its own work, probably more than most other roads of the same size, and has extensive shops occupying an entire block in Minneapolis, bounded by West 31st and West 32nd streets and Nicollet and Blaisdell avenues, south. The ground plan of this plant is shown herewith.

THE LOWER DAM.

The building on the northwest corner of the lot is about 65 ft. by 95 ft., three stories high, and was built in 1890; it is occupied by the general storehouse and the offices of the purchasing agent and general store-keeper, A. M. Baldwin, Jr.; the engineer and roadmaster, David Curtin, and the master mechanic, W. M. Brown. The vice-president, Mr. Goodrich, and the general manager, Mr. Hield, keep in very close touch with the work at the shops, and usually spend a portion of each day there, as all requisitions of the purchasing agent and all requisitions on the general storehouse must be approved by the manager. Two rooms on the second floor have recently been fitted up as offices for Messrs. Goodrich and Hield, so that the records, plans, etc., which they wish to keep at this building can be more conveniently arranged.



EXTERIOR OF CAR SHOPS.

The heavy supplies are arranged in tiers of boxes and bins on the lower floor and the lighter supplies on the second floor. The third floor is used for storing patterns, of which the company has a complete line; the iron castings are about all that it has done outside, and for these it makes its own patterns.

The greater portion of the building joining the storehouse on the

south was built in 1884 and was the shop of the Minneapolis, Lyndale & Minnetonka Railway Company (a steam road), which was purchased by the Twin City Company. It is, of course, no longer operated by steam. Various additions have been made to the original building, and it now comprises the machine shop, 94 ft. x 110 ft.; the armature room, 52 ft. x 53 ft.; the brass foundry, about 27 ft. x 52 ft.; the blacksmith shop, 42 ft. x 52 ft., and the general repair shop of irregular shape.

All the repairs for the system are made here, as it is found cheaper to haul disabled cars and apparatus from St. Paul than to keep up the shops and storehouses that would be necessary to make repairs at the car houses. The machine shop regularly employs about 45 men. Its equipment comprises 10 lathes, 6-ft. to 16-ft. bed; 1 turret lathe, 2 power punches, 3 gear cutters, 1 planer, 1 key-seating machine, 2 shapers, 4 Brown & Sharp milling machines, 3 bolt cutters, 2 tapping machines, 2 speed lathes, 1 universal grinder, 5 emery wheel stands, 6 drill presses, 3 sensitive drills, 1 gear blank machine, 1 wheel boring machine, 1 hydraulic wheel press, 1 rail saw, a rail bender for special work, and a full line of tinsmith's tools. For hand work there are 20 vises.

The tool room occupies one corner of the shop, and in it are a milling machine, a lathe, and two grinders kept exclusively for toolmaking. There is a full line of reference and snap gages for close work. The system of checking out tools is combined with the system of checking the time. Each man has a shop number and a bundle of small checks, bearing the same number, on which to draw tools. When he goes to work he receives from the tool room a large check with his number and this is turned in at noon, drawn again in the afternoon, and returned at night.

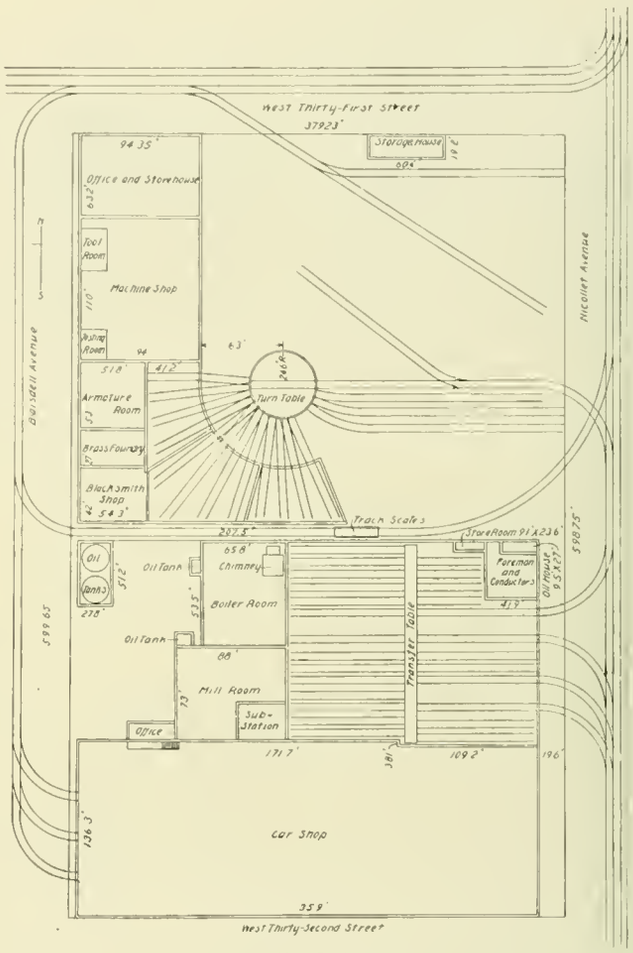
The gear and pinion work, turning trolley wheels, etc., furnish work for several machines. The pinions used on cars are of novel design. They are built up of 75 disks of No. 24 sheet steel, and five

VIEWS OF STANDARD CAR.

disks of raw-hide, punched out and assembled between two 1-in. brass disks. The assembled pinion is subjected to a pressure of 60 tons and five ½-in. steel rivets put through it. When riveted they are placed two at a time in a milling machine and the teeth cut, the steel blanks, being already formed, need only a light cut. One machine will mill 12 pinions in 10 hours. The pinions and the seats for them on the shaft are turned to a taper of ⅝ in. to 1 ft., which greatly facilitates their removal.

The cast wheels used are ground and the steel tired wheels turned down in this shop. The company had some trouble with cast wheels breaking under the heavy cars, and now very generally uses steel tired wheels for the motor axles, having about 400 such wheels; when the tire becomes worn thin the wheel is placed on the non-driven axle of the truck.

Throughout the shop the shafting has been carefully arranged so that portions of it may be cut out when the machines are not needed. The shop is driven by one of the discarded traction generators rewound for a motor.



PLAN OF SHOPS.

A great deal of rebuilding has been done in the machine shop and the W. P. 50 motors appear to have come in for their full share. As originally built, these motors had only one field coil containing 165 lbs. (about 165 turns) of No. 3 wire. This coil is replaced by one with 192 lbs. of wire in it, and the lower pole piece is chipped and planed so that a lower field containing 65 lbs. of No. 4 wire may be inserted. These lower field coils are known in the shop as "horse collars." The commutator in this type of motor has been placed outside the pole piece. The shaft is replaced by one 6 in. longer, made hollow at one end, and the leads from the armature carried through the center of the shaft. This arrangement removes the armature from all contact with the dust from the commutator.

In one corner of the machine shop is a small room fitted with the necessary prony brakes and instruments for testing motors. Fuse boxes and lightning arresters are also tested here.

In the armature shop about 13 men are employed, the company doing all its own repair work. One of the labor saving devices here is a shellac stirrer; the shellac is in a barrel mounted in bearings and belted to the line shaft, so that it is always stirred. To draw off shellac for use the belt is thrown off and the barrel stopped. In the armature room are motor cases and brakes for quickly testing armatures.

The brass foundry employs four men, who usually make three heats per day each. All the brass castings used are made here. The method of making pinions, which has been described, causes a

great deal of the brass turnings and borings to be mixed with steel, and a most ingenious machine for separating these turnings is used. The mixed metal is placed in a hopper, which discharges it into a cylinder having strong magnets on the interior. The iron and steel particles adhere, while the brass drops off as the cylinder turns. The steel is swept off by a stiff brush during the latter part of the revolution and falls into a separate box.

The blacksmith shop is equipped with eight forges, a steam hammer and a trip hammer. There are now 26 men employed, working in day and night shifts.

The general repair shop, which employs 31 men, is in what was the round house of the railroad. There are 12 pits, three of which are long enough to take two cars. One of the pits is fitted especially for dropping the wheels and axles from under cars. The screws moving the wheel platforms are driven from the line shaft. Outside is the turn-table, and several tracks for temporarily storing cars are laid in the yard. The scrap pile is also here.

South of the buildings already described is the old 31st street power station and car house of the company, built in 1889. The car house is still so used. It is, approximately, 280 ft. x 158 ft., and has 14 tracks. In one corner is a room for the foreman and car service employes.

The boiler room still has its equipment, seven Stirling boilers, but only enough of these are used to heat the shops. The engines and generators formerly in the room south of this have been removed and a small space in one corner partitioned off for the 600-h. p. converter and the three transformers, which constitute the equipment of sub-station No. 2, before mentioned. The rest of the old engine and dynamo room is now filled with wood-working machinery and called the mill room.

South of the car house is the new car shop, which was completed in April, 1898. This is a building of brick 359 ft. long, outside measurement; the north wall is formed by the old car house, so, while it is 136 ft. 4 in. wide at the west end, the offset in the old wall reduces it to 130 ft. at the east end. Windows 4 ft. wide x 10 ft. 4 in. high are spaced two to each 20 ft. of wall along the south side. At the ends are 14-ft. doors for the entrance and exit of cars, with windows where the wall spaces admit. There are six monitors in the roof, each 20 ft. x 52 ft., affording ample light.

The south wall of the new shop is 21 ft. 6 in. high; the east and west walls 25 ft. 6 in. The roof is 4-ply gravel supported on wooden trusses. The clear space under the trusses is 16 ft. Three rows of 7-in. round cast columns support the roof trusses. From the outside of the south wall to the centers of the first row of columns is 35 ft. 11 in., and the distance between rows 36 ft. The columns are spaced 20 ft. apart in the rows.

Walls have been erected in the exterior corner of the car shop and mill room buildings, forming a two-story building 14 ft. x 36 ft., inside measurement, which is marked office in the general plan. The lower floor is occupied by the stock room, where are kept the bolts, screws, etc., from the time they are drawn from the general storehouse until issued to the workmen. The upper floor is occupied by the master mechanic as his car shop office. The office is reached from the car shop by a flight of stairs, and from the gallery which extends along the side of the office the whole shop is in plain view. Windows in the east wall of the office give a similar view of the mill room, and the yard where lumber is stored may be seen from the exterior windows. The whole office is most conveniently arranged to enable a man to keep the shop under his eye.

The car shop is 11 tracks wide. The south side, three track, is set apart for the paint shop, and this portion has a cement floor with drains to the sewer, so that cars sent in for painting can be conveniently washed here. Throughout the rest of the building the floor is of wood. Arc lamps are provided for lighting, when necessary. Steam pipes are carried along the walls for heating, and in cold weather these radiators are supplemented by hot air from a Sturtevant plant.

The mill room is well equipped with machinery for wood-working, a great deal of which was made by the J. A. Fay & Egan Company, of Cincinnati. The mill room machinery includes 1 wood-worker, 1 molding machine, 2 rip saws, 1 shaper, 3 planers, 2 cut-off saws, 1 re-saw, 2 jointers, 1 mortising machine, 2 tenoning machines, 1 band saw, 1 Fay boring machine, 1 combination rip and cross-cut saw, emery grinders, and some smaller machines.

There are 74 men in the car shop, not including 13 painters. The capacity of the shop is eight cars per month. It was first opened in April, 1898, though not at that time completely finished. Last year 22 cars of the company's standard type were built and an order of 30 is now going through the shop.

MILL ROOM.

CAR SHOP.

The master mechanic, W. M. Brown, has been with the company for seven years, and has occupied his present position for over three years. He has had an extended experience in car building, and designed the company's standard car.

The foremen of the several shops are: Machine shop, E. Stoudt; repair shop, J. Reardon; blacksmith shop, O. Shoemaker; wood shop, W. H. Day.

The new cars, which are very fully shown in the accompanying illustrations, are regarded with considerable pride by the officers of the company, who feel that no road has any better cars. The greatest care is taken in the selection of material and in the construction, and the aim has been to build the best car possible.

These cars are designed for both summer and winter service; the window sills are but 27 in. from the floor and the two sashes may be slipped down into the side of the car, making practically an open car. The length, as shown in the floor plan, is 41 ft. 7 in., and at the front end is added a buffing timber (bent to conform to the car end) 9 in. thick at the center line of the car. This makes the total length 42 ft. 4 in. The weight of the body is 10 tons; with trucks and motors, 17 tons. The long sills are of Oregon fir, 4¾ in. by 6¾ in.; steel plates ⅝ in. by 5 in. are let into the side sills; the short sills are of oak. The ends of the car are rounded, and both are vestibuled. There is but one entrance, and that is protected by gates of the type described elsewhere. There are two steps, each 11½ in. high, to reach the platform; the steps are of the Stanwood type, made by the Q & C Company.

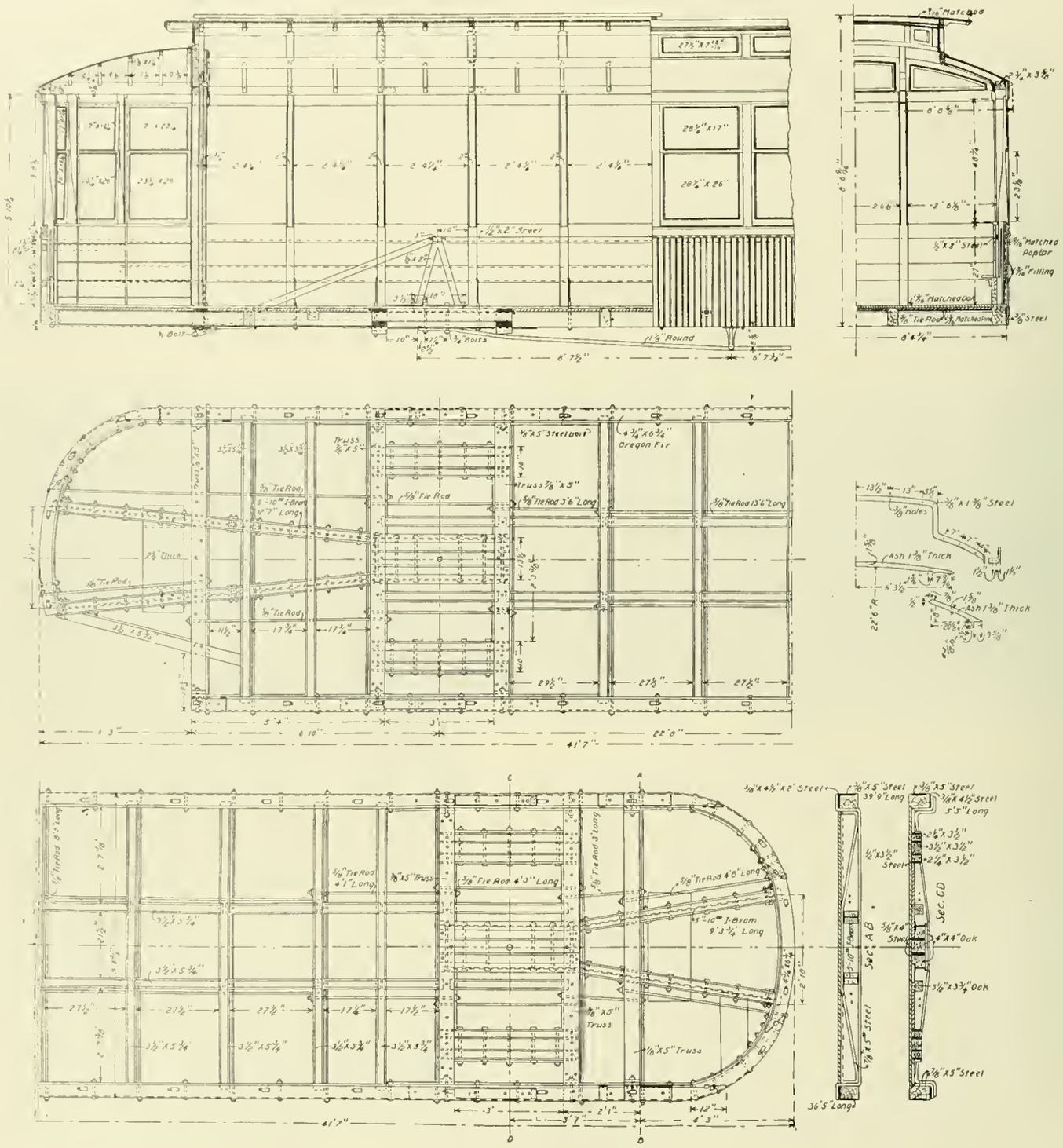
Over the trucks are two cross trusses (shown in the section CD) spaced 3 ft. 5 in. between centers. These are of ⅞ in. x 5-in. steel. Between these, to receive the center bearing, is a beam built up of

three pieces of oak 4 in. x 4 in., two steel bars 5/8 in. x 4 in., and portions of two 5 in. I beams (which support the vestibule ends). Over the side bearings are similar longitudinal pieces built up of three oak pieces and four steel bars 1/2 in. x 3 3/4 in. A third cross truss (shown in section AB) is placed under each end of the car body proper. From the innermost truss to the curved platform sill are two 5-in., 10-lb. I-beams; between the inner cross trusses the lower flanges of these I-beams are cut away to reduce the total height of the trusses. Oak filling pieces are placed on each side of the I-beams, as shown in section AB. In each side of the car is a steel truss of 1/2 in. x 2 in. steel, as shown in the longitudinal section, and the two side sills are further trussed with 1 1/8-in. rods.

The posts, water tables, and rafters are of southern white ash; the plates are of Oregon fir; the flooring is double, 13-16-in. matched oak on top of 13-16-in. matched pine; the roof is of poplar, covered with No. 6 canvas; the outside sheathing is of poplar, the inner sheathing of 1-in. white oak; the inner finish is of northern red birch, except the ceiling, which is quartered white oak. The details of the rafters are shown in the drawings, and also the details of steel rafters placed at four of the posts to give additional strength to the monitor roof.

This car seats 40 or 51 persons according as the heater is or is not in place. As an experiment one car was fitted with seats upholstered in leather, but the Hale & Kilburn rattan seats were decided upon as preferable, particularly for warm weather. The seat arms are brass, and were cast in the shop, as were also all the fittings.

The car is heated with the Baker hot water heater, and lighted by 20 electric lamps. Electric headlights of the company's own design are used.



SECTIONS AND FLOOR PLAN OF CAR.

The trucks to be used under these cars have not been decided upon; one of the new cars is now in use with Brill trucks.

Nearly all the cars of the company are equipped with safety gates, which were designed several years ago, and have proved so satisfactory in operation that Mr. Goodrich would sooner send out a car without motors than without gates. This last is literally true, as the only cars without gates are trailers, and these are to be superseded by the larger cars now building. The standard type of gate adopted, after mature deliberation and numerous experiments, was fully illustrated and described in the REVIEW for March, 1895, page 154. It is operated by the motorman, who opens the gate after having brought his car to a full stop, and closes the gate before again starting the car. The gates are placed at the extreme outer edge of the step and open outward. It might be thought that bringing the car to a full stop and opening the gate before permitting any passengers to alight would cause a considerable loss of time, but such is not the case; what time is lost by operating the gates is more than gained by the quicker stop and quicker start that can be made when the motorman absolutely knows that no one is attempting to leave or board the car while it is in motion.

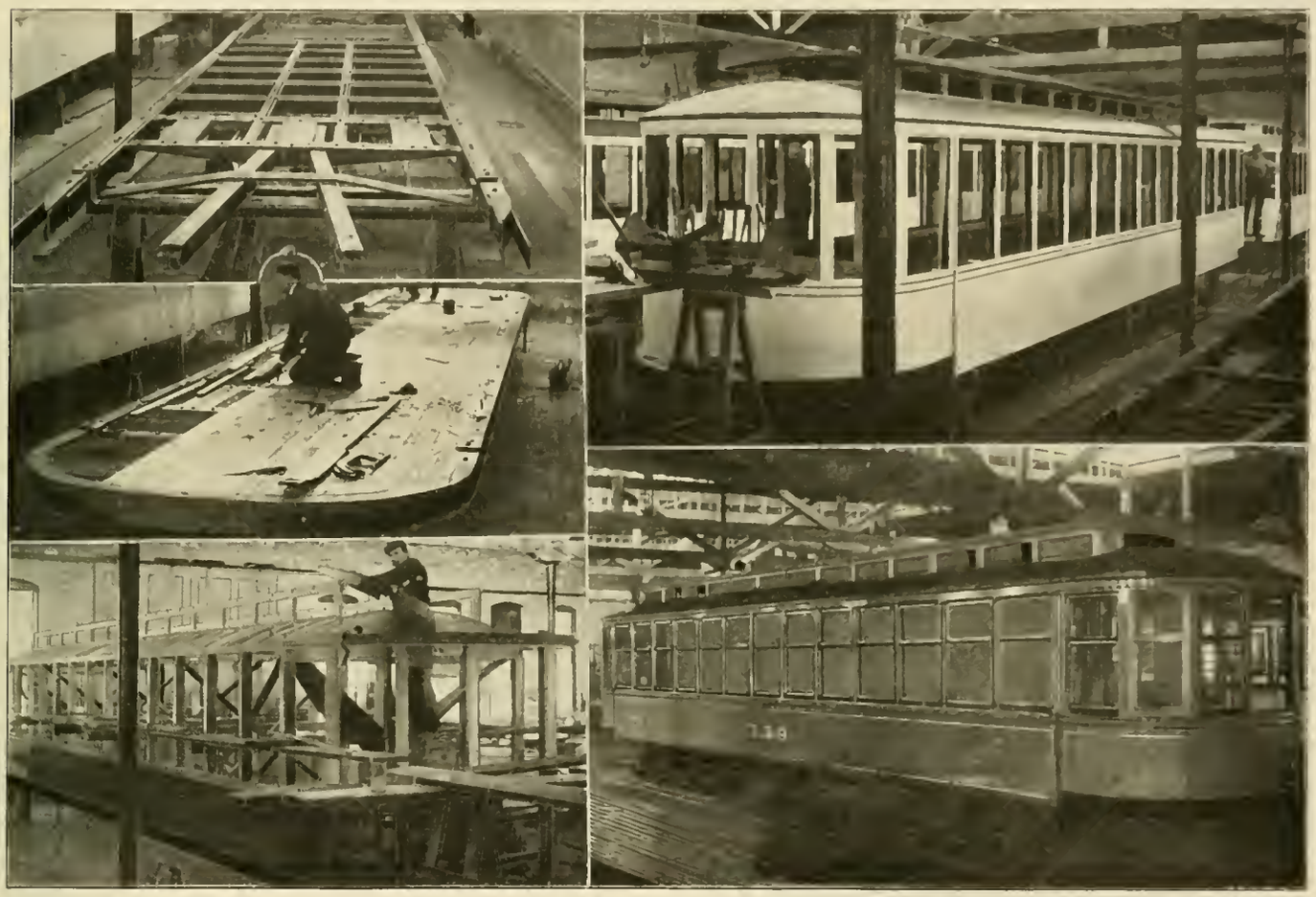
When the Twin City Company first began to operate by electricity it was insured in a casualty company which failed and left the Transit Company with damage claims aggregating $100,000 to settle. As a preliminary step to finding a means of preventing these accidents, Mr. Goodrich analyzed the causes of accidents, dividing them into 23 classes, and it was found that the most expensive and troublesome accidents were those caused by persons boarding or leaving cars when in motion. The adoption of safety gates followed.

How successful the remedy proved is shown by the following table, which gives the number of accidents on the Minneapolis division for the years 1898 and 1895, occurring from these causes. But few cars had gates in 1895. Some trail cars are without gates at the present time.

Cause.	1898	1895
1. Boarding moving cars.	32	83
2. Leaving moving cars.	55	141
3. Cars starting, alighting or boarding	23	14
4. Fell, alighting or boarding	35	71
5. Fell on or off car	8	36
6. Fell on curves	0	4
Total	153	349

In connection with these figures it must be remembered that in the four years the mileage and number of cars operated have increased nearly 100 per cent.

The other causes of accidents, as separated in the company's records, are: 7. Cars off track. 8. Collisions, cars. 9. Collisions, persons. 10. Collisions, vehicles. 11. Collisions, animals. 12. Cable slot injury. 13. Center pole injury. 14. Employes injured on duty. 15. Electric shock, persons. 16. Electric shock, animals. 17. Frightened horses. 18. Disturbances on cars. 19. Trouble on account of fare. 20. Ejections from car. 21. Miscellaneous. 21a. Gate injury. 21b. Bicycle accidents.



STAGES IN THE CONSTRUCTION OF THE CAR.

The Twin City Company was one of the first to experiment with the concrete beam track construction, and the construction adopted by it in streets paved with asphalt has been described in the REVIEW. In February, 1897, we published sections of the standard trench work of this company, showing 5-in. T-rails. There have been several miles of concrete beam track built since that time, but in the new work a deeper rail, 7-in., 80-lb. T, is used. This height of rail is preferred principally because it permits the use of a deeper toothing block.

When the street is to be newly paved throughout at the time this roadbed is put down, the method of procedure is as follows. The paving contractor lays down the concrete foundation over the entire street, leaving two or four trenches (as the case may be)

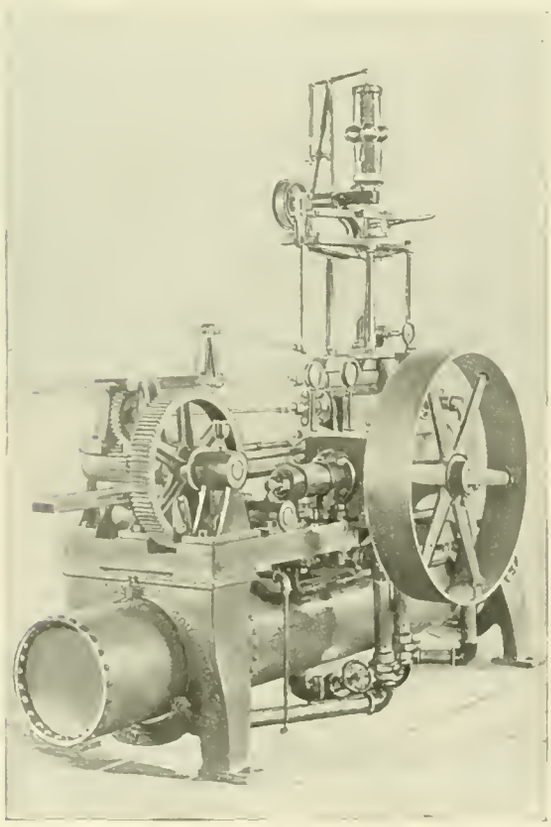
where the rails are to be; the paving foundation is usually of American cement concrete, 8 in. deep. The beams supporting the rails are of Portland cement concrete 15 in. wide x 8½ in. deep. In laying the rails they are levelled properly and supported temporarily on ties. Tie rods 2 in. x ⅜ in. are spaced 10 ft. apart to preserve the alignment. Then the concrete is put in place, and filled in about the base to within 2½ in. of the head, the ties being withdrawn as the work proceeds. A wooden form is laid against the inner edge of the rail when the concrete is tamped, to leave a space for the toothing blocks. The joints are cast-welded by the Falk process,

CONCRETE CONSTRUCTION IN PAVED AND UNPAVED STREETS.

and the welding gang keeps just ahead of the concrete gang in building the track.

The cost, exclusive of rails and joints (the railway paying the cost of paving from outer rail to outer rail), is about $3.10 per lineal foot of single track.

There are now about 15 miles of this construction in the two cities. About 60 miles of the company's track has cast-welded joints. The engineer and roadmaster who has charge of this work is David Curtin. One of the illustrations shows the process of construction in a street already paved with asphalt.



LOMBARD GOVERNOR, TYPE "B."

Another view of the water wheel governor, shown at the extreme left of the engraving of the interior of the power house on page 75, is given herewith. The other six governors in the station are not visible in that illustration, being concealed by the generators. As may be seen on page 75, the governor is directly geared to the gate stem coming out through the head of the water wheel case, and thus the governor positively connected to the water wheel gate through one pair of gears only. These governors are the type B made by the Lombard Water-Wheel Governor Company, and the regulation of the plant under street railway load variations is within 3 per cent. This type is the most improved form made by the Lombard Company, which builds eight distinct types of water wheel governors, adapted to the various requirements found in practice. The Lombard governors are now used to regulate about 80,000 h. p. of water wheels in this country, besides being used quite extensively abroad. The direct connection used here has also been adopted in a number of other large plants in this country, using the same type of governors, and has been found entirely satisfactory.

NEW COMPRESSED AIR COMPANY.

The Compressed Air Motor Company is the name of a new corporation organized in Chicago to promote the use of compressed air for street car service and to build and sell the motors. The officers are: W. J. Chalmers, president; H. G. Cooke, vice-president and manager; Alexander Soper, treasurer; and Charles W. Hinckley and W. R. Donaldson, directors. Mr. Cooke is already known in compressed air work, as also the engineer, Robert Hardie.

POWER PLANT OF THE THIRD AVENUE RAILROAD.

When the Third Avenue Railroad Company, of New York, decided to adopt electricity for a motive power on all its lines it was necessary to make provisions for one or more power stations of great capacity. Plans were made to construct one mammoth station on the Harlem river, between 216th and 218th streets, which was to supply current not only for the downtown districts, but also for lines far north into Westchester county. Alternating currents will be generated and transmitted at high potential to 30 or more sub-stations containing step-down transformers and rotary converters, and from these direct current will be fed into the trolley lines at suitable points throughout the city. The normal capacity of the station will be 64,000 h. p. but capable of carrying an overload of 50 per cent.

It was essential that a work of such magnitude be well done and by responsible firms, so the railroad company invited several of the largest electrical concerns to submit plans and bids for the entire undertaking. As mentioned last month the contract was awarded to the Westinghouse Electric & Manufacturing Company and Westinghouse, Church, Kerr & Co. drew the plans for the station.

The power house will be an imposing structure of brick and terra cotta, and its architectural effect will be gained by its color and huge proportions. It will be under two roofs, one arch covering the engine room and that over the two-story portion will cover the boilers. Alongside the river will be docks for unloading the coal boats, and coal handling machinery for conveying the fuel to a bin of 10,000 tons capacity. The coal after passing through automatic weighing machines is deposited into the hoppers and then into mechanical stokers. Machinery will convey the ashes out of the build-

ing and into boats at the docks. There will be four smoke stacks 200 ft. high and for purposes of forced draught there will be powerful exhaust fans.

In the engine room there will be 16 Westinghouse engines, each of a capacity of 4,000 h. p. with a maximum of 6,000 h. p. The generators are direct connected and excited from dynamos driven by independent engines. A switchboard 200 ft. in length will be arranged in a gallery above the machinery. With an ultimate capacity of 100,000 h. p. this station when completed will exceed that of any other in size, even Niagara not excepted, and will break the record for large stations recently made by the Metropolitan Street Railway Company.

STREET RAILWAY PARK AT OSHKOSH.

The lines of the Citizens' Traction Company cover the principal streets of Oshkosh, Wis., and extend south along the shores of Lake Winnebago to Electric Park, which is the property of the company. The company owns all the street railway lines in the city of Oshkosh, having 14 miles of track in the city and 2½ miles beyond the city limits. An interurban line is contemplated connecting Oshkosh, with a population of 32,000, with Appleton, population 12,000, and passing through Neenah and Menasha, population 13,000. Should a franchise be granted, which is expected, the line will be in operation by August 1, 1899.

During last summer Electric Park proved a great attraction. It is located on a high and beautiful site along the lake shore about 3½ miles from the city. The company has built a handsome casino, summer theater, arbors, swings, bath houses, etc. General Manager E. E. Downs made arrangements for music and special attractions which were liberally patronized this last season. One specialty was sending up hot air balloons with several dollars' worth of street car tickets attached, which were eagerly sought after by the visitors. The accompanying cut was reproduced from several photographs taken in the park and along the line last summer.

SCENES IN THE CITIZENS' STREET RAILWAY PARK, OSHKOSH, WIS.

ORLEANS TERMINAL, PARIS.

In the REVIEW for June, 1898, page 400, was described the preliminary plan of the Orleans Railroad of France for building an underground extension of 2½ miles in Paris to secure a more central terminal. At that time Messrs. Solacroup and Sabouret visited the United States to examine the electric railways of this country. Electric traction was decided upon because nearly two miles of the extension is in tunnels, which would be fouled by the use of steam engines.

The company had fully decided upon building a lighting station of 750-k. w. capacity and the power station is to be combined with that. The station being three miles from the Quai d'Orsay terminus high tension transmission with transformers and converters will be used. There are to be two sub-stations, one at each terminus of the extension, and each will have a storage battery of 1,100 ampere-hours capacity. There will be eight 8-wheel locomotives of a type similar to those used by the Hoboken Shore road.

METHODS FOR COLLECTING AND REGISTERING FARES ON INTERURBAN LINES.

BY F. H. FITCH.

The advent of the interurban electric railway has brought forward many interesting problems. Not of the least importance among these is that of the collection and registration of fares. This of course is one of the chief problems of any road. But on city lines the fare is one price to all whether the passenger rides one block or the full length of the line, and thus few complications arise, and the register at the end of the trip should indicate the number of cash passengers carried. On interurban lines, however, the fare ranges from 5 cents up to something less than one dollar, usually in multiples of five, and the problem of collection and registration is an entirely different proposition than that on city lines.

Interurban lines have grown by gradual expansion. At first they were extended a little way beyond the city limits to nearby suburbs, or built to connect two adjacent towns. In these instances, one extra fare was charged, or 10 cents for the entire trip. This was collected and in most cases where 10 cents is the maximum fare, is yet taken up by two separate collections, there being a designated point of general collection somewhere near the center of the line. When 10 cents is the maximum fare, this system of making two separate collections seems to be the most satisfactory. By this method the number of passengers carried cannot be ascertained, the register merely showing the number of 5-cent fares collected. This information is not however of vital importance, though desirable.

Interurban lines grew, and from five and six miles, with a maximum fare of 10 cents, they were extended until cities and towns, 30 and 40 miles apart, were united, and the fare accordingly increased to 10, 20 and 30 cents, and upward. As if by force of custom, street railways having from time immemorial collected 5-cent fares, or perchance not having thought out a one-collection system adequate to the occasion, some of the earlier interurban roads which extended their lines collected increased fares in installments of 5 cents each. One road in particular, for a time, made eight separate and distinct collections during the course of a single trip.

It is hardly to be wondered at that the passengers complained bitterly at having to be disturbed so frequently, and one regular passenger, on the line mentioned, even threatened to bring suit against the company to recover the value of a pair of trousers, the pockets of which had become frayed before their time, by reason of their wearer being compelled to "go down into his jeans" so frequently for change.

The problem then which presented itself was to invent a system by which the entire fare might be collected at one time, and yet:

(1) Permit an easy and reliable checking up of the conductor.

(2) Insure just returns to the company of moneys taken in.

(3) Identify passengers that their destinations might be readily seen, and the conductor be not confused as to who has paid and who has not paid their fare.

(4) Permit no perverting by either passenger or conductor of the methods used.

(5) Be handled with facility and rapidity.

(6) From which might be deduced all necessary information for statistics and accounts.

A great many, and perhaps the greater part of the interurban roads today, use the duplex ticket, the same as are used by the Pullman and Wagner sleeping car companies. The chief objection to these duplex tickets is that a dishonest conductor could punch the half of the ticket which he keeps, and which is turned into the company as a record of the amount he has received, differently from the half which he gives to the passenger. The other serious objection to duplex tickets is the time it requires to punch and detach them. There is one place upon an interurban line known to the writer, where the cars, on very frequent occasions, are loaded to the guards at a park, and in six minutes a transfer point is reached where many passengers are discharged, and it is essential that the collection be completed before reaching this point. In a place like this, duplex tickets could hardly be used.

Other forms of tickets are such as are used by the interurban lines running out of Cleveland, which have been described in a previous issue of the REVIEW, and a form designed by the writer for use upon the Southwest Missouri Electric Railway.

The essential principle of this last form and of the Cleveland form is the same, and is a ticket designed to be torn in two, one part to be given to the passenger to be retained by him for his identification throughout the trip, and the other part to be retained by the conductor and by him turned in to the office, from which portion the conductor's debit is determined, and either portion of the ticket to indicate the amount of fare paid, and the stations between which the passenger is traveling.

Fig. 1 shows the passenger's side of this ticket, and Fig. 2 the reverse or conductor's side. The bold figures, 1, 2, 3, 4, 5, 6, 7 and 8, indicate the number of 5-cent fares paid or collected. The abbreviated words, part of them in vertical position, are the names of the various stations where an additional fare is collected, or in other words, they are points of general collection. There are nine of them, or eight spaces between which 5 cents is charged. The full set of stations does not appear with the figures 5, 6, 7 and 8, for obviously, if eight 5-cent fares are paid, that being the maximum fare, there is only one station to which such fare would be collected, viz., the opposite terminus of the line. And likewise there are only eight stations to which five 5-cent fares would be collected, and accordingly with the figure 5, the ninth or middle station in this case is omitted, for even from the two terminals the fare to the middle station is only four 5-cent fares. On the conductor's side, these stations are still further abbreviated, being designated merely by letters. The letter on either margin of the passenger's side is a certain conductor's letter, no other conductor having tickets with that letter. Each conductor's tickets are numbered consecutively.

These tickets are put up in block form, two hundred to the block, and are detached by use of a rule, both the block of tickets and the

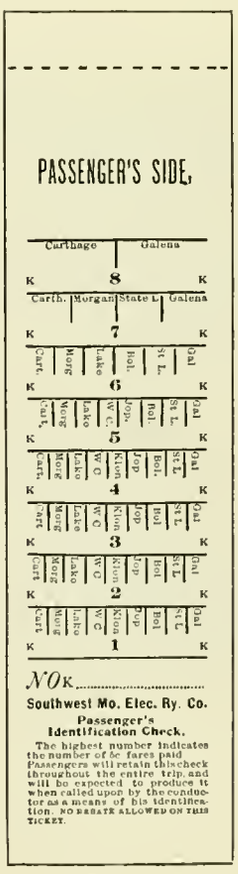


Fig. 1

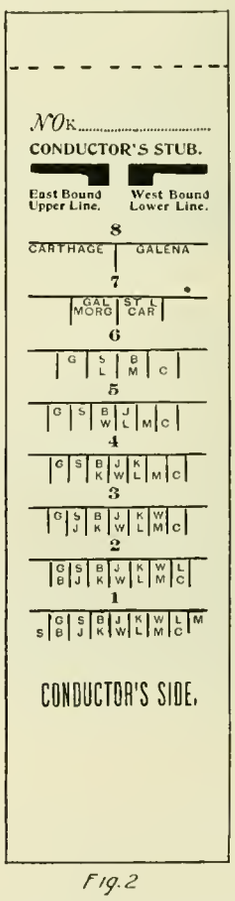


Fig. 2

rule being suspended about the conductor's neck by a small chain. The manner of holding the rule when in the act of tearing off the passenger's portion of the ticket is illustrated in Fig. 3.

Now to illustrate the use of the ticket: Suppose a passenger boards the car at Joplin, wishing to go to Carthage. The fare is

25 cents, as will be seen on the ticket. The conductor detaches the ticket as shown in Fig. 4, and gives the portion torn off to the passenger; if it is a male passenger, sticks it in his hat. The reverse side of the portion which he retains, which remains in the block, is shown in Fig. 5. The portion given to the passenger indicates first, by the bold figure, that he has paid 25 cents; second, that he has started at Joplin, and third, by the offset in the upper edge being

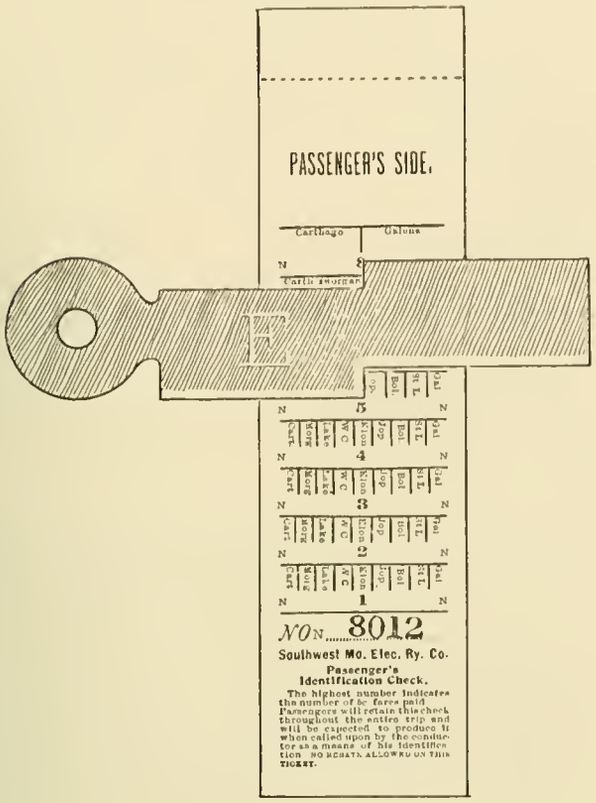


Fig. 3

on the left hand side, that he is east-bound. The reverse side of the conductor's portion gives the same information. The heavy black forms at the top are to show the direction. When the ticket is torn as in Fig. 5 the bottom edge is similar to the form on the left and indicates east-bound. When east-bound, to determine the point of starting, one refers to the upper line of letters, which in the illustration is J, which stands for Joplin.

As will be observed, the rule has two edges, one of which is used on east-bound trips and the other on west-bound trips. To illustrate a west-bound trip, suppose the passenger boards the car at Joplin to go to Galena. The fare is 15 cents, and the resulting tickets for passenger and conductor are shown in Fig. 6.

Should either the conductor or passenger attempt to alter his portion of the ticket by further mutilations, he would do so to his discomfiture. The conductor would be held responsible for more money and the passenger be entitled by his check to ride a less distance. Should the passenger tear off or cut off, say in Fig. 6, the abbreviated Joplin, he would then be entitled to ride by his check only three fares distance west from Klondike, the next station east of Joplin.

It may appear that the conductors would consume much time in finding the place at which the rule should be held to make the tear, and this as well as innumerable other objections were raised against the system by the conductors, who, by the way, always object to innovations. But the rapidity and skill with which they soon became accustomed to handle the tickets was really beyond all expectations, and the fact that all handled them with almost equal facility, showed that it was no extraordinary feat.

From an accounting standpoint, this ticket will show:

(1) The number of passengers carried.

(2) The number carried at the various rates and of course the average fare collected per passenger.

(3) The number of passengers traveling from any particular, or each station, and to what stations they go, if this is desirable.

No second hand checks can be worked on a conductor, because each conductor has his distinct appellation, and if by chance the forger should board the same conductor's car, at the same place, and going in the same direction, the conductor would have his serial number to fall back upon.

Last of all, and no doubt the most important requisite of a suitable ticket system is to get one by which dishonest conductors can be reliably detected. I say reliably, because a conductor should not be called upon to face so serious a charge as that of theft, unless there is absolutely no doubt of his guilt. It is rather a difficult proposition for any one to get on a car of an interurban line and ride for perhaps two hours, with passengers constantly getting on and off, and to report how many passengers should have paid 5 cents, how many should have paid 10 cents, how many 15 cents, etc. I claim that it cannot reliably be done. It was on account of the difficulty of inspection, where the fare was collected all at one time, that some roads did, for a long time, and that many yet collect their fares in installments of 5 cents each, so that their inspection is no more difficult than on city lines. By the ticket system which I have just described, an inspector need only report the maximum number of passengers between each section of the line. For instance between Stations A and B, there were so many passengers, being the maximum number; at B he begins his count anew, and reports that between B and C there were so many. Furthermore, it is not essential that the inspector should ride the full length of the line and this, by the way, is a weak point in inspection. Conductors grow suspicious of a frequent through traveler. If the inspector reports so many passengers between any two stations, the conductor's stubs can be referred to and these should show a like number of passengers.

Aside from the count, let the inspector take pains to observe that no passenger is slighted in the giving of checks. Should the conductor give a check for a less amount than he receives, the stub will

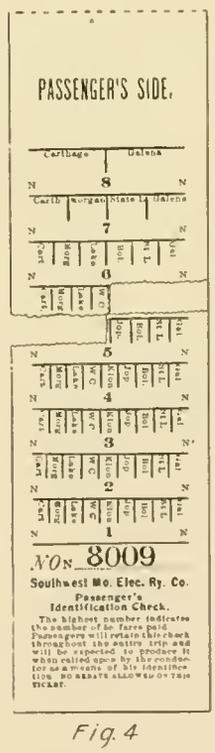


Fig. 4

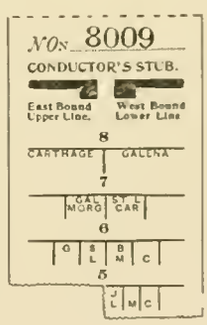


Fig. 5

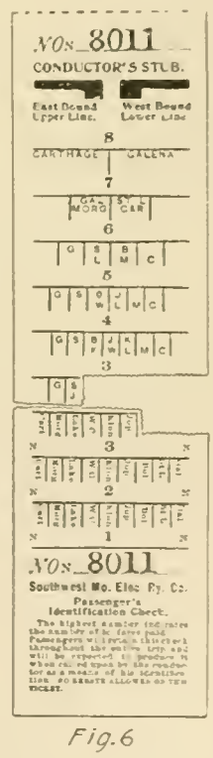


Fig. 6

not show that passenger as on the car over that section of the road; or if instead of giving the passenger a new current check he gives him a second hand one which he has picked off the floor or found in a seat, although it may fit all conditions, his stubs will not tally with the inspector's count.

In conclusion, I will say that while I do not claim for this system perfection, yet I believe it comes nearer than any other yet pro-

duced in complying with all the necessary requisites of accounting, rapid handling, non-perversion, identification, inspection and of just returns, for when properly torn the stub gives the company a credit with the conductor which cannot be effaced.

STREET RAILWAY MAIL SERVICE.

The following interesting statistics showing the growth of the street railway mail service in the United States are taken from the report of the general superintendent of the railway mail service for the fiscal year ending June 30, 1898, and compared with the similar statistics for 1896 and 1897, which were published in the REVIEW for December, 1897, page 808.

The remarkable feature of the table is the increased efficiency of the service; with but seven more routes, six more cars, and 10 more clerks than in 1897, the number of pieces of mail handled daily was over three times as many and the number of closed pouches handled per day was increased over 70 per cent.

The number of electric and cable lines handling only closed pouches was increased about 38 per cent, the miles of route over 60 per cent, and the number of pouches handled nearly 40 per cent.

STREET RAILWAY POSTAL CAR SERVICE.

	1896.	1897.	1898.
Number of routes	21	33	40
Miles of routes	198.58	303.68	379.47
Number of cars	45	65	71
Number of round trips with clerks per day	195 5-6	343	388
Annual miles of service with clerks	907,863	1,619,829	1,744,694
Estimated pieces of mail handled daily	505,481	593,860	1,889,092
Average number of closed pouches handled daily	398	568	971
Number of crews	60	87	98
Number of clerks appointed to lines	75	102	112

CLOSED POUCH SERVICE ON LINES HAVING NO POSTAL CLERKS.

	1896.	1897.	1898.
Number of routes	126	146	201
Miles of routes	726.84	798.24	1,304.43
Annual mileage	1,986,838	2,368,786	2,296,703
Pouches handled per day	1,924	2,485	3,440

PORTLAND & YARMOUTH (ME.) ROAD CHANGES HANDS.

At the annual meeting of the Portland (Me.) & Yarmouth Electric Railroad Company, on January 21, it transpired that local parties had secured control. Officers were elected as follows: President, Seth L. Larrabee; vice-president, F. C. Boyd, of the New Haven Car Register Company, New Haven; secretary and general manager, Louis B. Wheildon; treasurer, Henry P. Cox. The bonds of the company have all been placed in Portland.

It is the intention of the new management to thoroughly equip the road and develop a park to encourage summer traffic.

REPORT OF COLUMBUS (O.) STREET RAILWAY COMPANY.

The annual report of the Columbus (O.) Street Railway Company for the year 1898 has been published in pamphlet form and gives exactly the information that an investor in street railway securities wishes. The last year has been a very successful one from a financial standpoint, showing a surplus of $155,376, against $124,293 for 1897.

The company has 64.17 miles of (single) track laid with 45, 52, 70, 86 and 93-lb. Johnson girder and 60, 72 and 80-lb. 6-in. and 8-in. T-rail. In the power station are 10 Babcock & Wilcox boilers furnishing steam to three McIntosh & Seymour, and two Buckeye tandem compound condensing engines, aggregating 2,700 h. p.; there are two 500-k. w. direct connected and eight 75-k. w. belted generators. The car equipment comprises 119 motor trucks; 57 open motor cars, 28, 30 and 36 ft. over all; 20 open 7 and 8-bench trail cars; 87 closed motor cars and 14 trail cars; four electric sweepers, sand cars, etc. The cars were made by Brill, Brownell, Stephenson and Barney & Smith. Twenty-five of these cars were added during the year.

The earnings and expenses were:

Passengers	$680,172.53
Less operating expenses	327,691.94
Net earnings	352,480.59
Carrying U. S. Mail	410.16
Advertising in cars	3,000.00
Power sold	3,580.01
Other sources	1,869.65
	361,340.41
Fixed charges	205,964.17
Surplus	155,376.24
Gain over 1897	31,083.13

During the year $10,874 was charged to roadway and track construction, of which $1,552 was for street improvement assessments, and $248 to park construction. There was charged to equipment $32,320 for new cars, $15,281 for motor equipment, and $252 for power house equipment.

The capital stock of the company is $3,000,000 and the funded debt $3,572,000.

The following tables show some interesting statistics:

Statistical.

	1898	1897	Increase or Decrease.	Per cent Increase or Decrease.
Total Revenue passengers carried	14,905,955	13,284,530	I 1,621,425	12.2%
Total No. motor car miles run	3,638,558	3,514,545	I 124,013	3.5%
Total No. of trail car mileage run	87,504	95,603	D 8,099	8.5%
Average mileage per car per day of 18 hours	153.3	148.1	I 5.2	...
Earnings per car per mile	c. 18.30	c. 16.80	I c. 1.50	.....
Earnings per car per day	$28.02	$25.54	I $2.48	.....
Operating expenses per car per mile	c. 8 70	c. 7.90	I c. 80	...
Operating expenses per car per day	$13.50	$12.09	I $1.41	.....
Net receipts per car per mile	c. 9.60	c. 8 90	I c. 70	.....
Net receipts per car per day	$14 52	$13 45	I $1.07	...
Rate of operating expenses	48.20%	47.30%	.....	.....

Operating Expenses per Car per Mile.

	1898 Cents per Car Mile.	1897 Cents per Car Mile.
Maintenance of Way	1.0	0.6
Maintenance of Equipment	0.8	0.7
Conducting Transportation	4 6	4.6
Power	0.7	0.7
General Expenses	1.6	1.3
Total	8.7	7.9

The officers are: President, Robert E. Sheldon; vice-president, Edward K. Stewart and Clarence M. Clark; secretary and auditor, P. V. Burington; treasurer, Edward K. Stewart; general superintendent, Willis F. Kelly.

The Canton & Massillon (O.) Electric Railway Company is now building 1½ miles of new track; it will probably be completed by March 1.

A TRANSMISSION LINE TO LOS ANGELES.

The number of water power plants is constantly on the increase and where their distance from a city is moderate it is a great convenience and saving for a street railway company to receive current from a transmission line. The numerous trolley roads about Niagara, at Salt Lake City and Ogden, Utah, Sacramento, Cal., Minneapolis and elsewhere all take current from high voltage currents. The San Gabriel transmission, conducting current from Azusa to Los Angeles, Cal., 23 miles, is the latest to supply current to move electric cars. The peculiarity in this case is that the steam power station of the Los Angeles Railway Company is reinforced by the current from the transmission line and in turn assists in carrying the lighting and power loads at certain intervals.

Operations began on July 1 and within a month afterwards the rated capacity of the water power plant had been reached and the machinery and line carry an overload of 50 per cent at times. Although the water in the San Gabriel river has not been so low in 30 years a satisfactory service has been continued without interruptions. In a recent issue of the "Journal of Electricity" George P. Low has contributed a comprehensive account of the hydraulic and electrical features of the San Gabriel plant and it is to this we are indebted for the data and accompanying illustrations. The writer expresses the opinion that the Azusa-Los Angeles transmission is in some respects the most remarkable to be found on the Pacific coast, if not in America. Of all transmissions, the San Gabriel

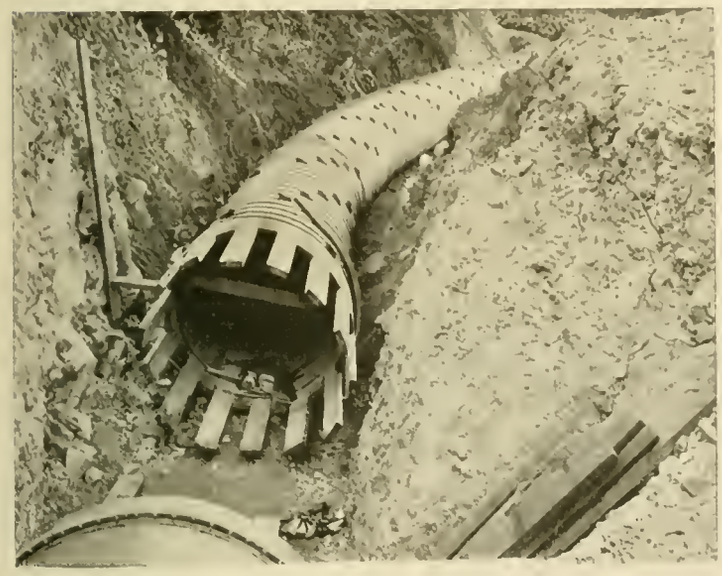


FIG. 1 WOODEN STAVE PIPE.

plant resembles the Hartford installation more than any other. Each is driven by water power, each has an auxiliary steam plant, and each delivers direct current, lighting and power service from rotary converters, but while the Hartford plant has a storage battery to equalize the load factor, the San Gabriel system gives or takes 500-volt direct current from the power circuits of the Los Angeles Railway Company, thus evening the load factor and affording a reserve of practically unlimited capacity. It is in the ingenuity of the combinations that result from the use of these three plants—water, steam and railway—that the remarkable novelty of the San Gabriel system, from an electrical engineering standpoint, exists.

The water system contains over 20,000 ft. of tunnels, nearly 9,000 ft. of wood pipe, and over 1,500 ft. of concrete culvert. No open ditching, in the ordinary sense of the term, is used, and the system has no fluming; the tunnels are lined on the sides and bottom with concrete varying from 4 in. up to 36 in. in thickness, according to the characteristics of the rock, and, except where firm rock is pierced, the tunnels are arched with masonry. The longest of the 38 tunnels in the waterway is 1,610 ft. In summer time a material part of the flow of the river is in the underflow that seeps through the sand and gravel beneath the river bed, and that this underflow should be thrown into the canal as well as the surface flow, a submerged dam is to be built across the bed of the river. About 75 ft. of the length of the dam will have an average height, or rather depth, of 50 ft., while the remaining 300 ft. of the dam will have an average depth of not more than 25 ft. The dam so constructed will be of concrete with an average thickness of perhaps 20 ft. at the base, tapering to a width of probably 6 ft. at the top; this top or crest, of course, being level with the surface of the gravel that forms the bed of the river.

All pipe, except the last short section leading down from the penstock to the power house, is 48-in. wooden stave pipe, Fig. 1,

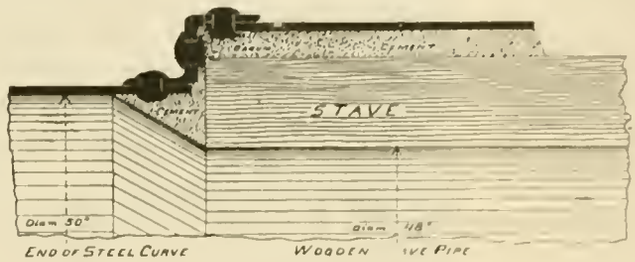


FIG. 2.

laid uniformly 10 ft. below hydraulic grade, and is buried in the side of the mountain. The pipe can be laid in curves, the radius of which depends upon the diameter of the pipe and the thickness of the staves. The sharpest of the curves of the San Gabriel pipe has a radius of 125 ft. Where sharper curvature could not be avoided, steel elbows were introduced of slightly larger diameter, having a riveted bell or socket to connect with the wooden pipe, the space between the pipe and bell being partly filled with oakum, driven in hard, the remainder being filled with clear Portland cement as shown in Fig. 2.

Fig. 3 gives an idea of the arrangement of the power house, from which it will be seen that it is composed of three apartments extending in the direction of its length. The apartment farthest from the mountain side contains nothing but the impulse water wheels with their gate valves, regulator hoods and housings, and the receiver. The center of the building, which forms the main portion, contains

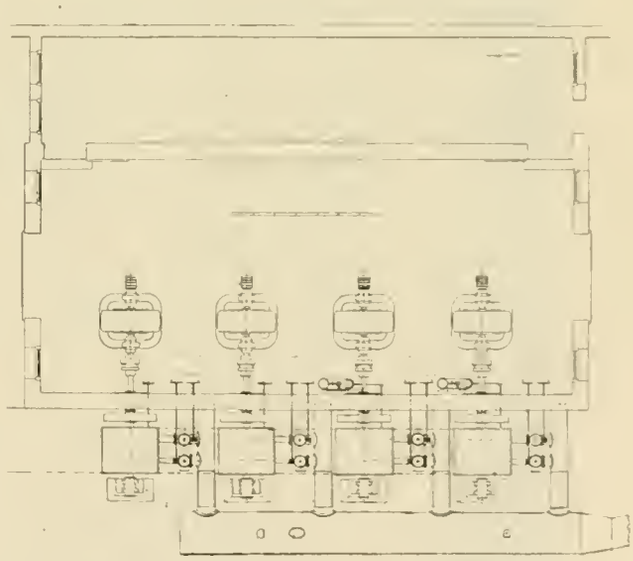


FIG. 3 DIAGRAM OF POWER HOUSE.

the generators, exciters, switchboards and water wheel governors, while the third apartment, constituting the transformer house, contains the step-up transformers, high tension switching devices, lightning arresters and choke coils, and from this room the line wires are carried out through a usual form of opening. A gable roof covers the whole power house, and in the center apartment, where the roof is highest, a traveling crane of sufficient capacity to handle any of the machinery, is installed. All walls of the power house, even the two inner ones dividing the building into compart-

ments, are of massive concrete work, and as the roof is of corrugated iron supported on iron trusses, the building is both substantial and thoroughly fire proof. Each water wheel shaft carries a three-ton fly wheel placed next to the wall, as may be seen in Fig. 4, and

FIG. 4—ARRANGEMENT OF FLY-WHEELS, RECEIVERS AND BUCKETS.

each set consists of two wheels, each supplied from an individual nozzle, and controlled by an independent gate valve. The water wheel governors were guaranteed to prevent a variation in speed of over 3 per cent with load fluctuations of 25 per cent.

A flexible connection between each water wheel and generator is obtained by means of two discs placed close together in parallel planes on the abutting ends of the generator and wheel shafts. Each of these discs has four pins projecting and a pin of each disc is connected to the corresponding pin of the opposite disc by means of oblong links of leather. This is an improvement over the old coupling of this type in that it uses the leather edgewise without cutting, rather than wrapped around flat as formerly. All of the electrical equipment of the entire plant is of Westinghouse manufacture, and in the Azusa station are installed four generators. These are of the revolving armature type with overhanging collector; their output is in two-phase current at a voltage of from 500 to 550, and their normal speed is 450 r. p. m. They are erected on concrete foundations, capped by wooden frames, and in order to insure accuracy of alignment and to make slight changes more easy, a sheet of boiler plate ¼ in. thick was placed on top of each wooden frame. This obviates the trouble in the erection of direct-connected machines from cutting into the wood while the alignment was being perfected. The bearings are of the usual self-oiling type with large oil reservoirs. The armatures are entirely bar wound and the coils

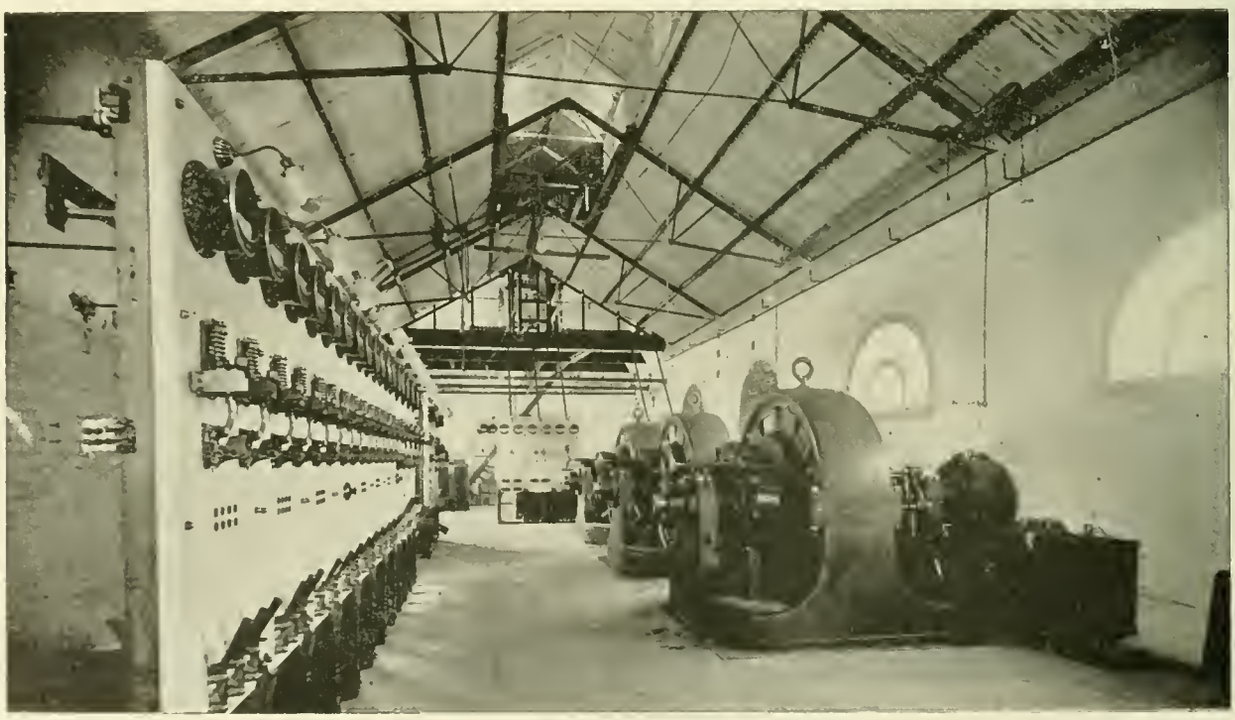


FIG. 5—INTERIOR OF LOS ANGELES SUB-STATION.

are held in place with fiber wedges so that no band wires are required. As a result the armatures remain perfectly reliable under most trying treatment. The exciters are of the four-pole type, having a capacity of 7½ k. w. each, which is sufficient for two generators, and delivering 125 volts at 1,300 r. p. m. All of the station wiring is placed in subways made of redwood boards and painted with P. & B. paint on all sides. The wiring is done with rubber covered wire on porcelain knobs, and all work is open for inspection and changes as the subways are covered entirely with removable boards. This presents no difficulty, as the cement floor of the building is made flush with the tops of these boards and thus the even floor is not interrupted. The paralleling of the two-phase equipments of the San Gabriel transmission is a process that is as reliable and satisfactory as is the paralleling of two direct current generators, despite the fact that water-driven generators are synchronized with a steam-driven one; or that rotaries or the railroad circuit are synchronized with each other or with either one or any combination of the preceding. All station transformers used by the

The Los Angeles sub-station is a one-story brick building with steel roof trusses, corrugated iron roofing and concrete floors; an interior view is reproduced in Fig. 5. The transformers are set in pairs in the room immediately under the high tension room, and each pair reduces the three-phase line current at 15,000 volts to two-phase current of the voltage required for its particular service. Each transformer is set on a separate wooden base and the floor is arranged with sub ways so that all of the low tension wiring is below the floor. The sub-station was installed so as to enable the operation of four varieties of electric service, viz. (1) a single-phase 2,400-volt lighting system for residence and outlying districts; (2) a 2,400 volt two phase power service for synchronous and induction motors; (3) a 500 volt direct current power service for direct current motors, elevators, etc., and (4) a 220-volt direct current three wire service for incandescent and constant potential arc lighting on either the 110 or 220 volt system. The 2,400-volt single-phase lighting circuits are, of course, merely one side or the other of the two-phase 2,400 volt power system, as the delivery of both

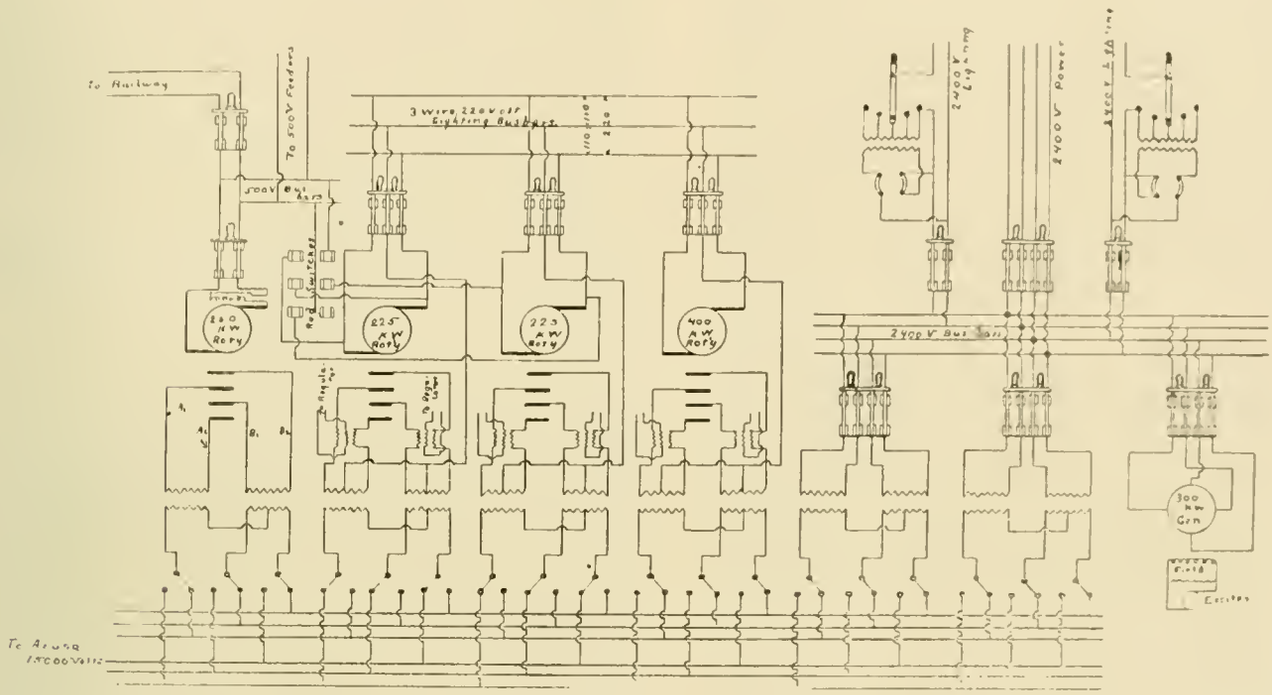


FIG. 6—DIAGRAM OF CIRCUITS.

San Gabriel Electric Company are of the self-cooling, or oil-insulated, air-cooled type, and except that different numbers of leads are taken out from the different styles of transformers as they may be adapted for rendering various characters of service.

The transmission proper is on the Scott system, that is, two-phase generation, three-phase transmission, and two-phase distribution. The four 250-k. w. step-up transformers at Azusa are, therefore, two-phase three-phase transformers, and step-down transformers at Los Angeles are three-phase two-phase transformers, but the last named deliver variable electromotive forces as required, while the former are wound at a fixed ratio, approximately taking 500 volts and delivering 16,500 volts to line. The noteworthy features of the line are that it is in two three-phase circuits, each consisting of three No. 5 hard drawn copper wires, supported on 5½-in. Locke glass insulators which are mounted on locust pins boiled in paraffine and then driven into cross arms previously painted with P. & B. paint. Each set of lines is spiralled—one-third turn at 7¾ miles from the Azusa end, and one-third turn at 7¾ miles from the sub-station. The two lines are spiralled in opposite directions. The line is twenty-three miles in length, the poles are round and placed about 125 ft. apart. The six wires are mounted on two cross arms, four wires being on the lower arm and two on the upper, the three wires of each circuit being placed at the corners of an equilateral triangle having 30-in. sides.

incandescent lighting and power from the same transformers are not attended with difficulty. The 500-volt power service was made necessary by the large number of 500-volt direct-current motors in use in Los Angeles prior to the installation of the San Gabriel plant, and the 220-volt three-wire system was preferred by the San Gabriel company's engineers to a low tension alternate current distribution because direct currents enable a more satisfactory operation of constant potential arc lamps, and, above all, their power factor is at all times 100 per cent, while against them can only be charged the fact that the efficiency of the rotary converter is slightly lower than the efficiency of the stationary transformers. The 500-volt power circuit is taken from a 250-k. w. compound wound rotary which is supplied with two-phase currents, at nominally 380 volts, from two 150-k. w. transformers. Four secondary leads, of 270, 400, 440 and 460 volts respectively, are brought out of these transformers so that any necessary voltage may be obtained on the direct-current side of the rotary. Direct current is taken off by 12 sets of carbon brushes, with two brushes on the arm of each set; the brush holders are of the swivel type; the armatures are bar wound; the cores have cooling air ducts, and there are four collector rings on the alternating current end, while overhanging as an extension of the main shaft is a 10-h. p. induction starting motor. Starting from the alternating current end is, therefore, a process of driving the rotary as a direct current generator by the starting motor and thereby exciting the

fields, which, in the 225-k. w. rotaries, are simply shunt wound. When the rotary is up to synchronism, the two-phase current may be thrown on and the rotary will always be of right polarity. This is a marked advantage over rotaries that are self-starting from the alternating-current end. While the San Gabriel rotaries may be started from either side, they are ordinarily started on the direct current side, that is, one from the other by means of a water rheostat, in fact, a start can be made from the direct current side of any rotary with much less fluctuation than from the alternating current end, since the starting current can be applied very slowly, giving the governors at the power station ample time to act.

No better way exists of conveying an understanding of the different combinations under which the electrical equipments of the plant have been worked during the trying season of drought just passed than by recalling the fact that the system may be resolved into five distinct portions, viz: (1) The Azusa station; (2) the Los Angeles auxiliary plant; (3) the practically unlimited power at 500 volts from the plant of the Los Angeles Railway Company; (4) the 500-volt rotary, and (5) the 250-volt rotaries. From the three first named sources of power, the four different characters of service, heretofore enumerated must be rendered. Last summer the Azusa plant was capable of delivering but about one-third of its capacity to the line, and when it is known that within a month after the plant was started it was called upon to carry a greater load than was believed it would be possible to secure within six months, it will be seen that it was necessary to take heroic action to meet the exigencies thrown upon the plant by reason of the shortage of water and the unlooked for increase in business. The auxiliary plant was therefore installed early in the summer in the belief that it would carry the 2,400-volt service, and that the Azusa plant could, with the assistance that it would receive from the auxiliary plant, carry the direct current lighting and power loads. It soon transpired, however, that these two plants were unable to carry the load, being short 250 k. w., practically all of which would have to be delivered to the three-wire mains at 220 volts. The only available source of power from which this 250 k. w. or more of energy could be drawn was from the Los Angeles railway plant and the reinforcing of the transmission line thereby through the operation of the 500-volt rotary from the direct current side. At all times the four classes of service have been delivered without interruption: First is the ordinary combination of running the entire plant from Azusa, in which the generators, as well as the 250-volt rotaries were run either singly or in multiple; second was the running of the entire system from the steam plant; third, the running of the entire system from the railway plant through the 500-volt rotary; fourth, the operation of any or all of these sources of power either singly or in multiple; fifth, the running of the 225-k. w. rotaries in multiple from the alternating current side, and in series on direct current sides, in which event one rotary delivers 220-volt service, and the two being in series operate the 500-volt power circuit; and sixth, the operation of the two 225-k. w. rotaries in series from the railway plant, one rotary operating one-half the three-wire system direct at 220 volts, and the other rotary operating at 220 volts in series with the other half of the three-wire load. These combinations can be effected by an arrangement of circuits as shown in Fig. 6.

It is evident that the plant is so arranged that it can be operated under several advantageous conditions; for instance, the first advantage was gained from the 500-volt rotary. The electrical end of the transmission plant was ready for operation before the water could be turned in and each day that could be saved on the installation was considered a great advantage. The railroad current at 500 volts was, therefore, run into the substation and the 500-volt rotary was used as a direct current alternating current rotary, giving alternating current which was used for getting the whole plant in operation. The other rotaries were started with this current; all the transformers were dried out and properly filled, etc.; all of the bearings were tested and put in proper condition for operation; all electrical connections completed, synchronizers adjusted and instruments tested, and everything was ready for operation, both at the substation and at the generation station, before the water was turned on. This saved about one week's time in starting the plant.

The conditions under which the plant is now operating are equally interesting. The entire day load is carried by the Azusa and auxiliary plants working in parallel; the San Gabriel Company has taken over the 500-volt power or commercial motor load of the Los Angeles Railway Company, on which is a direct current motor driving two Edison generators feeding into the underground mains of the Los Angeles Edison Company; during the peak of the load the 500-volt rotary takes current from the railway plant, stepping it up to 15,000 volts, at which electromotive force it is thrown in parallel with the Azusa and auxiliary plants, and, finally, the main generators of the Los Angeles Edison system are driven by steam and work in parallel with the motor-driven generators just referred to. During the peak of the load, therefore, five different stations are electrically tied together for the delivery of incandescent service, viz.: the Azusa water power plant, the auxiliary steam plant, the San Gabriel substation, the Los Angeles railway plant, and the Los Angeles Edison station. In other words, four stations, which are entirely dissimilar in that they deliver 15,000-volt three-phase current, 2,400-volt two-phase current, 500-volt direct-current, and 220-volt direct-current respectively, are all coupled together in parallel for the operation of two entirely different and independent systems of three-wire direct-current distribution.

All of the electrical equipment of the entire plant from the power house to the lighting and power services, was built and installed by the Westinghouse Electric & Manufacturing Company, with one or two minor exceptions, notably in the use of Weston instruments The copper for the transmission lines was furnished by the Washburn & Moen Manufacturing Company, that for the underground distribution by the John A. Roebling's Sons Company. Locke triple petticoat glass insulators are used throughout. The Paraffine Paint Company supplied the P. & B. paint used on the cross arms and in the underground work.

PURCHASE, INSPECTION AND DISTRIBUTION OF STREET RAILWAY MATERIAL AND SUPPLIES.

BY H. W. BROOKS.

Review of a paper and discussion presented at the meeting of the New York Railroad Club, October 20, 1898, with application to street railway practice.

When we stop to consider the enormous monetary value, together with the cost of purchasing, storing and distributing attached thereto, of material and supplies annually consumed by the railways of this country, we recognize the importance of giving this department of railroading very careful study, in order to effect economy in this enormous expenditure of money. Street railway managers are constantly striving to find some new way to reduce operating expenses, and so earn dividends for their roads or keep the deficit from piling up. They have tried some means and found them impracticable; they have tried others and found them successful. By giving careful, detailed study to the purchase and handling of supplies, and by putting the results of this study into practical operation, I believe every street railway manager can find another effective means of reducing operating expenses. Experience has taught superintendents, master mechanics and roadmasters to be economical in the use of material; but of what avail is this economy if the purchasing agent is extravagant in the price paid and method of purchasing? Buying is a difficult art. In business circles the failure of one concern and the success of another may often be traced to the buying, and in railroading the influence of a good buyer is felt in the prosperity of the company, although his skill is seldom fully appreciated.

What are the essentials of good buying? To know exactly what is wanted, i. e., the best article for the purpose, where to go to get it, and what price to pay are the principal points of good buying. No one knows all the points better than the manager, and consequently he should do the buying if his time will permit. If not, then it should be done directly under his supervision. On some roads this department is in charge of the secretary or other official, in connection with his other duties. Whoever does the buying should have a rare combination of qualities. He should be an able, honorable, broad-minded business man, possessed of sound judgment, and at the same time keen, shrewd, alert and energetic. He should be a man above suspicion, with no other business, especially with no pecuniary interest in railway supplies. He should have the ability to secure good prices for his road.

Quoting from Mr. Hodge's remarks; "The purchasing agent

should be something more than a mere price clerk and medium of communication between the chief engineer * * * and the dealer or manufacturer; he should, before he is competent to hold this responsible position, become familiar with the different classes of supplies used in all departments, the service required of them and the peculiar uses to which they are to be put. He should furthermore post himself as to the different kinds and qualities of railroad supplies on the market, with which object some study of the process of manufacture at the mills and factories is of great advantage, so that he may select his supplies with some judgment, and not make the selection depend solely on price—frequently a very expensive practice in the long run."

Also if the buyer would visit the shops and other places where material is used, so as to familiarize himself with the use and handling of material, he would learn why it is often more economical to pay a higher price for an article than to buy a cheaper substitute. Buying requires close watchfulness, and a careless, easy-going and indifferent man will never make a successful buyer. If a special purchasing agent is employed, the proper importance and salary should be attached to his position; and where the size of the road will warrant, it is recommended that a competent man, who shall devote his entire attention to buying, be employed. It is well to remember that a good buyer is worth a good salary, and a "cheap" man may be a most expensive one in the end. Whoever does the buying, whether the secretary, purchasing agent or employe, should be in close touch with all departments of the road, and should freely consult with the various officials.

Just how far the buyer's jurisdiction shall extend rests with each individual road. On some he is a mere order clerk, while on others he has considerable latitude, even dictating just what material his fellow officials shall use; but the latter is manifestly unjust to the other officials. As Mr. Hodges states, "The purchasing agent has no right to force a fellow official to use material which that official believes will not give satisfactory results in service, and as a matter of policy should not desire to do so, as he thereby relieves that official from all responsibility in case of any failure of the material to serve the purpose for which it was wanted; or in case of any accidents which can be traced to its use, the responsibility in these instances can very properly be placed on the buyer." It cannot be too emphatically stated that railway companies should first of all know distinctly and fully precisely what they need. Intelligent, experienced and well-trained railway men should know the best article for the purpose, and the authority to make requisitions on the buyer and storekeeper should only be given to such.

What quality shall be purchased? The rule to follow is to buy the right thing for the right place, or in other words, to make service, rather than price, the basis of selection. I think all managers are agreed on the ultimate economy of using only the best quality of material for its particular use. It is a very short-sighted policy to buy only the lowest priced goods, thinking thereby to reduce the cost of operating; and at the same time it is equally poor policy to buy material of too expensive quality, as to buy cheap material of inferior quality.

"A marked saving due to the longer service obtained from high-priced goods than cheap ones, is also readily shown in the case of supplies, such as shovels, scoops, lamp chimneys, lantern frames and globes, galvanized iron pails and cans, brooms, brushes and car washers made of genuine bristles instead of horse hair, etc. In these cases, as in others, I have satisfied myself that it is an economy to pay the difference in price in view of the longer life and better service obtained." Especially important is it to purchase only the best quality of electrical equipment of cars, which forms quite an item of the expense for maintenance, as nothing but the best grade can stand the very severe strain to which it is subjected. Dangerous material should never be bought. Its failure might result in loss of life or property, with consequent legal complications and heavy damages. Its final cost may be many hundred times the cost of safe material.

"The use of cheap shoddy so-called (wool waste), which has no elasticity and settles down in the box and fails to feed the oil up to the journal, causes hot boxes, and is soon thrown out by the inspector, whereas an elastic, long-fiber wove will far outlast the other and keep the bearings well lubricated. It frequently happens that the cost of making renewals is so much greater than that of the material used, that it is economy to pay twice as much for material which will last twice as long," and as an instance, the economy of long lived nes may be cited.

Now the scrap pile is an interesting thing and well worth watching. If you will only take the time to look into it, it will tell you a great deal. As Mr. Forney has well said: "There is one other matter that may be mentioned, which is the failures that occur on railroads. I think in an investigation of the sort of material that ought to be used, a great deal can be learned from the failures. One of the most instructive things to me, in traveling about the country among the railroads, has been to examine scrap heaps. I never have failed to be interested in them. They usually contain all sorts of material that has failed. You may take brass journal bearings. Suppose you get such bearings that do very bad service. As a usual thing they are dumped into the scrap-heap and melted up and buried perhaps. It seems to me it would be very instructive if you would take the bad metal and have that analyzed, and find out what is in it, and what the reason was that caused the failure of the bearing metal. It would be sure to shed some light on what the qualities are, or what a good bearing metal ought to have."

One of the most important questions that confront the buyer is that of price. Prices are often hard to determine. In New York city, for instance, you can buy goods for almost any price you are willing to pay. The buyer must keep himself constantly posted on the latest market prices and secure good prices for his road. By calling for competitive bids for definite qualities of articles, the lowest market price for material of any kind can be secured. The buyer should never pay "fancy prices" and should beware of exceptionally low priced goods, for exceptional cheapness often means adulterated or defective goods. If a purchasing agent thinks that by buying cheap supplies he is making a good showing, he is greatly mistaken, for while he may make a good showing temporarily, the ultimate showing will be very much against him. A favorable showing must be based ultimately on the actual service you get out of the goods.

The question of quantity, which is a serious one, was not touched upon in the paper presented to the club. The aim of all skillful buyers is to carry in stock only so much as is absolutely necessary to avoid delays in filling requisitions. Money locked up in idle material and supplies adds to the interest cost and cost of storing, and may be quite embarrassing to a road in financial straits. The greater portion of supplies should be bought at monthly intervals, but such staples as coal may be provided for in advance by contract. It is decidedly advantageous for the company to enter into contract with responsible houses for the delivery, at fixed prices, of certain things, in order to secure the lowest market prices and insure certain delivery.

"As I understand it," said Mr. Hodges, "the object of making a contract is to effect a saving, and in many cases a purchasing agent, by agreeing to purchase of a certain firm all of a certain class of material the road uses in 12 months, is able to get a better rate than he could by buying of different concerns at different times during that period. In other words, a manufacturer may feel that he can afford to agree to furnish that material at a lower price, if he knows that he can count on a certain amount being purchased during that time, than if he has to compete every few weeks with others for it, and that can be the only excuse for making a contract. Of course there is a certain risk attached to it, a risk on both sides. The dealer takes a risk, because the raw material which he uses in his factory, or the cost of labor, may go up during the year, and the purchasing agent runs the risk of having the price fall during the year. To a certain extent he is speculating on the rise and fall of prices during the coming twelve months. He simply takes his chances. So far as he can see he can at that particular time make a better arrangement as to price than if he buys for a few weeks' supply. So I think it is no reflection on the purchasing agent's judgment if during those 12 months prices may fluctuate so that he could possibly have bought elsewhere at a lower price. It does not seem to me that this contract principle would apply to every class of supplies, but in certain lines I think it a very good principle to follow, and I have followed it in a number of cases."

"There can be little doubt that the contract system tends to secure beneficial results in several ways," said another speaker. "The field is perfectly free and fair at a good letting, the material goes to the lowest bidder, and the contracts being let, the case is closed for a year and the defeated bidders have to hustle around to see how

they can beat the ruling prices at the next year's letting, while the railway has only to determine by inspection that it gets the material contracted for. One of the blessings of the contract system is that it lengthens the life of the purchasing agent, because when the contracts are let there is nothing in this line to do but to inspect the material; while if no contracts are let there are continual offers of 'better' material at much reduced prices during the whole year, and time which can be much better employed is spent in listening to the efforts of one set of men to undersell another set."

It is not good policy in the long run to purchase at one time large quantities of material ahead on some prospective rise in price, or in other words, to speculate in material. Railroad companies are not speculators, and if the buyer wants to speculate he had better go down on Wall street on his personal account. Then again large supplies result in the accumulation of articles that become "out of date" or shop-worn, and thus a dead loss to the company. Standardizing equipment and interchangeability of parts result in great saving in amount of stock necessary. Annually a large sum of money is squandered in the purchase of repair parts and supplies for electric railways, owing largely to the want of standards in their electrical apparatus. The distance of the railway from the market will also affect the amount of stock it is necessary to carry, those roads which are further away being obliged to carry a larger supply, bought at less frequent intervals and in larger amounts.

From whom shall we buy? Sometimes we are compelled, as a matter of policy, to buy from prominent stockholders or local politicians, and on steam roads, also from large shippers and industries located along the line, to foster their growth. In such cases higher prices may be paid than in the open market, but are more than offset by the indirect gain. But as a rule purchases are made in the open market, and a house furnishing a definite quality at the lowest price and giving prompt service should be selected. "The system of buying only of firms of long established reputation, because they can be trusted in the opinion of the buyer, does serious injustice to younger houses, equally honest and often turning out goods of equal quality. The purchasing agent should invite all respectable houses to compete for his business on a fair and impartial basis."

Of late there has been considerable discussion among railroad men as to the advisability of buying on specifications. While it is true they are scientific, the collection of the experience of other men and bringing it together for use in your own purchases, are of great value to railway systems making large purchases, at the same time they are not adapted to the average street railway, with the exception, perhaps, of machinery, rails and certain other construction material. Practical specifications are hard to get up, they are the work of experts, require too much expensive "red tape" for a small road, and demand minute tests of the material bought under them. Many a buyer has been tangled up in his own specifications. Buying from reliable houses, with the usual examination of articles bought by a competent man, has been found far more satisfactory.

How far shall railways carry on the business of manufacturing the supplies they consume? Although this practice has been successful in certain instances, as a rule it is not recommended, especially with the smaller roads. On this subject a man of ample experience remarked: "In going about the country and looking into railroad matters, the fact has been impressed upon my mind that the business of railroads is that of carrying freight and passengers, and although there are a great many very able railroad people who differ from me in this, it has always seemed to me that it was not desirable for railroad companies to go into the manufacturing business, and that if they confined their attention exclusively to the business for which they were chartered, which is the carrying of traffic, they would find that they had as much to do as it was possible for them to give attention to."

The proper inspection of material which has been bought is a thing that is often carelessly neglected. Too often material is ordered and that is the end of it; the buyer hears no more of it unless some one makes a kick. Many dealers knowing this, send an inferior quality, knowing it will be promptly accepted. Close inspection secures good quality, therefore an economical system of rigid inspection should be established, and whatever falls below the line should be promptly rejected. If dealers know to what close inspection their goods will be subjected by you, they will be very careful to send only first-class material.

Many of the larger steam roads have a testing department or a corps of mechanical engineers, chemists and inspectors attached to either the supply or motive power departments, and a thorough system of tests and inspection, but such a system is manifestly impossible for the average street railway, owing to its costliness. This work may be simplified to a great extent by being attended to by the heads of departments or by a competent man acting as buyer and inspector under the direction of the manager. It is always good policy for the buyer to also inspect his purchases, if his time will permit. The inspector should be a man of honesty and ability, one intimately acquainted with the quality of street railway supplies. In order to prevent the acceptance of inferior goods for those of better quality, and other frauds, the inspector must be a man of established character, experience, and not susceptible to flattery, favors or bribery. He should be a painstaking man, one that will inspect in detail, and not a sample from a car load. In every case the inspection should be fair and intelligent. Never try to cheat the dealer and never let him cheat you. Rails should be inspected at the mills before shipment, and if you are having cars built by the contract shop, you should have your man there to look after the work. Ties and lumber should be carefully inspected before going into the work or shop. But there are some supplies, such as paint and varnish, that seem incapable of immediate test, requiring months of service before the quality can be ascertained. Such articles can be purchased most safely from reliable houses, who have furnished you good articles in the past.

In the proper storage of material will be found another source of economy: Did you ever consider what money you lost by fire, deterioration and other results of improper storage? By a little forethought in properly locating the storehouse or storeroom near the principal shops, and in such a manner as to facilitate the easy handling of material, much time and money may be saved. By centralizing material at the most convenient point the following advantages may be obtained: Greater economy in storing and handling, necessitating fewer watchmen; better security from theft and destruction; greater ease in inventorying, and in being directly under the eye of the buyer, affording him a better knowledge of the condition and quantity of the supply on hand. The storehouse should be, if possible, a one-story building, substantially built, with ample fire protection. It should be equipped with appliances for handling heavy articles, as an elevator, overhead track and tackle, warehouse truck, etc. The storeroom should be light, dry, airy, clean and commodious. Every article should have a place, so that its location may be readily known, thus saving time and labor. Heavy articles, such as brake shoes, oil barrels, kegs or spikes, etc., bulky articles as bales of waste, oakum, bundles of brooms, etc., and articles most frequently used, should be located nearest the door. Such things as small hardware, stationery, and articles seldom used should be located farthest off. Racks should be built for bar and sheet iron. The various articles should be so arranged on the shelves and elsewhere that they may be readily seen.

In locating the power-house of a new road the engineer will, of course, make arrangement for the most economical handling of fuel, according to the particular conditions of the road in question, and therefore it will be impossible to state in a general way the most economical way to store and distribute coal, which forms a large part of the material used by an electric road.

In distributing material the idea is to handle it as few times and with as little cost as possible. On most of the medium sized roads the storehouse, power station, car barn and repair shops are located at one point, perhaps in one building, and therefore there is little expense attached to the distribution of material. But owing to consolidation of roads some systems find themselves with several power stations, car barns, storage yards, a machine shop and a car shop in different parts of the city. In such cases material can be distributed much cheaper by use of a freight car, with motor equipment, than by trucking. One large system, which I have in mind, is composed of cable, electric and horse lines, and buys its goods deliverable at dealers' warehouses, therefore it finds it more economical to carry on a trucking business, employing a number of trucks and delivery wagons.

Every manager realizes the importance of proper accounting, I hope, and unless material and supplies are properly accounted for, there will be a lot of operating accounts that are worse than useless, for they are misleading. The limits of this article will not permit

me to enter into detail on this subject, and I only wish to call the attention of managers to this subject, for the material accounting offers a great opportunity for intentional or unintentional errors in the construction and operating accounts.

In conclusion, I wish to emphasize the economy which may be effected by wise and judicious buying, storage and distribution of street railway material and supplies, and that the purchasing agent as well as the superintendent may be largely instrumental in earning dividends for the stockholders.

CABLE RAILWAYS OF EDINBURGH.

It has been a matter of surprise to street railway men to learn that in Edinburgh, Scotland, an extensive system of cable railways is being constructed and is now nearing completion. In this country the cable is being gradually and surely superseded by the electric cars. Even on trunk lines and routes of long and heavy grades the trolley car has proved its superiority.

In a paper on the "Conversion of Edinburgh, Leith and Portobello Horse Tramways' Systems into Cable Traction," W. N. Colam, consulting engineer, explains the reasons which influenced the adoption of cable traction for the most extensive system of tramways in the United Kingdom. It may be added that Mr. Colam has had wide experience in street railway affairs, having received his early training in that line in the United States. The illustrations are from the "Railway World" and the following extracts from the paper read before the Incorporated Association of Municipal and County Engineers.

In 1890 the cable system in Edinburgh was in its infancy, as the second line built had only been opened to the public in February of that year, and the first line in January, 1888. The information available at that time as to the operating costs was not reliable, because the lines had not been at work long enough to ascertain how far the working costs would be increased after the lines and machinery had been in use for some years. This can now be given without any dubiety from the regular balance sheets for the last ten and a half years up to the date when the corporation of Edinburgh bought the lines at a price which yielded a profit over the original cost of construction of about 30 per cent.

The conditions under which these lines have been compelled to operate cannot be considered conducive to the best financial results for either receipts or expenditure, for the following reasons: (1) The maximum speed was limited to six miles per hour when the system was inaugurated, mainly because it was something new, and has not since been raised because in the hilly district perhaps slow speed is not so noticeable. (2) No Sunday traffic on tramways has been permitted. (3) The routes are most exceptionally hilly. (4) The ends of the routes are not built over and lead nowhere in particular. (5) The engines are high-pressure, non-condensing, working at low pressure of steam. (6) There are no economizers for utilizing the gases nor feed water heaters. (7) The whole managerial department was in London which necessitated heavy traveling expenses.

Notwithstanding the unfair limitation in speed and other drawbacks, the results have been eminently satisfactory, as will be seen from the following statement (Table No. 1) made from a comparison of results in 1890 with the last year of the company's working in 1896.

TABLE I.

Year.	Motive Power.	Maintenance.	Total.	Car-Miles.	Passengers.
1890	$6,395	$11,095	$17,490	222,822	2,582,620
1896	5,940	13,550	19,450	376,725	3,715,989
Increase Per cent	.....	22.12	11.23	69.06	43.88
Decrease Per cent	7.74	.....	.....	.....	.....

Note.—The motive power includes wages, coals, oil tar, waste, water and engine room requirements. Maintenance is for road, cars and plant.

The reduction in cost of motive power has been due to improvements and a slight reduction in the price of coal, and the reason for no increase is that the loads up and down balanced on an average. These figures once more prove that cable haulage is able to enormously increase its car service, and so provide for the future without appreciable increase in its working expenses.

It will be observed from the returns that, whereas the number of passengers only increased 43.88 per cent, the car mileage increased 69.06 per cent. This is most important to note, because it points to a factor peculiar to cable haulage. It is directly in the interests of the management to improve the service of cars beyond even the requirements of the public, because, beyond the wages of the drivers and conductors, very little extra is incurred in placing each additional car on the line.

Even more satisfactory results than are shown in Table No. 1 were recorded on one of the cable lines during a week of greatly augmented traffic, and the author now presents these figures, believing them to show the most unique results for the conditions of operating which have ever been obtained in tramway practice in Great Britain. The ordinary weekly working expenses given in the table was arrived at by a division of the yearly certified accounts of 52 weeks, and the increased cost of operating was carefully checked during the week, and was mostly due to wages and gratuities given to the men and inspectors for close attention to their duties.

TABLE II.

Year 1893.	No. of Cars.	Mil'ge of Cars	Passengers.	Tons hauled per Mile.	Cost per Ton Mile in Cts.	Total Receipts.	Total Exp'nses
Show week, 24th to 29th July	47	3395	112,663	7.14	$1.50	$2,340	$375
Ordinary week. Average 4 w'ks	36	2514	27,541	5.75	2.22	570	335
Increase Per cent	31	35	309	24	..	311	12
Decrease Per cent	..	..	..	..	33	..	..

Table 2 shows that with the same fares a cable tramway was able to increase its receipts 311 per cent by a rise of working expenses of 12 per cent only.

That by quickening the service of cars by 1⅛ minutes, when the traffic would warrant it, the working expenses per car-mile run were reduced 1½ cents.

That the tons hauled per mile increased 24 per cent, and the cost of hauling a ton-mile was reduced 33 per cent. This is elasticity in the right direction, and the author is of opinion that local authorities and tramway companies too often make the mistake of not thoroughly arriving at sound conclusions as to the elasticity of a mode of traction in this direction when considering the initial cost of systems under scrutiny.

The last return of the company's workings showed that the cost per car-mile, including every charge possible, excepting depreciation and interest on capital, was 10.4 cents, notwithstanding the restriction on speed and the severe hills, etc. The receipts per car-mile had only been 20.26 cents, which was just about what the cost per car-mile run has been on the horse system of Edinburgh. The foregoing facts conclusively prove that the lines have been a great success financially, and the fact of the corporation of Edinburgh still favoring cable should be sufficient authority for the statement that mechanically they have met with public approval.

It may be of interest to give what the author believes to have been some of the reasons for adopting cable haulage in preference to other mechanical traction.

First of all, it must be stated that the original lines were self-contained and there was no inducement for extending the system for the preservation of continuity.

Secondly. The overhead system, which was the only other reported as being anything like a financial success was not entertained in Edinburgh because of its interference with the amenities of the city.

Thirdly. Because the contour of the city is peculiar in being exceptionally hilly, and where so many hills exist in a city, it is of paramount importance that the speed ascending hills shall not be less than that attainable on level portions of the routes.

Fourthly. The building limit of the city is more markedly defined than in most cities.

Fifthly. From the operating expenses of the cable systems in Birmingham, London and Edinburgh an approximate working cost per car-mile with the cable system could be determined, whereas by any other system which could be in any way considered, no such reliable information was available, particularly from experience of operating under British Board of Trade regulations. Further, it is within the author's knowledge that eminent electrical opinion has been given that Edinburgh is not a suitable place for electrical traction in any form.

The subsequent table gives the miles of lines within Edinburgh, Portobello and Leith reduced to single track of tramway.

TABLE III.

	Miles of Double Track.	Miles of Single Track.	Reduced to Miles of Single Track.
Edinburgh.....	19.004	.700	38.708
Portobello.....	2.110	...	4.220
Leith.....	2.165	.170	4.500
Total....	23.279	.870	47.428

Throughout the system there will exist nearly all conditions of tramway operating which are to be met with in ordinary practice. For instance, the grades are as high as 9 per cent, there are right angle branches, "S" junctions and compound triangular junctions to be worked. Single lines of track with passing places are not common, but at places are required. Cross traffic, where cables cross each other, have also to be dealt with. Bridges and cellars have already been crossed by the cable construction in Edinburgh, when clearances of 14 in. only from the surfaces of the roads have been available, and lastly, an arrangement for crossing a swing bridge in the Leith district has been designed.

Arrangements are made by which the traffic can be returned or (short circuited) through turn-outs when the management considers it will be advisable during parts of the day to provide an augmented service of cars short of the terminus of the route, and such provision is also made for isolating a cable section where a block may occur.

The general speed of cars throughout the Edinburgh district is to be eight miles per hour, but passing round important corners and over congested crossings, the drivers of cars will not be able to acquire a higher speed than four miles per hour, and they will be able to go as much slower than four miles as may be required.

Provision is being made to increase the maximum speeds when the Board of Trade may give permission. In the outlying district of Portobello, it is expected that the Board of Trade will raise no objection to nine miles.

The permanent way will be of interest. The track rails are of the usual type now common for tramways, and are 6½ in. deep, weighing 83 lbs. The joint adopted was designed with two objects in view:

Firstly. That the wheel in rolling along the tread of the rail shall not, in passing from one rail to the other, be left without a support, and thereby it is hoped that all chances of concussion due to break-joint will be abolished. Secondly. That by the arrangement of recessed nuts and flat cheese-headed bolts, the paving may be brought square up to the edges of the rails, and the author submits these two improvements are of very considerable importance.

The tests of 42 to 44 tons per sq. in. for tensile, 15 to 20 per cent on 8 in. for elongation, and 40 to 45 per cent contraction called for in the specification was objected to by British manufacturers, but the engineers are pleased to report that the effort was made, and the tests were fully obtained, with the result that extremely hard and yet tough rails have been laid in the system.

The slot rails weigh 48 lbs. per yard, and are made of a somewhat milder steel than the track rails, the tensile asked for being 39 tons to the sq. in., with 15 per cent elongation and a contraction of 30 per cent. The actual amount of metal appearing on the surface of the street in these slot rails is 1 3-16 in. Against these rails also it will be observed that the paving can be placed right up to the edge of the rail without any chipping, and on a square bed, which is important. The Barrow Haematite Steel Company carried out one contract for rails, and Dick, Kerr & Co. the other.

The points and crossings are all to be made of steel, and no facing points are used excepting when they cannot be avoided, such as at junctions.

Trailing points for track and slot rails will work by springs, but where facing points are required, the track points are connected underground to the slot points by levers in such a manner that, whichever way they are thrown over, there is a locking apparatus introduced to fix the slot correctly with the track points. The slot points are built up of cast and spring steel.

CABLE TRACK CONSTRUCTION, EDINBURGH.

The track points are made of cast steel, and track over slot and slot over track crossings are built up from the section of these rails, but the junctions of slot and slot are made of cast steel with renewable points.

The paving is granite, of two qualities as far as workmanship is concerned. Inside the track the blocks are 3 in. wide by 5 in. deep, and the average length is about 6 in. Outside the track the blocks are 6 in. deep by 3 in. wide. The better quality of blocks are axed on top as well as square on ends and sides. The hatch covers, which are used in the track for obtaining access to the pulleys, are filled with granite blocks specially dressed, and of the same size as other blocks, so that in ordinary conditions they are almost imperceptible on the road surface. In the road construction a great deal of wood has been used, and this has chiefly been of the hard Australian qualities. In some cases the wood has been laid from curb to curb, including inside the tramway track.

The standard distance between the tramway tracks is 4 ft., but where the streets are narrow, this has been reduced to 3 ft. At places where the streets are exceptionally wide, the tracks have been spread apart to give a distance between of 6 ft., and electric light posts have been erected in the center. The width of the slot is specified to be in no case more than ¾ in.

The terminal pits for diverting the cables at the terminal of each route are so constructed that, regardless of whether the route ends on an incline upwards or downwards, the cars will proceed to the extreme end of the journey by means of the cable, and no gravitation whatever will be resorted to. This is attained by passing the cable around two large vertically placed pulleys, one behind the other, and one slightly inclined. By this means, even in a heavy

snowstorm, a car could proceed through the snow to its terminus, and start out again without the tracks being cleared.

Where cables terminate in the middle of a route and meet other cables, the two cables are made to lap past each other by arrangement of large pulleys placed in a pit. At these places the cables are so arranged that the operation of releasing from one cable and taking the other is performed while the car is at a state of rest, and will not require more than 15 seconds to accomplish the change over. The operation is practically automatic.

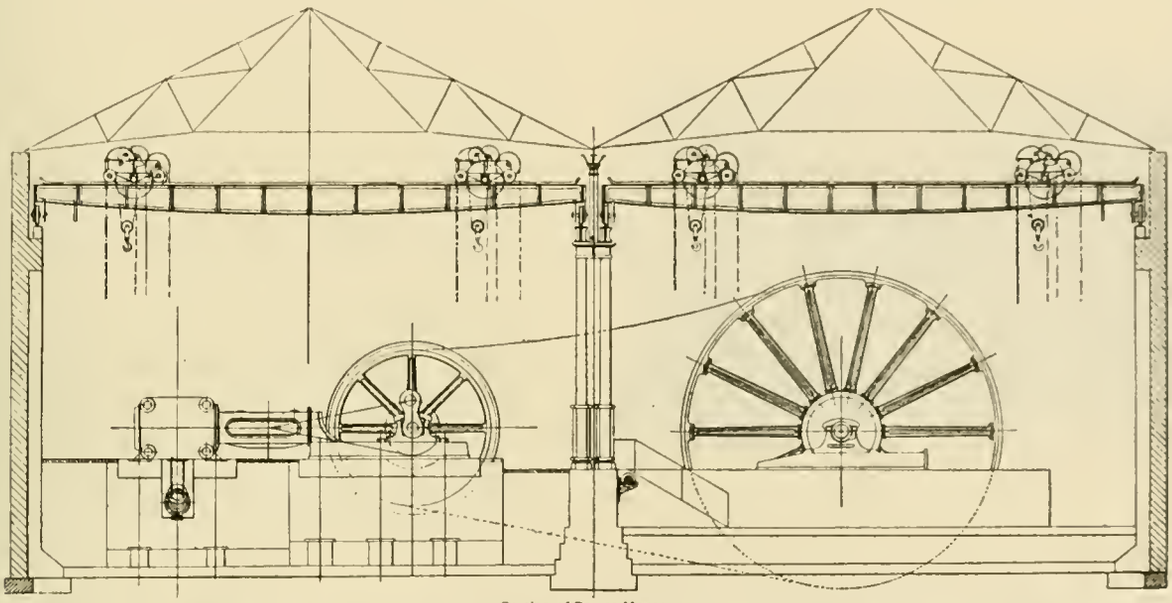
The reduced maximum speeds of cables for passing round important main corners in streets is obtained by the introduction of auxiliary cables, which are worked off the axles of large pulleys kept in motion by the main cable, and the main cables are thus saved from a great deal of hard work, and their lives, consequently, will be materially lengthened.

There seems to be an idea existing that cable tramway tracks are very serious innovations for streets, because they require a tube construction beyond an ordinary tramway track. The following information will confute any such erroneous impression.

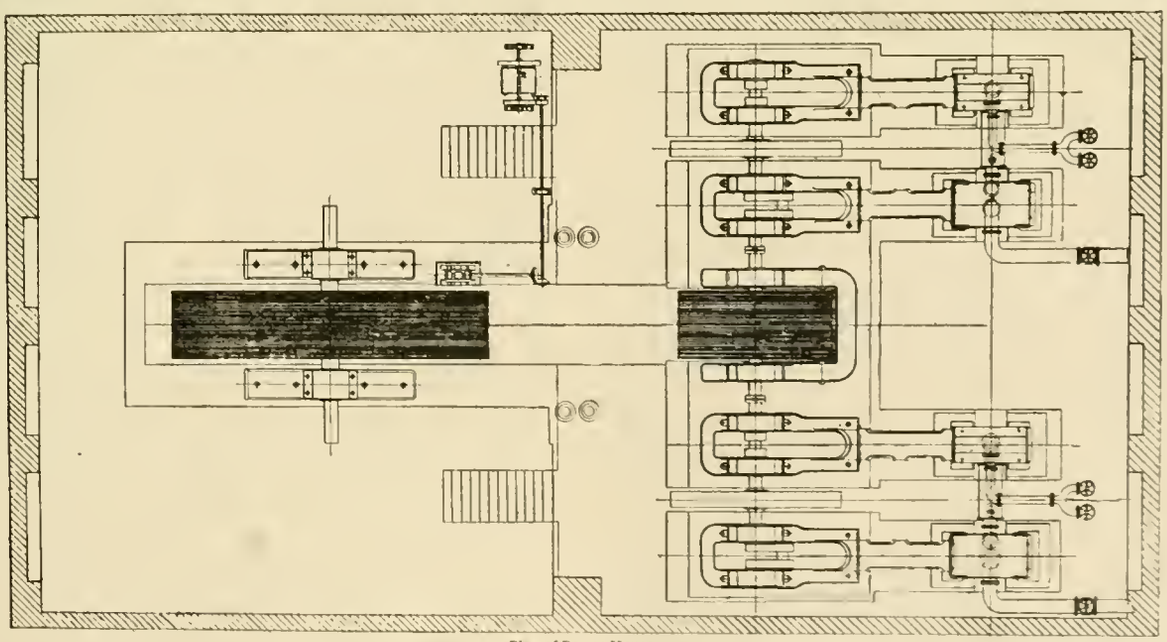
During the first 12 months of the contract there were laid in the streets of Edinburgh a trifle over 20 miles of cable track. The greatest speed attained was during six consecutive days, when an average of 220 yds. per day was attained on one section of new lines. It will be seen that the amount of finished work during 12 months averages a little more than 112 yds. per working day, which would be considered splendid work for an ordinary horse line, where the traffic is such as in Edinburgh, and where the tramway service has to be maintained. The contract for road and pit work was secured by Dick, Kerr & Co., Limited.

Station No. 1 is the main power-house and is located in the western district. The site is by no means an ideal one for the purpose, but by its adoption a miserable collection of houses has been removed, and a great public improvement effected. The principal materials used in the building are red stone and a fine quality of brick, the former being exclusively employed for the front elevations. The buildings include engine room, boiler room, chimney 180 ft. high, pump room, built-in water tanks to hold 40,000 gal., tension room, car sheds for 43 cars, cart sheds and stable for three horses, stores for road work, and underground stores for oils, etc., lavatories, offices, etc. The chief point for storing, painting and repairing cars is at No. 2 station, where the sheds are divided into sections, to isolate the cars in case of fire. Total accommodation for the storing of 225 cars is being provided.

The engines are horizontal compound non-condensing, with cylinders placed side by side on separate cranks set at right angles. There are three pairs of engines attached to the one line of main



Section of Power-House.



Plan of Power-House.

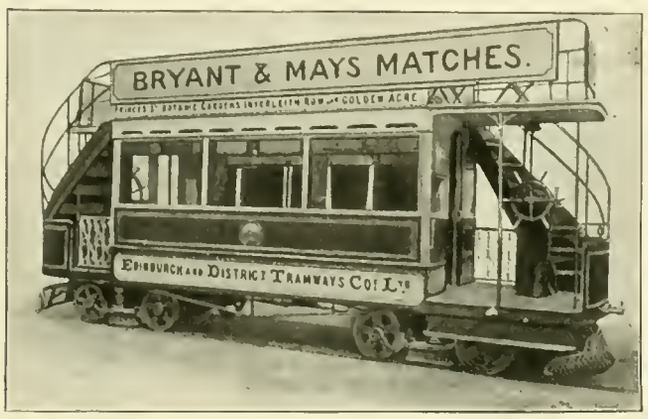
CABLE POWER STATIONS, EDINBURGH.

shafting. Each main shaft is divided into sections which can be connected by specially arranged couplings forged on the shaft ends. Two 14 ft. 6 in. diameter grooved pulleys are mounted in the line of shafting, so that any two of the three engines can be geared to work the two pulleys. These pulleys are made for carrying 32 ropes of 1 5-8 in. diameter, and they will revolve at 45 r. p. m. The power of the engines will be transmitted to the counter shaft through pulleys 30 ft. diameter. The high-pressure cylinders are 23 in., the low-pressure cylinders are 40 in. diameter. The stroke is 5 ft.

The engine room is provided with two cranes to lift 24 tons each. Dick, Kerr & Co., Limited, secured the contract for this portion of the work.

The boiler house is placed immediately behind and considerably lower than the engine room. All the pipes to and from the boilers and engines pass underneath the engine room floors without dipping, and do not appear at all in the engine room, also the low level of boilers should also reduce the chance of priming through siphoning.

The boilers are of the cylindrical marine type, 10 ft. 6 in. by 12 ft., with super-heater tubes on the top. The gases from the fire enter a back combustion chamber, from which they pass to the front of the boiler through tubes into the smoke box. They are returned over the top of the boiler, passing on their way around super-heater



CABLE CAR, EDINBURGH.

tubes into a second back chamber which directs the gases along the bottom of the boilers into the main flue.

Apparatus is provided for diverting the gases down the sides of the boilers, in case the super-heater tube should require attention when the boiler is under steam. The duty of these boilers is to evaporate not less than 9,000 lbs. of water per hour at a boiler pressure of 160 lbs. There are four such boilers designated to work up to a pressure ultimately of 160 lbs. These boilers will not be worked to anything like their full capacity, and a large reserve will always be kept in hand.

The main steam piping is welded steel, and all in duplicate. The feed pipes are in copper and are duplicated. The boilers are fitted with mechanical stokers, supplied with coal from an overhead bunker running the full length of the boiler house. Coal is taken up with ropes to the bunkers in receptacles resembling contractors' steel wagons, which are so adapted that they are suitable either for use on the body of a cart through the streets or to form the tipping body of a tramway coal truck which will travel on rails over the top of the coal bunker.

There are two heaters, arranged so that they may be used together or separately, and each is capable of passing 1,600 gal. of water per hour. The pumps are in duplicate, and are 8-in. double vertical type.

The arrangement of pipes from the pumps is such that any or all of the boilers may be fed with either hot or cold water.

At station No. 2 the arrangements of boilers and machinery is much the same as at No. 1, only the boiler house is not placed exactly in the same relative position to the engine house, but has the advantage of being at the side of a railroad, so that a siding has been made by which means coal can be lifted direct up into the bunkers instead of having to be brought in carts as at No. 1. At this station the repair shops are placed.

From No. 1 station there will be five cables driven, and the longest at present will be 24,000 ft., but these will all be capable of considerable extension. The longest cable in the system at present is 34,500 ft. Opposite each rope drive there will be an iron drum, with a spare cable for its respective route, ready at any moment to be run into the road. At the side of the engine room an engine and drum is provided for hauling out old cables, and it is estimated that the longest cable will be taken out, and a new one put in, within the space of one hour.

The grip apparatus to be placed on the cars is an important feature of the arrangements made for cabling the Edinburgh extensions. The old grip would not meet all the requirements of the new lines where some cables have to be taken in the gripper to the left, and others to the right, of the direction in which the car is proceeding. The new grip also has to be able to pass over crossing cables. The whole machinery is enclosed with a cast iron box standing on the platform of the car. The main improvements over the old grip consists of provision by which the driver of the car standing in the front of the car can operate the grip by his side or the one at the rear end of the car by a simple reversing of a lever. It is by this means that the driver can cross over the cable running at right angles to his path. He proceeds to a stopping point with the grip attached to his main cable, he then by the one process lets go that cable in the front, and takes it in the rear grip and proceeds over the crossing of the cable. The operation takes only a few seconds, and should be quite safe, because there is an automatic arrangement provided for stopping the car providing the driver should be forgetful or careless. Another improvement is, that the portion of the grip which works in the tube underground can be quickly detached from the car and dropped into the tube if anything should go wrong with it. There are 125 cars being built on the bogie principle. The bogies are very light in construction, being made of 5-16 in. pressed steel frames. The chief feature about them is that the wheels are on the axles outside the bearings, and that the wheel base is 3 ft. 9 in. and less than the gauge of 4 ft. 8½ in. This is contrary to customary practice, but the author has tried them very severely, and finds them to answer admirably. The cars are designed to seat 18 passengers inside and 28 outside, and the only noticeable departure from ordinary practice is that the insides of the cars will be domed after the manner of railroad coaches, instead of the type of roof common in tramway cars.

The whole of the work is from the designs of the author and your vice-president, Mr. Cooper, who are superintending the carrying out of the work with the assistance of their respective staffs.

MILEAGE MADE BY STREET CAR WHEELS.

Wheels for street cars for the most part are made with spokes, being similar in design to those used under horse cars, though they have been increased in both diameter and weight as electric traction has developed. From a 30-in. wheel, weighing 200 lbs. the increase has been to a 33-in. wheel weighing 350 lbs., or more. The advantage of the spoke section for cast-iron wheels is that for a given weight the metal can be massed and a deeper chill given the wearing surface; with plate wheels the web could not be made thicker than ½ in. or ⅝ in. and the use of a heavy chilling mixture would make it harder and more liable to crack in service

At the 1897 convention of the New York State Street Railway Association, F. D. Russell, of Rochester, presented a paper on "Street Car Wheels," discussing the subject with particular reference to whether they should be made heavier. The conclusions drawn by him from his experience as a manufacturer and from observation were that 335 lbs. is heavy enough for a 30-in. wheel, though they run from 325 to 350 lbs., and that for 33-in. wheels 380 to 400 lbs. is not too heavy

Electric service is severe upon car wheels because: (1) With groove rails and at jump crossings the load is carried on the flanges; (2) on motor trucks the wheels are drivers; (3) on curves with rigid wheel base the flange wear is great; (4) the higher speeds require more energy to be absorbed by the brakes, heating the tread and straining the spokes

MILEAGE OF STREET CAR WHEELS AND CAUSES OF FAILURE.

							Wheels taken out per cent for:					
Road	Dia. Ins.	Wt. Lbs.	Tread Ins.	Guarantee	Average Mileage	Maximum Mileage	Flat	Worn Flange	Irregular Worn Tread	Worn out	Broken or Chipped Flange	Cracked or Broken Tread	Poor Chill
1	33	350	2	None	40,040	72,000	23	4		50	21	1	1
2	30 33	290 350	2¼	None	55,000	.....		5		90			
3	33	350	2¼	Mileage	54,000	.....	5	20	20	50	3	1	1
4	27 33 36	240 420	2½	Mileage	38,000		15	10	10	65	Included in other items		
5	33	350 390	2½	None	90,000	112,000 to date	30	20	10	30	5	5	
6	30 33	300 340	2	40,000 mi.	...		10	15	12	20	40		3
7	30	320	2	Mileage	50,000	....	43	.....	.	41	15		
8	30	370	2½	Mileage	42,000	....	.....	.....	.				
9	30	300	2¼	Mileage	40,000	120,000	.....	.....	50	40	8		

The above table exhibits some data concerning the life of wheels and the causes of their failures on nine street railways, all but one of which are extensive systems in large cities. The first five roads keep mileage records of individual wheels.

It is very noticeable in this table that the percentage of wheels removed for the same cause are widely different for different roads. To reduce the number of flat wheels some roads take drastic measures; we have in mind one that makes the motorman pay for them. No. 1 frequently discharges motormen for bringing flat wheels into the shop. No. 2 has scarcely any trouble from this cause, "flats" being very rare. No. 3 does not impose any fines for "flats." No. 4 fines the motorman for flat wheels, unless it is shown that he is not to blame. No. 5 imposes fines when carelessness is shown; it may be that the smaller proportion of flat wheels on No. 4 is because the burden of proof is on the motorman.

One manager writes: "We do not fine our motormen for flattening wheels, as, to our mind, it would be a very unjust proceeding. The motorman is given a car to operate through the public streets, and is required to avoid accidents as much as possible, and many times, to avoid an accident, it is impossible to avoid skidding the wheels. Theoretically it is all right to say that a man should not skid his wheels, and that he should be fined for so doing; but my experience is that practically it is wrong. The better way to do is to reason with the motorman, and educate him to using discretion and judgment to the best of his ability under the circumstances."

The point is made against regrinding wheels that the cost of shopping them is in most instances greater than is justified by the additional mileage which is got out of them. There is, of course, a limit of mileage after which it does not pay to regrind the wheels. This limit is placed at 20,000 by the manager of No. 9, whose wheels average 40,000 miles, and at 30,000 by the manager of No. 2, where the average life is 55,000 miles. A third says that it is not profitable to grind wheels if it is necessary to remove them, which is usually the case on his road, as the axles become sprung and it is necessary to straighten them, and in order to do that the wheels have to be removed from the axles and the axles put on the lathe.

Those who have had experience with steel-tired wheels agree that they are not as desirable as chilled wheels, as they wear no longer and cost more. The flanges wear rapidly on curves and flat spots are more frequent than with chilled.

An interim dividend of 3 per cent has been declared on the stock of the Cape Electric Tramways, Ltd., of Cape Town, South Africa.

THE CLEVELAND & EASTERN INTERURBAN.

Cleveland has a greater number and more mileage of interurban electric lines than any other city in the world. This being the most fertile field for experience in this line it is natural to turn to this city to determine if the interurban roads are as successful as was anticipated. The fact that every year for some time past new interurbans have been planned and built, or extensions made, is the best kind of testimony that interurban lines are in demand and are prosperous.

The latest interurban will be built from Cleveland to Chadron and Burton, a total length of 36 miles, which will be in operation by May or June. It is planned to extend the line to Andover, 70 miles, and ultimately to Meadville, Pa., 100 miles. The new corporation is called the Cleveland & Eastern Railroad Company and has offices at 710 New England Building, Cleveland. The officers, who are men of large business experience, are as follows: President, H. P. McIntosh, who is also president of the Canadian Copper Company and the Guardian Trust Company; vice-president, N. B. Sherwin, of the Sherwin & Williams Paint Company; secretary and treasurer, E. G. Tillottson, treasurer of the Cleveland Trust Company; attorneys, Baldwin & McGraw; chairman of the construction committee, H. Clark Ford; engineer, W. C. Jones, and consulting engineers, E. P. Roberts & Co.

Mr. Jones is now receiving bids for a 600-h. p. engine, boilers of 600-h. p. capacity, condensers, heaters, pumps and a steel self-supporting stack. The car equipment is to be purchased in the near future. The cars will have air brakes and four 50-h. p. motors which will give a speed of 45 miles an hour.

The Cleveland Electric Railway Company is installing a 2,400-k. w. generator made by the General Electric Company. It will be direct connected to an E. P. Allis corliss engine. The company has ordered 50 double truck open cars from the John Stephenson Company, and each one will have 14 benches and will seat 70 passengers. The cars will be mounted on Brill trucks and equipped with Westinghouse No. 49 motors.

At the annual meeting of the stockholders of the Cleveland City Railway Company all the officers were re-elected, including Senator M. A. Hanna as president of the company. Secretary J. B. Hanna reported that more passengers were carried and more car-miles run than during preceding year. A quarterly dividend of ¾ per cent was declared. There had been much street talk of consolidation, but this matter was not even discussed at the meeting.

ROTARY CONVERTERS.

Read by Prof. Silvanus P. Thompson, before the Institute of Electrical Engineers, England.

(Continued from page 33.)

Another solution of the problem, of more limited application, lies in so altering the distribution or concentration of the magnetic field at the poles as to change the irregular ratios into more regular ones. It was pointed out above that any concentration of the field will alter the conversion ratio. For example, the ratio in the case of the three-phase converter with sine distribution being 61.23 per cent., if the poles are narrowed a little, this may be raised to 66.6 per cent.; so that a machine which is a 300-volt machine on the continuous current side will be a 200-volt machine on the three-phase side. An example of this is afforded by a four-pole 55 k. w. converter constructed by the Oerlikon company, the description of which has been kindly furnished by Dr. Behn-Eschenburg. Drawings of this machine are given in Figs. 11 and 12. It was designed to receive continuous current at 300 volts, and to run at 600 r. p. m. Its armature is a two-circuit multipolar drum 20½ in. in diameter, 14 1-6 in. long, having 117 slots, and two conductors per slot. It has four sets of carbon brushes, set at zero lead. It runs quite sparklessly at all loads. As originally constructed the poles were furnished with pole-pieces (as shown) each of about 72° span, therefore having a breadth about 80 per cent of the pole-piece; the chord across the tips being 13 1-5 in. So shaped, the coefficient of conversion was found to be 57.7 per cent, as against the 61.23 per cent if sine distribution had been present. When supplied at 300 volts on the continuous current side, its open-circuit three-phase voltage was only 173 volts. The pole-tips were then cut away (as shown in Fig. 12), so that the arc of the pole-span was reduced to a little under 50°; the chord across the tips being now 9 in. and the pole-breadth being 54 per cent of the pole-pitch. This had the effect desired of bringing the conversion ratio up to 66.6, the open-circuit three-phase voltage being now 200. The ratio of conversion was constant within 2 per cent at all loads. Fig. 13 gives a plot of the performance of the machine under different excitations. It will be seen that the ratio of the ordinates is approximately that of 3 : 2. Two other points plotted show the demagnetizing reaction due to wattless currents. They affect, of course, the speed and heating of the machine, but practically have no influence upon its ratio of conversion when the excitation of the field magnets is normal. In its original shape, when operated as continuous-current motor at 300 volts, with an excitation of 2.1 amperes, without load on the three-phase side, it ran at about 470 r. p. m. When loaded so as to give out 153 amperes per phase on an inductionless circuit the speed fell, in consequence of reactions, to 440 r. p. m. At this speed the measurements were: continuous-current side, 295 volts, 153 amperes; on the three-phase side, 165 volts, 3 × 153 amperes. Then the output was changed to one of 235 amperes per phase of lagging current on a load of induction motors running light. The speed went up to 640 r. p. m. (showing a weakening of the field), and the instruments measured: continuous-current side, 298 volts, 32 amperes; on the three-phase side, 157 volts, 3 × 235 amperes. To keep the speed, and, therefore, the frequency, constant under such conditions, the (shunt) excitation would need to be adjusted in accordance with the load and its lag.

The pole-cores and yoke of this machine are of cast steel, each pole being wound with 3,200 turns of No. 14 copper wire; the total resistance of the shunt winding being 80 ohms. The armature resistance from brush to brush is 0.028 ohm. The machine runs sparklessly with zero lead of the brushes. It will also run as a synchronous motor delivering continuous current sparklessly, with or without excitation of the field magnet, and with brushes set at zero, or set with either a large forward or a large backward lead. With a large backward lead, running synchronously, without excitation, at 627 r. p. m., giving out 46 amperes at 100 volts, it took in three currents of 155 virtual amperes (largely wattless) at about 100 virtual volts at the three-phase side. The reactions in this curious case are exceedingly complicated.

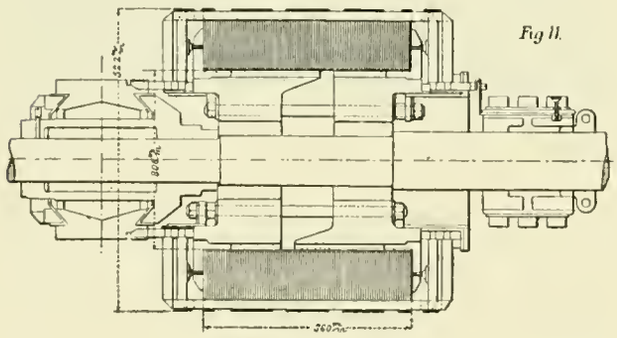
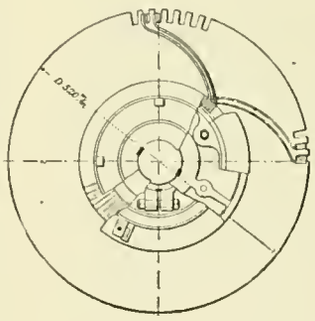
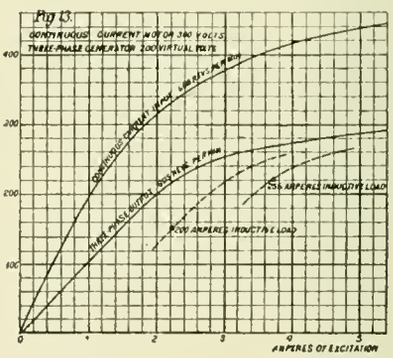


Fig 11.





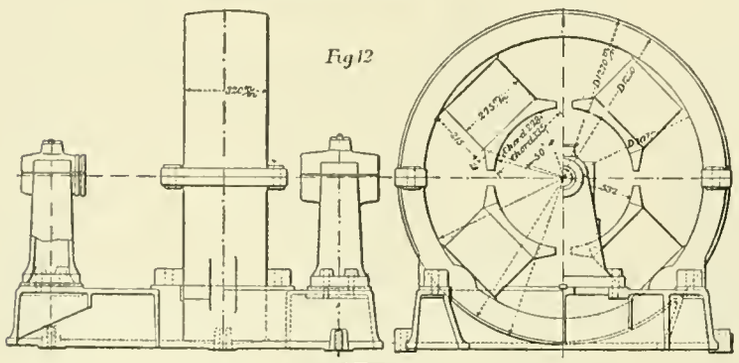


Fig 12

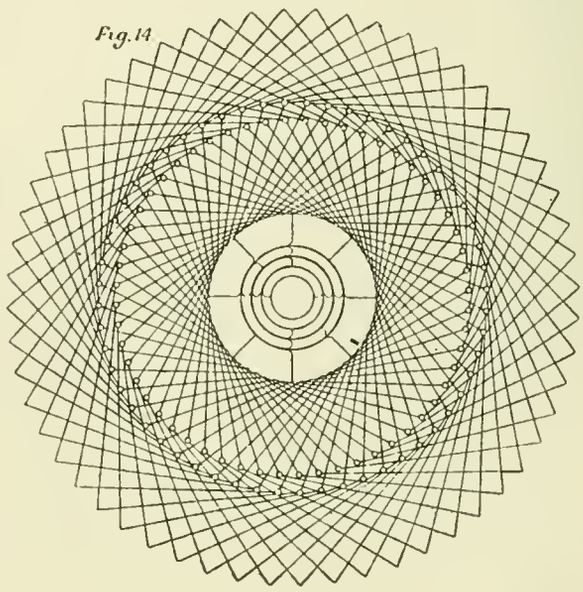


Fig. 14

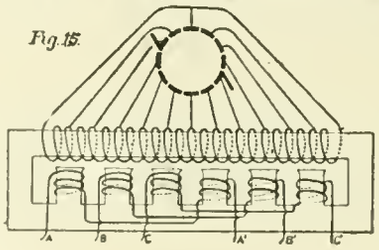


Fig. 15.

Quite recently Gisbert Kapp has re-examined the question of the influence on the conversion ratio, and on the efficiency of changes in the distribution of the flux. With the theoretical case of a sine-law distribution he compares analytically other cases, equally unreal in fact—namely, those of a distribution of supposed uniform density over a limited arc of polar span. From his calculations it may be deduced that the conversion ratio will be the same as the sine-law distribution if the poles are such that the breadth of their faces is about 70 per cent of the pole pitch. If the faces are broader, the voltage ratio for a single-phase machine will be lower than 70.7 per cent, and the ampere ratio higher than 141.4 per cent. If the pole-breadth is reduced to 2-3 of the pole-ditch, or to ½ the pole-ditch, the respective voltage percentages become as follows:

TABLE VI.

Voltage for	Sine Law.	Pole Ratio, ⅔	Pole Ratio, ½.
Continuous current ..	100	100	100
Single-phase ..	70.7	75	82
Two-phase	70.7	75	82
Three-phase	61.2	65	71
Four-phase	50.0	53	58
Six-phase	35.35	37	42

M. Routin has made another study of the effect of varying the pole-breadth in a mathematical paper, in which also he assumes the uniformity of the field beneath the poles.

In the Oerlikon converter (above described), the pole-breadth was only 55 per cent of the pitch, yet the voltage ratio was 66.6; showing that the field does not distribute itself uniformly, but is less concentrated, with fringing at the pole-tips.

Mr. Kapp has further treated the question of the limit of output for equal heating, for different pole-breadths, and for different angles of phase displacement in the currents. When the phase displacement is zero, the limiting output of a single-phase converter armature was (see above) 85 per cent of that when used as a continuous-current armature simply, if the sine law is assumed. For pole-breadths of 2-3 and ½ respectively, Kapp finds this increased to 88 to 95 per cent. This is equivalent to saying that if by concentration of field one makes the midway coils relatively more active, there will be for equal output less heating of the coils next to the connectors, and a less total heating. If there is a phase displacement such that cos ph = 0.8 (ph = 35°), the percentage output for sine-law distribution is 69, but with pole-breadths 2-3 and ½ respectively, this is raised to 73 and 80 per cent. But in practice the fringing of the field will reduce these latter values. For the more favorable cases of two-phase and three-phase converters, these percentages of output for equal heating of the armature are greatly raised. The three-phase converter, assuming sine distribution and no phase displacement, has a limiting output 134 per cent of that of the simple continuous-current armature. With pole-breadths of 2-3 and ½, the output rises to 138 and 144 per cent respectively; and if there is a phase dislocation such that cos ph = 0.8, to 117 and 126 respectively. For a two-phase converter the limiting output of 164 per cent, for the case of sine distribution and cos ph = 1, becomes 167 and 170 per cent respectively for pole-breadths of 2-3 and ½; whilst, when cos ph = 0.8, these numbers fall to 144 and 153 per cent respectively.

A four-pole 30-k. w. two-phase converter, constructed by Brown, Boveri & Co., has been described to me by M. B. Field, who designed it for that firm. The armature is wound according to the scheme shown in Fig. 14. It has four poles (two wound, two unwound), and runs at 1,200 r. p. m., giving a frequency of 40 periods per second. Its efficiency is about 90 per cent. The input being two currents, of 415 working amperes each, in quadrature at 40 volts, the output is 500 amperes at 60 volts. The armature is a cylindrical drum-wound, in 56 slots, with two conductors per slot, as a singly re-entrant double winding, being cross-connected at the slip rings to give four parallel circuits. At normal load, the excitation is such as to give a flux-density in armature core body of 7,800 lines per square centimetre, and in the teeth of 10,700 to 14,900. It runs (as exciter for some two-phase alternators) in parallel with some turbine-driven exciters and with a two-phase to continuous motor-generator. The ratio of conversion when running as two-phase motor did not alter greatly with the excitation, as the following figures show:

TABLE VII

Exciting current.	Virtual volts between slip-rings.	Volts at commutator.	Ratio of conversion percentage.
2	18·5	30·0	60·8
3	27·0	43·0	62·7
4	34·0	53·0	64·2
5	41·0	62·0	65·1
6	46·5	68·5	67·8
8	53·0	77·0	68·5
10	56·5	82·0	68·8
12	59·0	86·0	68·6
14	62·0	88·5	71·0

It is, however, in America that the converter has found its application on the larger scale, for the purpose of supplying continuous currents for tramway circuits, electric lighting systems, and electrolytic processes from distant power stations, whence the transmission is accomplished by polyphase currents at high voltage. These high voltage currents, when they reach the receiving end, are first passed through transformers to reduce the pressure to a suitable lower voltage, and are then passed through the converters.

* * * * * * * * * * * * *

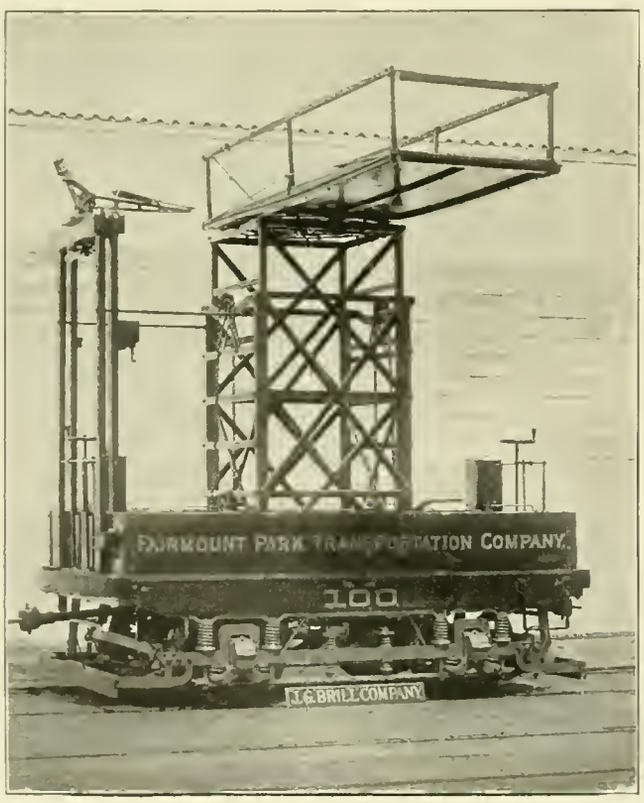
One difficulty which has been experienced when operating converters in their application on the large scale—a difficulty which could hardly have been foreseen from the working of small isolated machines—is a tendency for them, when grouped in parallel, to set up a see-sawing interference of slow period, probably in consequence of armature reactions, similar to those which in certain types of alternators trouble their parallel running. Another puzzling defect is a similar tendency to hunt, observable when two converters are arranged in series at the two ends of a long three-phase transmission line for the purpose of feeding continuous currents from one point to another. The cure for these troubles will probably be found in an analagous treatment to that adopted for securing good parallel running in alternators, namely, careful design so as to prevent armature reactions from unduly distorting the magnetic field. But the point demands further investigation.

Before quitting the subject of converters it is but right to refer to the existence of another class of rotating machines for effecting the same aim, and to which, for distinction, the name of "permutators" may be allotted. In this category are comprised those machines in which alternating currents (of one, two or three phases) are first transmitted through a stationary part of the apparatus (a species of transformer) where they create in a re-entrant sectional winding a series of alternating currents which differ from one another in phase by small successive phase-angles; these currents then being led off to a commutator and commutated section by section into a continuous current. To fix ideas, consider Fig. 15, which is adapted from a recent article by Dr. J. Sahulka in the "Zeitschrift fur Elektrotechnik." The lower part of the diagram represents the stationary transforming apparatus, having three pairs of projecting poles, wound with three circuits, A, A', B, B', and C, C', to which are brought the three-phase primary currents. The action of these three-phase currents is to produce traveling polarities along the row of poles, and induce electromotive forces in the coils wound around the portion of the core about the six-pole faces. This winding, it will be observed, is electrically the precise equivalent of a Gramme ring. In an ordinary Gramme dynamo the ring revolves between the two poles. Here, instead, the two polarities travel past the re-entrant winding. Under these circumstances, seeing that the commutator stands still, it is necessary that the brushes should be rotated synchronously in order that they may collect the continuous current. A development of permutating machines was made by Hutin and Leblanc, who turned the difficulties of revolving brushes by the following device: Upon the shaft of the synchronous motor is fixed the commutator and a series of slip-rings equal in number to the bars on the commutator, so that though the commutator revolves, each segment may still be in connection with its corresponding point on the stationary re-entrant winding. The brushes may then be fixed as in ordinary machines. The sole advantage of machines of this type seems to be that they can transform and convert the three-phase currents from

a high voltage without requiring the interposition of any other transformer. Their disadvantage in requiring many slip-rings is obvious. It is also very doubtful whether, under varying conditions of use, the sparking would not be excessive. Nevertheless, this type of converting machine is well deserving of the further attention of engineers. Probably there are cases where it is to be preferred to either the motor-dynamo group or the rotary converter proper. The motor-dynamo can transform the voltage as well as change the species of current. The converter can change the species of current, but only by adopting a fixed ratio of voltages.

TROLLEY TOWER CAR.

The trolley car, shown in the illustration, was built by the J. G. Brill Company for the Fairmount Park Transportation Company, Philadelphia. The road is peculiar in that there are no roadways along its route so that the usual trolley wagon was out of the question both for construction and repair work. The car body is mounted on a four-wheel No. 7 Brill truck with 33-in. wheels and two W. P. 50 motors. The wheel case is 6-ft. and the gage is 5 ft. $2\frac{1}{4}$ in. The body of the car is 12 ft. over the end sills and 6 ft. 10 in. wide. The sills are about 9 in. deep and are framed so as to give a strong support to the angle iron buffers. The sides are 18 in. high by $1\frac{3}{4}$ in. thick. They are strapped and made very solid. A short length in the centre of the side is made to drop. At one end there is a trolley stand on a separate frame which is braced from the tower. This stand carries four incandescent lights. In the same circuit there is a movable light with long leads, so that it can be used



TROLLEY TOWER CAR.

at the extreme end of the platform or at any other point about the car where a light may be needed. In each corner of the body there are tool boxes built in. The platform has a 9-ft. reach, and is placed in the middle of the car. The wide wheel base made this easily possible. The reach of the platform had to be great enough to cover the opposite track. There are brake wheels at both ends of the car, two controllers, two gongs, and the usual sand boxes are provided. The total weight complete is 15,000 lbs.

EXTENSIONS TO THE CITY AND SOUTH LONDON RAILWAY.

The underground railways of London have been brought to the attention of American readers lately by the large orders for electrical appliances placed in the United States. Although the cost of driving the tunnels is enormous the traffic in London is great enough to justify the expense. When compared with the surface lines the length of the tunnels is very short, with the further disadvantage that each short line is owned by a separate company. The pioneer of these railways is the City & South London Railway which was commenced 13 years ago.

Some important extensions are now in progress and they include the driving of a tunnel under the Thames river and constructing an underground station beneath a large church. A description of this work is given in the London "Electrical Review" from which

OLD AND NEW TUNNELS, LONDON.

the illustration and data are taken. The work of tunneling was commenced in October, 1886, and it was at the time and in this work that the feasibility and economy of the Greathead system of tunneling were demonstrated. In 1888 the hydraulic elevators were completed and in 1889 the contract for the electrical equipment was let. After four years had elapsed the road was at last opened in December, 1890.

The line consists of two iron lined tunnels which besides passing under the Thames, in some places go through water-bearing strata, compressed air in combination with the shields having been successfully used for this portion of the work. Grouting by compressed air was first employed on this line for the purpose of filling in the cavity left by the advance of the shield.

The rolling stock of the line consists of 17 locomotives and 54 cars, their peculiar design being shown by illustrations published in the REVIEW in September, 1893. In the first six months' operation 174,000 train-miles were run and 2,412,000 passengers were carried and in the half year preceding January 1, 1898, 230,000 train-miles were run and 3,337,861 passengers carried. During the latter period the operating expenses were 56.67 per cent of the gross receipts and a dividend of $1\frac{3}{4}$ per cent was declared. The system has never been particularly successful financially and the new work has been undertaken with the hopes that the traffic will be materially increased. One new station will be near the London Bridge terminus and connections will be made with the Northern & City Railroad and the Metropolitan, Central London and Waterloo & City underground railways. The line has heretofore been out of touch with other railway systems but with the extensions it will connect with a complicated network of railways. The most conspicuous feature from an engineering standpoint is the underpinning of St. Mary Woolnoth church, underneath which the shafts

for the elevators have been sunk. The company was granted power at one time to pull down the church but later the condition was imposed that the structure was to be left intact but the subsoil could be used for a station. The large oblong shaft is 24 by 73 ft. and divided into five bays, each of which contains an elevator. It is lined with a cast-iron casement for a depth of 52 ft., the remaining portion being brickwork in which are the entrances and exits to the elevators. The two station tunnels are each 21 ft. in diameter and lined with cast iron rings.

In underpinning the church the four main girders, designed to support the four groups of columns which carry the roof, were fixed in position, and small needle girders were then threaded through the bases of the columns. The south wall was pierced at intervals of about 5 ft. and strong needle girders fixed through the wall, one end resting on the solid stone on the outside, and the other tied down to one of the main girders supporting the columns. For the wall on the north side the same method could not be adopted, as the work could not be executed from the street. One main girder was therefore designed to carry the whole weight. Needle girders were fixed just below the church floor level, under cover of which the wall was cut away to allow of the girder being fixed. After the wall had been securely pinned up above the girder, suspended needles were put in one at a time, and the intervening masonry held up by cross steel joints placed on the top of the needles. Grouting under air pressure has been largely employed in the work, especially for filling up between the girders and the old masonry.

The power station which is located near one terminus has been in operation for eight or nine years and the machinery is of obsolete design, Siemens bi-polar dynamos being belt driven from Willans engines. The illustration shows the junction of the new tunnel with one of the old ones, the original line being to the left in the picture. The work at the junction was accomplished without at any time stopping the regular traffic.

WASHOUTS IN THE MIAMI VALLEY.

The six views here shown were taken after the flood on March 23, 1898, which was one of the most disastrous known in the Miami Valley and doing great damage to railroad and electric railway property. It represents one of the obstacles with which many interurbans have to contend. On account of these washouts the Cincinnati & Miami Valley Traction Company which owns 37 miles of track had to suspend operation for three days between Miamisburg and Hamilton and one day between Dayton and Miamisburg. There was also great damage between Middletown and Trenton and more than a mile of the roadbed between Overpeck and Hamilton was destroyed. It cost a large sum to put the roadbed in shape again and it was six weeks before the trestle was pulled back into place.

RESULT OF A FLOOD OF THE MIAMI RIVER.

The trestle was built in the Miami river between Franklin and Middletown and is 1,700 ft. long. The northern half which was not affected by the flood was anchored with stone but the lower half, which was lifted and thrown to one side, was not anchored. The reason for this was that the river bed is formed of shale rock and the piling instead of driving into it,dubbed up on end and just stood on the bottom of the river. The water coming up under the stringers floated it.

The pictures are from the following views: 1. The washout at Franklin dam. 2. The south end of the river trestle. 3. Another view of the south end of the trestle. 4. The center of the river trestle. 5. Building up the roadbed at Franklin dam, the break in the bank having been stopped with gunny sacks. 6. Looking south from the Franklin dam washout.

J. Walter Gillett, electrician of the Marinette (Wis.) Gas, Electric Light & Street Railway Company, has resigned and has accepted a position as superintendent of a large electrical concern in United States of Colombia, South America.

STOREROOM ACCOUNTS OF THE CALUMET RAILWAY.

There are few leaks in street railway management that can be so easily and effectually stopped as the loss of stock material, but if it does not receive proper attention the waste soon grows to considerable magnitude. Whenever a road is of sufficient size to have its own repair shop it becomes a manufacturing institution on a small scale and it would be well to copy factory methods. In the care of stock material there is great negligence with many roads. It is not uncommon to see stock kept under benches in the repair shop and in the car barn, open to everyone, and no one in particular responsible for its keeping; or, even worse, parts are left outside exposed to theft and to the weather. When J. J. Williams was appointed auditor of the Calumet Electric Street Railway Company of Chicago, he believed that the material saved by providing a place and a man to care for it would more than compensate for the cost.

The company owns about 90 miles of track and has 225 cars. It is a suburban road throughout its entire length and has quite a variety of equipment, some of which has been in service for several years. In consequence there is much repair work and a large stock has to be carried. The stores are kept in a separate building at the rear of the repair shop. On the first floor shelves are built up around the walls and subdivided into boxes. Every kind of article or material, no matter how bulky it may be, has a separate box and number. There are now 2,340 boxes and this number will shortly be increased to 2,500. The different oil cans and barrels are given a box number, as are also the racks holding iron for the blacksmith shop. All the scrap iron about the place is gathered, sorted and boxed. The heaviest material is kept in the basement, which is about on the ground level. The parts most frequently called for are kept close to the storeroom window, all arrangements being made with a view to quick delivery.

All material is delivered to the storeroom, together with the bills for the same after they have passed through the hands of the general manager and purchasing agent. The storekeeper counts or weighs everything and then makes the proper distribution. He then enters on his stock-book the number and size of each article with date of delivery. In the price-book is entered the cost of each article from the bill. A duplicate stock-book is kept by the clerk in the auditor's office, the records of which are made from the daily reports of the storekeeper. Nothing leaves the storeroom except on a stock requisition.

Form 60 20M 5-5-98

THE CALUMET ELECTRIC STREET RAILWAY COMPANY.

STORE ROOM.

Please issue the following material for

QUANTITY.	ARTICLE	PRICE.	BOX NO.	CLASSIFICATION

Issued by *Date* ..... *189*....

Received by *Foreman*

REQUISITION BLANK.

parisons are made. By this means if the storekeeper should change the requisition in any way it would at once be detected. If there was a desire to defraud the company a collusion between the storekeeper, the foreman and workman would be necessary.

The stock-book contains a page for each separate kind of material, and each page is divided across for four years of 12 months and the months are subdivided into 31 days. When the day's requisition comes in entries are made for all the stock consumed.

At the first of the month the amount or number of each article is given and beneath each day the number used is checked off. At the end of the month the number or amounts used are added together and substracted from the stock on hand at the first of the month. As a check on the accuracy of the accounts, each month the auditor orders some of the boxes to be inspected, choosing any number he may think of, but not in rotation, from month to month. At the end of the year an inventory is taken. That these accounts are carefully kept is demonstrated by the one for the last year. The inventory came within $3.10 of checking with the records made from the bills and requisitions.

It might seem a difficult task to keep records of the value of each article while the market prices are fluctuating more or less. This is simplified by the rule that every article must be valued on the requisition at the price paid for it. The present market value has nothing to do with the use of material from the storeroom. As an example of this: if 100 bolts were purchased for $1.50, and after 75 had been used another lot of 100 was received, the price of which had dropped to $1.00, the first 100 bolts are charged at 1½ cents apiece, and it makes no difference whether the last 25 of the 100 bolts are actually taken from the first or second lot. A complete record is kept of all the old material that is sent to the storeroom and a price set on each article. Piping and valves which have been put aside for the time being are placed in the storeroom and given a value. A price is fixed on the sorted scrap iron, and a charge is made against the foundry whenever any is used there.

STOCK BOOK. **ARTICLE No.** **NAME**

2 Bks—S. A —5657.

DATE	On Hand Last Day Previous Month	Received on Requisition	Received by Transfer	TOTAL	Remaining on Hand	TOTAL Consumed	RECORD OF MATERIAL USED. 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
1898 May							
June							
July							
August							
September							
October							
November							
December							
January							
February							
March							
April							

PAGE FROM STOCK-BOOK, CALUMET RAILWAY.

When a workman has to use so many bolts, oil, etc., he goes to the foreman and gets a requisition which is made out in duplicate. He takes the slip to the stockkeeper, and at the delivery of the stock the workman signs the requisition in receipt for the material. The storekeeper places this on file and at 9 o'clock each morning he delivers to the auditor's office all the requisitions, with price and box number added to each, which were honored the previous day. The foremen send their duplicate requisitions to the office and com-

The complete system of accounts which has been introduced and developed by J. J Williams is almost identical with the standard system of accounting of the Accountants' Association. In the classification there are a few minor differences, but Mr. Williams intends changing these to conform with the standard. A feature which is of great value for reference is the special construction accounts. For any work which is in any way out of the ordinary, such as putting in machinery, new line or track work, paving or crossing work, new buildings, vestibuling cars, etc., General Manager Sloan issues an order which is known by its number. Copies of this numbered order are posted in the office, car barn,repair shop and one given to the timekeeper. The time, material from stockroom and material specially purchased for it are separately charged to the order, and in this way an itemized account is kept of the costs. Afterwards the amounts are transferred to under the headings of the regular classification. At the end of the month a statement is given to each head of a department showing the cost of labor and material, and in this way any leak or mismanagement is soon detected and attention called to it.

GENERAL MANAGER'S ORDER NO. 313.

In construction work at power house, charge to above general manager's order. Distribute labor and material as follows:

A. Excavations for stack.
B. Foundations for stack.
C. Stack proper.
D. Excavation for boiler foundation.
E. Foundation for boilers.
F. Boilers proper.
G. Furnaces.
H. Preparatory work.

The Cleveland City Railway is building a new car house at Rocky River; it is 85 ft. by 340 ft.

TOLEDO TRACTION COMPANY BAND.

Thos. H. McLean, general manager of the Toledo Traction Company, is one who believes not only in the desirability of improving his men in every way, but favors also frequent gatherings for social and literary purposes, and at these functions he is always one of the moving spirits. Not long ago he discovered that a large number of the men, like himself, are very fond of good music and that among the several hundred employes were quite a number of excellent musicians. When he proposed to organize a brass band to be composed exclusively of Traction men, the plan met with instant favor, and with a generous subscription of his own and the company the boys had no trouble in raising the balance of the thousand dollars necessary to buy the instruments. Though in existence but a few months the Traction Company Centennial Band has already become famed for its excellence, and is the pride of everyone from president down, and its services are in demand for parades as well as the special monthly concerts given exclusively for Traction employes and their families. The band includes 25 members and has chosen for its motto the admirable sentiment: "Life, Liberty and the Pursuit of Happiness." J. Collins, superintendent of the company, is president of the band and his portrait is shown in the lower right hand corner of the engraving. The band manager, whose portrait appears in the lower left, is A. A. Atkinson, contracting agent for the lighting department of the Traction Company. As noted in a recent issue of the REVIEW the band gave a most enjoyable and successful public entertainment on November 10, last.

TOLEDO TRACTION COMPANY CENTENNIAL BAND.

The Mahoning Valley Railway Company, of Youngstown, O., contemplates building about five miles of new track and making some radical changes in the power station arrangement. The plan is to discontinue the operation of three separate stations, now in use, and build a new station sufficiently large to furnish current for the entire system.

ANNUAL REPORT OF THE "ALLEY L."

At the annual meeting of the stockholders of the South Side Elevated Railroad Company, of Chicago, the officers and directors were re-elected. President Carter stated in his report that the road had been earning for the past six months 3½ per cent on its capital stock and although it had seemed best to expend the earnings so far for betterments, if expectations of business continue dividends can be declared in the near future. The average daily traffic for the year has been 51,771 passengers against 36,525 last year. When the motive power was changed it seemed that 120 cars would be sufficient to take care of the traffic, but now the entire equipment of 180 cars has been prepared for electric traction. During the past year storage batteries have been installed, the Union Loop station has been connected to the feeder system, an inspection shed has been built, the machine shops completed, the lighting station remodeled to suit the new conditions and a bridge built to connect the Stony Island avenue station with the terminal station of the Calumet Electric Street Railway Company. But one passenger was injured on the cars of the company during the past year and that one not seriously. A combination with the Chicago City Railway Company which was discussed during the year was prevented by legal objections. The following table gives the average traffic per day for each month of 1898, the percentage of increase over the corresponding months of 1897, earnings, operating expenses and the percentage of operating expenses to gross earnings. The reduction from 84.5 to 55 per cent in the ratio of expenses and earnings represents the comparative economy of steam locomotives and electric motor cars.

	Average daily traffic.	Pct. inc. over 1897.	Earnings.	Expenses.	Percent of earnings.
January	52,117	48	$82,927.22	$70,242.55	84.7
February	52,691	47	76,119.32	63,597.85	83.6
March	54,828	54	87,631.33	71,101.20	81.1
April	54,149	56	84,391.38	68,170.47	80.8
May	49,459	51	79,925.78	56,101.25	70.2
June	45,427	54	70,633.88	53,442.91	75.7
July	44,148	63	70,662.98	49,762.77	70.4
August	41,770	54	67,733.75	43,175.69	63.7
September	46,576	55	72,336.36	45,681.43	63.2
October	58,198	48	92,618.58	52,602.76	56.8
November	59,257	*09	92,372.14	52,923.58	57.3
December	62,735	*10	100,938.78	55,583.10	55.0
Totals	51,777	42	$978,291.50	$682,385.56	69.8

*Loop in use in November and December, 1897.

At Cleveland, recently, as two cars were passing, the trolley wheel of one fell and was carried through the vestibule and front partition of the other, breaking glass and slightly injuring two passengers.

SIGNAL SYSTEM OF THE LEHIGH VALLEY TRACTION COMPANY.

The Allentown & Lehigh Valley Traction Company has developed a very neat signal system. The steep grades, curves and single track requires a signal which will operate positively and hold the cars on switches until the track between switches is clear. This system is a manual one and this method has the advantage of making the conductor responsible for maintaining his right of way.

The system is operated as follows: A conductor before entering a section between switches pushes a switch rod which sets a signal at the turnout ahead, a magnet operating a red semaphore and incandescent lamps behind a red glass disk. This makes the signal visible both night and day. This semaphore stays set until he reaches the switch ahead; then the conductor opens the circuit which sets that track behind him to safety. If on reaching the switch he finds the semaphore is set to danger, he has to wait on switch until the car passes. Conductors only set semaphores ahead of them and release those behind; the car is controlled by the semaphores operated by the conductors of cars passing it at the

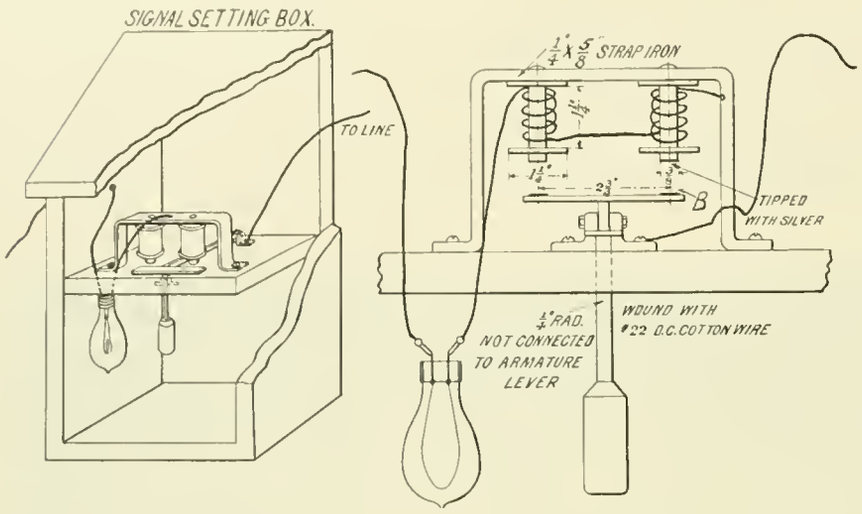


FIG. 1.

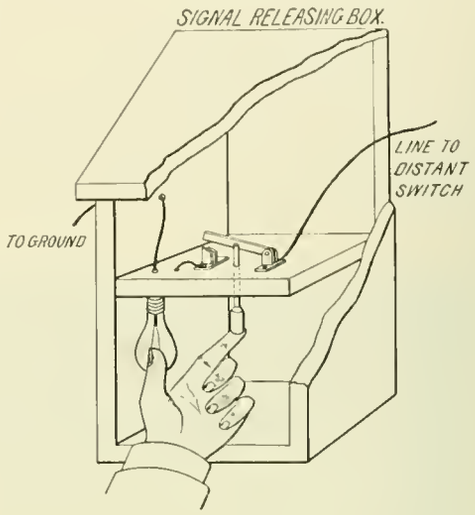


FIG. 3.

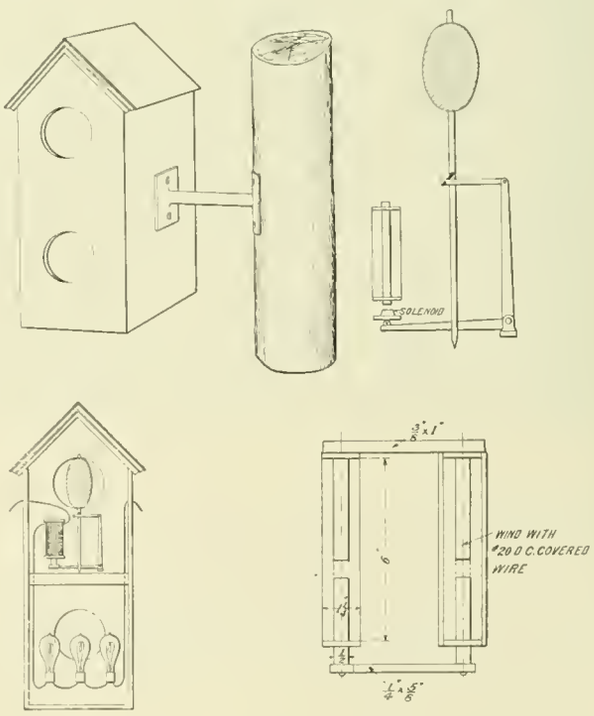


FIG. 2.

switches, and the signal systems for cars operating in opposite direction are entirely independent. In each signal box there is also a pilot lamp which is extinguished when the section of track is opened and illuminated when the section is closed; this gives the conductor knowledge that his signals have properly operated at the distant switch. As the first signal set gives the right of way there is no meeting between switches. The detailed description is given below and by it its construction is readily understood.

There are three separate operating parts, a signal setting box, a signal releasing box and the semaphore box.

The signal setting box is shown with details in Fig. 1. The magnets are 1¼in.x1¼in. winding space with fiber heads and ⅛ in. core; the end of the iron cores exposed to the armature are tipped with platinum or silver, and the armature, B, is also faced as these surfaces come together and complete the circuit and are held in contact by this current also passing through the magnets. The armature B normally rests out of the influence of its magnet. A rod entering from the bottom of the box shoves this armature up

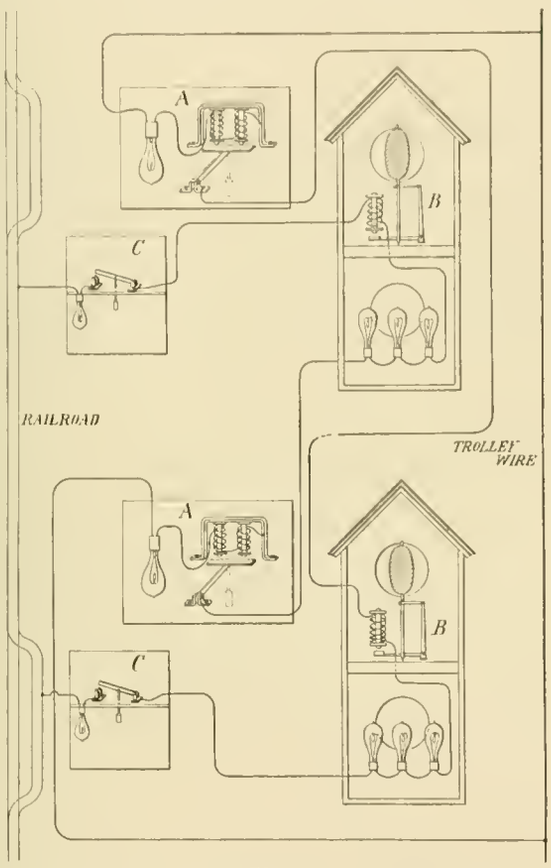


FIG. 4.

into contact with the ends of the magnet, and is held in this position until the circuit is broken.

The current from the trolley enters first through a lamp, then through the magnet winding to the frame. When the armature is up the current passes down the arm holding the armature and then through the signal line to the distant semaphore box.

The semaphore box contains a pair of solenoid magnets which set the semaphore disk and light the lamps. These lamps are arranged behind a red glass disk inserted in the semaphore box. The disk is set by means of a solenoid operating a bell crank and link, which turns the semaphore rod and displays the red disk. The dimensions and methods of general construction employed are shown in Fig. 2 The circuit first passes through three lamps, then through the solenoid and out to the signal releasing box. The construction of this box is shown in Fig. 3. and consists of a switch and a lamp in circuit with this switch. It is operated by pushing up the rod and when the rod is released the blade falls back into position, but it will not close the circuit now, for on opening the circuit, the magnet in the circuit making box dropped its armature and opened the current at the distant switch, which can now only be closed by the conductor on the car following. The diagram of connections is given in Fig. 4 Covered No. 10 iron wire can be used. Robert Doumblaser developed all the details, and Assistant Manager Walter says it greatly aids in the satisfactory operation of the road.

SHOP NOTES FROM PEORIA.

BY H. P. DAY.

The Central Railway Company, of Peoria, Ill., has a system of monthly inspection of all its car motors, and each one is thoroughly cleaned and everything tightened and worn-out parts replaced at the time of inspection.

It was found that the axle linings of the G. E. 800 motors were wearing out altogether on the collar. Instead of replacing the collar as a whole it was found better to have castings made in ring form and sweat them on under the old lining. This resulted in practically a new lining at a sixteenth of the cost, being about 15 cents. In the new linings the collar is made ¾ in. wider from the axle out, which gives more wearing surface where it is needed.

It was the custom to shrink the sleeves of the W. P. 30 and 50 motors on the shaft but it was found that 20 per cent of them failed. The heat in expanding the metal made the sleeves loose. Now they are put in the lathe and bored out 1-64 in. small for the shaft and forced on solid. The sleeves are made out of worn-out pinions so that they cost practically nothing.

Some trouble was experienced from the noise made by the F 30 motors and the old pinions were replaced by rawhide pinions which operate noiselessly and are much easier on the armatures. They have an average life of nine months. The armature linings have proved another source of noisy operation but this was stopped by set screws which were put in the caps, leaving no play.

In refilling burned-out 51 D rheostats, it is now the practice to renew only the first half instead of putting in all new filling. The motormen are given strict orders to use the first half only in starting the car. This reduces the cost one-half and gives the same results.

The diameter of small trolley wheels has been increased from 4 in. to 5 in. which makes the wheel last a third longer and does not wear out the bushing. Whereas the smaller wheels would wear out three bushings the larger ones requires only two before the trolley wheels are worn out.

Iron guards have been put on the roof headlights to prevent the trolley poles from breaking them. An air plant giving compressed air at 60 lbs. has been installed in the power station to be used in blowing out and cleaning armatures.

INCREASE IN TORONTO.

At the annual meeting of the Toronto Street Railway the directors reported net profits for the year 1898 of $404.738. Dividends aggregating $240,000 were paid and a mileage allowance of $64,000, leaving a surplus of $100.738.

The receipts from the operation of the Sunday car service have shown a steady and marked increase, the average receipts as compared with the period during which the service was in operation in 1897 showing an increase of $367.24 per Sunday.

Comparative statistics are as follows:

	1892	1897	1898
Gross earnings	$820,098	$1,077,612	$1,210,618
Operating expenses	590,333	525,801	578,857
Net earnings	229,765	551,811	631,761
Percentage of operating expenses to earnings	71.9	48.8	47.4
Transfers	5,592,708	8,169,022	9,287,239
Passengers	19,122,022	25,271,314	28,710,338

Last year the company built 30 new cars and now has 40 more under construction.

Walter Frohle, a child four years old, was last month awarded $23,000 damages for the loss of one leg, having been run over by a Brooklyn, N. Y., trolley car. This is one of the largest verdicts on record.

REORGANIZATION UNDER RAILROAD LAW IN ILLINOIS.

Charles L. Bonney, vice-president and general counsel of the Chicago General Railway, which is one of the four so-called independent street railways of Chicago, has prepared a bill which was introduced in the Illinois legislature by Representative Drew. The bill was accompanied by a petition from Mr. Bonney setting forth the conditions of the street railways in the state and the reasons in favor of the bill drafted by him.

The street railways of Illinois, aside from the large roads in Chicago, have been hampered in their development by reason of the fact that investors look askance at the bonds of a "horse and dummy" road, because so many questions affecting rights and liabilities of such companies have never been passed upon by the courts. In endeavoring to finance the Chicago General Railway Company Mr. Bonney had to meet this difficulty; he overcame by reorganizing his company under the general railroad law. Investors everywhere are familiar with the provisions of this law; the rights of companies organized under it have all been passed upon by the courts; and the securities of such companies have a standing that "horse and dummy" securities can never expect to attain.

This Mr. Bonney has demonstrated in his own case and the plan he proposes is to enable the companies outside of Chicago to give the same standing to their bonds. Statistics have been collected which show that the outside companies and the four independent Chicago companies have a total of 730 miles of track as against 685 miles for the special charter companies of Chicago.

Mr. Bonney has carefully examined the question and states that there is no difficulty in reorganizing under the railroad law, that no rights will be lost in so doing, and that the gain in financial standing will be of enormous advantage to these small roads, which need money to make necessary extensions and put them on a paying basis.

In conversation with a REVIEW representative Mr. Bonney said: "My bill has been designated by one newspaper as a Chinese puzzle; in fact it is largely based on and its language closely follows the constitution of Illinois. Briefly stated it is a bill relating to the use of streets by railways which will give all companies of this state good financial standing in the money markets of the country. Section 1 is based on section 4, article 11, of the constitution of 1870. Section 2 is based on clause 90 of section 62 of the city and village act. Section 3 defines a 'street railroad' and a 'railroad in a street' as being the same. Sections 4, 5, 6, 7, 8 and 9 are based on sections 9 to 14, inclusive, of article 11 of the constitution of 1870. Section 10 is designed to retain the proper police regulation of the vehicles operated under the control of the local authority, without interfering with the charter right of the company to continue its occupation. Section 11 is designed to fix the period for which corporations may remain in business without interfering with the right of the local authority to exercise proper police power. Section 12 repeals the entire horse and dummy law, and section 13 provides that horse and dummy companies may assign their property to companies organized under the general railroad law, as has been done by the West and South Towns Horse Railway Company. Such assignment has already been sustained by the courts.

"The railroad commission would have the same authority over street railways as over steam railroads. This plan would greatly facilitate the development of interurban lines in which direction the most promising prospects of electric roads lie."

A GENEROUS STREET RAILWAY OFFICIAL.

The Newport News, (Va.) Hampton & Old Point Railway Company sold its street railway property, including 14 miles of track and 32 cars, to the Newport News & Old Point Railway & Electric Company on October 26, 1898. On that date there was between $20,000 and $30,000 in the treasury of the old company which was not included in the purchase. This amount was the cash balance in the hands of the treasurer and was the property of the stockholders, and not money accumulated from fares turned in by the conductors and not rung up, as was stated in some of the newspapers.

F. W. Darling, president of the company, and his father and mother held two-thirds of the stock, and they proposed that the sum be divided among the employes in recognition of their faithful service. This did not meet the approval of the minority stockholders and the matter was dropped at the time. When Christmas came the Darlings decided to divide their portion of the accumulated profits of the defunct company, amounting to $16,000, among the men according to the time of service and position.

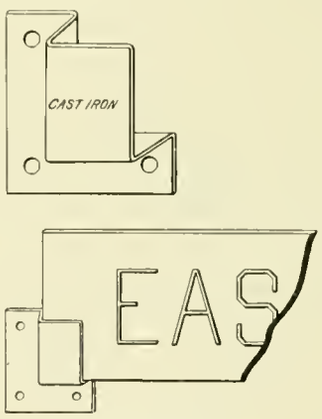
Christmas eve the employes received notice to report at the power station. There was some anxiety among the men to know what such an emergency call at that time meant until each was handed the following note:

> "In recognition of your faithful and efficient service while in the employ of the Newport News, Hampton & Old Point Railway Company, which we feel has added very materially to its success, we take pleasure in enclosing you a check for $———."

The cashier who had been with the company since its organization received $1,000, the engineer $712, two of the conductors $414 each, and the others sums ranging down to $100. The men, who had not the slightest intimation of such good fortune, were overjoyed and were unstinted in their praise of the generosity of the Darlings. It is needless to say that F. W. Darling, who is general manager of the new company, holds a warm place in the hearts of his men.

NOTES FROM EASTON TRANSIT COMPANY.

The Easton (Pa.) Transit Company has avoided any trouble from sleet on the trolley wire for the past year. Late in the fall trolley wire is greased, which prevents the water from adhering, and there has been no use for sleet cutting trolley wheels. The best method found for applying the grease is to drive the construction wagon under the trolley wire and have a man apply stiff lubricating grease that they used, by dipping his gloved hands into



SIGN BRACKET.

the grease and letting the trolley wire slip through his hands as the wagon is driven along. Two men with a team can cover about 10 miles of wire per day. This application lasts during the winter season and obviates sleet troubles.

The company has also changed its method of attaching destination signs, having found that the hook and eye allowed the sign to flap against the outside of the vestibule, injuring the paint, and being very noisy. A cleat, like shown in sketch, was cast so the wooden sign is slipped into it, and placed on the front of the dash. The sign can be slipped in place from the ground. They like this method much better.

The railroad employes in Missouri are vigorously opposing the bill now before the Missouri legislature providing for the reduction of railroad fares in that state from 3 cents to 2 cents per mile.

By standing at his post Motorman Nichol, of the Toledo Traction Company, prevented a serious collision with a Clover Leaf train on January 10. Because of slippery rails he was unable to stop his car until almost on the track; the front of the vestibule was carried away by the railroad train, Nichol escaping injury by a few inches.

RECENT STREET RAILWAY DECISIONS.

EDITED BY J. L. ROSENBERGER, ATTORNEY AT LAW, CHICAGO.

FACTS EXCUSING FROM LIABILITY FOR LOOSENED RAIL.

Kelly v. Metropolitan Street Railway Company (N. Y.), 54 N. Y. Supp., 173. November 10, 1898.

A judgment was obtained in this case for injuries caused by a loosened or upturned rail catching a wagon, causing the whiffletree to break, and precipitating the man driving in the wagon to the ground. According to the testimony introduced in his behalf, the end of one rail, where two rails had been joined, projected about six inches upward from the other, and one of the spikes had loosened.

On the other hand, it stood uncontradicted that about 10 minutes only before the accident a car passed safely over the alleged defective rail, that no imperfection was then observable, and that traffic in that street was quite heavy at that time of day. There was not a particle of evidence introduced to show that the defendant's road was either improperly laid, or constructed of poor material; nor was it shown that the then condition of the rail was caused by one of the company's cars, or was in any wise the result of its acts, nor yet that the company's method of inspecting its tracks was not the proper one. Proof was also absent of any previous defect, or of any circumstances from which, in the opinion of the court, it might be inferred that the company had reasonable grounds to apprehend danger because of either loose rails or spikes.

These undisputed facts, the appellate term of the supreme court of New York holds, showed an absence of negligence, and rebutted the presumption of knowledge which was implied from the existence of the defect; and so it reverses the judgment above mentioned, and orders a new trial.

SUDDEN AND UNUSUAL APPLICATION OF BRAKE IMPORTS NEGLIGENCE.

Bradley v. Second Avenue Railroad Company (N. Y.), 54 N. Y. Supp., 256. November 11, 1898.

This was an action brought to recover damages for the death of a passenger alleged to have been caused by the defendant company's negligence. At the time the accident occurred, this passenger was riding upon the front platform of the car, standing behind the driver on the right side, with his back against the window, and smoking a cigar. When the car reached the place of the accident, it was going on a slight downgrade, and gave a sudden jerk, and the passenger was thrown over the dashboard, under the wheels of the car, and killed.

Upon the part of the company, it was argued that it was a physical impossibility that the accident could have happened if the brake were suddenly put on and as quickly let go. But the first appellate division of the supreme court of New York holds that this was a consideration to be submitted to the jury. They were to judge as to whether there was a sufficient interval between the putting on of the brake and the release of it to throw the passenger over the dashboard. If there was upon the part of the company's driver this sudden and unusual application of the brake, by which the passenger was thrown over the dashboard of the car, the court continues, it was incumbent upon the company to excuse this extraordinary management of the car by showing the existence of some emergency which appeared to require such prompt and decisive action.

The court further declares that it could not be held that the mere fact that the passenger was standing upon the front platform was, as matter of law, conclusive evidence of contributory negligence. That, it says, depends upon the circumstances of each individual case, and it is a question for the jury to determine whether, from the evidence, any reasonable excuse has been offered. In this case, it appeared that it was the custom of the company to allow smoking upon the front platform, and that this passenger was smoking; and, the court adds, the jury had a right to consider all these circumstances, as well as the state of the weather and the condition of the streets, in determining the question as to whether the passenger had been guilty of contributory negligence.

Upon the whole case, the appellate division thinks that the dismissal of the complaint was error. And even if the trial court was of the opinion that one of the witnesses had amended his testimony to fit the opinion of the general term upon a previous appeal, it says that fact would not authorize the court in taking the case away from the jury. It was simply a fact to be considered by the jury in weighing his evidence.

NO DAMAGES ALLOWED FOR INJURY TO DRESS TORN ON DOOR LATCH OF CAR.

Atwood v. Metropolitan Street Railway Company (N. Y.), 54 N. Y. Supp., 138. November 10, 1898.

This was an action brought to recover damages for injury to a passenger's dress that was caught in the door latch of a car and cut or torn. She described the latch or catch as a sort of a hook, square looking, worn so that it was bright at the edges, and as sharp as a knife. Her sister testified that it was a well worn, very sharp catch.

On the other hand, the conductor who was in charge of the car at the time stated that it was a new car, and that the catch used upon it was of the same kind as that which was employed on the other cars operated by the company, and that there was nothing wrong about it. The superintendent of the road and the general repair man were also called as witnesses, and they also gave evidence tending to show that the catch in question was in good order, and that they knew of no better appliance for the purpose for which it was used than the one in question. Besides, there was evidence given showing that each car on the line carried an average of 500 or 600 passengers per day, and that no accident of the kind described here had happened before upon the road.

Assuming, without deciding, that, when the plaintiff closed her proofs, there was enough to make out a prima facie case in her favor, still, the appellate division of the supreme court of New York says, it was for the court, as the trior of the facts, upon a consideration of all the proofs, to determine what the condition of the catch was, and whether it was such as to have made it the duty of the company, in the exercise of proper care, to discover and repair the defect. It certainly cannot be said, declares the court, that the case was one in which no issue of fact arose, and that the company was guilty of negligence as a matter of law. And to this it adds that, in its opinion, in rendering judgment for the company, the trial justice had rightly found the facts in its favor, and that therefore the judgment should not be disturbed.

RIGHT TO RELY UPON STATEMENTS AS TO EARNINGS OF ROADS.

Old Colony Trust Company v. Dubuque Light & Traction Company (U. S. C. C.), 89 Fed. Rep., 794. October 28, 1898.

The foreclosure of a trust deed on what had been two distinct lines of street railway met with opposition in this case by parties who had practically owned one of the lines intervening and setting up that they had been induced to transfer that line and join in a consolidation scheme through alleged false statements of a heavy creditor of the company operating the other line, one of such statements being that the net earnings of this latter line, while in the hands of a receiver, had been sufficient to pay one year's interest, at 6 per cent, on $300,000.

But this was met by the argument that the statements referred to were of the nature of mere puffing, or trade talk, upon which the interveners were not entitled to rely as being anything more than a mere expression of opinion, and, further, that the interveners should not have relied thereon, but for their own protection should have made inquiry into the facts.

If the statements made had been with reference to the future earnings of the road, to the effect that they would be large enough

to pay a named interest, the construction sought to be put thereon, District Judge Shiras, of the United States circuit court, in Iowa, says, might have been admissible. Such, however, not being the case, the statement made having reference to the past, not to the future, and being a positive averment as to what the earnings of the line had been, and not made as the expression of a mere opinion or hope or belief, either as to the past or future, and having been made to impress upon the interveners a fact which, if true, must have been of persuasive force in inducing them to agree to a combination of the lines, it is held that responsibility therefor could not be evaded on the theory that the statement was merely idle puffing, not intended to be relied upon by the parties to whom it was made.

Nor is there considered to be any merit in the suggestion that the interveners had not the right to rely upon this statement of fact thus made to them, because they might, by inquiry on their own part, have ascertained what the actual fact was in this particular. The reason given for this is that had they undertaken to make inquiry about this matter, they would have been compelled to rely upon the statements of the parties in charge of the line, and it was not to be supposed that it would have been open to them to make a search through the books and papers in the company's office in order to ascertain the facts.

Likewise, it is held that reliance could be placed upon the statements of the creditor company as to improvements it intended making.

Finally, it is held that the interveners were entitled to rescind the contract and transfer in question, though it was stated to be the duty and within the power of the court to mold the final relief granted in such form as to meet the exigencies of the case, having due regard to the rights of all who might be affected by the decree, whether parties to the record or not, and that while granting a decree of rescission in favor of the interveners, the court might require them to take a judgment for the money value of their property, if it appeared that the property itself could not be returned without serious injury to other parties, who were not participants in the wrong whereby the interveners were induced to enter into the rescinded contract.

PRESUMPTION ARISING FROM BREAKING OF TROLLEY WIRES.

O'Flaherty v. Nassau Electric Railroad Company (N. Y.), 54 N. Y. Supp., 96. November 3, 1898.

A woman was passing along the street, as was lawfully her right, when a trolley wire broke, and she was thrown down twice. Whether her fall was occasioned by electrical shock, a question raised by the company endeavoring to show that she was not in the vicinity where the wire grounded, the second appellate division of the supreme court of New York says, was for the jury to determine, measurements and statements of witnesses as to particular places where the wire struck or remained upon the ground not being conclusive.

The falling of the trolley wire into the street, the court further holds, raised a presumption of negligence on the part of the company, and, in the absence of contributory negligence, created liability for the injuries sustained, whether the woman received the shock by coming into contact with the wire, or whether she occupied such a position as caused her body to form a circuit through which the electricity, flowing from the broken wire, or some part of it, passed, unless the company satisfactorily explained the conditions so as to overcome the presumption of negligence which thus arose. And while it is true that injuries arising from fright alone do not authorize a recovery of damages, yet, where there is physical injury accompanying fright, the court says that it furnishes basis for a recovery of damages, and that here the jury were authorized to find the existence of electrical shock and fright produced by it, the whole causing the woman's present condition.

But the company insisted that by its proof it successfully met the above stated presumption, and established by conclusive evidence that it was without fault. In this regard it contended that its evidence established that it used, in the construction of its trolley wire, and the supports for the same, such material as is commonly in use for such purpose, and the best which the market affords; and that its method of construction and supports was in accordance with the best plan which practical use has demonstrated to be proper. It also urged that, in addition to thus establishing the use of proper material and care in construction, it had a system of inspection under which its trolley wire and the supports were carefully examined at least once in every four days; and, in addition thereto, that the wire which broke, and the supports in connection therewith, were inspected the day before the wire broke, and found to be in perfect order.

Unfortunately, however, it seems that the system of inspection which the company claimed to have existed rested for its support upon the testimony of interested witnesses, charged with the duty of discharging this obligation. Under well-settled rule, therefore, the court says, this testimony was that of interested persons, who had, or might have, a motive for shielding themselves from blame, and that under these circumstances their credibility was involved, and became a question to be determined by the jury.

In addition to this, it was disclosed by the testimony that the company employed a device called the "breaker system," which, when properly constructed, and in proper working order, would throw the current off the wire the moment it came into contact with the ground. But, upon this testimony, the court says that the jury were authorized to find that the automatic device was either not properly adjusted, or was not in proper working order; for, had it operated properly, the current would have been immediately cut off, and thus none passed through the body; whereas it continued to escape for a period long enough to twice shock the person.

Under these circumstances, the court says, the jury were permitted to find that the condition of the wire and its appliances was not consistent with the testimony of the company, and therefrom to conclude that the company was guilty of negligence in not discharging its duty.

It follows, therefore, adds the court, that this contention of the company may not be sustained, and it affirms a judgment against the company.

SPECIAL RULES FOR GUIDANCE OF MOTORMEN NOT EVIDENCE AGAINST COMPANY.

Isaackson v. Duluth Street Railway Company (Minn.), 77 N. W. Rep., 433. December 20, 1898.

This was an action at law, brought to recover damages for personal injuries received on a street railway track, in a public street. Against the company's objection, the trial judge permitted the plaintiff to introduce in evidence a rule adopted by the company for its own protection, and the private direction and guidance of its motormen. That rule was as follows: "He must keep a sharp lookout to avoid running into pedestrians and vehicles, especially at cross streets. While the car is in motion, the responsibility for safe running rests with him. He will never allow any unauthorized person (the conductor is not an authorized person) to use the handles. He will be held responsible for any damage arising from negligence on his part." In the trial judge's ruling in this matter, the supreme court of Minnesota sees reversible error.

The supreme court says that this rule of the company's was evidently intended for the guidance of its own motormen and as a standard of duty to the company on the part of such motormen. Rules may be adopted by the company which impose a higher degree of care upon its employes than that imposed by the law itself. Such rules are meritorious in this: that the stricter the rules are against negligence or willful misconduct, they tend to make the employe diligent and careful in his management of the car, and thus lessen the dangers which result in personal injuries to passengers or persons on the track of a railway company.

Moreover, there was not the slightest evidence here to show that the plaintiff knew or relied upon the rule in question. Neither was there any evidence showing or tending to show how long this rule had been in existence, or of any custom based upon it, and, in the absence of knowledge of such custom, the court takes the ground that the plaintiff could not have been influenced by it in his conduct at the time of the injury.

The rule itself, continues the supreme court, required a higher degree of care on the part of the motorman than the law imposed upon the company itself. The plaintiff sued for the violation of duty imposed by law, not for the violation of a special rule about which he knew nothing. It was the duty of the company through

its employes to use ordinary care so as not to injure persons lawfully on its track, but the rule requiring the motorman to keep a sharp lookout to avoid running into pedestrians and vehicles might well have been understood by the jury as requiring an extraordinary degree of care in such case, which is not the law. It is only a reasonable degree of care and vigilance of the street car motoneer in watching for persons upon the car track in a public highway that is required.

In still further explanation, the supreme court says that the duty of a street car company requires it to exercise the greatest care and foresight while operating its road as respects its passengers, but the rule is not so strict as to persons upon its right of way, though in a public street. It is only guilty of negligence, in respect to this class of persons, when it has not used ordinary care, which, of course, embraces reasonable attention and caution upon the part of the employe operating or controlling the car on its track. Of course, it might be liable for wanton injury inflicted upon a pedestrian under certain circumstances. So, too, it is the duty of the traveler on a car track in a public street to use ordinary care in looking out for an approaching car, and avoid injury, as the latter has the right of way.

A new trial granted.

CAR BARNS AND SWITCHES IN RESIDENCE DISTRICTS NOT CONSIDERED NUISANCES.

Romer v. St. Paul City Railway Company (Minn.), 77 N. W. Rep., 825. January 6, 1899.

This was an action for damages against the defendant company for so maintaining and operating one of its street car barns, and switching the cars in and out of it, as to constitute a nuisance, whereby the rental value of the plaintiff's real estate was impaired. At the close of the evidence, the trial court directed a verdict for the company, and the plaintiff appealed from an order denying his motion for a new trial. Now the supreme court of Minnesota affirms that order.

The supreme court says that the defendant company has for some years maintained and operated by public authority a street car system, the motive power of which is electricity, in the city of St. Paul. As a necessary incident to such operation, it has maintained this car barn in a residence district, for the purpose of storing a part of its cars when not in use on the streets. The barn fronts on Ramsey street, with its sides abutting on Thompson and Smith avenues respectively. It is not authorized to operate its system on these avenues, but it has, without any negligence in the premises, laid tracks and curves thereon, over which it runs, from early in the morning until late at night, its cars to and from the barn. Such operation of its cars over such tracks and curves causes loud and disagreeable noises, whereby the rest and comfort of the plaintiff are disturbed, and the rental value of his real estate abutting on the street and avenues is materially reduced.

The court could find in the city ordinances granting to the company the right to operate its street car system no express grant to maintain the curves and switches in the avenues in question for the purpose of taking its cars in and out of the barn, but it holds that the right to do so was given by necessary implication. It says that it would be a very narrow and technical construction of these ordinances to hold that the company was authorized to lay switches and curves for the purpose of getting its cars in and out of its barns only on the streets on which it was expressly authorized to operate its street railway system. And the court maintains that where, as in this case, its barn fronts on a street upon which it is authorized to and does operate its street railway system, and it is reasonably necessary to take its cars in and out of the barn from the streets on each side of the barn, it has the right, by virtue of the ordinances, to do so, although it has no right to operate its electric lines thereon.

In this connection, it may be of importance to note that the court says that while it is true that all public grants, unlike private ones, are construed strictly and favorably for the grantor, the public, it is equally true that where a grant is made for the benefit of the grantee, and also for the express accommodation and benefit of the public, everything which is reasonably proper and necessary (not simply convenient) to effect the essential objects of the grant passes by necessary implication, otherwise the purpose of the grant would be seriously impaired, if not wholly defeated. And the court recognizes that it is practically impossible for a street railway company to operate its street railway system without car barns in which to place its cars when not in use, for it would be intolerable to permit them to stand upon the streets, and that the only practical way to get the cars in and out of its barns is by the use of the usual motive power, and the use of tracks and curves on the streets adjacent to the barns. Hence, its decision that the defendant company was authorized to lay and operate the tracks and curves on the avenues, as above stated.

This still left the question of whether the loud and disagreeable noises occasioned by the running of the company's cars in and out of its barns over the curves and switches on the streets at the place and at the hours in question, although authorized by the city ordinances, constituted an actionable nuisance, as to the plaintiff. The answer to this question—there being no negligence in the case—depended, the court says, on whether the location of the car barn was a reasonable and proper one, and whether the use of the streets at the times and in the manner they were used by the company in running its cars over the curves and switches, whereby the noises complained of were produced, was one of the reasonable uses or purposes for which the streets were acquired.

The plaintiff cited and relied on a class of cases to the effect that, where a party is carrying on a lawful business on his own land without negligence, yet if it is a business which is attended with loud and disagreeable noises, or produces noisome smells or noxious vapors, whereby the property and comfort of those dwelling in the neighborhood are materially injured and disturbed, the business is a nuisance per se, that is to say, in itself. Such cases, however, the court insists, are not particularly in point; for this is not the case of carrying on an offensive trade or business on one's own premises which may be carried on at places removed from the occupied parts of a city, or beyond its limits.

The court also maintains that there is a radical difference between an ordinary commercial railway, operated by steam, and a surface street railway, operated by electricity, as to the selection of its roundhouses and machine shops by the one, and its car barns by the other. In each case the selection must be made with reference to the rights of the property owners in the neighborhood; also, those of the railway company and of the public. The rights and conveniences of property owners cannot alone be considered, for one living in a city must necessarily submit to the annoyances which are incidental to urban life, and individual comfort must in many cases yield to the public good.

Now, the only ground for claiming in this case that the location of the car barn was an improper one was that it was in the residence portion of the city. But, the court points out, the exclusive business of the company is the carrying of passengers within the limits of the city and in its streets. Its lines traverse the streets of the residence portion of the city. Its business is there. It takes on and discharges passengers in all parts of the city. It must have its car barn so located that it can promptly get its cars upon its lines for the purpose of enabling the people of the city to seasonably get from their homes to their respective places of business or labor. It cannot locate its barns outside of the city, because it is only authorized to build and operate its lines within the city limits and upon its streets; and, if it had the authority to do otherwise, it would be impracticable and detrimental to public interests to do so. Again, if it locates its barns at points where there are at present no dwelling houses, it is only a matter of time when some property owner will be disturbed by the loud and disagreeable noises necessarily occasioned by taking its cars in and out of the barns. The rights of such an owner are the same as those of the plaintiff.

The barn in question is only one of five barns located and used by the defendant company for the same purpose in different parts of the city, and the court holds that, upon the undisputed evidence, its location is not an improper or unreasonable one.

The question, whether the maintenance and use by the company of the switches and curves in question were a proper street use, the court says is settled adversely to the plaintiff by previous decisions. Such maintenance and use are a necessary incident to the operation of its street car system, which derives its business from the streets, is intended for the convenience of the travel therein, and is in aid of the identical use for which the streets were acquired; hence the maintenance and operation of these switches and curves are a proper street use, and not an additional burden thereon.

The discomfort and injury sustained by the plaintiff from the

loud and disagreeable noises produced by taking the cars of the company in and out of its barn over the switches and curves at the place and at the times in question, continues the court, are the same, except in a greater degree, as are sustained by property owners at the street corners where its cars are operated over curves.

And so it holds that the acts of the defendant company complained of do not constitute a private nuisance for which the plaintiff is entitled to recover damages.

THE MILCREEK VALLEY STREET RAILROAD.

The Millcreek Valley Street Railroad Company owns one of the suburban lines running northward from Cincinnati, and operates eight miles of double track, one terminus being at the Zoological Garden in Cincinnati and the other at Lockland, in Hamilton county. The line passes through the villages of St. Bernard, Elmwood Place, Carthage, Hartwell, Maplewood, Wyoming to Lockland. Plans have been completed and will be carried out this spring for extending the lines through Reading and Glendale to Hamilton, and the company will serve a territory containing over 60,000 inhabitants without counting Cincinnati or Hamilton. In addition to the foregoing it is intended to rebuild the tracks, put in complete overhead construction and build a new power station of 3,000-h. p. capacity.

The car here illustrated is the standard type and is one of 18 operated by the company. Each car is 26 ft. over all with 18 ft. body,

MILCREEK VALLEY CAR.

side seats, upholstered in plush and heated with H. W. Johns panel heaters. The cars are painted a dark green, the standard coach color of the New York, New Haven & Hartford Railroad Company, and lettered in gold and aluminum. The trucks are the Peckham No. 7 D, the Cincinnati type of heavy truck fitted with the Kilgour safety brakes. The cars can be operated either by a single or double trolley, to conform with the overhead work in Cincinnati. Each car is equipped with two Johnson No. 22 motors and is run at a speed of 12 miles an hour in the city but this may be increased to 30 miles in the less populous districts. They go up the 9 per cent grade on Vine street at nine miles per hour.

At the Zoological Garden the cars are received by the employes of the Cincinnati Street Railway Company and run to Fountain square in the heart of the business district. They are returned to the Zoological Garden and there taken charge of by the regular crew; a continuous service is thereby given between the heart of the city and the villages up the valley. The Millcreek Valley Street Railroad Company is composed of Cincinnati capitalists and the operating department is in strong hands, W. G. Wagenhals being general manager and R. Powers superintendent.

The American Trust Savings Bank, of Chicago, for the bondholders of the City Electric Railway Company, Decatur, Ill., made application for the appointment of a receiver, January 13.

EVERETT PRESIDENT OF CLEVELAND ELECTRIC.

At the annual meeting of the Cleveland Electric Railway, commonly called the Big Consolidated Company, on January 19, the active campaign for control of the company waged by the Everett and the Andrews factions culminated in the former electing a majority of the board of directors. Officers were chosen as follows: President, H. A. Everett; vice-president, C. L. Pack; secretary, R. A. Harman; treasurer, E. W. Moore. Mr. Harman is the only officer re-elected.

Mr. Everett urged Mr. Andrews, the retiring president, to take the chairmanship of the board of directors which has been vacant since Tom L. Johnson left it, but he declined. It is stated that J. J. Stanley was requested to continue as manager, and H. J. Davies to continue as assistant secretary, but both declined to do so.

Mr. Everett was president of the company for one year after the consolidation was effected in 1893, after which his friends lost control of the organization. The new management is pledged to economy and the first act of the board was to reduce the salaries of the higher officials; the president's salary was cut from $10,000 to $5,000.

The Akron, Bedford & Cleveland and the Cleveland, Painesville & Eastern offices where Mr. Everett as president of the former company made his headquarters are now in charge of C. W. Wason, president of the latter. F. S. Borton, secretary of these two companies, succeeds H. J. Davies as assistant, or active, secretary of the Cleveland Electric.

PERMANENT INTERNATIONAL TRAMWAY UNION.

We have received from F. Nonnenberg, of Brussels, secretary-general of the Permanent International Tramway Union, the official report of the 10th annual convention held at Geneva in August last. Accompanying the report was a list of the questions to be discussed at the next convention to be held in Paris in 1900, which we translate below.

1. How have urban rates of fares been changed in the last five years? Why were changes made? What are the results as affecting receipts, expenses and profits? Give total figures and figures per car-mile. Do you consider your present rates reasonable?

2. What have been the consequences of electric traction upon the operation of transformed lines, as affecting traffic, expense of operating and net profits? Give total figures and figures per car-mile. State nature of your electric lines as to profile and also special circumstances influencing results, such as duration of concession, etc.

3. What are the advantages and disadvantages of narrow and standard gages, particularly in view of the use of powerful motors?

4. What is the arrangement and equipment of your power station? (There is enclosed a list of questions covering the station, equipment and operation in great detail.)

5. What is the best system of distributing current in extensive systems using electricity—continuous, alternating, polyphase?

6. Have you used the Falk joint? For how long? On what length and what type of roadbed have you these joints? On what technical considerations did you adopt it? What is the cost, giving items of cost in detail? What proportion of the joints break? Why do they break? Do the number of failures vary with the season? After what time do they occur? What is the maximum length of rail you have been able to cast-weld without making special expansion joints? Do you use electrical bonds with the Falk joints? What else can you say on this joint?

7. What progress has been made concerning accumulators, as to construction, increase of capacity, decrease of weight, duration, cost of maintenance, practical and economical application on tramways?

8. Give your experience as to the best means of heating cars. Give cost of installation, operation and maintenance of the various systems you have employed.

9. What are the advantages and disadvantages of operating branch lines as compared with the main lines?

STREET RAILWAYS OF PENNSYLVANIA.

From the report of Isaac B. Brown, superintendent of the bureau of railways of the department of internal affairs of the state of Pennsylvania we abstract the following statistics concerning the street railways of that state.

There are 94 corporations operating their own and other lines, with capital stock outstanding of $100,900,335; in addition there is outstanding capital stock of lessor companies amounting to $56,027,922. The bonded indebtedness of operating companies is $32,440,850, and the current liabilities amount to $14,229,491. The total funded and unfunded debts of non operating companies is $40,810,690. The grand total of capital stock, funded and floating debts is $244,418,288.

The total of assets of the Pennsylvania street railways is given at $247,328,522, which it is stated is not accurate because even the officials reporting in many instances have not the data necessary to a correct valuation of the assets.

The total income from operation was $19,745,706, an increase of $866,057 over that for the fiscal year ending June 30, 1897. Over one-half of the total income is received by the Union Traction Company, Philadelphia, and this company together with the four companies in Allegheny county (Pittsburg) have about 75 per cent of the total gross receipts.

This increase in the receipts is indicative of the improved business situation. In the matter of bicycle competition the situation is also improved; in the report for the previous year were some data as to the number of persons passing a given point in Harrisburg on street cars and on bicycles, and similar records were taken for two days in November, 1898, which are compared with those of the previous year. The report says:

"Last year the number of persons passing a given point was 6,078. This year the number was 5,819. Last year the number in cars was 1,962, and on wheels 4,116; this year the number in cars was 2,370, and on wheels was 3,449. Last year the percentage on wheels was 67.7 and in cars 32.3; this year the percentage was 59.3 on wheels and 40.7 in cars."

A further observation was made as to the time when bicycles were most used. "Of the 5,819 persons passing, 1,470 passed between the hours of 12 noon and 2 p. m., of which 1,028 were on wheels and 442 in cars. The figures show very clearly that the clerk and the laborer in going to and from their work use the wheel quite generally. They also show that there is no particular increase in the number of passengers carried by the cars during the hours named, which is proof that the large increase in favor of the wheel is due to the fact that business people are adopting that method of transportation from one point of the city to another. The figures referring to the use of the wheel during other hours of the day indicate that fewer persons are using the wheel as a source of pleasure."

The total operating expenses were $9,486,573, approximately 50 per cent of the gross receipts. Taxes were $1,211,135; interest, $2,250,797; rentals, $6,087,871; other expenses, $256,367; dividends, $804,169. This is a total of $20,096,912.

The total mileage of Pennsylvania street railways is reported at 1,422.84, and the aggregate length of tracks at 1,708.32 miles. There are 6,616 cars and 12,680 employes who receive $6,542,840. The total number of passengers carried was 432,779,314.

During the year 15 passengers were killed and 506 injured. Of employes 11 were killed and 86 injured. Of other persons 80 were killed and 409 injured. Total killed, 106; injured, 1,101.

Lessor companies received $7,227,347 for track rentals and from other sources; they paid $4,636,489 in dividends and $2,433,934 in other disbursements.

TRANSFERS IN ATLANTA.

The Atlanta (Ga.) Consolidated Street Railway Company on January 19 decided to adopt a transfer system as an experiment for six months in order to determine whether such a system is practicable in Atlanta. The city council will be asked to pass ordinances preventing abuses.

The East Liverpool (O.) Street Railway was tied up for several days in January because of a strike.

NEW ELECTRIC STREET RAILWAY, NORWICH, ENGLAND.

The very ancient city of Norwich beloved of "Ye Virgin Queen" dating back almost beyond the range of history, has been drowsing beneath the shadow of the old cathedral for centuries, with nothing but civil wars and now and then a fire to give passing excitement. Though in paving and sanitary matters improvements have been made in modern times, and electric lights installed, there has been no real alteration in the city, the principal pride of which is its antiquity. However, the trolley has at last made its appearance, and those who are foresighted are preparing to take advantage of the great changes which must result from adapting so modern a means of transportation.

The new transporting agent is the New General Traction Company. The offices are at 35 Parliament street, London; J. E. Winslow is chief engineer and A. E. Hopkins managing director. The

NORWICH CATHEDRAL.

company is not a Norwich association, but is designed for the purpose of attending to the wants of the whole country. The Norwich enterprise is called the Norwich Electric Tramways Company, and the engineer in charge is A. N. Bannister, but the work is controlled and done by the New General Traction Company. At present about 15 miles of track is laid and some of the narrow streets have had to be widened, while two new streets are being cut through the oldest part of the city. The cars will doubtless soon be running. The poles had not appeared a few weeks ago, but they will be the last things to be put up.

The track gage is 3 ft. 6 in. The rails are 65-lb. girder, with a 1-in. groove; they are laid on steel cross-ties or "sleepers." The sleepers weigh about 40 lbs. each and are placed at distances of 10 ft. apart. There is a steel tie-rod between each cross-tie; these latter are made by the Askham Engineering Company, of Sheffield, England; the rails come from Belgium.

The Falk cast-welded joints are used throughout; this work is being done by the agents, R. W. Blackwell & Co., 39 Victoria street, Westminster. The rails will rest on 6 in. of concrete, in which the stamped, or rolled, steel cross-ties are bedded. In this concrete foundation will also be laid Doulton stoneware conduits

for the feeders. The rails will be cross bonded every 200 ft. The line will be single-track nearly everywhere in the city, with turnouts, except in the very narrow streets.

One of the features of the track construction at switches and turn-outs is shown in the accompanying sketch, furnished by Mr. Bannister. The switch points are of cast steel, and when worn may be taken out and replaced without disturbing the rest of the track. Electrical connection is provided by placing an angle 3 x 3 x 5/8 in. under the movable piece and cast-welding it to the rails which it connects.

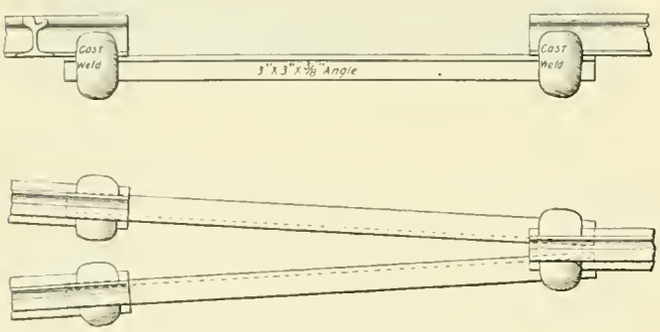
The electrical equipment will be furnished by the Westinghouse Company. In the power station there will be four 150-k. w. West-

PARLOR OF "MAYDE'S HEAD INN."

inghouse direct current generators, coupled to 300-h. p. engines built by Browett & Lindley, of Manchester, England. The engines are compound, condensing, with two independent Worthington compound jet-condensers, each capable of handling three engines. Steam will be supplied by four 300-h. p. Babcock & Wilcox boilers.

The poles, supplied by R. W. Blackwell & Co., are made by Morris Tasker, New York. The trolley wire, No. 0 B. & S. gage, is from Washburn & Moen. The wire will be carried on brackets, span wires on poles, and spans on rosettes.

Fifty cars, made by the Brush Electric Company, of Loughboro, are ready for delivery; these are double-decked, with open tops, and have a total seating capacity of 70. The cars are 29 ft. 6 in. long,



CONNECTION AT SWITCHES.

over all, and 6 ft. wide, outside measurement. A car shed is built to hold 60 cars and a repair shop for six cars. With the line nearly complete, something over $500,000 have been spent, which seems quite a small sum considering that compensations have had to be paid for widening and making streets, though the city has taken its share of this. The very important department for purchasing property has been under the active management of S. Mealing Mills, a local estate agent, who, though raised in the old cathedral city, would be able, for business acumen, to hold his own anywhere.

The fares will be determined by the company, but the run will, doubtless, be divided into sections for each of which one penny, (two cents) will be charged. There will, however, be workmen's fares of two cents for the whole distance, morning and evening; this is one of the conditions invariably attached to concessions for any kind of city or suburban transportation, whether light railway or steam roads, in the United Kingdom.

The Board of Trade speed-limit is eight miles an hour, and as the public desire for rapid locomotion grows by what it feeds upon this maximum will certainly have to be made wherever it is possible to do so. The speed cannot be high in the very heart of the museum of antiquities, past the cathedral; the "Mayde's Head Inn," that has stood since the year 1287, and has never at any time been anything else but an inn; past the castle, that was, in Norman days, a stronghold many times besieged, later a prison and now a museum; but once outside in what is now country, but will presently be broad streets and a new city, full speed can be maintained and the rapid transportation is expected to produce a building boom all along the line.

EARNINGS OF BROOKLYN ROADS.

The earnings by months of the Brooklyn Rapid Transit Company's system and of the Nassau Electric Railroad, of Brooklyn, N. Y., are shown for 11 months, the years 1897 and 1898, in the following table:

BROOKLYN RAPID TRANSIT.

	1897.	1898.	Gain.	Per cent. of gain.
January	$392,285	$414,809	$22,524	5 75
February	360,128	385,967	25,839	7.10
March	407,760	466,387	58,627	14.50
April	437,356	491,802	53,988	12.35
May	488,059	528,347	40,288	8.25
June	495,006	580,039	85,038	17.17
July	489,463	572,116	82,653	16.90
August	477,400	563,257	85,857	18.00
September	460,837	534,941	74,104	16.11
October	443,923	509,629	65,703	12.57
November	417,818	446,501	28,683	6.87
Total	$4,870,035	$5,493,795	623,304	12.81

NASSAU ELECTRIC.

	1897.	1898.	Gain.	Per cent of gain.
January	$109,623	$135,438	$25,815	23.68
February	102,409	128,809	26,400	25.50
March	122,277	156,420	34,143	28.00
April	141,441	166.797	25,356	17.98
May	173,073	187,145	14,072	8.13
June	191,614	216,325	24,711	12.90
July	218,508	238,088	20,300	9.31
August	226,811	239,586	12,775	5.74
September	184,614	205,560	20,946	11.38
October	151,221	180,041	28,820	19.08
November	138,527	145,649	7,122	5.16
Total	$1,760,118	$1,999,858	$240,459	13.05

PUBLIC OWNERSHIP A FAILURE.

On January 19, the St. Joseph & Benton Harbor Railway & Light Company, of St. Joseph, Mich., was awarded the contract for lighting and heating the court house and jail in that city for three years for $3,900. The county paid over $6,000 for the years 1896, 1897 and 1898. The reason for this difference is that for the last three years the county has been experimenting with public ownership of lighting plants. In 1895, the building committee of the county board refused to give the railway company the contract, and for the last three years the president, W. Worth Bean, has been showing the loss resulting from the public ownership scheme, using the supervisor's own figures. The difference was $2,100 or 54 per cent against the public plant, and the majority of the board has at last seen light. This time Mr. Bean got the contract.

PROPOSED CANADIAN ASSOCIATION.

There has been some agitation among Canadian street railway men over the question of organizing an association, the purpose of such being to discuss topics relating to street railway management and secure desired improvements. Such an organization would correspond to one of our state associations rather than the American Association. In order to ascertain whether or not the movement was a popular and far reaching one the REVIEW addressed inquiries to the managers of the Canadian street railway companies. The replies given below indicate that while the matter is being discussed and is strongly favored by some, yet other officials believe that the street railway companies of Canada are too few and widely separated to form a successful association, and as for the consideration of subjects on the operation of electric railways, this need is fully met in the American Street Railway Association, of which many of the Canadian companies are members.

"In reply to yours, with reference to a Canadian Street Railway Association, I have heard but little about it. Personally, I would be very much pleased to see such an organization, similar to the American one, established in Canada, but fear that our territory is rather large, and, as yet, the number of railways so limited that I am in doubt if it could be made successful."—A. J. Nelles, secretary and manager of the Hamilton, Grimsby & Beamsville Electric Railway Company.

"About a year ago there was quite a strong feeling in favor of a Provincial Street Railway Association for Ontario, but, like all such movements, it fell flat for the want of some one to take the time to complete the organization. At the present time there is talk of united action on the part of all street railway companies, telephone and electric light companies in Ontario. No doubt an association of the different street railway companies, along the line of your state associations, would be most desirable, but until such time as the different companies become educated to the advantages of such an association, it will never become a fact."—C. E. A. Carr, manager of the Montreal Park & Island Railway Company.

"I have heard nothing of the agitation in favor of the organization of a Canadian Street Railway Association. It seems to me that the American Street Railway Association fills the bill."—T. Ahearn, vice-president and managing director of the Ottawa Electric Railway Company.

"In reply to your letter with reference to the formation of a Canadian Street Railway Association, I beg to say that I have not heard of any agitation here in respect to the formation of such an organization, and I have some doubts as to whether an institution of the kind is required or would be a success."—E. H. Keating, manager of the Toronto Railway Company.

"In reference to a Canadian Association, I have heard the matter discussed, but I have always felt that there are not enough of us near together to make such an association a success."—J. B. Griffith, secretary, treasurer and manager of the Hamilton Street Railway Company.

"Replying to your inquiry, I have not as yet heard of any agitation in favor of the organization of a Canadian Street Railway Association, and do not at present see any necessity for the formation of one."—Edward A. Evans, general manager and chief engineer of the Quebec, Montmorency & Charlevoix Railway.

"Replying to your inquiry regarding a Canadian Street Railway Association, would say that I am, personally, very much in favor of the formation of one; in fact, I have discussed the matter with several managers. I do not think there should be much difficulty in the formation of an association for Canada on the lines you speak of."—Mark B. Thomas, manager of the Hamilton & Dundas Street Railway Company.

"Replying to your favor regarding the agitation in favor of the organization of a Canadian Street Railway Association, would say, that our company has only been in existence a short time, and, personally, I am not aware that there has been any movement in favor of the organization referred to by you. I am not in a position to say whether such an association is desirable, and would have to hear from some of the older street railway companies before I could give an intelligent opinion."—J. H. Still, president of the St. Thomas Street Railway Company.

"I have not been able to hear of any actual proposition for the organization of a Canadian Street Railway Association, but I certainly think it would be desirable."—W. B. Close, manager of the Toronto Suburban Street Railway Company.

CAR FOR THROUGH TRAFFIC ON THE MAHONING VALLEY INTERURBAN.

For a year past the Mahoning Valley Railway Company has been running a special car for through traffic between Youngstown, Girard, Niles and Warren, O. It is the fast "train" of the road and makes but few stops, all other cars giving it the right of way. As may be noted from the illustration the car is a large and handsome

MAHONING VALLEY CAR.

one. It is 36 ft. in length and fitted with McGuire maximum traction trucks. Each truck carries a 50-h. p. high speed Westinghouse 38 B motor. The speed between towns is 35 miles an hour. A. A. Anderson, general manager of the company, states that the car has made a good record from an operating and financial standpoint showing that there is a demand for such service on interurban roads.

COALS TO NEWCASTLE.

The Filer & Stowell Company, of Milwaukee, which has very large engine works in that city, and makes a specialty of heavy duty Corliss engines, has recently placed an order which causes more than ordinary interest. It is that of a cross-compound condensing engine for the Union Railroad Company, of Providence, R. I. In view of the fact that Providence is the native heath of the Corliss engine, this causes the question asked by foreign makers who have recently had to meet American competition: How can they do it with the high freight rates they have to meet?

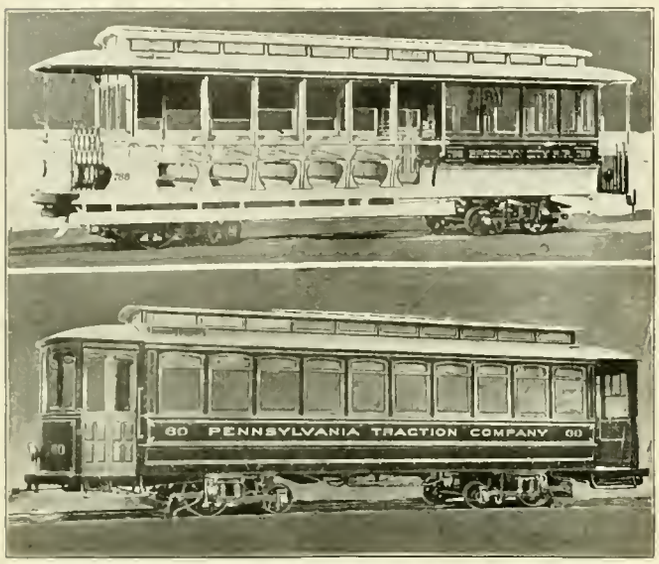
The engine for Providence is to drive a 1,200-k. w. generator, with capacity for an overload of 50 per cent. As stated, it is cross-compound condensing. The cylinders are 28 in. and 54 in. by 48 in. stroke. The armature is on the engine shaft, which is 26 in. in diameter. The fly-wheel is to be 18 ft. in diameter and weigh 100,000 lbs.

Other recent sales of the Filer & Stowell Company are: A cross-compound with cylinders 24 in. and 44 in. by 48 in. to the Edison Electric Light & Power Company, Erie, Pa.; a simple engine 22 in. by 48 in. to the Menominee (Mich.) Electric Light Railway & Power Company; a cross-compound, with cylinders 32 in. and 64 in. by 54 in., to the Armour Elevator Company, Chicago.

The company is now building for Armour & Co., for their central power station at the Stockyards, Chicago, two cross-compound engines, with cylinders 23 in. and 46 in. by 48 in., to be direct connected to 1,000-k. w. generators.

CARS AND LOCOMOTIVE RECENTLY BUILT BY THE BRILL COMPANY.

The Brooklyn City Railway Company has just put in operation a new car of the California type which, from its large size and arrangement of details and the fact that it is of a decided improvement over anything of this class which has been used in the east, is of considerable interest. It is similar in general appearance to the large cars recently put in service by the Metropolitan, of New York, but has a lower platform and no side steps on the closed portion. Considerable objection has been made to the high platform of the New York cars, and the new Metropolitan cars will have a low rear



BROOKLYN CITY AND PENNSYLVANIA TRACTION CARS.

platform, such as here shown. The step is 13¾ in. from the rail with a 13-in. riser.

The length of the car over the corner posts is 36 ft., the length over the buffers being 44 ft. It is 6 ft. 6 in. wide at the sills and 7 ft. 2 in. at the post. On the front or open end of the car the platform is 3 ft. 8 in. Ample strength is secured for the side sills by plating them with iron. The closed section is 11 ft. 2 in. over the end panels, and has two double doors. The open section has seven cross seats, two of which, those against the forward bulkhead, have stationary backs. Along the open portion there are the usual folding steps at the sides. These steps are 18½ in. from the ground, with a 13 in. riser. The height in this case from the head of the rail to the under side of the sill is 28 in. Brill maximum traction trucks with a 4-ft. wheel base are used under the car. The wheels are respectively 30 in. and 20 in. in diameter. There are two W. P.-50 motors.

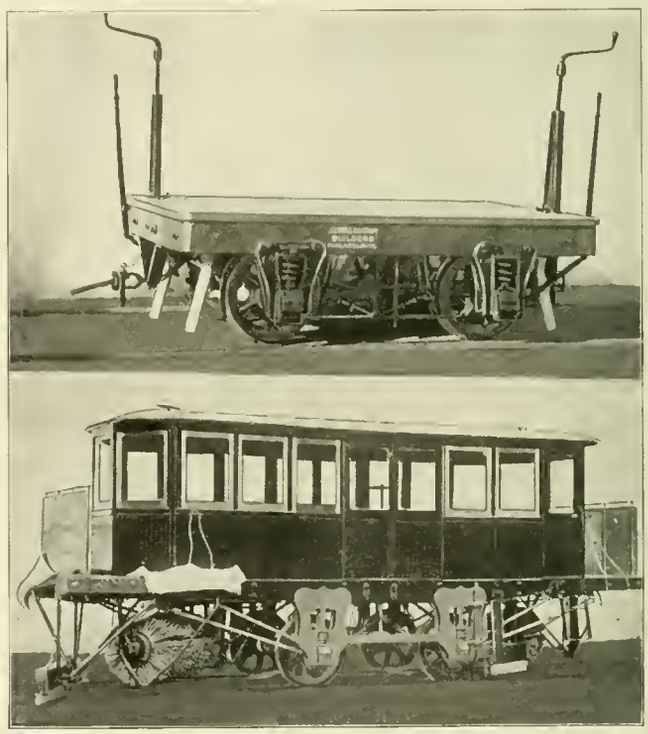
The ends of the car are provided with angle-iron buffers, and gates are used on one side of the rear platform, with a Brill folding gate on the opposite side. The seats in the closed compartment are longitudinal and covered with spring rattan, seating 14 passengers; the open portion accommodates 35; making a total of 49 seats. The closed compartment is finished in cherry throughout, with three-ply quartered oak ceilings. Cherry and ash are used for the finish in the open section.

Push-buttons are placed on each post, to signal the conductor. There are two 12-in. Dedenda gongs with disappearing buttons, and there are two sandboxes. The headlights are in the dasher. The trolley board extends the whole length of the car. The grab-handles of the posts are of ash set in solid bronze sockets. The seats in the open part of the car are fitted with a Brill round-corner seat end panels.

The weight of the car without motors is 17,200 lbs. The trucks weigh 3,250 lbs. each. The California car, with the modifications which are going on in its design and construction since its introduction in the east, is rapidly coming into favor wherever a large traffic has to be accommodated.

The Pennsylvania Traction Company, of Lancaster, Pa., is one of the largest suburban roads in the State outside of the Philadelphia interurban lines, and the practice of the company is especially interesting because it has tried many different kinds of cars with a view to finding out which will accommodate the heavy traffic to the best advantage. The car is 28 ft. long, 38 ft. 8 in. over all. It has curved sides and is 7 ft. 5 in. wide at sill and 8 ft. wide at the posts. The platforms are 4 ft. 6 in. long and the height to the sill from the head of rail is 30 in. The step is 17 in. from the head of the rail and has a 12-in. riser to the platform. Each end of the car is provided with a stationary round end vestibule with doors folding against the vestibule. This is a complete enclosure and there is no entrance to the car until it has stopped. These vestibules give perfect protection to both motormen and conductors while at the same time it adds greatly to the comfort of the passengers. The car is mounted on Eureka maximum traction trucks. The wheel base is 4 ft. and the wheels are 33 in. and 20 in. in diameter. There are two Westinghouse No. 38 motors. The gage is 5 ft. 2½ in. The car is furnished with 20 reversible back seats covered with spring rattan. This gives a seating capacity for 40 persons. The inside finish is of cherry with bird's eye maple headlighting; the trimmings are of bronze throughout. There are two electric headlights and two Brill sandboxes. The buffers are of the Brill angle iron type. The weight of the car without motors is 20,500 lbs. The trucks weigh 4,500 lbs. each.

The electric locomotive illustrated was recently built for the Deadwood & Delaware Smelting Company. It is powerful, although it measures but 8 ft. in length and is only 5 ft. 3 in. wide.



ELECTRIC LOCOMOTIVE—MONTREAL SWEEPER.

It stands 2 ft. 3 in. to the floor and is furnished with a W. P. No. 5 motor with two K 10 controllers. The wheel base is 4 ft. and the gage of the track 36 in. Its small size and compactness made it possible to use a light pedestal gear arranged to take the motors. Four Brill sandboxes are placed within the frame to give an equal and complete distribution of sand when it is necessary. The convenience of a machine of this kind is hardly to be estimated by those who have had no experience with them. It is intended for use within a mine and on the surface as well. A third rail transmission of power is to be employed and the General Electric Company put on the necessary electrical equipment. Electricity is available in a large percentage of all manufacturing establishments and railway tracks are equally commended. A small expense for overhead wires or for third rail conductors makes a machine of this kind possible and its convenience is much greater than a pair of horses, while the economy is in favor of the electric machine which when not in use is not "eating his head off."

The sweeper illustrated in the accompanying engraving is of unusual interest as illustrating a form of construction specially adapted to the needs of the Montreal Street Railway Company, and may be taken as a type of those necessary in cities where the winters are of extreme severity and the snow fall very heavy. The body is 21 ft. long and the width over all is 6 ft. 10 in. At each end of the body there is an 18-in. platform which is used to carry salt, tools and miscellaneous materials necessary for attacking snow and which need to be easily accessible. There are No. 12 Westinghouse motors for driving sweeper; the brooms are operated by Westinghouse No. 3 motors. It will be observed that both of the brooms are hung on radial guides so that they rise and fall with the motor shaft as the center thus preserving the sprocket chains at constant tension. The sills extend 6 in. outside the dasher so as to carry the shear outside of the front broom; this takes the snow from between the tracks; when down this shear extends 2 ft. 8 in. outside the inner rail. The distance between the rails being 4 ft. enables the whole space to be cleaned in this manner; this peculiarity was specified by the company. There are four doors to the cab. In the center on the further side of the engraving is a swinging door 4 ft. 2 in wide; the door on the near side is of the same width, but is blind, being screwed in place. At diagonally opposite corners of the cab there are two doors each 20 in. wide. The screw brake which is seen between the wheels comes up in front of one of the doors and is made with a toggle joint connected with a nut so as to give immense pressure on the wheels. The hand wheel is 16 in. in diameter. The driving axles are 4 in. in diameter; those for the brooms 3 in. Double braces are used from the pedestals on each side and the whole floor of the sweeper is framed in the strongest and most solid manner. The sprocket chains are forgings of special patterns and have given great satisfaction on account of their strength and durability.

CHICAGO, HARVARD & GENEVA LAKE RAILWAY.

This is one of the most promising interurbans that will be built this year. It forms a short cut to the lake, effecting a saving of from two to six hours time each way. The line starts from Harvard, Ill., where two lines of the C. & N. W. Ry. cross, and follows the public highway and over private right of way to Geneva lake, Wisconsin, a distance of 12 miles. This lake has long been one of the most noted in the west, and is visited by thousands. Its spring fed waters are remarkably clear and cold, and in places 300 ft. deep. With the exception of the mountains it is conceded to rival the Swiss lake from which it takes its name. Here the merchant princes of the west have laid out extensive summer palaces, and thousands of less pretentious structures which help form the chain around its shores swell the value of the improvements to upwards of $10,000,000, and this sum is rapidly increasing each year.

The company's franchises cover a term of 50 years and permit the transportation of passengers, baggage, express, mail and all kinds of freight. What the latter item means is suggested in the one million pounds of butter made annually in a single district on the line where over 5,000 cows are milked and some 400 car loads of cattle shipped each year. Farm lands are worth $100 per acre and this richest dairy country in the United States is very thickly settled. The Yerkes telescope, the largest in the world, is within walking distance of the lake terminus of the line, and from this point also the steamers leave for all points on the lake which is about 10 miles long. The remarkable purity of the air and the hundreds of springs which abound everywhere combine to make Geneva lake at once a pleasant ground for the masses and a favorite resort for persons seeking health. In the territory now for the first time made easily accessible to the lake are the thousands engaged in industrial work in such manufacturing cities as Belvidere, Rockford, Janesville, Beloit, etc. While the summer season will furnish easily 100,000 excursionists, there is a good paying business the year around.

The road will be laid with 60-ft. 60-lb. T-rail and constructed and equipped in the best possible manner, the contract for all the work having been let to the Continental Construction Company, of Boston. Work on the power house has already begun. The initial equipment will be 400 h. p. of engines and boilers, with room left for as much more. The rolling stock will include both 40-ft. combination cars and 28-ft. motor and trail cars. The freight equipment will provide for heavy service. There are three towns and villages along the line, which at present have no rail transportation facilities whatever. A rate of 3 cents per mile is allowed, but a 25-cent fare will probably be made for the 12 mile ride. The line will do a paying business from the start, as it is what residents along the route have been trying to secure for years.

FURTHER CONSOLIDATION IN BALTIMORE.

January 26 the board of directors of the Baltimore Consolidated decided to recommend to the stockholders that they sell their holdings to the syndicate represented by Alexander Brown at $37.50 per share; the stockholders are offered cash or securities of the properties it is proposed to combine. Messrs. Perin and Jenkins, who control a majority of the stock of the Consolidated, will go into the syndicate.

The plans of the Brown syndicate look to the consolidation of the Baltimore City Passenger Railway, the Baltimore Consolidated Railway (itself a consolidation of the Baltimore Traction and the City & Suburban Companies effected in 1897), the Baltimore & Northern, and the Baltimore, Middle River & Sparrow's Point Companies. The track of these companies aggregate 270 miles.

The capital stock of the consolidated lines will be less than the sum of the present capital stock of the separate companies in order to make a saving in the taxes imposed.

The management of the properties will be in the hands of a board of directors consisting of seven members. It is considered that a small number of directors can work to better advantage than a large number. Interest centers in the composition of this board, whose members will have under their control the entire street railway mileage of Baltimore. It has been settled that four of the seven members will be Alexander Brown, Henry A. Parr and George R. Webb, who compose the Brown syndicate, and Nelson Perin, who will have large interests in the combination. The entrance of Mr. Perin in the directory is also with the understanding that he will be the president of the corporation. It is also understood that George C. Jenkins will be a member of the board.

PAY FARE AND THEN SUE TO RECOVER.

January 13, an interesting case brought against the Detroit Citizens' Street Railway Company was decided in the lower court at Detroit. Wm. G. Schroeder had been given a transfer which was improperly punched, and the conductor of the second car ejected him because he refused to pay his fare. The court held that the passenger should have paid his fare the second time and then have sued the company to recover the 5 cents; however, he instructed the jury to bring in a verdict for nominal damages (6 cents) because of the assault committed on the passenger in ejecting him.

TROLLEY FOR MANCHESTER, ENGLAND.

Estimates made by Mr. Higginbottom, mechanical engineer, and chairman of the committee on street traction for Manchester, England, show in favor of the overhead trolley system, as compared with underground conduit, as follows:

1. The first capital cost per mile of track was £2.135, against £11,491 for the conduit system; or, for the 67 miles required in Manchester, £144,000 against £773,897.

2. The working cost per car mile was ½d. more for the conduit system, or £14,000 per year.

3. Difficulties of construction of the conduit system in the narrow and congested Manchester streets.

Beverly, Mass., proposes to pay the car fare of its councilmen who live in the suburbs and have to use steam or electric cars to attend council meetings.

Two cars on the Citizens' Electric Railway, of Mansfield, O., met in a head-end collision on January 16. Both motormen were slightly injured; there were no passengers on either car. One of the motormen left his regular passing point without orders and failed to keep a look-out.

TRAIN RESISTANCE FORMULAS.

In the "Street Railway Journal" for February is an editorial on a new general formula for train resistance which is extremely interesting. The opening sentences are as follows:

"The alchemists of old sought diligently for the philosopher's stone, the inventors of a later age for perpetual motion, and engineers of the nineteenth century have been almost as eager to obtain a general formula which shall reconcile all existing data and experiments upon train resistance. The first two objects of effort are now known to be unattainable,and the third has until now baffled the best minds in the railroad profession. Only a month ago 'Locomotive Engineering,' which for years past has devoted special attention to this subject, said editorially: 'We do not believe that it is possible to devise a formula that will show an approximation of the resistance due to different kinds of trains at different speeds when train tons are the basis of calculation.'

"A general formula which appears to be applicable to passenger trains of all weights, running at all speeds up to the highest limits so far reached, has been lately worked out, however, by John Lundie as a result of a long series of tests of trains in actual service, and is here given to the engineering public for the first time."

Mr. Lundie's formula is as follows:

$$R = 4 + S\,[0.2 + 14 \div (35 + T)]$$

where

T = the weight of the transportation unit in tons (2,000 lbs.).

R = resistance in pounds per ton.

S = speed in miles per hour.

This formula gives a family of straight lines, all passing through the point which corresponds to a train resistance of 4 lbs. per ton for a speed of zero. The lines corresponding to the train weights of 100 tons, 200 tons, 500 tons, 1,000 tons, and infinity are shown solid in the diagram.

The editorial proceeds:

"The test of any formula lies in its application. Gaged by this test, Mr. Lundie's formula unifies in a remarkably close manner nearly all recently published experiments, together with other formulae of more limited application, as will be seen by an inspection of the accompanying table. The Stroudley, Sinclair and Dudley tests of train resistance scheduled in this table were brought together by A. M. Wellington in the 'Engineering News' in 1892, and referred to as intrinsically worthy of confidence on account of the careful manner in which they were made. To these we have added further experiments made on the Philadelphia & Reading Railroad in 1889, and on the Central Railroad of New Jersey in 1892, so that a fairly complete range of train weights from 200 to 400 tons, and of train speeds from 40 to 70 miles per hour is given in the table. The Lundie formula checks up all these tests very closely, though in all but one case the results obtained by its use are slightly higher than the observed results. In this connection it may be noted that Mr. Lundie obtained his speed figures by positive methods, having found that speed recorders for variable speeds are not sufficiently accurate owing to the inertia of the moving parts.

"These tests are all for heavy railroad passenger trains, upon which Mr. Lundie himself has made no experiments. For trains of from 20 to 100 tons, and for speeds of from five to thirty miles per hour, the Lundie formula is accurate, inasmuch as it is obtained directly from 150 or more observations made by Mr. Lundie in Chicago, as before stated. For lighter units still, the formula agrees with the results of private tests made by several of the great electric companies, and checks very well indeed the Clark formula,

$$R = S^2 \div 171 + 7.16,$$

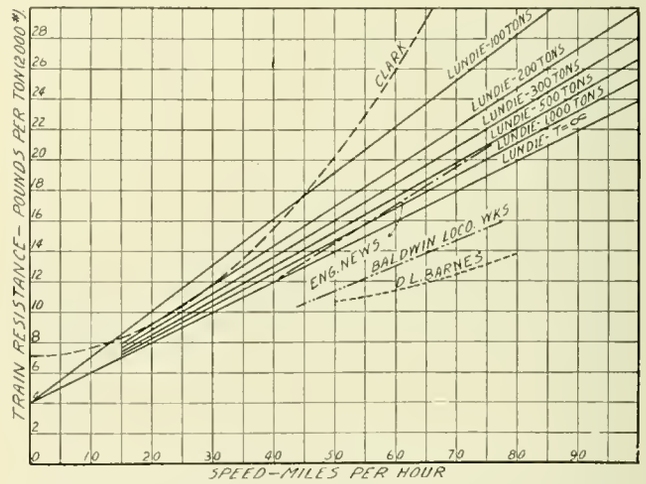
bearing in mind that the latter is generally admitted by engineers to be from one to two pounds too high.

"Now it need scarcely be pointed out that when a formula of this general kind, deduced on mathematical principles from a large series of experiments within a comparatively narrow range of action, is found to be equally applicable over a much wider range, a strong presumption in favor of the soundness of its underlying principle is established. It seems practically certain, therefore, that the Lundie formula is thus applicable to the whole range of passenger train traction on straight, level, exposed track in a calm atmosphere. It cannot, however, be said to be applicable to street cars running on gritty or dirty rails, and, in fact, it is unfortunately too probable that no formula whatever can be devised for street railway work for which a large factor of safety would not have to be allowed in practice to provide for great differences in condition of track."

The table referred to is not reproduced here, but the results shown in it will be apparent from the inspection of the diagram, where a number of formulas for train resistance are plotted. The Engineering News formula was developed after considering the Stroudley, Sinclair and Dudley tests, and it is seen to give results one or two pounds below the Lundie formulas for 200-ton and 300-ton trains. The Engineering News formula is admitted to be too low for speeds below 40 miles per hour and hence the line in the diagram is not shown for lower speeds.

For speeds below 40 miles per hour the "Journal" compares the Lundie and the Clark formulas and finds them in close agreement. Had the Clark formula been correctly stated the agreement would have been found even closer than it was. It is not stated whence the Clark formula was taken, but it appears to have come, with alterations, from the "Engineering News" of June 9, 1892, page 585. The "Engineering News" correctly gives the Clark formula for pounds per long ton as $R = S^2 \div 171 + 8$, and incorrectly gives it for pounds per short ton (2,000 lbs.) as $R = S^2 \div 181.5 + 7.16$. The "Journal" takes part of each of these and gets $R = S^2 \div 171 + 7.16$. The correct Clark formula for pounds per short ton of total train weight is $R = S^2 \div 191.5 + 7.14$.

The later formulas for train resistance were devised because it was found that locomotives were hauling trains which would be impossible were Clark's formula correct; hence it was discarded and formulas made which accorded more nearly with observed facts. A



few years ago the Baldwin Locomotive Works discovered that the formula used in designing engines was incorrect, giving too high values for R. What followed is thus stated by S. M. Vauclain, superintendent of the Baldwin Locomotive Works, in the proceedings of the St. Louis Railway Club, November 11, 1898: "Engine 1027 (a Vauclain compound on the Atlantic City Railroad) exceeded our guarantee about 10 per cent, and Engine 839 on the Milwaukee road exceeded the guarantee by four cars, hauling 13 cars, the train with locomotive and tender weighing 1,200,000 lbs., in the specified time. We immediately proceeded to make an accurate test of Engine 1027. * * * * * Our first effort was to determine the resistance of modern passenger trains at high speeds, and found it as shown [Mr. Vauclain presented a chart showing various formulas plotted; from his chart the Baldwin and Barnes lines of our diagram were taken.—Ed.]; you can compare the curve of Clark's, Engineering News' and Barnes' with ours. We devoted several days to this, taking about three diagrams per mile and from this collection produced the curve, from which all our high speed estimates are made.

"You will notice that the resistance set forth by Clark is considerably in excess of that of the Engineering News, whereas the Engineering News is slightly in excess of ours. Mr. Barnes' card is for 50 miles [and over] per hour. The last two lines are close enough to indicate that Barnes was correct in his determination. The differences in the atmospheric influences of the two days would be sufficient to make the differences in the two lines. The line given by the Engineering News, however, is a perfectly safe one for any designer to follow in calculating the horse power necessary for a locomotive to do a certain prescribed work."

The Engineering News formula is R = 0.24 S + 2.

The Baldwin Locomotive Works formula is R = S ÷ 6 + 3.

The two trains referred to by Mr. Vanclain weighed 322 tons on the Atlantic City, and 600 tons on the Milwaukee road. As the Baldwin formula has been found to be sufficiently accurate and conservative for them to base guarantees of performance on it, it is certainly entitled to great respect. It is granted that the Lundie formula for T = 300 tons is "safe," being 4.6 lbs. (40 per cent) higher than Baldwin's practice at 50 miles per hour, and 6.5 lbs. (42 per cent) higher at 75 miles per hour; by the same token Clark is a still safer guide, for he is nearly 80 per cent higher at a speed of 50 miles.

The formula devised by Mr. Lundie is said to be accurate for trains of from 20 to 100 tons, and for speeds of from five to thirty miles, because obtained directly from experiments. The claims for it should stop here. And even if such were the case it would be highly desirable that more complete data be given, in order that those who are expected to use the formula may judge of the weight to be given it. Details as to the length of run, the methods of taking the velocity, etc., would be very welcome.

A priori, the weight and speed are not the only elements determining the total train resistance. David L. Barnes, in an editorial in the "Railroad Gazette," March 18, 1892, pointed out that for a train on level track an approximate formula in its simplest form would, at least, have as many elements as the following: the friction of the journals, wheels, flanges, etc.; the friction of the air on the side of the train; the pressure per square foot of the air on the front of the train; the area of the front of the train; the weight of the train; the length of the train.

Many of the engineers who have proposed train resistance formulas, have considered the speed the most important element, and neglected all the others; Clark thought that the speed entered in the second power,and made the mistake of not fixing limits to the application of his formula; the three other formulas shown in dotted lines on the diagram were devised on the assumption that the speed enters as the first power only, but they are all confined to narrow limits as to that variable, their authors recognizing that undoubtedly other elements entered which might change the character of the line outside the known limits.

In 1898 S. T. Dodd presented a paper before the Civil Engineers' Club, of Cleveland, (Street Railway Review, December, 1898) which contained some data on train resistance of interurban cars running on T-rails over a straight and level track at uniform speed. The trains weighed from 20 tons to 95 tons, and the speed was from 25 to 50 miles per hour. When the Lundie formula is applied to these data it gives results differing from the observed resistance by from .15 lb. to 8 lbs.

We do not know whether it is Mr. Lundie or the editor of the "Journal" that makes the claim of universal application to passenger service for the Lundie formula, but in either case it is the height of assurance to say that a formula good for passenger trains of 20 to 100 tons at speeds from five to thirty miles per hour, is equally good for passenger trains of all weights at all speeds. The "Journal" states that the Lundie formula is not applicable to street cars on gritty or dirty rails, nor to heavy freight service on steam roads. We have shown that it does not accord with late results obtained with heavy passenger trains at high speeds, and a comparison with Mr. Dodd's tests leads to the inference that Mr. Lundie's results are perhaps not entirely conclusive even for the train weights and speeds investigated.

THE POPULARITY OF THE TROLLEY IN THE BRITISH ISLES.

The trolley must be seen to be appreciated, and its conveniences, experienced in daily life, make staunch friends of all its patrons. This is substantiated by the testimonials below which certainly come from conservative sources. In nearly every English city where mechanical traction has been adopted there was much discussion as to the motive power, and delegations or committees were sent on junkets to other cities in the British Isles and on the continent to inspect traction systems. They all reached the same conclusion, viz., for the particular needs of their own city the trolley filled all the requirements better than any other mode of traction. In spite of this unanimity of opinion each municipal corporation goes through the same painful operations, probably for the sake of retaining the appearance, at least, of British conservatism.

It was proposed to introduce the trolley at Ealing, but objections were raised on the grounds of danger and that property adjacent to the street railway lines would be depreciated, and the following communication was sent to the municipal authorities of the cities having electric railway systems: "Impressions created here that the introduction of overhead trolley electric tramways depreciates the value of property and lowers the character of districts through which the cars run. It is also suggested that the electric lines are more dangerous, and, on scientific, sanitary and economic grounds, afford no greater advantage to a community than horse tramways. Kindly wire opinion on these points, based upon your experience."

The replies are given below, most of them being telegrams, which explain their brevity and force.

Bristol: "Absolutely mistaken impression. Has distinctly improved our district; no longer void buildings and houses. Better class houses than before, as result of over two years' working. Residents unanimously favor overhead electric traction."

Kingswood: "Electric tramways have proved the greatest boon to our district, which had no tramways, horse or otherwise, before. Ratable values improving, and district becoming popular for residence of people engaged in city."

Coventry: "Your telegram just received. Impression quite mistaken; streets through which tramways run among the most progressive in the city. Two years' experience very satisfactory on scores of safety, health and efficiency."

Douglas, Isle of Man: "Continental experience shows property not depreciated, nor character of neighborhood lowered. My opinion electric tramways superior on sanitary, scientific and economic grounds, and possess greater advantages in many ways."

Dover: "Tramways. No justification, from our experience, for impression named. Electric cables no source of danger; great economy over all other traction, especially horses. Send critics here. All local opponents converted."

Dublin: "Overhead trolley traction has increased value of property along line Dublin to Dalkey. Not more dangerous than horse traction; only one accident within nearly two years. More advantages to public on scientific, sanitary and economical grounds."

Guernsey: "System established. Harbor and coast line, no streets, answers admirably; does not depreciate property or lower character of district. More economical than horse traction. Has proved free from danger."

Hartlepool: "Do not think electric tramways depreciate value of property, or lower character of district in this town; is better than horse or steam. Generally appreciated by community."

Kingstown, Dublin: "Value of property along line of tramways here much appreciated, not depreciated, in value, and electric traction, so far as I can ascertain, is not more dangerous than horse traction, while on sanitary grounds it is more advantageous."

Wednesbury: "No depreciation of property followed overhead system here; not one accident has happened since introduction five years ago. On sanitary and economic grounds much preferable to horse or steam traction."

Walsall: "Trams overhead trolley system has been most satisfactory here. No depreciation of property. One accident only. Safer than steam. Have been great advantage to community and are much appreciated. Cleaner, quicker, and better than horse or steam."

Leeds: "Dear Sir.—I have taken the first opportunity of speaking with the chairman of the tramways sub-committee on the question raised by you, and he instructs me to say that, to his knowledge, the overhead trolley electric tramways do not depreciate the value of the property or lower the character of the districts through which the cars run. Our accidents with the electric line are not more serious or frequent than those of horse or steam tramways, and there are greater advantages to a community by electric traction than by horse tramways. The former are highly appreciated here and the system is most successful."

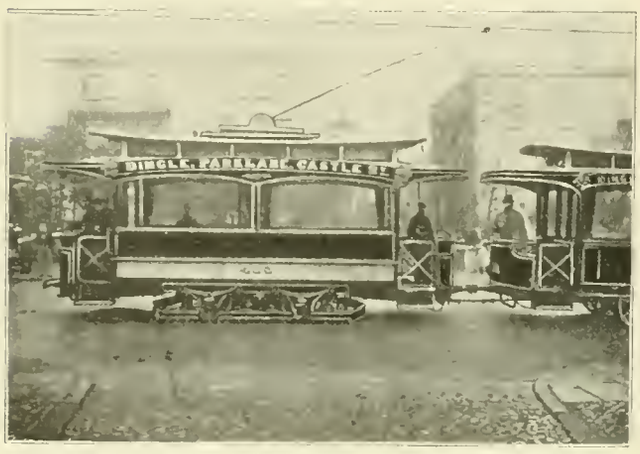
At the annual meeting of the stockholders of the United Traction Company, of Reading, Pa., President John A. Rigg presented the following figures: Receipts from all sources, $430,955; operating expenses, $260,318; gross earnings, $170,637; fixed charges, $166,517. The car-mileage for the year was 1,115,198 and 4,655,028 passengers were carried. The equipment of the company comprises 2,875 h. p. in engines, 2,242 h. p. in generators, 70 car equipments, 47 closed cars, 35 open cars, three trailers, one snow plow and three sweepers.

THE INTRODUCTION OF THE TROLLEY IN LIVERPOOL.

The experimental trolley line of the Liverpool Corporation Electric Tramways has been opened for traffic, and upon its success depends the final acceptation of the overhead electric system for all the surface railways in the great English seaport. Although the line is but 2½ miles long, 30 cars have been provided for the heavy traffic anticipated. Until September, 1897, the tramways in the city were owned by the Liverpool Tramways & Omnibus Company, the track and right of way being leased from the corporation, but at that date the complete system was purchased by the city for $2,757,000. A committee was appointed to devise plans to improve the service and investigations were made both in America and on the Continent. Expert reports were received from Bramwell & Harris and F. S. Pearson, of New York, and the late Dr. John Hopkinson was the consulting engineer for the corporation.

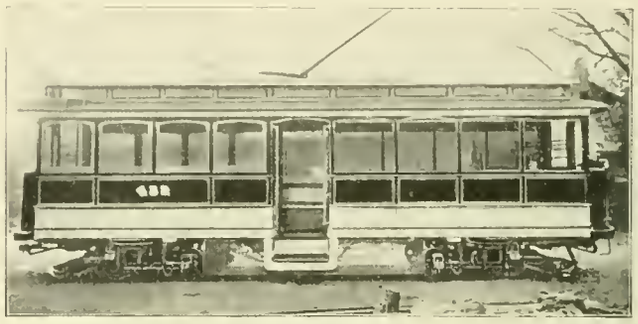
Although little was said publicly about the matter, the committee was confronted at the outset with the opposition to foreign competition, yet several of the most active of the promoters of the improvement were in favor of a free field and no favor. The first success of the opponents of foreign competition was in the defeat of the proposition to employ an American street railway expert. Bids were obtained for steel rails from a number of firms in England, the United States and Germany. It was discovered that the English bids ranged from $2.43 to $7.29 per ton more than the American and German bids. It was claimed that the American and German bids did not fill the conditions exactly as to height and shape of the rails, so the contract for the rails was awarded to a London concern. There was no stipulation as to material, but the understanding was that English rails should be supplied. It turned out, however, that the English company sublet the contract to a German firm, and all the rails which have been laid on the experimental line, just completed, are marked "Made in Germany." The excuse given by the London firm was that, owing to the accumulation of orders on hand, it could not meet the contract in time with English rails. The track was laid with 100-lb. rails on a concrete foundation. The rails were connected with Chicago bonds, but in the new track construction the Falk cast-welded rail joints will be tried.

The overhead construction is mainly span wire suspension, although at some points center poles are used. The side poles are placed at intervals of 120 ft., but in many cases the span wires are attached to rosettes fixed to the walls of buildings adjoining the line. The diagram shows the plan of suspension at one of the principal corners. Two types of poles are employed, one being of single section and the other built up in two sections. The weight of the first type is 950 lbs. and of the second 1,300 lbs. The poles are painted gray, which makes them less noticeable than any other color. The poles are of ornamental design and some of them carry a lantern for a gaslight. The trolley wire is about No. 000 and is hard drawn copper wire of circular section. The trolley wires are divided into sections of a half mile long and reinforced by feeder cables of 400,000 c. m. which are carried in iron troughs. There is an absence of guard wires, which is usual in English cities, but wherever telegraph or telephone wires cross, a strip of wood is attached to the upper side of the wire and effectually guards it.



GERMAN CAR.

Liverpool has tried the experiment of combining the power station of tramways with the lighting station, although separate engines and generators are operated for supplying current for the tramway lines. In the interior view of the engine room the first



BRILL CAR.

three units are for tramway service. The same boiler plant is used for both the tramway and lighting engines. Three compound non-condensing triple-crank Williams engines of 300-h. p. capacity are direct connected to two-pole shunt-wound 550-volt Siemens generators. The normal speed is 350 r. p. m. Working in parallel with the dynamos is a large battery of storage batteries; it is unusually powerful, and could give 1,000 amperes for five minutes, if necessary.

The battery is erected on the floor of a spacious room adjoining the engine room. It consists of 246 cells, manufactured by the Electrical Power Storage Company, each cell containing 21 plates, the battery being rated at a maximum discharge of 480 amperes at 550 volts for one hour.

The switchboard is simpler than one usually finds in a tramway station. An automatic circuit breaker protects the feeder circuits, and a similar device is employed to protect the battery, and the dynamos are supplied with fuses. There are the usual recording instruments, and a special panel is provided to carry out the specified tests of the Board of Trade. An interesting feature is the employment of a booster, one side of which boosts up the feeder current, the other side being employed to prevent fall of pressure in the return circuits. The plant feeds into the line at two points, one near the power house and the other near the end of the line. The new units which are building will be of 1,500 h. p. each. The engines will be of the vertical compound Willans type, and are so designed that they can easily be converted into triple expansion engines. At the Dingle terminus are located the car barns, capable of housing 50 cars. A small repair shop is being equipped, and inspection pits and facilities for handling motor trucks have been arranged.

The type of car to be adopted is another matter for experiment to determine. The committee found that no English firm could build the cars in suitable time, and at first purchased one American and one German car and later 14 cars of each type were ordered. The two types of cars are shown in the illustrations, and it is not difficult to determine the superiority of the American design and workmanship. The Brill car was described in the November, 1898, Review. Each car is fitted with Brill maximum traction trucks and two 35-h. p. Walker motors and series-parallel controllers. The American apparatus was supplied through Dick, Kerr & Co.

The German cars are of two kinds: the "Altona" type and the "Ringbahn" type, as used on the Hamburg tramways bearing these names. Both types of cars are carried on rigid trucks, and are equipped with two 20-h. p. Schuckert motors together with Schuckert series-parallel controllers. There are, in addition, 15 German trailers. Each of the American cars is capable of carrying 40 passengers, while the German motor cars have a capacity of only 20 passengers and the trailers 18. One car is fitted with a Standard air brake, the air pump being connected to one of the axles and the pump automatically cut-out when the pressure in the

air reservoir reaches the maximum pressure. This brake actuates the same brake blocks on the car as the hand brakes, and is found to work very satisfactorily. Electric emergency brakes are fitted to all the cars. The trolleys are of the pivotal type commonly used on American cars. The trailers are used for smoking cars and a reduced fare is charged for transit in them.

POWER STATION.

With a fair trial of the trolley in Liverpool it is needless to say the advocates of gas and oil motors, cable and conduit lines will cease their denunciations of the overhead electric system. The equipment of the other lines for electric traction will doubtless proceed with all the celerity possible with the slow moving municipal authorities.

ELECTRIC CANAL TRACTION IN FRANCE.

The accompanying illustration from "La Nature" shows the scheme for electric canal traction employed since last September near Bethune, in the north of France. It has proved so successful that the method is to be adopted on a length of 50 miles of the canal

ELECTRIC CANAL TRACTION IN FRANCE.

between Bethune and Cambria. The boats are drawn by a three-wheeled electric locomotive operating on the tow-path, and taking alternating current from overhead wires. This machine makes a speed of 1.8 miles per hour drawing boats loaded with 200 tons, about twice the speed made with horse traction.

It is stated that the minority stockholders of the Nassau Electric Railroad will endeavor to prevent the consolidation of that company with the Brooklyn Rapid Transit Company, contesting the matter in the courts.

THE STREET RAILWAY AS A PUBLIC INSTITUTION AND ITS RELATIONS TO THE PUBLIC.

Extracts from an address before the Political Economy Club, University of Chicago, by H. H. Windsor.

Instead of being the extremely simple problem the riding public supposes, a street railway and its operation is a difficult one and complex, and, moreover, presents a radically different aspect as viewed from the several standpoints. While capable of still further division, we may classify under four general heads the cardinal points of the manager's compass; these are: What the public wants; what the employes want; what the city wants, and what stockholders want. Each of these four have claims, and to harmonize these naturally somewhat conflicting interests is the chief end of the operating man; and I may assure you, those who have never stood under the equatorial heat and intensity of service have any conception of the undertaking. Schools have vacations, banks close Sundays and holidays, there are times when the office cat sits enthroned alone in its glory in the daily newspaper office; but there is never a day in the year, or an hour in any day or night, when the heart-beats of street railway operation entirely cease. On a city system cars are always running somewhere.

The riding public everywhere has for years looked upon street railway operation as a decidedly easy matter, and one which almost any person could assume on a moment's notice, and conduct with numerous improvements. The running of the same cars over the same tracks day after day certainly does appear not only easy, but even a monotonous undertaking; and it is this familiarity growing out of the visible portion of the service, and an entire ignorance of the intricacies absolutely necessary to systematic method, which mislead people in a judgment which is not meant to be unfair.

As a matter of fact, there is nothing in the rest of the world in the line of city transportation which can be compared with the street railway systems of the United States. All they have on the Continent has been either made here or copied from this country, and we lead the world in street railways to an extent even greater than in our steam railroads.

This misconception on the part of the public is not so surprising when we remember that the public bases its opinions on what is published in the daily papers, and that in the inevitable haste necessary to daily journalism there is no time to corroborate either facts or figures.

Moreover, the daily press naturally takes advantage of what appears to be popular with the masses, and as it seems to be popular to criticise, condemn and harass a corporation because it is a corporation, it naturally follows that a street railway, not only of necessity a corporation, but also on account of it being a quasi-public one, becomes the notable object and mark for these thrusts. The fact that it occupies public streets with its tracks, and operates its cars along these streets, is taken to be a confiscation of rights private and public; still, every owner of a vehicle, from a peddler's cart to the four-in-hand, uses these same streets for private convenience or gain, giving in return practically nothing for the privilege. And yet the street car is the people's conveyance—the poor man's carriage, without which he would walk to his work or remain at home, when otherwise he may with his family reach the parks and other breathing places. One of its cars, accommodating 30 to 50 riders, occupies no more room on the street than the carriage of the well to do. It does not effect any wear whatever of the pavement, as does the horse-drawn vehicle, and it, moreover, is required, in many cities, to lay and keep in repair from 16 to 18 ft. of paving on the streets occupied by its tracks. The streets are dedicated to public travel, yet no other method of conveyance begins to approach to a fraction of the carrying accommodation rendered by the street car service. On certain streets, moreover, omnibuses and carettes perform a service as common carriers, furnishing accommodations so inferior in point of time and comfort as not to be in comparison; and yet who thinks to criticise these in their appointments, or to limit what possibilities they do possess with restrictions such as are constantly thrown upon a railway? The explanation appears to be in the fact that none of these companies are large enough to attract attention, and it is not expected of them to furnish accommodations at unreasonable hours, nor during any hour of the day when

such operation is attended with a loss. There are very few of what are known as the night cars, running from 1 to 5 a. m. in any city, that have ever paid expenses. The undesirable nature of the work forces the company to pay a full day's wage for the four hour's labor, and yet no one denies the necessity for the service, and I concede it is proper that every company should maintain as good a night service as conditions will permit; but they receive no credit for the same, nor does any one ever seem to think but what it is highly profitable.

Another distinction is in the price charged for service at unseasonable hours. In the early hours of the morning cabs and carriages are allowed a greater rate of compensation than during business hours, and the public takes no exception to the rule, and looks upon the extra charge as fair and just. The street car fare, however, must be no more, although the service is furnished at more than double the cost of day service.

This is but one, and a very inconsiderable, feature of the many services the company performs. The street car makes values as does no other agency. Put a line on a street where a few scattered stores are found and speedily it becomes a business thoroughfare. Take it away and the result is immediate. An illustration in Chicago is Madison street, from Jefferson across the river east to 5th avenue. I remember well when this was the great artery through which the west side daily turned its vast population into the business district. Then the street and Madison street bridge was one moving stream of humanity, day and night; and rents were at a figure high even for those days. What it is to-day, with travel all diverted through the tunnel, is best evidenced by a stroll along those blocks, forsaken by the crowd and with wholesale houses where once were popular retail stores.

Now let us look at this from another side. Have you ever considered the return to the city and state in increased revenue from taxation growing out of values thus enhanced? A farm of the richest land, under climate conditions most highly favored, and capable of producing the choicest fruits and grains, is of practically no value if far removed from shipping opportunities. The rich fruit lands of California had little value until the railroads opened her doors and let out the delightful products of vine and tree. Land which was worth $5 an acre then, sells for $300 and $400 now. Not an electric line passing through a country district, and bringing the farmer into hourly touch with the outside world, but enhances the value, and selling value, too, of the adjoining farms from $5 to $10, and in many cases much more per acre. We think of steam roads as pioneers, and so many of them have been; but with the exception of the Union and Central Pacific, made possible only by governmental aid, the steam roads do not begin to be the pioneers the streets railways have been. The former wait until the population has reached a point, or the natural resources a development which is believed to insure a paying, or, at least, self-supporting business. On the other hand, hundreds of miles of street railways have been laid in the face of certain loss the first few years, and in some cases with the full expectation that no profit need be looked for during a long period. Some have received their reward sooner than expected; many others have not.

One practical illustration of this is close at hand in the line of transportation within a few hundred feet of where we are to-day. This entire territory, nearly a mile wide and two miles long, had lain dormant for 15 years. Once it had a future, but the panic in the early '70s killed its prospects. During all this time values had steadily declined through 10 years, and then remained stationary for five more. How much longer this condition would have lasted no one can say. However, at the time the Cottage Grove line was cabled from 39th street to 72nd street, and east on 55th street to Lake avenue, the spot where we are to-day, while scarcely a howling wilderness, presented a very different aspect. It was all practically farm land, used for pasture, where horses grazed and the lowing of kine were heard; rabbits bounded from bush to bush, and Mother Earth had not yet opened her arms to gas and sewer and water mains. At that time, in going from 55th street to 67th street, I counted exactly 11 houses, which were all there were in sight. In fact, the cemetery to the south presented more signs of activity than all else combined. Take all transportation out of this territory to-day and what would properties be worth, even with the present expensive improvements?

No sooner was this line built than people began to leave the crowded districts north of 31st street, and to erect dwellings hereabouts and for a mile east. At first the buildings were near the tracks; then, as the territory gradually filled up, farther back, until it is as you see it this afternoon. These lines were built under a 99-year franchise; they would not have been laid at the time they were under a 20-year grant. The element of chance was too great. It seems a perfectly safe proposition to-day, but who could assure the growth which did result? Many of the best-posted men in the city shook their heads and pronounced the venture a crazy undertaking which would bankrupt the company.

Would it have been wiser to have waited 10 years, when annexation could have offered only a 20-year lease? Who would have been benefited? Not you nor I to-day—not any of the men and women who had held land at prices from $10 to $35 per foot for over 15 years, unable to sell a lot at any price, but who, in a hundred days, found ready sale at prices ranging from $40 to $100 per front foot. Would the thousands of days' work which were required in the 10 years following to build houses and stores, lay sidewalks, and water and gas mains, build sewers and streets, have been more welcome to those laborers later on? Would those who have had the most delightful portion of the city in which to live and educate their children been better off to have waited a decade? It is practically the same land to-day that it has doubtless been for hundreds of years, remaining unimproved save for a few board fences until transportation came and breathed into it the breath of life.

Why is the entire business life of the country, the money market, and values of every kind put in jeopardy every four years? It is all expressed in the one word, uncertainty. And the larger the interest the greater the caution necessary and the anxiety felt. A battleship cannot turn on the radius of its keel; a fishing smack can put about in smaller space and in shallow water. The larger the interest the farther it must look ahead. When the night is foggy the ocean liner proceeds under slow speed and with caution. If it were foggy all the trip across from New York to Liverpool there would be no six-day records to break.

The street railway of our large cities is a gigantic institution; it cannot revolutionize in a day or a year. To do its best for all concerned, public, employes, stockholders, it is absolutely essential that its course be plainly marked out a long way in advance. But it cannot proceed with a progressive policy, however desirable, and pull up suddenly in a moment. Such a course means disaster just as much as when a ship strikes a rock.

But, you say, we argue for long-time franchises, with fixed fares of correspondingly long periods, and admitting that five-cent fares are just now, will not four cents or three cents or even less be possible in 10, 20 or 30 years? Under the old horse car regime, were not the prevailing rates of fare five cents, and are they any less now? Hence, why tie ourselves up for a long period, only to cause us regret later on? The point is well taken, I concede; but what are the facts now and what is the record? Let us see. The broad claim is made that while economies in production, resulting from labor-saving machinery and competition, have reduced the selling price of all commodities of necessity and luxury during the past decade, street car fares alone of all the rest remain the same. Sugar, petroleum, flour, shoes, iron, books, jewelry, newspapers have bent to the downward trend of prices, but the car fare is a Gibraltar. But is it true? What is the history of car fares the country over, and here in Chicago?

During the horse car regime, which dates from the first car in 1831 to 1885, when electricity came into practical use, there were frequently 10 separate, and some of them competitive, companies in a single city. The longest haul in those days rarely exceeded four or, at the most, five miles, while the majority were probably three miles or less. The service was slow, infrequent and performed with cars dimly lighted and but little better than a shelter. There was no interchange of passengers, and to go three or four miles often necessitated the payment of a second or even a third fare. With the advent of electricity came many comforts, and the ability to use larger and heavier cars than was possible to haul with animal power.

The ability with electricity to supply several roads from one power station brought about consolidations. Without a single exception the public was the direct gainer by this merger system. It became possible to give transfers where formerly two fares were required. On parallel lines, where competition was running empty cars (for I have visited cities where the supply of cars on parallel lines one block apart was two and three times in excess of the possible de-

mands), in such cases the unnecessary cars were removed, and either placed on new lines or held in reserve for emergency. The expense thus saved became available for improvements in numerous ways, but which before were unwarranted. In these consolidations the new company, or the old one absorbing the others, voluntarily surrendered its rights to extra fares. This has been the history for more than ten years. Not only this, but extensions were made in every city, greatly increasing the length of the haul, but without any increase in the fare. This has been continued until in almost all, if not every one, of our larger cities the five-cent fare carries the rider two, three and four times as far as for the amount paid 10 years ago. In other words, on the basis of the ride sold for five cents only a decade ago, the pasenger would to-day be paying 15 or 20 cents.

On the line nearest us to-day, the company voluntarily reduced its rate from 10 to five cents, and the ride is 10 miles. The same is true of many other cities, and I desire to emphasize this fact—not a theory, but a simple fact of easy confirmation—that the street railways have steadily pursued a liberal, a progressive policy; not only have kept pace with the times, but have of their own accord made frequent and valuable concessions of their legal rights, and this, too, in the absence of any moral or legal obligation whatsoever. At the time these concessions were made the public did not even consider it fair to ask these concessions; and yet I am confident that not one of all the companies throughout the country which did this, would have ever dared to accept a franchise and build under it, calling for these concessions at the date they were actually put in force, or even at any date. They could not look into the future and know it would even be a possibility. It does seem to me that it is the lack of information as to what has been the record, the actual history, of the attitude and doings of street railways which lead so many intelligent people to insist on the stringent and unfavorable terms which they do in their treatment of street railways.

A liberal policy pays everywhere, if it is only in the conduct of a peanut stand; give well-baked nuts and good measure. The street railway has demonstrated in a large degree its broad-gaged, progressive, liberal policy. Then accord to it the same kind of treatment and it is my firmest conviction of convictions, after the closest observation for 16 years, that in no other way can the people get so much for so little, so large a measure of return for what they give, as they have and do and will from a liberal treatment of city lines of transportation.

The liberality cannot all be on one side, for in exactly the proportion you burden and restrict a street railway, in just that proportion do you limit its range of usefulness. Does the company ask what you are pleased to term certain privileges and concessions in exchange for certain concessions or performances on its part? If so, it is because the company has been actually forced to use in barter that which, under a liberal and just treatment from the city, it would gladly have done voluntarily. And what, too, are these same "concessions" the company seeks? Investigation will, with scarcely an exception the country over, find them to be that which will go to improve the service and add value to property in which the company has no share.

If the North Side road in Chicago would run its cars through a tunnel it must pay a large sum, build a bridge, and keep the tunnel in repair. The repairs, I grant you, are fair; but why, when it removes several thousand cars from other bridges, thus leaving more room for any who desire to use them, should it pay for getting out of the way? But the tunnel cost public money and is for the public, and we would take it for a car track. Yes, it was built from public funds,and for the public. But did you ever walk or drive through the La Salle street tunnel before the cable cars entered some years ago? I have driven through it several times. It was absolutely deserted; dark, damp, uncanny for the pedestrian, a favorite place for thugs and hold-ups, and so steep that loaded teams kept out. With the exception of that memorable night when the city was in flames, there has rarely in a day passed through so many persons as have gone through every daylight hour since the car tracks made it for the first time of any practical value.

Would it be any improvement to stop the cars across the river and let the tired thousands walk over the bridges and through tunnels to get a car? The public now get daily use of that tunnel; they never did before, and yet it was built for the people.

What a street railway asks it asks for the good of the public and the city, more than for itself, and if you have never studied that assertion, and will do so, you will be surprised. Does the street railway constantly ask for more and new grants? You should congratulate yourself that transportation is being conducted along progressive lines. When a street railway stops expanding you may be sure of one of two things—either that the city has ceased growing, or the public good demands a new manager for that road.

Did time permit I would like to trace for you the evolution and revolution of the street railway. It is as interesting as a romance. It is a story of patient, persevering, ceaseless endeavor toward something better. A few know of the trials and lives and millions of treasure which have gone into the striving; the world has never heard of these. Success only is crowned. I would have told you of the cars of 50 years ago, small wages and long hours. I should like to picture the great social change in the life of the farmer and his family which the trolley has wrought in four years; of the brightness and happiness poured into the life of drudgery of the poor by music and entertainment and parks, now provided free by hundreds of street railways; of reading-rooms and libraries and social clubs, and free baths and benefit associations for employes.

There are so many phases to a subject seeming to possess but few we must pass them by, but I cannot close without a word for the social and moral benefits which it has brought to those whom we are accustomed to term the laboring classes. Why the man who carries a dinner pail is any more entitled to be called a laboring man than you or I, is something I could never comprehend. But what has the railway done for the man with the dinner pail?

When cities were young in point of size in this country, their boundaries were limited by the distance a man could walk in, say, 30 minutes, from place of business or labor to his home. At first this radius from the city's center was about a mile and a half. When the horse car appeared it increased this radius to about double in the direction of the car route. Now the electric car makes it possible to ride 12 miles in the time formerly consumed in walking two.

For 50 years walking and horse cars were practically the only means of travel between work and living place. In those days also the hours of labor were longer, thus placing an additional burden on a greater distance between the two. Thus it happened that our cities were badly congested, becoming more and more so each year. To accommodate this steadily increasing army of laborers tenement-houses, with all their misery, discomfort, unsanitary and immoral conditions, grew rank within our cities. If an epidemic broke out it raged most fiercely here; if a criminal was in hiding he was sought here. Children grew up literally in the gutter, a product of the slums. But how help it? Away out somewhere there was green grass and pure air, but both might as well be across the sea, for all the good they were to these unfortunates. Population extended but little, if any, beyond the end of the track, and there was a positive line where buildings ceased and farms began, in some places as marked as if a wall had been thrown about the city. It was only the more favored class, with time to command, who could live out any distance.

With the advent of mechanical power lines were immediately extended in all directions, as one reaches out his hands for food and air. For the first time it became possible to cover a distance from four to six or even 10 miles in the time previously required to walk one or two. Then followed an exodus as remarkable as that commanded by Moses, and the trolley car led the people out literally to the promised land. A little house on a little lot sometimes, but it was at least a home where the children had a chance to grow up strong physically, mentally and morally. It is the modern system of transportation which has made possible the phenomenal growth of American cities during the past decade, and if this growth had otherwise been possible, consider the home life and condition of the poor, forced up into the air because expansion could go no other way.

No one pays his fare so uncomplainingly as the working man. Could he be heard you would hear him say: "Instead of lower fares, give me longer lines." And when you are inclined to judge harshly of the street railway, don't forget its service to these hundreds of thousands, and the gladdened hearts of the father and mother and the little children, to whom existence has been changed to living by their good friend—The Trolley.

The Consolidated Traction Company, Jersey City, N. J., is now defending a personal injury suit brought by a girl who tripped on an advertising sign fastened to the car steps.

In the Power House

This department is devoted to the construction and operation of electric railway power houses. Correspondence from practical men is specially invited. Both the users and makers of power house appliances are expected to give their views and experiences on subjects within the range of the department.

HIGH-SPEED TANGENT-SPOKE FLY-WHEEL.

In discussing the paper on "Mechanical Features of Electric Traction," read before the Institution of Mechanical Engineers (England) in 1898 by Philip Dawson, the subject of fly-wheels was considered by Archibald Sharp, who presented a design of his own. Mr. Sharp's discussion and the accompanying drawings are taken from the published proceedings of the Institution.

Mr. Sharp said a good deal had been heard about fly-wheel accidents in America; but in this country (England) they were not unknown, for within the last two years there had occurred three accidents to large fly-wheels, one of them involving great destruction of property, in Glasgow, in Barrow, and a few months ago in Lancashire. The fortunate circumstance that no lives had been lost had proved unfortunate for arriving at the causes of the accidents, inasmuch as the fact of their occurrence was consequently known to a limited extent only. When a fly-wheel is in motion, the rim tends to expand under the action of centrifugal force; and the stresses on the rim depend greatly on the method in which it is constrained by the mode of its construction. In a freely rotating rim with a circumferential speed of 100 ft. per second, which is above the safe limit, the circumferential tension produced in the rim is only 0.47 ton per sq. in. of its transverse section. This is probably the low figure which the author (Mr. Dawson) had in mind when stating in his paper that fly-wheels were running with factors of safety varying from 17 to 18; such a margin he thought must be erroneous. In a large fly-wheel with six or eight arms the stresses on the rim are due principally to the bending induced by the constraint of the arms. The bending moment on the rim of a fly-wheel is proportional to the centrifugal force per foot length of rim, and also roughly to the square of the distance between the outer ends of two consecutive arms. The tensile stress due to bending is probably always much greater than that due directly to the hoop tension: so that, in a fly-wheel running with a rim speed of 200 ft. per second, the hoop tension just before bursting might be 1½ tons per sq. in., while the maximum tension due to bending might be somewhere about 7½ tons per sq. in.; consequently on the section of the rim just in line with an arm there might be a maximum tensile stress of 9 tons per sq. in., and a maximum compressive stress of 6 tons per sq. in. Such conditions of stress are quite unsuitable for cast-iron; in fact they are nearly what would occur in a Hodgkinson cast-iron beam turned upside down. A plate fly-wheel is no doubt a good design for a large size, on account of the rim, receiving practically continuous support; and in this respect it is in the same position as a solid disk fly wheel of small diameter; but its cost must militate against its wide adoption.

A fly-wheel designed by Mr. Sharp is shown in Fig. 1; it has been tried with a fair amount of success, and is not of such an expensive construction. It has three distinct features. In the first place it has numerous spokes, so that the unsupported length of rim is small. The wheel illustrated has 24 spokes: so that, comparing it with a six-arm fly-wheel of the same diameter, the stresses due to bending in the rim would be only one-sixteenth—or according to Professor Unwin's exact formula only about one-fourteenth—of those in the rim of the six-arm fly-wheel. The second feature is that the nuts at the ends of the spokes were all screwed up tight in building the wheel, whereby an initial tension is put upon each spoke, and an initial circumferential compression upon the rim. The initial compression put upon the rim should be made great enough to exceed the direct tension due to centrifugal force when the wheel is running. The third feature is that the spokes being slender must be made tangential to the hub and oblique to the rim, otherwise the wheel would not have circumferential rigidity. A direct-spoke bicycle-wheel would be an utterly unsuitable construction for a fly wheel. A subsidiary feature of detail is the method of fastening the spokes to the hub. This is done by frictional grip alone. The spokes are made in pairs, and the middle of each pair is wrapped half round the hub, lying in a spiral groove, as shown in Fig. 1. The sides of the groove are inclined at a small angle, as shown, so that any desired amount of wedging action can be obtained. In the actual running of a fly-wheel so constructed of 10 ft. diameter there had not been the slightest cause of doubt that this mode of connecting the rim to the hub was sufficient. The fly-wheel had been designed for a gas engine to run at 180 r. p. m. with a circumferential speed of 94 ft. per second. In default of exact measurement of the tension applied the endeavor was made to tighten up the spokes to an initial tension of 4 tons per sq. in., which would produce an initial compression on the rim of about one-third of a ton per sq. in: so that, when the wheel was running with a rim speed of 100 ft. per second, the average circumferential stress on the rim would be nearly zero, while the stresses on the spokes would be increased to 4½ tons per sq. in., and the stresses due to the bending of the rim would be only ½ ton per sq. in. for compression and tension. An experiment had been made for comparing the efficacy of this 10-ft. fly-wheel with that of an ordinary fly-wheel of 5½ ft. diameter on the same shaft. The records of the experiment are given by the Moscrop diagrams shown in Figs. 2 and 3. The height of

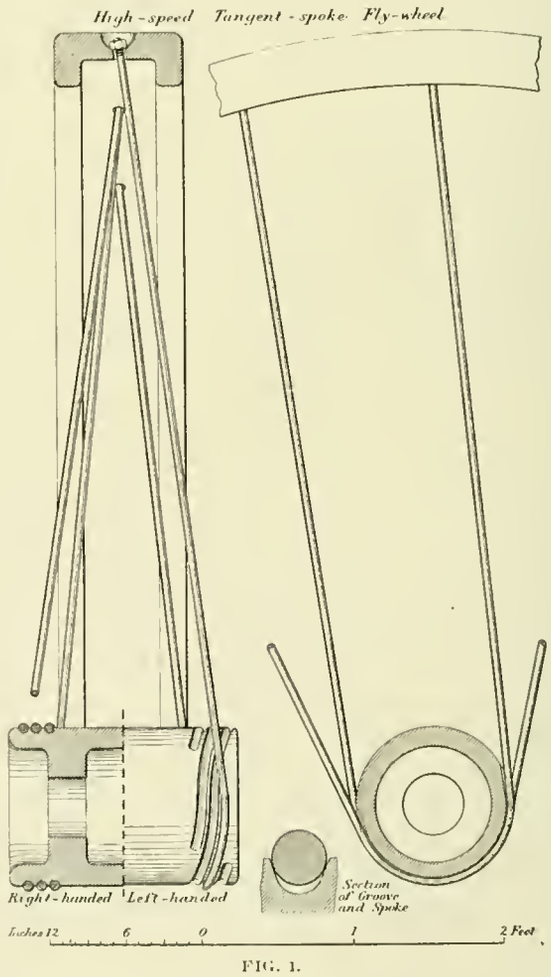


FIG. 1.

COST OF POWER FOR ELECTRIC RAILWAYS.

Output Measured by Wattmeter in Each Case.

Station.	Month.	Monthly Output, Kilowatt-Hours.	Cost of Electrical Output per Kilowatt-Hour Cents. Fuel.	Labor	Supplies, Oil, Waste, etc.	Water.	Repairs.	Total.	Gals. Cylinder Oil per 10,000 k. w. h.	Gals. Lubric'ting Oil per 10,000 k. w. h.	Lbs. Water per Lb. Coal.	Lbs. Fuel per k.w.h.	Price of Fuel per Ton of 2,000 Lbs.	Kind of Fuel
1	Oct.	1,452,271	.293	.165	.037	.027	.055	.577	4.04	1.72	9.40	2.87	2.11	Bituminous
3	"	178,509	.504	.320	.071	.006	.....	.901	10.	6.	. . .	..	2.13	"
4	"	306,950	.409	.208	.039	.005	.058	719	3.20	3.68	. . .	3.78	2.16	"
5. Metropolitan Elevated, Chicago.	"	1,683,619	.300	.140	.020	.020	.020	.500	1.8	4.98	. . .	3.52	1.70	"
8	"	966,992	.508	.223	.067	.....	.007	.805	.....	.....	.....	.....	.....	.....
9	"	249,220	.478	.378	.046	.....	.063	.985	.....	.....	.....	.....	.....	.....
10 Central Av., Metropolitan, Kansas City, Mo.	"	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

the pencil drawing the diagram corresponded with the actual speed of the crank shaft at the instant, so that the amplitude or width of the band drawn by the oscillations of the pencil up and down was proportional to the variations of speed from point to point during the revolutions of the wheel at an average speed of 150 r. p. m. with no load on the engine. The broader band in Fig. 2 pertained to the working of the gas engine under the ordinary conditions with two heavy cast-iron fly-wheels, each 5½ ft. diameter and 1,670 lbs. weight. In the second half of the experiment at the same average speed and with no load on, represented by the narrower diagram, Fig. 3, one of the ordinary cast-iron fly-wheels was taken off, and

Moscrop Recorder Diagrams
from Gas Engine running light at 150 revolutions per minute.

Fig 2. *Two Cast-Iron Fly-wheels 5½ feet diameter.*
Weight of Rims 1470 + 1470 = 2940 *lbs.*
Total Weight of Wheels 1670 + 1670 = 3340 *lbs*
Eleven impulses per minute

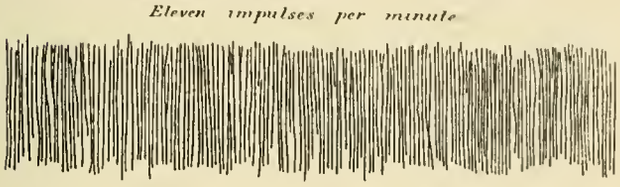
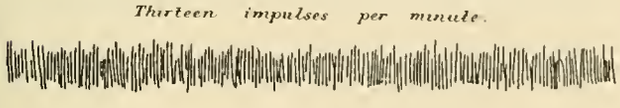


Fig 3. *One Cast-Iron Fly-wheel 5½ feet diameter,*
and one Tangent-Spoke Fly-wheel 10 feet diameter
Weight of Rims 1470 + 2600 = 4070 *lbs*
Total Weight of Wheels 1670 + 2900 = 4570 *lbs*
Thirteen impulses per minute.



the tangent-spoke fly-wheel of 10 ft. diameter and 2,900 lbs. weight was put on in its place, the total weight of the fly-wheels being now 4,570 lbs. against 3,340 lbs. previously, whereby the speed variation was considerably reduced, as seen in Fig. 3. Approximately the speed variations in the two cases were inversely proportional to the moments of inertia of the fly-wheel rims. These two diagrams, Figs. 2 and 3, show the effect of mere weight in a fly-wheel, as distinct from its efficacy or controlling power. The latter is proportional to its weight and to the square of the rim velocity: so that it is to the advantage of the steadiness of the engine to have the rim running at as high a speed as possible. With a heavy fly-wheel the pressure on the bearings, and therefore the total resistance of the engine, is increased, as is illustrated by the fact that the heavier fly-wheels in action, Fig. 3, 13 impulses per minute were required to drive the engine at no load, whereas with the lighter fly-wheels in Fig. 2 only 11 impulses per minute were required.

The power-house of the Dublin (Ireland) Tramway Power Company was fireproofed with tile made by the Pittsburg Terra Cotta Lumber Company of Pittsburg, Pa., and we understand that the purchaser is greatly pleased with the work.

BERTHIER METHOD OF COAL CALORIMETRY.

When a boiler test is made, one of the things to be determined is the efficiency. There are two methods of defining and calculating efficiency: 1. The efficiency of the boiler, which is the ratio of the heat absorbed per pound of combustible to the heating value of one pound of combustible. 2. The efficiency of the boiler and grate, which is the ratio of the heat absorbed per pound of coal to the heating value of one pound of coal. The first of these is recommended as the standard of comparison for all tests; the second is needed when comparing different furnaces, grates, fuels or methods of firing.

To determine the heating value of the coal, recourse is had to various forms of calorimeters. The Berthier method of coal calorimetry was treated in a paper recently read by Charles V. Kerr before the Western Society of Engineers, Chicago, from which the following abstract is taken:

The Berthier method consists in heating a quantity of coal with litharge (Pb O), the air being excluded, and M. Berthier in his "Treatise on Assays," published in 1833, thus describes the method:

"Mix intimately 1 part by weight of the substance, in the finest state of division, with at least 20, but not more than 40, parts of litharge. Charcoal, coke or coal may be readily pulverized; but in the case of wood the sawdust produced by a fine saw or rasp must be employed. The mixture is put into a close-grained conical clay crucible, and covered with 20 or 30 times its weight of pure litharge. The crucible, which should not be more than half full, is covered and then heated gradually until the litharge is melted and evolution of gas has ceased. At first the mixture softens and froths. When the fusion is complete, the crucible should be heated more strongly for about ten minutes, so that the reduced lead may thoroughly subside and collect into one button at the bottom. Care must be taken to prevent the reduction of any of the litharge by the gases of the furnace. The crucible, while hot, should be taken out of the fire and left to cool; when cold, it is broken, and the button of lead detached, cleaned and weighed. The accuracy of the result should be tested by repetition."

In using litharge in clay crucibles a bright red heat should be avoided, because the liquid litharge combines with silica at a high temperature, forms a fusible silicate of lead, and soon perforates the crucible. This property occasions the use of litharge in the manufacture of glass and in glazing earthenware. The purpose of covering the mixture of fuel and litharge in the crucible with a quantity of pure litharge is not only to prevent access of air to the fuel, but also to prevent the escape unoxidized of the more volatile portions of the fuel. And this covering of pure litharge must likewise be protected from the furnace gases. A yellow flame like that of a gas jet would reduce the litharge to lead in the oxidation of the incandescent carbon of the flame; while the blue flame of a Bunsen burner would have no such effect.

The Berthier method is based on Welter's law, which is: "The quantities of heat emitted by combustible substances are proportional to the amounts of oxygen required for their complete combustion."

Thus 1 lb. of carbon requires 2 2-3 lbs. of oxygen for its complete combustion and gives out 14,600 B. T. U. The chemical equation is—

$$C + O_2 = C\,O_2$$
$$12 + 32 = 44$$

When we divide the O_2 by the C we get $32 \div 12 = 2\ 2\text{-}3$, and the heat per pound of oxygen is $14{,}600 \div 2\ 2\text{-}3 = 5{,}475$ B. T. U.

If the oxygen is furnished by litharge the equation is

$$C + 2\,Pb\,O = C\,O_2 + 2\,Pb$$
$$12 + 2\,(206.9 + 16) = 44 + 413.8$$

Dividing the 2 Pb by the C we get $413.8 \div 12 = 34.48$, and the heat per pound of lead reduced will be $14{,}600 \div 34.48 = 423.4$ B. T. U., or Heat = 423.4 (Lead ÷ Fuel).

But Welter's law does not hold true for hydrogen compared with carbon. When hydrogen is burned with oxygen 7,830 B. T. U. per pound of oxygen required are evolved; with carbon the figure was 5,475. This wide divergence has caused the method to be discredited, but Mr. Kerr makes the point that the methods of coal calorimetry correct in theory, on account of experimental errors, give more widely varying and erroneous results than the Berthier method which is defective in theory but freer from errors in practice.

If hydrogen be burned with litharge we get

$$Pb\,O + H_2 = H_2\,O + Pb$$
$$222.9 + 2.02 = 18.02 + 206.9$$

The lead reduced per unit weight of hydrogen is $206.9 \div 2.02 = 102.42$. The ratio of lead reduced per unit weight of hydrogen to that per unit weight of carbon is $102.42 : 34.48 = 2.97$. If Welter's law were true for hydrogen, the heating power of hydrogen would be $2.97 \times 14{,}600 = 43{,}362$ B. T. U. per lb., but this is 18,638 B. T. U. less than its true heating value, which is 62,000 B. T. U. Thus if a fuel containing 2 per cent of hydrogen be judged by the formula, Heating value = 423.4 (Lead reduced ÷ Fuel burned) or V = 423.4 L ÷ F, the heating value will be too low by 2 per cent of 18,638 or 373 B. T. U. Dividing this figure by 34.48 we get 10.8 which must be added to the constant in the formula for V making it V = 434 L ÷ F for fuel with 2 per cent hydrogen such as coke, charcoal or anthracite.

For fuel containing an average of 5 per cent hydrogen the formula becomes V = 450 L ÷ F for bituminous coal, lignite and wood. The percentage of hydrogen in the fuels named is so nearly constant that these last two formulas are probably correct within 1.5 per cent.

When fuel is burned in the ordinary boiler furnace a large excess of air is usually present and the products of combustion are sent into the chimney at a high temperature. It may be of interest, therefore, to consider here the heat actually available in what is at present called good practice. Assume 18 lbs. of air at 32° F., and normal pressure, an excess of about 50 per cent, to be required for the combustion of each pound of fuel, and that the products of combustion together with the excess of oxygen and nitrogen to enter the chimney at a temperature of 400° F. Then the loss of heat to the carbon burned will be about 1,600 heat units, the total carried away by the carbonic acid gas, the oxygen and the nitrogen. Hydrogen will lose almost 15,000 heat units, more than half of which is due to the latent heat carried away in the aqueous vapor or steam. The available heat will be for carbon 14,600 — 1,600 = 13,000 B. T. U. and for hydrogen 62,000 — 15,000 = 47,000 B. T. U. The excess available in hydrogen over that required by Welter's law is $47{,}000 - 13{,}000 \times 2.97 = 8{,}390$. The formulas then become

V = 377 L ÷ F for pure carbon.
V = 382 L ÷ F for fuel with 2 per cent hydrogen.
V = 389 L ÷ F for fuel with 5 per cent hydrogen.

and in this form give at once what a given fuel should do when burned under a boiler in good condition.

Determinations of the heating values of different fuels made by this method showed much more harmonious results than tests made of the same fuels with an oxygen calorimeter, and the author believes this method accurate and reliable. The cost of the crucible and the litharge used in a determination is only 6½ cents.

The annual report of John Overn, chief of the Bureau of Engines and Boilers, in Philadelphia, states that of 3,579 boilers under the supervision of the bureau, 625 are temporarily out of use because electric power has been substituted for steam in these plants. In 1898, 306 new boilers (112 horizontal tubular, 9 compound tubular, 115 vertical tubular, 9 locomotive, 46 sectional, 17 patent) were installed. No boiler explosions occurred during the year; there were two serious accidents to boiler steam piping.

ANNUAL REPORT OF THE STORAGE BATTERY ROAD.

The annual report of the Chicago Electric Traction Company for 1898 has been prepared by General Manager E. R. Gilbert, and the following figures have been extracted from it. During the past year the company has been reorganized and put on a substantial basis. The traffic for the 12 months past has increased 53 per cent over that of the preceding year. On an average 10 cars have been in constant operation, and a total of 609,767 car-miles run, the operating expenses being 8.72 cents per car-mile. The average cost of running a car per day was $14.61.

Perhaps the most interesting data in the report are regarding the batteries and their work. The total battery expense was .758 cent per car-mile. The batteries for the past year averaged 23,233.6 car-miles before being dismantled, the best making a run of 27,174 miles. Experience has shown that one set of negative plates will outlast three sets of positives. The latest positive plates have an increased surface without additional weight, so that they will last about 50 per cent longer than the old ones.

There are in the power station two 250-h. p. Willans triple expansion engines connected through quill shafting to four 250-k. w. generators. For a complete description see the Review for February, 1898. From the report of the power station expenses they are divided: Fuel, 58.5 per cent; wages, 34; repairs, 4; supplies, 2.7; and water, .7 per cent. During the year 4,741 tons of coal were consumed, and the station output was 1,227,228 k. w.-hours, making a coal consumption of 7.726 lbs. per k. w.-hour; cost of coal per k. w.-hour .557 cent, and a total cost per k. w.-hour of .977 cent. In the summer months when a larger number of cars are running and the track and other conditions are more favorable to the operation of the batteries a better showing is made. Last July 61,288 car-miles were run; the output of the station was 104,552 k. w.-hours; coal consumption, 6.77 lbs. per k. w.-hour; cost of coal per k. w.-hour .479 cent, and total expenses per k. w.-hour, .835 cent.

The result of this year's operation have been so satisfactory that some extensions are to be built this spring, including a line from Blue Island to Harvey; in all 6½ miles of new track. A new car barn for 50 cars will be constructed and additional rolling stock purchased.

MILWAUKEE IMPROVEMENTS.

In 1898, the Milwaukee Electric Railway & Electric Company spent nearly $500,000 in extensions and improvements. Among the extensions are the 16-mile Waukesha line, the Whitefish Bay line, displacing the old steam line, and the substitution of electricity on the Wauwatose dummy line. The new power house on River street also called for a large investment. Vice-President Payne states that the principal work of 1899 will be the building of an extension to Calvary cemetery through a portion of the Soldiers' Home and west to connect with the Waukesha line.

The Cleveland City Railway is installing a new engine (marine type) direct coupled to a 1,200-k. w. Walker generator.

The executive committee of the board of directors of the Manhattan Elevated, of New York, has given President Gould full authority to raise funds for the electrical equipment of the road.

In view of the presence of smallpox in Rochester, N. Y., the board of health has ordered that the employes of the Rochester Railway Company be vaccinated at once.

A head-end collision occurred on the line of the Citizens' Rapid Transit Company, of Nashville, Tenn., on January 10, in which one of the motormen was killed and the other injured. There was a dense fog and a misunderstanding as to the proper passing point.

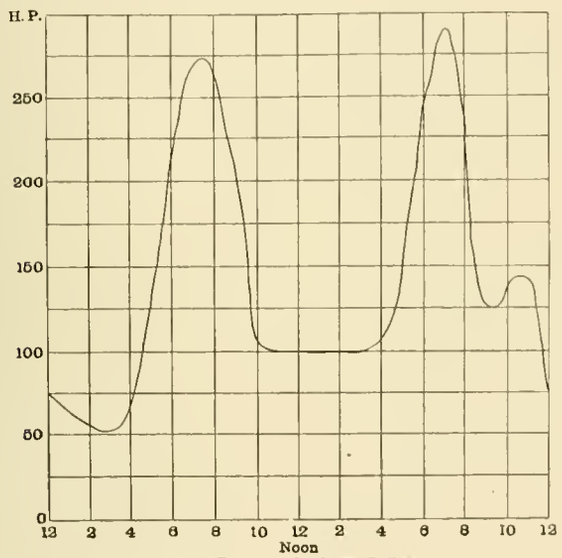
January 25, a freight train on the Puyallup line of the Tacoma (Wash.) Traction Company left the track on a curve at the foot of a steep grade and plunged into a deep gulch. The motorman and conductor both jumped and landed in soft mud, escaping without injury.

Designing Boilers for a Small Street Railway Plant.

BY WILLIAM KENT, M. E.

PART I.

In entering upon the studies preliminary to the design of the steam boilers for a small or medium sized electrical street railway power plant, the engineer must take into consideration some peculiar features of the service required from the boilers which differ more or less from those which govern the design of boilers for other purposes, such as a factory. Such features are: the extreme variations of the load upon the engines from hour to hour, and the consequent variation in the quantity of steam to be furnished; the prime necessity of having the boiler plant constantly in condition to furnish the maximum amount of steam required during the hours of heaviest load; the absence of holidays or slack seasons during which general repairs or alterations may be made; and the considerable uncertainty that exists before the plant is put in operation concerning the actual amount of power that may be required and the probable additions that may be needed as the road is extended or as traffic increases. The first considerations, therefore, in the design of the boiler plant are certainty of operation under the severest load, and capacity for furnishing the maximum amount of steam that may be needed under the most adverse conditions, such



Load Diagram of a Street Railway.

as a combination of heaviest load, bad weather, poor coal, and a portion of the boiler plant being laid off for cleaning or repairs.

To meet these requirements it is necessary not only to have the boilers of sufficient capacity to meet the greatest demand for steam, but also to have enough boilers to allow one of them to be laid off without curtailing the steam supply below the maximum quantity that may at any time be required by the engines. In even the smallest sized plant it is advisable to have not less than three boilers, any two of which are able to run the plant at the time of heaviest loading. In larger plants, four, five or more boilers may be installed, and arranged that any one of them may be laid off at any time for cleaning or repairs without interfering with the operation of the others.

Assuming that our boiler plant is to contain one boiler more than is sufficient to generate the steam required under the conditions of maximum load, the poorest coal being supplied that is ever expected to be used at the station, and the weather the most unfavorable as regards the draft and the amount of moisture in the air and in the coal, we proceed to consider the number, size, proportions and style of the boilers to be selected.

The boiler plant is usually one of the last of the divisions of the complete power plant that are to be designed. Before designing it we must know the maximum quantity of steam that will be needed. The electrical engineer of the railway company will furnish data as to the electrical horse-power that will be required from the dynamos, and he will hand to the steam engineer a diagram something like the one shown in the accompanying cut, giving the heaviest loads expected on the dynamos during 24 hours. From these data the steam engines will be selected or designed, involving a long study of the relative advantages and disadvantages of horizontal and vertical, of simple and compound, of condensing and non-condensing engines, of their size and of their probable steam consumption at different loads. The two "peaks" of the load diagram will be carefully considered, and the question will be decided whether these peaks are to be taken care of by storage batteries, by overloading the engines or dynamos, or by the use of a separate engine and dynamo to be operated during three or four hours of the day when the load is heaviest.

The steam engine questions being decided a careful calculation is then made of the probable steam consumption per hour during the single hour or fraction of an hour of maximum load, having due consideration for the fact that an overloaded engine may be very wasteful of steam. How wasteful will depend on the type of engine. Not until this question is settled is it time to prepare the design of the boiler plant.

The boilers, after one of them is reserved for cleaning or repairs, must be capable of furnishing sufficient steam to the engines during the time of the peak of the load, even when the coal is poor and the weather bad, and the engine not in its best condition as to steam-tightness and valve adjustment; and to this consideration every other one, such as first cost of boilers, or economy of coal, must be made secondary.

The maximum number of pounds of steam per hour now being given, and the pressure of steam required by the engines and the probable feed water temperature being known, we have the data with which to begin figuring on the boilers. By referring to a table of the properties of steam, or to a table of "factors of evaporation," we may reduce this given number of pounds to the equivalent number of pounds per hour evaporated "from and at 212° F." Multiplying the figure so obtained by 965.7 gives the number of heat units per hour to be furnished by the boilers, or dividing it by 34½ gives the number of "boiler horse power." A slight allowance, say 1 per cent, may be added to cover loss of heat due to radiation from the steam pipes.

(Definitions.—A heat unit or British thermal unit; B, T, U, is the quantity of heat required to raise the temperature of 1 lb. of cold water 1° F. A boiler horse power is the evaporation of 34½ lbs. of water from and at 212° or its equivalent. It is equal to 33.317 heat units per hour. When used as a rating of the capacity of a boiler in the market, the term is thus defined by the Boiler Test Committee of the American Society of Mechanical Engineers—code of 1898,—"A boiler rated at any stated capacity should develop that capacity when using the best coal ordinarily sold in the market where the boiler is located, when fired by an ordinary fireman, without forcing the fires, while exhibiting good economy; and further, the boiler should develop at least one-third more than the stated capacity when using the same fuel and operated by the same fireman, the full draft being employed and the fires being crowded; the available draft at the boiler, unless otherwise understood, being not less than ½-in. water column.")

Having the figure of the equivalent evaporation from and at 212° in pounds per hour as the amount of work to be done by the boilers during the time of the peak of the load, we now consider how this capacity is to be obtained. The first essential in a boiler of a given capacity is its capacity to burn coal. No matter what its type or proportions, or the extent of its heating surface, it will not develop the required power unless it can burn enough coal. This qualification strictly does not belong to the boiler itself, but chiefly to the furnace under the boiler, and largely to the chimney, to the area of flues or gas passages through or beyond the boiler, and to the quality of the coal. We must therefore proportion the furnace before we proportion the boiler, and to do this we must first find

out how many pounds of coal are to be burned per hour during the time of maximum steam demand. This is rather a complex question, for it involves many variable elements, such as the quality of the coal, the kind of furnace, the rate of driving of the boiler, and the skill of the fireman.

The number of pounds of coal required per hour will be equal to the quotient obtained by dividing the equivalent evaporation from and at 212° per hour, in pounds, by the number of pounds of water that may be evaporated from and at 212° by one pound of coal. This latter number will vary anywhere from 12, when the best grade of semi-bituminous coal, low in ash, is used, in a furnace adapted to burn all the volatile part of the coal, with a boiler so proportioned as to be capable of absorbing 75 per cent of the heat generated in the furnace, and with skillful firing, down to five pounds or less, with a poor grade of western bituminous coal, high in moisture, ash and sulphur, burned in an ordinary furnace directly under the boiler, with no provision for burning the volatile matter or preventing smoke, with a boiler having insufficient heating surface, and therefore overdriven, and with unskillful firing. With lignite, or lignitic coal, from Utah, a figure as low as 3.70 lbs. has been obtained. (Trans. A. S. M. E. Vol. IV, p. 263.) The writer once obtained as low as 5.09 lbs. from a poor quality of Illinois coal, with expert firing, with the boiler driven 16 per cent below its rating, but with both the furnace and the grate bars unsuited to the coal. (Trans. A. S. M. E. Vol. IV, p. 267.)

To be continued.

THE TRAMWAYS OF LAUSANNE, SWITZERLAND.

The electric tramways of Lausanne are noteworthy not only for the steep grades on all the branches but also for the gas engine installation at the central power station. The Lausanne Electric Tramway Company was organized June, 1895, and secured a 50-year concession from the municipal, cantonal and federal authorities. Work was commenced in March, 1896, and 8.4 miles of tramway were completed in five months. It may be of interest to note that Lausanne is a city of about 35,000 population and is situated on the northern shore of Lake Geneva. The steep slopes, intersected by deep ravines, presented many difficulties for constructing and operating an electric tramway. The map of the tramway system and the data are taken from a contribution by C. Du Riche Preller in "Engineering." As may be seen from the plan the tramway lines comprise an inner circle in the upper or central part of the town with a number of suburban branches radiating out from it.

The altitude of the roadbed varies from 1,246 to 1,900 ft. But 3 per cent of its length is level, the rest having an average grade of 3.5 per cent, and on one line there is a 11.3 per cent grade. Furthermore 36 per cent of the entire length consists of curves with radii from 28 to 330 ft. The girder rails are 4½ in. deep and weigh 60 lbs. to the yard. They are laid on iron sleepers 6 ft. long, weighing 46 lbs. each. The trolley wire is suspended from span wire and brackets, the poles being spaced at intervals of 115 ft.

The power house is situated practically in the center of the system and beside it are the car barn and repair shop. The car barn has accommodation for 16 cars, but it will be increased to shelter 50 cars when proposed extensions are completed. All the cars return to the barn at night. The power house comprises the engine room, 50 by 66 ft., for four sets of gas engines and generators, a gas generating room, 40 by 50 ft., two storage battery rooms and the offices of the company. The three sets of Crossley gas engines are direct connected to six-pole Thury generators by Raffard friction couplings. Each unit consists of two twin gas engines, each developing 75 h. p. at 160 r. p. m. and provided with an 8-ft. fly-wheel weighing 6.5 tons. The gas is ignited from porcelain lamps which are kept incandescent by a burner fed from the gas plant. A mixture of French coal with Belgian anthracite, costing about $6.70 a ton, is used giving a h. p.-hour with 1.3 lbs.; this is a cost of 1 cent per car-mile.

The storage battery consists of 300 elements and has a capacity of 700 ampere-hours, or a discharge rate of 23 amperes at 500 volts for three hours. It works in parallel with the generators and the line, and compensates for the great fluctuations in load resulting from steep grades and is used in case of accident to any of the station machinery.

The rolling stock comprises 21 four-wheel motor cars and one trailer. Each motor car carries 32 passengers and is 23 ft. 4 in. over all and weighs 6.7 tons. A car is fitted with two 20-h. p. four-pole Thury motors, having a single reduction of 1 to 9. The motors always run in parallel, the speed being regulated by resistances placed on the roof of the car. This arrangement has proved satisfactory as the speed can be varied within wide limits. The controller consists of a flat contact box mounted one on each platform, the handle being moved left or right; the sections marked by incisions in the edge of the box. For starting, the handle is moved from the zero point to the left and a movement to the right applies the electric brake.

The cars are heated by two radiators in series absorbing five amperes, and are lighted by six 16-c. p. incandescent lamps. The trolley is a steel tube weighing 22 lbs. Instead of a trolley wheel there is a sliding shoe filled with alloy which wears very rapidly, and is refilled at frequent intervals. When going down grade the motors are thrown in parallel and act as generators independent of the trolley circuit, and the resistance is so designed that the speed does not exceed 5 miles an hour on steep grades. The car is fitted with a screw brake rigging which applies two brake shoes to each wheel. The third brake is for emergency purposes and consists of two steel blocks whose lower surfaces are toothed. Each block is movable in a frame fixed to the car body between the two axles, and when in a state of rest compresses a pair of spiral springs, having the force of a ton to each block. By raising a handle on the platform and thereby releasing the lever which keeps the springs compressed they at once force the blocks downwards so that the serrated surfaces scrape along wood planks placed outside the rails. This brake is very effective although there has been few occasions to use it.

Some interesting figures are given regarding the cost of construction and operation. The cost per mile is based on seven miles, the turn-outs and double sections not being included in that length.

	Total.	Per Mile.
Administration.	$	$
Engineering and general charges	15,840	2,260
Track.		
Rails, sleepers and fastenings	43,400	8,800
Switches, crossings and turntables	5,200	
Excavation, packing and ballast	8,000	
Laying	5,000	
Electrical Equipment.		
Overhead line	22,000	4,400
Underground feeders and return	8,800	
Repair Shop and Sheds.		
Repair shop and car-sheds	11,660	1,900
Waiting rooms and huts	1,540	
Rolling Stock.		
21 motor cars, including equipment	74,400	10,840
One trailer	600	
Three trucks	900	
Tools, Furniture and Sundries.		
Tools for repair shop and sheds	3,000	745
" maintenance of line	1,400	
Furniture for offices and station	880	
Total	202,620	28,945
Power Station.		
Land and surveys	6,600	15,680
Earthworks and walling	7,480	
Building	33,440	
Gas, generating plant and motors	29,260	
Dynamos, storage batteries and switchboard	33,000	
Total	312,400	44,625

The cost of the power station and plant, comprising three units of 150 h. p. each, and a storage battery equal to a further unit of 150 h. p. works out as follows:

			Per H. P.
	H. P.	$	$
Three sets of gas plant and gas motors	450	29,260	65.0
Three sets of dynamos and accessories	450	20,000	44.4
One set of storage and reserve battery	150	13,000	86.6
	600	62,260	103.7
Land, works and building	...	47,520	79.2
		109,780	182.9

The annual operating expenses are divided as shown by the table

		Total.	Per Car-Mile Cents	Per Cent.
	$	$		
Administration and general charges		2,978	.82	7.0
Maintenance of Line and Buildings.				
Wages	2,553	4,521	1.26	10.4
Work	1,968			
Traffic.				
Wages of station masters, inspectors and guards	9,246	10,020	2.82	23.4
Sundries	774			
Traction.				
Wages of motormen and car cleaners	8,020	14,591	4.08	33.8
Maintenance and repairs of rolling stock, lighting and heating of car-shed	6,571			
Sundries.				
Rates, taxes, insurance, &c.		1,965	0.52	4.6
		34,075	9.50	79.2
Power Station.				
Wages	2,461	8,914	2.50	20.8
Maintenance and repairs of machinery and storage battery	2,000			
Fuel, oil and water	4,452			
		42,989	12.00	100.0

The car service varies from intervals of five minutes in the city to 30 minutes on some of the suburban lines, and the fares are differential, depending on the length of the grades. The maximum fare allowed is 4.6 cents for the first mile and 1.5 cents for each succeeding mile with an increase in the latter amount of 50 per cent on grades from 4 to 7 per cent and 100 per cent on grades above 7 per cent. During 1897 there were carried 2,180,430 passengers, and 341,338 car-miles run. The income in 1897 was $55,700 which increased to $76,000 in 1898. The cars each ran on an average of 50 miles per day, and the traffic was about equal to 50 passengers per head of population, which is approximately 44,000 in the city and

MAP OF LAUSANNE TRAMWAYS.

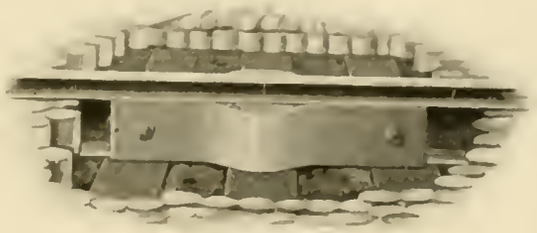
suburbs. The employes are divided as follows: Management, 6; inspectors, 8; motormen, 28; ticket collectors, 25; repair shop and barn, 13; power station, 8; line, 11; total, 99. The wages of the motormen and conductors average 66.5 cents per day of 11 hours.

The average power consumption in summer is about 170 k. w., which in the winter is increased by 2 k. w. per car for heating, making a total of 210 k. w. During the hours of light traffic one unit and the storage battery will carry the load and as the current demand increases another set is thrown in. A dividend of 4.64 per cent was paid in 1897 to the stockholders.

A company of which G. T. Dinwiddie is president; J. W. Morrison, vice-president; James McClamroch, secretary, and D. A. Coulter, treasurer, has been formed at Frankfort, Ind., to build an electric railway.

A NEW CAST-WELD JOINT.

Inasmuch as cast weld joints for street rails are so widely used, the new method of cast welding which has been brought out by the Milwaukee Rail joint & Welding Company, of Milwaukee, Wis., will not fail to interest street railway men. The illustrations show a side view and a section of the joint. It differs from other cast-weld joints in form and in the materials, as it consists of both cast iron and steel. The joint extends along the sides of the rail about 15 in. and projects at the sides opposite the joint, but not below the rails. When making the joints a space about 2 ft. square is cleared about the rail ends and the rail ends cleaned by means of a sand blast; steel strips bowed out to form a cavity around the joint are placed on each side and riveted to the rails; then the rail ends are



THE MILWAUKEE RAIL JOINT.

heated and molten iron poured between the rails and the steel strips.

An important advantage of this method is the small amount of excavation necessary in preparing the track for welding; the roadbed is not disturbed and paving removed is quickly replaced.

In 1897 the company cast-welded the joints on about half a mile of the Milwaukee Electric Railway & Light Company's track; in 1898 10,000 joints on the same road were welded by this method, including a suburban line from South Milwaukee to Milwaukee, a distance of eight miles of exposed track. In welding the South Milwaukee line expansion joints were made from 500 to 1,000 ft. apart, but the company states that subsequent work on other exposed lines shows such joints to be unnecessary; if the joints are

SECTION OF JOINT.

properly made they will hold as well on exposed as upon embedded tracks.

Tests made to determine the electrical conductivity of these joints showed it to be from 118 to 120 per cent of that of the rail. The Milwaukee Railway states that the cost of preparing the track for welding is only one-third as much as when the other processes with molds are used. On the work done in 1897 no joints have broken; in the 10,000 welded in 1898 the breakage has been less than one-half of one per cent.

That the Milwaukee Electric Railway & Light Company is well satisfied with this work is shown by the fact that the Milwaukee Rail-joint & Welding Company has a contract to make 20,000 more joints on this system during 1899; this will complete the work on the Milwaukee road, 15,000 joints having been cast by another company in 1896 and 7.

The Rail-joint Company has its own patents covering this joint, and states that roads using the joint need not fear infringement suits; the outlook for the coming season is very encouraging.

1899 Convention of the American Street Railway Association.

October 17 20 the Time—Executive Committee Meet in Chicago, Lay Out the Program and Decide on Place for Meeting.

The executive committee of the American Street Railway Association met in Chicago February 6 and 7 and decided to hold the next convention in this city on October 17, 18, 19 and 20. Tattersall's, the building selected by the local committee, was accepted as the place for meeting and exhibits.

The following members of the executive committee were present: C. S. Sergeant, Boston, president; Walton H. Holmes, Kansas City, vice-president; T. C. Penington, Chicago, secretary and treasurer; and Albion E. Lang, Toledo; George E. Yuille, Chicago; Frank G. Jones, Memphis; John I. Beggs, Milwaukee, and Ira A. McCormack, New York.

The subjects for reports are as follows:

"The Modern Street Railway Shop:—Its Design, Machinery and Shop Practice."

"Maintenance of Car Equipment."

"Train Service and Its Practical Application."

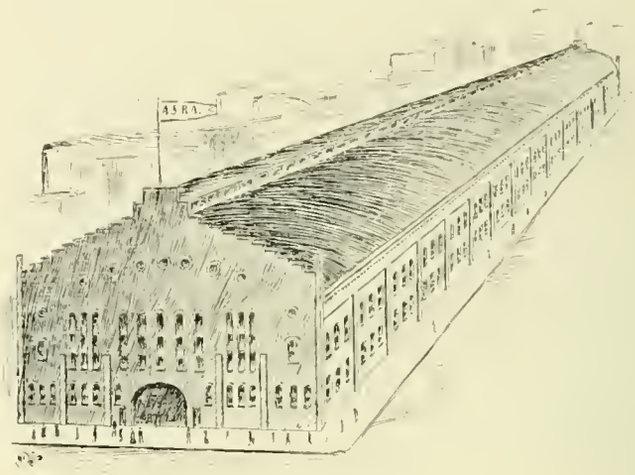
"Investments in Street Railways:—How Can They be Made Secure and Remunerative?"

"Construction and Maintenance of Street Railway Tracks."

It was the unanimous expression of the committee that it was far better to assign a fewer number of reports than has been the custom for many years, and use the time in a very thorough and detailed discussion of the paper. The committee will urge delegates to come prepared to speak on the several questions, and bring data and figures.

The executive committe discussed at some length the matter of excursions and entertainments, the general feeling being based on the expressed wishes of a large number of members of the association that hereafter more time be devoted to the practical work of the convention and less to side trips and sight seeing. While this decision is greatly disappointing to the local committee, which asked for four half days for this purpose, and while it is with many regrets to all our local members that the rule should be first applied to Chicago, the REVIEW feels that it is a move in the right direction, and is on record for two years past in favor of more work and less play. The Association has grown and expanded in its work to such an extent that twice the time is required which was ample ten years ago. Our visiting friends will not be without entertainment, however, and everything will be done in genuine Chicago style, and excursions will be made to various points of greatest interest.

One radical change will be inaugurated which cannot be too highly commended, and which will be alike pleasing and satisfactory to delegates and supply men. For several years past the length of program and multitude of excursions has left practically no time for an examination of the exhibits, and members have been obliged to absent themselves from the meetings or get what chance they could early in the morning or late at night. Several managers of very large roads last year deliberately cut the sessions for an entire day to examine the exhibits, saying they could read the papers and the discussions in the reports, but could not afford to miss the instructive display. On the other hand, it was very discouraging to an exhibitor to go to several hundred or thousand dollars expense

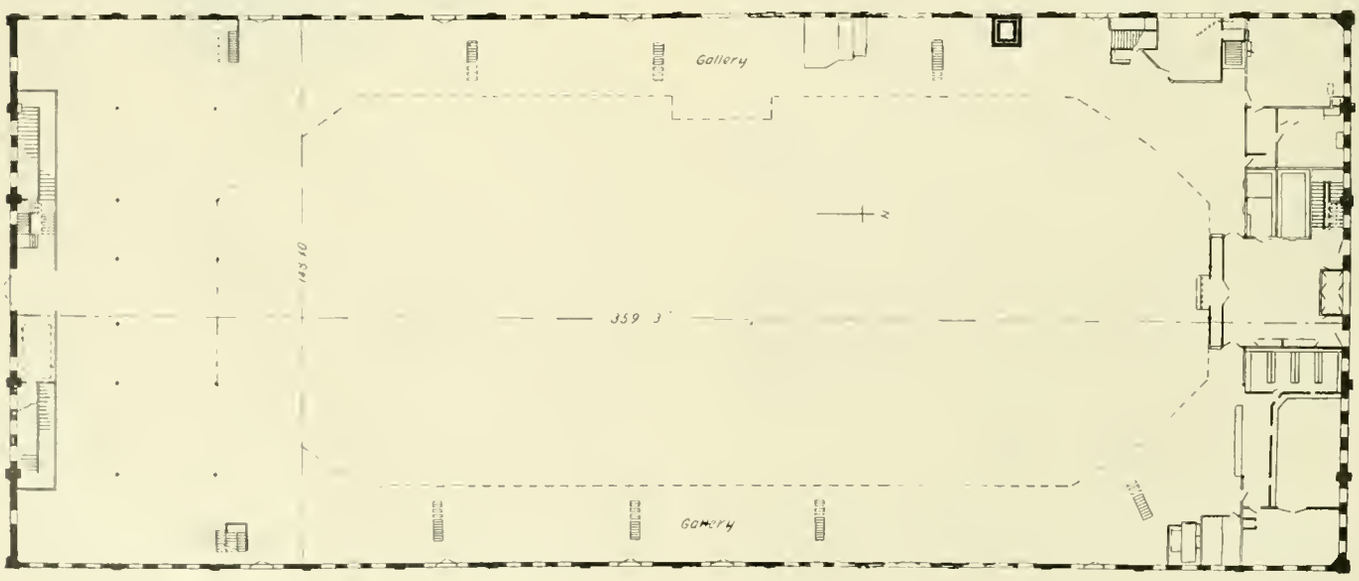


TATTERSALL'S.

in providing a fine display and have it receive only a hurried inspection.

This year one entire day will be devoted to this feature. It will be Friday, the last day, and the installation of new officers and the banquet will occur that evening.

Everyone will be interested in the meeting place. For this the largest suitable building in the city has been engaged. It is on the South Side, reached by three lines of cars from the hotels in ten minutes. Exhibits will all be on one floor, which has a space of over 50,000 square feet, unbroken by posts, as the roof is very high and carried on steel arches. The floor is laid directly on the ground and will support any desired weight. Switch tracks lead to the



FLOOR PLAN OF THE CONVENTION HALL.

side doors, which are ample to admit the largest cars and machinery. Pleasant session rooms for both associations and parlors for the ladies are in the same building. There is an abundance of light day and night and good heat. Tattersall's will afford the largest single-floor space ever had for exhibits.

Secretary Pennington will issue the floor plan and spaces in a few weeks and allot spaces. The price remains the same as last year, 10 cents per square foot. The executive committee were entertained Monday evening by the officers of the city companies. The dinner was given at the Union Club, and most delightfully presided over by J. M. Roach, vice-president of both the West and North Chicago systems, to whom the credit is due for the perfect arrangements of the evening. The guests were all seated at one round table which was elaborately decorated. The menu left nothing to be desired. Those present were: C. S. Sergeant, president American Street Railway Association and vice-president of the Boston Elevated Railway, also A. L. Plimpton and H. F. Grant of the same company; W. H. Holmes, manager of the Metropolitan of Kansas City; Ira A. McCormack, general superintendent Brooklyn Heights Railroad; John I. Beggs, general manager Milwaukee Electric Railway & Light Company; A. E. Long, president Toledo Traction Company; F. G. Jones, vice-president Memphis Street Railway; W. W. Bean, president St. Joseph & Benton Harbor Railway; George E. Yuille, second vice-president, and F. L. Fuller, general superintendent, West Chicago Street Railroad; George O. Nagle, superintendent, and Frank R. Greene, secretary, Chicago City Railway; T. A. Henderson, superintendent, and J. R. Chapman, chief electrician North Chicago Street Railroad; W. Warmsley, superintendent South Chicago City Railway; H. M. Sloan, general manager Calumet Electric Railway; T. C. Pennington, treasurer Chicago City Railway; T. C. Crossman, New York; and H. H. Windsor, editor STREET RAILWAY REVIEW.

After the dinner the entire party attended the theatre and later were entertained at a supper at the Grand Pacific hotel. The following day the guests were taken in Mr. Yerkes' private car and, after calling on Mr. Yerkes, inspected several of the West Side power plants. Returning, lunch was served in the car. The executive committee are highly pleased with the work already done by the local committee and the plans submitted for the future, and express the confident expectation that the convention of '99 will exceed in attendance and importance any yet held, and the Chicago street railway people do not intend to disappoint them.

The local work of the convention will be done promptly and effectively, and within two weeks all arrangements possible to make at this time will have been completed. On the evening of February 10 a largely attended meeting was held at the Auditorium, at which Mr. Yuille presided, in the absence of Mr. Roach, who was ill, and the following committees of workers were appointed.

Members of committees report to their chairmen; the local executive board is composed of the chairmen of the several committees.

GENERAL COMMITTEE.

Chairman, M. K. Bowen, president, Chicago City Ry.
Secretary and Treasurer, Geo. E. Yuille, 2nd vice-president, West Chicago St. R. R.
J. M. Roach, V. P. and G. M. North & West Chicago St. Railroad Co.
Geo. C. Nagle, Supt., Chicago City Railway Co.
H. M. Sloan, Gen'l Mgr., Calumet Electric St. Ry. Co.
H. H. Windsor, Editor STREET RAILWAY REVIEW.
F. L. Fuller, Gen'l Supt., West Chicago St. R. R. Co.
Jas. R. Chapman, Gen'l Mgr., Electrical Dept., North & West Chicago Street Railroad Companies.

ENTERTAINMENT COMMITTEE.

J. M. Roach, Chairman, V. P. and Gen'l Mgr., N. & W. C. St. R. R. Co.
T. M. Henderson, Supt., N. C. St. R. R. Co.
A. S. Littlefield, Railroad Contractor.
Geo. C. Bailey, Jno. A. Roebling's Sons Co., Chicago.
Harry Keegan, Ass't Supt., N. C. St. R. R. Co.
Frank R. Green, Sec'y Chicago City Railway Co.
Geo. A. Yuille, 2nd Vice-President, W. C. St. R. R. Co.

EXHIBIT COMMITTEE.

Jas. R. Chapman, Chairman, Gen'l Mgr., Electrical Dept., North & West Chicago St. R. R. Companies.
C. E. Moore, M. M., Chicago City Ry. Co.
Jno. Miller, M. M., North Chicago St. R. R. Co.
F. T. C. Brydges, M. M., West Chicago St. R. R. Co.
A. C. Heidelberg, Ass't Supt., Chicago City Ry. Co.
Geo. W. Knox, Chief Electrician, Chicago City Ry. Co.
W. F. Carr, Supt., Electric and Track Dept., W. C. St. R. R. Co.
W. A. Harding, M. M., Calumet Electric St. Ry. Co.
N. C. Noe, Engineer, General Electric Co.

TRANSPORTATION COMMITTEE.

F. L. Fuller, Chairman, Gen'l Supt., W. C. St. R. R. Co.
W. Worth Bean, Pres. & Gen'l Mgr., St. Joseph & Benton Harbor Electric Ry. & Light Co., St. Joseph, Mich.
Wm. Walmsley, Supt., South Chicago City Ry. Co.
Wm. J. Cooke, McGuire Manufacturing Co.
T. D. Miles, with W. C. St. R. R. Co.
J. M. Atkinson, of J. M. Atkinson & Co., of Chicago.
Jno. O'Keefe, with Chicago City Railway Co.

PUBLICITY AND INFORMATION.

H. H. Windsor, Chairman, Editor STREET RAILWAY REVIEW.
C. S. McMahan, Western Mgr., St. Railway Journal.
D. B. Dean, Terre Haute Car Mfg. Co., Terre Haute, Ind.
J. A. Hanna, Peckham Truck Co., Chicago.
C. J. Riley, Chief Engineer, Chicago City Ry.
Jno. O'Keefe, Chicago City Railway Co.

HALLS AND HOTELS.

Geo. O. Nagle, Chairman, Supt., Chicago City Railway Co.
A. S. Littlefield, Railroad Contractor.
T. M. Henderson, Supt., N. C. St. R. R. Co.
Maurice Coster, Westinghouse Electric & Mfg. Co.
T. C. Pennington, Treas., Chicago City Railway Co.

BANQUET COMMITTEE.

M. K. Bowen, Chairman, Pres. Chicago City Railway Co.
D. G. Hamilton, Chicago City Railway Co.
M. B. Starring, Ass't Gen. Counsel Chicago City Railway Co.
B. E. Sunny, General Electric Co.
H. H. Windsor, Editor STREET RAILWAY REVIEW.
C. S. McMahon, Western Mgr. Street Railway Journal.
Geo. C. Bailey, Jno. A. Roebling's Sons Co., Chicago.

LADIES' COMMITTEE.

H. M. Sloan, Chairman, Gen'l Mgr., Calumet Electric St. Ry. Co.
Theo. P. Bailey, General Electric Co.
Joseph Leiter, Chicago City Railway Co.
Frank R. Green, Sec'y, Chicago City Railway Co.
F. L. Fuller, Gen'l Supt., W. C. St. R. R. Co.
M. K. Bowen, Pres., Chicago City Railway Co.
C. K. Knickerbocker, Griffin Wheel Co., Chicago.
L. S. Owsley, Sec'y and Treas., N. C. St. R. R. Co.
J. Chas. Moore, Sec'y and Treas., N. C. St. R. R. Co.

FINANCE COMMITTEE.

Geo. A. Yuille, Chairman, 2nd V. P., W. C. St. R. R. Co.
C. R. Pennington, with Chicago City Railway Co.
J. Chas. Moore, Sec'y and Treas., N. C. St. R. R. Co.
W. S. Bell, Ass't Sec'y and Treas., W. C. St. R. R. Co.
H. B. White, Sec'y and Treas., Calumet Electric St. Ry. Co.

The chairman of the General Committee will shortly call a meeting of the General Committee, at which time the duties of the several committees will be outlined, and this information will be transmitted to the members of the several committees by their respective chairmen.

MR. WISE'S VISIT TO CUBA.

Clift Wise, the well-known railway and paving contractor, of Chicago, has recently returned from an extended trip to Cuba, where he visited all parts of the island. Mr. Wise states that concessions for all street railway and similar enterprises which offer any promise of being profitable have already been taken; but that there are most excellent opportunities for men with some capital, say from $5,000 up, to make money in agriculture. While nearly all the plantations have been devastated, and the owners are not in a position financially to put them under cultivation again, they will not sell them; but there is money to be made by leasing plantations and cultivating them. Havana and the other cities are filled with disappointed Americans who went to Cuba in the hopes of securing lucrative positions at once; they have found that it is no place for a man without capital.

Mr. Wise took a large number of photographs while on the island, and has mounted them in a souvenir album which is very interesting.

TO HARNESS NIAGARA WHIRLPOOL.

An effort is about to be made by New York and Buffalo capitalists to harness the Niagara Whirlpool Rapids. Surveys have been made and plans are now ready to put the scheme into operation. John Brinkerbine, of the Franklin Institute, Philadelphia, is the superintending engineer. His plan is to build a raceway inside the gorge road to the power house, which will be situated around the bend of the whirlpool. It is expected that 35,000 h. p. can be generated.

The Union Railroad Company, of Mount Vernon, N. Y., on the night of Jan. 31, laid a mile of track in North Pelham, to connect its belt line around the cities of Mount Vernon and New Rochelle. A decision of the supreme court rendered that day was to the effect that both the Union Company and the New York, Westchester & Connecticut Traction Company had rights in the street. By its diligence in taking possession of the route the Union Company has probably excluded the other.

MERRY-GO-ROUNDS FOR PLEASURE RESORTS

From the experience of street railway managers the most profitable attraction at a summer resort is a merry-go-round, and these, when well managed, will pay for themselves in a short time. The foremost manufacturer of steam riding galleries is the Armitage-Herschell Company, of North Tonawanda, N. Y. The latest and most attractive of these machines is the "Mountain-Valley Railway," which has, in addition to a rotary motion, the undulatory movement of the switchback. Every detail of this railway is elaborately decorated. With the machine is a fine organ, an electric light plant and double engine. It has eight handsome chariots, each seating 12 passengers. For large pleasure resorts this should be a great attraction and a source of large revenue.

The standard machine of the company is 40 ft. in diameter and carries 24 horses and four chariots, holding in all 56 persons. All parts are numbered and easily attached, so that the machine can be readily set up or dismantled and transported from place to place.

The portable engine and boiler are mounted on wheels and weigh about 2,000 lbs. Another type is similar to the last, but has three horses abreast instead of two, there being 36 in all. Each three horses are rocked by two eccentrics, the outside and inside rocking opposite to the middle horse. The total seating capacity is 60, and the machine is considerably larger than the standard outfit. It can be loaded into one furniture car for shipment. This gallery is equipped with an electric light plant, double engine, plate glass center and an organ playing 16 of the latest popular airs.

It should also be stated that the company manufactures electric motors, and in any place where current is available the engine and boiler can be replaced by a motor. The Standard multipolar motor is shunt wound, and is of high efficiency and the best workmanship. All the armature coils are machine wound, baked after dipping in an insulating compound, taped and painted and then laid in mica troughs. These coils are symmetrical and interchangeable, giving a uniform distribution which contributes much towards sparkless commutation. The field coils are also carefully wound and insulated. These motors are made from 1 to 50 k. w. capacity. Compound wound generators of the same type are also made.

Letters have been sent the company stating that in one day the receipts from one of its galleries amounted to $300, another telling of $5,000 being taken in during the month, and another customer took in nearly $13,000 in four months.

SPEED IN FRONT OF SCHOOLHOUSE.

Judge Sutherland, of Rochester, N. Y., has made a ruling on a question relating to negligence that has never before been passed upon by the courts. The case was that of Charles Summers against the Rochester Railway Company. The question was whether a street railway company is guilty of negligence in not running its cars slowly by a schoolhouse, around which young children are in the habit of congregating. Judge Sutherland decided in the affirmative, and held that the contention as to speed of the car in the case on trial was a question of fact for the jury. The action was brought by the father of a six-year-old boy to recover doctor's fees and other expenses caused in caring for the injuries of the child who was run over in front of a schoolhouse in Rochester last September. After deliberating for a few minutes, the jury brought in a verdict in favor of the plaintiff, fixing the damages at $400. A $20,000 damage action brought by the injured lad through his guardian ad litem, to recover for his personal injuries, is now pending.

ST. LOUIS CONSOLIDATION.

It has been announced that C. H. Spencer, representing the purchasers of the Hamilton lines, of St. Louis, has given a Baltimore syndicate, consisting of J. H. Hambleton, C. R. Spence, W. H. Witheridge and others, an option on the Hamilton lines and on the Southern Electric.

Brown Brothers, of New York, have purchased the Missouri and the Lindell properties, and it was announced February 11 that the same firm had made all arrangements for the purchase of the Scullin properties, the Union Depot Railroad, the Grand Avenue Railway, and the Jefferson Avenue Railroad. The first payment of $30 per share has been made to the stockholders. The price agreed upon was $130 a share, making a total of $5,200,000. It is expected that there will be a large outlay for improving and increasing the roads and equipment.

Washington G. Benedict, a prominent street railway operator and real estate man of Boston, died at his home on January 25.

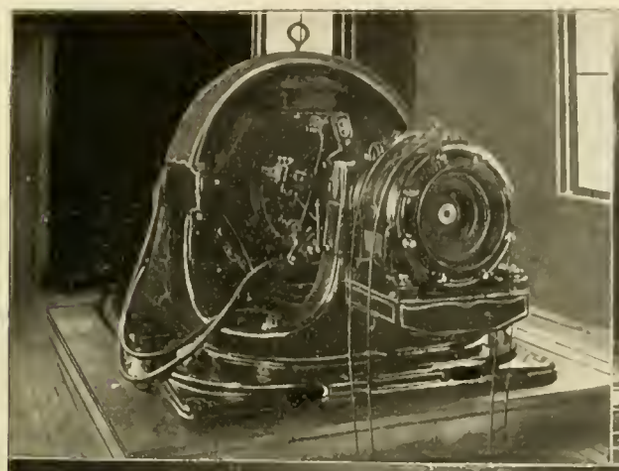
The report of the York (Pa.) Street Railway Company shows receipts for 1898 to be $58,262 as against $52,764 for 1897. The total number of car-miles run was 239,987, the average receipts per car-mile being 14.6 cents.

The Wilkesbarre Interurban Railway.

The interurban line extending from Luzerne, Pa., through Dallas to Harvey's Lake is notable for three features, viz.: Its tortuous roadway with many heavy grades through the mountains; its power station machinery and alternating current transmission lines, and its success both from a financial and operating standpoint where a steam road failed. At Luzerne, which is four miles northwest of Wilkesbarre, connection is made with a line of the Wilkesbarre & Wyoming Valley Traction Company. From this point a steam road was first constructed running 12 miles in a northwesterly direction to Harvey's Lake, which is a great pleasure resort. The steam line was a failure and last year the company was reorganized with John Graham, general manager of the Wilkesbarre & Wyoming Valley Traction Company, at its head. Immediately after the purchase plans were set on foot to equip the line for electric traction. This work was delegated to James Fagen, who for seven years has been the electrical engineer of the Traction Company. The original plan was to build a power station midway on the line, but this was abandoned for a site at Luzerne and alternating currents for transmission.

As may be seen from the various illustrations the route is through a mountainous country, the track being on a curve or grade along its entire length; in fact, the only piece of straight track is south of Harvey's Lake for a distance of 1,600 ft. as shown in the map. Commencing at Luzerne the line goes up into the mountains, passing through several settlements, the largest of which is Dallas, a town of 500 inhabitants. Harvey's Lake is about 1,000 ft. above the sea level and is the largest lake in Pennsylvania, being 12 miles around. At the lake the company has laid out a park and picnic grounds, and built a large summer hotel. On the first eight miles of the line there is a rise of 797 ft., then it drops to an elevation of 301 ft.; the highest altitude being 1,400 ft. above sea level. The average grade along the route is 2.6 per cent. In addition to the lake park there is another picnic ground in the mountains about four miles from Luzerne. In stringing the wire a locomotive was used, and rapid and effective work was done in this way.

There is but one power station and that is on the bank of a small creek at Luzerne at the terminus of the Wilkesbarre road. The power house is a brick building 50 ft. by 80 ft. with a steel truss roof covered with slate. A brick wall separates the boiler from the engine room. Across the creek on a high bank is a coal breaker, and the coal company has contracted with the railway company to build a chute so that the coal can be delivered into the boiler room. The coal is taken from the mouth of the mine and passed into the breaker, where it is properly sorted. A portion of the coal best adapted to use in the furnaces is diverted into the chute and into the railway power station right in front of the furnace door. There are few electric railway companies that are so favored with such facilities for handling and using fuel as this. In the boiler room there are three 200-h. p. horizontal tubular boilers 72 in. diameter by 20 ft. long, made by the Harrisburg Foundry & Machine Works, of Harrisburg, Pa. The stack is set on a brick base outside the building, and is of steel 5 ft. in diameter and 90 ft. high, made by the same company as the boilers. The feed water heaters were made by the Stilwell-Bierce & Smith-Vaile Company. The two



ROTARY CONVERTER IN SUB-STATION.
HARRISBURG TUBULAR BOILERS.

CAR HOUSE.
POWER STATION AND COAL CHUTE.

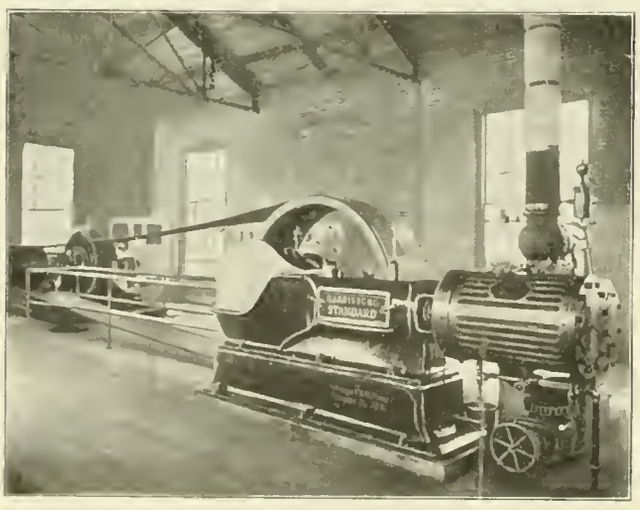
feed pumps were furnished by the same company and are connected so as to take water from either the creek or the city mains.

The two engines are the standard type of the Harrisburg Foundry & Machine Works and are of 300 h. p. capacity each. They are self-oiling and single expansion with a cylinder diameter of 18 in.

STRINGING THE TROLLEY LINE.

and 19-in. stroke, speed 225 r. p. m. The generators are connected with the engines by 27-in. belts. This style of engine has been long and favorably known in electric lighting work and in many of the smaller street railway power houses; in fact it was one of the pioneers in electric stations. These engines may be belted or direct connected to the generators, and the speed regulation by the well-known Ide shaft governor is very close.

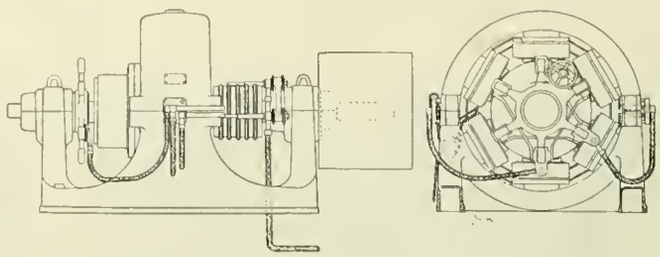
The two Westinghouse generators each have a capacity of 200 k. w. This type of machine has a commutator for delivering direct current at 550 volts at one end of the armature, and at the other there are collector rings from which is taken a two-phase alternating current of 3,600 alternations; the speed of the generator is 600



HARRISBURG STANDARD ENGINE.

r. p. m. The proportions and connections of the machines may be seen in the cut. The direct current is fed into the trolley line sections contiguous to the power station and the alternating two-phase current at 400 volts is raised and changed to an 8,000-volt three-phase current for transmission. The transformers are in a small brick building outside the power house.

After leaving the transformers the current passes to the transmission line consisting of three No. 6 copper wire. The lines are carried on double petticoated glass insulators which are on the same poles supporting the Creaghead trolley arm brackets, as may be seen in some of the illustrations of the track. It was thought that these glass insulators would not stand a potential of 8,000 volts, but so far there has been no trouble with them. The transformer station is located about eight miles up in the mountains. The voltage is here reduced through two Westinghouse static transformers to 400 volts, and the circuits from the transformers are connected through the switchboard to the alternating current end of a rotary converter shown on page 131. This converter is practically the same machine as the generator with the addition of a starting motor on the end of the shaft. The motor is of the Tesla rotating field type



ALTERNATING-DIRECT CURRENT GENERATOR.

and its function is to get the armature of the converter up to speed or in synchronism with the generator. The direct current is fed into the trolley wire, no feed wire being necessary. The trolley wire is No. 0000 round section. The diagram of the circuits of the power station, transmission lines and sub-station is shown below. For each generator and converter there are a direct ammeter, a direct current voltmeter, an alternating current voltmeter and ammeter, all Weston instruments.

Two of the switchboard panels, which are all of white marble, are

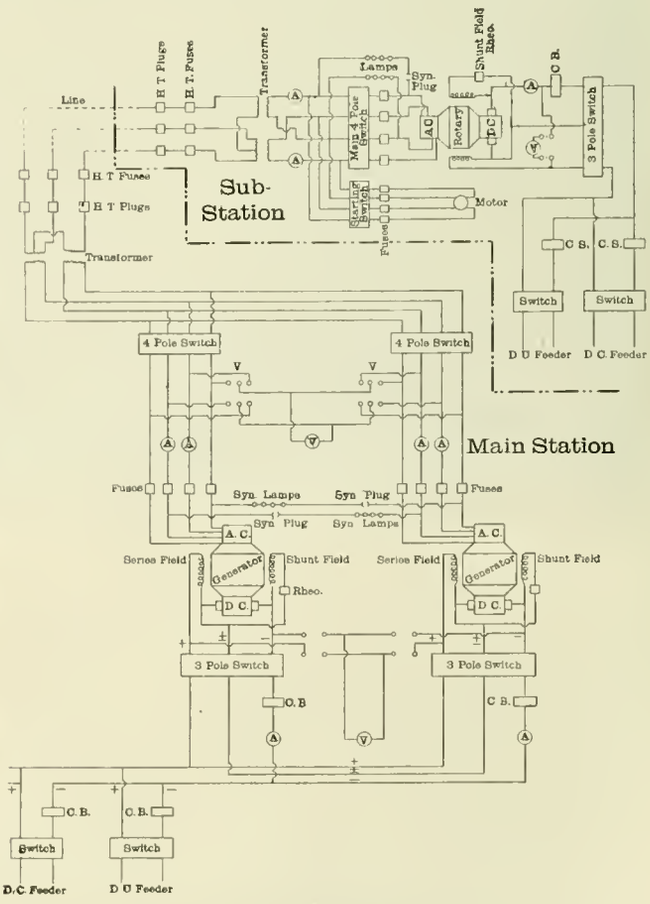


DIAGRAM OF CIRCUITS.

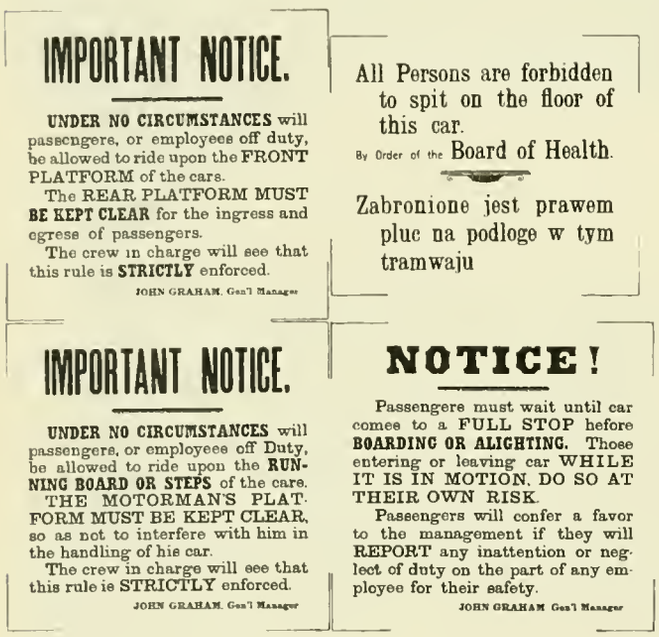
for direct current, two for alternating current and two for feeder connections.

The rolling stock comprises two closed passenger, one closed combination car, five open motor and three open trail cars. The

SCENES ON THE WILKESBARRE, DALLAS & HARVEY'S LAKE RAILWAY.

general appearance of the closed cars may be noted from one of the pictures on the preceding page. The car is 38 ft. over all and is equipped with four 35-h. p. General Electric 1,000 motors, and G. E. electric brakes. The controllers are General Electric B 6 type. Jackson & Sharp double trucks are used under all the cars. The cars have cross seats, are heated with Johns' electric heaters, and New Haven registers are used for recording fares. The signs placed in the cars are reproduced below. The car barn is a large wooden structure, an exterior view being shown on page 131.

The track is single with turn-outs, standard gage, laid with 60-ft. 60-lb. Johnson rails, from the works of the Lorain Steel Company. Horseshoe bonds, made by J. M. Atkinson & Co., form the electrical connections in the return circuit. All the overhead material was supplied by the H. W. Johns Manufacturing Company. Moulded mica round top hangers with heavy galvanized iron shells and ¾ in. steel studs were used to hold the No. 0000 trolley wire. There being a large number of curves on the line about the same number of pull-overs were employed as hangers and these were the standard "giant" type with ¾-in. bolts. The ears for both hangers and pull-overs are extra heavy and made of phosphor bronze. The eye-bolts, cross-arm braces and all iron parts with the exception of the bracket arms are galvanized. A number of the "Philadelphia" section insulators and splicing sleeves were used and made extra heavy on account of the large trolley wire. The company also supplied



SIGNS POSTED IN CARS.

the asbestos fire-felt sectional covering for the steam pipes in the power station.

The officers of the Wilkesbarre, Dallas & Harvey's Lake Railway Company are: John A. Schmitt, president; Theo. S. Barber, secretary; John Graham, treasurer and general manager; Thomas Wright, chief engineer, and James Fagan, electrical engineer. Mr. Fagan, to whom the credit of perfecting the electrical plans for the road is due, was born in Rahway, N. J., in 1857. At the age of 19 he worked in the shops of Thomas Edison at Menlo Park, being engaged chiefly in telephone work. In 1877 Mr. Fagan was employed in the Western Union shops in New York and remained there until three years later when he went to the city of Mexico to take charge of telephone work there. One year was spent at this work and another as consulting engineer for a large importing house. In 1882 he returned to the United States and was engaged with the Excelsior Electric Company. He was general manager and electrician of the lighting station in Harrisburg, Pa. Since commencing electric railway work in Wilkesbarre in 1892, 65 miles of railway have been built under his direction.

That the plans for the interurban have been carried out successfully is shown in the cost of power for the road; it also shows the advantage of electricity over steam for traction purposes under these conditions. The month before the cars were operated by electricity the two locomotives used $250 worth of coal and the coal consumption under electric traction conditions was $50 for the same time. That tells a long story in favor of the trolley.

TO BUILD IN PORTO RICO.

Hon. E. P. Shaw, treasurer of Massachusetts, and his two sons, J. F. Shaw and E. P. Shaw, Jr., who are interested in a number of electric railways in Massachusetts, together with other Boston capitalists, have applied for articles of incorporation under the laws of Massachusetts for the International Construction & Power Company. The company intends to operate in Porto Rico.

In a recent interview Mr. Shaw is quoted as follows:

"My term as treasurer of the Commonwealth expires with the present year, as the law provides that a man can hold the office for but five years. I am now making preparations for future fields of labor.

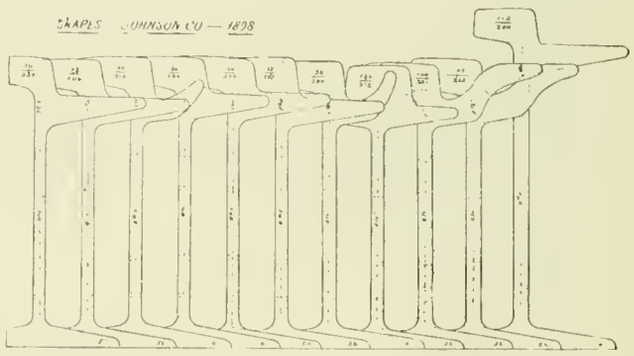
"It is my belief that the next three years or so will be a period of marked prosperity, and this belief has in a measure, I might say, some weight with respect to our present undertaking.

"What may be the outcome of our negotiations for the construction of electrical railways in Porto Rico I cannot say, but it must be remembered that the incorporation of the company is not being sought simply with the view of obtaining work in that island. There are many advantages in carrying out large contracts as a corporation rather than as a copartnership. This fact has appealed to us strongly.

"Some time ago the firm of J. F. Shaw & Co. attempted to secure a contract in Jamaica, but failed, although $8,000 was spent in studying the situation there."

A CONVENIENT CATALOG.

The American Rail Joint & Manufacturing Company, of Cleveland, O., has just issued a new catalog; it has been sent to all the street railways in the United States, and will certainly prove a most convenient reference book. The first 50 pages show sections of the different joints made by the company; then follow 18 pages in which are assembled miniature sections of all the rails rolled in the United



States, save those made by one company which failed to furnish its data in time. On each section are marked the weight, section number, height and width of lower flange. It has required a great deal of labor to make this compilation, but the company will without doubt achieve its just reward. Extra copies will gladly be sent on application. The cut is a reproduction of one of the six pages, showing the Johnson Company's sections.

In six months the N. Y., N. H. & H. third rail electric line has carried 34,421 passengers between Bristol and Hartford.

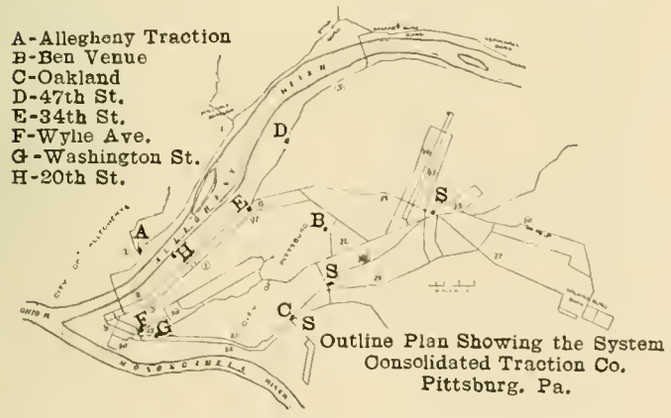
A San Francisco police justice has decided that a street railway passenger may give his transfer to whom he pleases, and refused to enforce a city ordinance punishing the offense. Whether the company concerned will endeavor to prosecute this case further is not now known. The contract of the company is to carry the passenger, and if to accomplish the object in view it gives a transfer ticket, it appears clear that the passenger cannot transfer his rights under the contract to some one else.

New Power Station, Shops and Pleasure Resort of the Consolidated Traction Company, Pittsburg.

The Consolidated Traction Company, of Pittsburg, was chartered in 1895 for the purpose of acquiring, by lease or purchase, the Central Traction Company, the Pittsburg Traction Company, the Duquesne Traction Company, the Fort Pitt Traction Company, the Allegheny Traction Company and the Citizens' Traction Company. The present mileage of the Consolidated is 120 miles. After the consolidation was effected the new company had seven power houses, of which four were cable and three electric. The relative location of these various plants is shown in the accompanying map, which is reproduced from the "Proceedings of the Engineers' Society of Western Pennsylvania."

Several of the stations were so situated as not to be convenient for coal and water supply. This is especially true of the cable stations, since they were necessarily located on the streets on which the cables run, and about midway of the line. The electric power houses were somewhat better located in regard to coal supply, but the 47th street and the Allegheny Traction stations were too far from the center of the system, and the Ben Venue station had no good water supply and only one coal supply. Thus it became evident that for the best efficiency, both in getting the power station in the center of the system and securing the best sources of coal and water supply there was a demand for a new station sufficiently large to carry the whole load, and suitably placed for coal and water supply. The location of the new power house at 20th street and the Allegheny river was chosen because of the natural advantages in securing coal and water, and also because it is not far from the center of the system. The property on which the building is located is 177 ft. deep and about 360 ft. from the harbor line. As the Pennsylvania Railroad has a 30-ft. right of way across the property, the length of the building was limited to 265 ft. The Baltimore & Ohio also has a line running down to the river end of the building, so that the coal supply can be furnished by either of these railroads or from the Allegheny river itself, and an unlimited supply of good water is at hand.

The capacity of the station was determined by extensive tests made on various lines by a testing car and checked by observations on one of the main lines. This was found to be about 6,000 k. w. The plant is designed to have one machine to furnish 1,000 k. w., so at present six machines are required. Provision is also made for the addition of two more units of the same capacity, which will be put



Outline Plan Showing the System Consolidated Traction Co. Pittsburg, Pa.

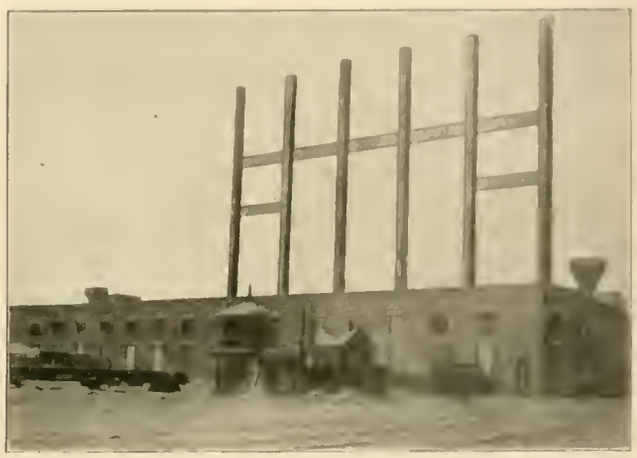
in as soon as needed, and ultimately, with little building expense, the capacity can be doubled, making a total of 12,000 k. w. The capacities of the old electric stations were as follows:

Allegheny Traction, three units	900 k. w.
Ben Venue, four units	1,875 k. w.
Oakland, one unit	800 k. w.
47th street, three units	300 k. w.
Total	3,875 k. w.

The three cable stations aggregated 3,250 h. p., making the grand total of the station capacity of about 8,450 h. p.

The new station has the same capacity as all the old ones, and its operating expenses are less than one-half (about 45 per cent) that of the old ones.

The work of excavating for the foundations was begun September 1, 1897, the total excavation being about 35,000 cu. yds. The floor level of the station was fixed at 1 ft. above the high water mark of 1884, in order that floods might not interfere with the operation of the plant. The intake pipe must be always under water in order not to lose the vacuum; accordingly, it was laid in a trench 13 ft. below the normal river level and over 40 ft. below the surface level. The trench for the intake pipe was over 300 ft. long, extending nearly to the center of the river; the pipe itself is 60 in. in diameter, and is surrounded with concrete to make it permanent and give a good foundation for the machinery above it.


EXTERIOR OF POWER STATION.

The basement walls and all foundations are of American Portland cement concrete, mixed with sand and gravel in proportions varying from 1, 3 and 8 to 1, 2 and 5; the concrete was mixed very wet. Three cement mixers were erected; they were of the worm type, and each was found capable of turning out as much as 500 cu. yds. per day of 20 hours. The cost of materials per cu. yd. for the proportions mentioned was $2.36 and $3.32 respectively; the cost of mixing, delivered by wheelbarrows 150 ft., tamping, etc., was 53 cents per cu. yd.

The engine room is 54 ft. 10 in. wide, 261 ft. long, and 32 ft. 6 in. from the floor to the roof. The basement walls are of concrete, 16 ft. high and 3 ft. thick. The exterior of the station is of Pompeian brick with sandstone trimmings; the interior of the engine room is of Pompeian brick, with wainscoting of enameled brick and slate cap; the floor is a mosaic floor of "granito;" the woodwork is quartered oak. The interior of the boiler room is of red brick; the roof is of cinder concrete, stiffened with iron bars, with felt and crushed slag imbedded in pitch on the outer surface. This is the Roebling construction, system B, type 1.

The steel frame work of the building was furnished by Jones & Laughlin, and the most interesting feature of this is a coal bin of 1,200 tons capacity over the boiler room. The floor of this bin is carried on 12-in. I-beams, 24 in. between centers; the sides are made of plate girders 10 ft. deep and 19 ft. apart.

The boiler room is at the east of the engine room; it is double, that is, provision is made for two lines of boilers. The length of the boiler room is 261 ft.; the width of the side which is to be used for the present boiler room is 38 ft. 9½ in.; the passage way is 10 ft. 3 in.; the other side is at present used for coal storage, and will contain about 2,000 tons. There are six batteries of two boilers each. The boilers are Babcock & Wilcox water tube, of special design, being shorter and higher than the usual make, and having three 36-in. drums 20 ft. long and 18 sections of 1¾-in. tubes. The heating surface of each is 4,000 sq. ft.

The boilers are fitted with down-draft furnaces, having a grate surface of 60 sq. ft., and are guaranteed to give 10 per cent greater efficiency than the ordinary grate, and to burn 40 lbs. of coal per sq.

ft. of grate surface per hour, consuming 92 per cent of the smoke. The boilers have been tested by hydraulic pressure to stand 300 lbs.; the normal pressure, however, is but 125 lbs. Each battery of boilers has an unlined iron stack 66 in. in diameter, and rising 147 ft. above the grate bars, giving a draft of from 1 to 1½ in. of water. Three Worthington duplex direct acting feed water pumps, capable of lifting 240 gallons of water per minute to the elevation of 20 ft., delivering it against a pressure of 160 lbs., furnish water for the boilers. Water may be taken either from the city mains through a meter or from the hot well. After passing through the pump on its way to the boilers the water passes through a small heater which is heated by the exhaust steam from the pumps. The feed piping is entirely of brass and in duplicate at front and rear of boilers; the steam piping is of cast steel. All boilers connect into one main steam line 20 in. in diameter, and all engines connect or tap into this main line. The large steam main is provided with two copper expansion loops.

The coal used in this plant is known as the 3-in. to 4-in. run of mine. It is brought to the plant by rail, and dumped directly into a hopper at the river end of the boiler room. This hopper is provided with a screen which prevents lumps of coal from passing through. From the hopper it passes through an automatic weighing device to a Mead conveyer, and is then carried to the coal bin and dumped where desired. The coal bin is located directly over the central passage way of boiler room, extending the whole length of the building, and has a capacity of 1,200 tons. In addition to this coal bin the east half of the boiler room is used for coal storage, as stated, and has a capacity of 2,000 tons. The coal is delivered to the furnaces by chutes. The coal conveyer passes from the coal bin down to and back through a tunnel beneath the floor of the boiler room to the coal tower; chutes from the furnaces lead into this tunnel, so that the ashes may be carried out by the conveyer when it is not used in carrying coal, or coal may be carried from the coal storage room to the bin in the same manner.

There are now in the engine room eight engine foundations, six of which are occupied by 30-in. and 54-in. by 48-in. cross-compound condensing Corliss engines, built by the Pennsylvania Iron Works Company, of Philadelphia. The distance between the center lines of the cylinders is 20 ft. 6 in. The shaft is 19 ft. 9 in. long and 24 in. in diameter; the fly-wheel is 20 ft in diameter, 18-in. face and weighs 50 tons. Each engine has its own air pump driven from the main shaft. Jet condensers are used. Oil is supplied to the engines under pressure, the tank and pump being located in the basement. The intake pipe, which was previously mentioned, is provided with strainers and will be protected by a crib. The overflow is 36 in. in diameter and placed 3 ft. 6 in. below the basement floor.

At the river end of the engine room in the basement is a well or cistern into which all drainage of the station and tunnel flows. The water is then pumped from the cistern into the overflow pipe by a pulsometer.

The generators are direct connected Westinghouse 800-k. w. machines; they are compound wound for 500 volts at no load, and 550 volts at full load, and are guaranteed to carry 50 per cent overload continuously for an hour or more and 75 per cent momentarily. The engine room has an electric traveling crane, made by Pawling & Harnischfeger, of Milwaukee, which travels the whole length of the engine room, and has a capacity of 90,000 lbs. at 5 ft. per minute; the maximum lift is about 40 ft.

The three-wire system of distribution is used; that is, part of the trolley wires are positive and part of them negative, the rails forming the neutral conductor. If—and in practice it is always the case—the positive and negative loads are not equal, the difference in the current will return to the power house through the rails. This system has been tried a number of times in other places and been abandoned in each instance; the result in Pittsburg will be awaited with great interest. The difference in potential between positive and negative wires is 1,100 volts.

The switchboard is located on the west side of the building. The power system adopted caused a radical change from the ordinary type of switchboard to be made. It is built from the basement floor up to 9½ ft. above the engine room floor, and consists of three vaults with a slate platform covering the top vault; each vault is 48 ft. long, 9 ft. 5 in. wide and about 8 ft. high. On the slate platform are located stands for the electrical instruments. Each generator has a stand provided with an ammeter, voltmeter connections, wheel for regulating the potential, two air valves, one controlling the switch and the other the circuit breaker, and a signal lamp which shows when the circuit breaker is out. Each feeder stand has a similar equipment, with the exception of rheostat and voltmeter connections. There are also a voltmeter stand and an ammeter stand carrying three ammeters. There is also one lighting stand which controls all the lights in the building. The interesting feature of this last stand is that the lights may be thrown on any machine, even though power circuits are all cut out. All indicating and recording instruments are of the Western make. In the upper vault are placed two wattmeters, one on the negative bus-bar and one on the positive bus-bar. Immediately below the floor of the upper vault are placed the bus-bars, in the same horizontal plane, insulated by porcelain and supported by iron I-beams, and below these on the ceiling of the middle vault are placed the switches. These switches are not of the ordinary kind, but act back and forth with slide contact. The circuit breakers are placed on the east wall of this vault and make a pressure contact instead of the usual contact. In the lowest vault are the outgoing feeder cables which connect directly to the lead cables, the neutral cables and the cables from the generators to the switchboard. As was intimated above, there are devices for regulating the circuit breakers and switches. As soon as a circuit breaker is cut out a signal lamp is lighted, and the attendant can at once throw the circuit breaker back by the pneumatic device. The switches may be thrown upon either the positive or negative bus-bar.

When it is desired to keep the switch on the positive bus-bar, there is an interlocking device to keep from throwing it on the negative bus-bar and vice versa. The arrangement is such also that it is impossible to throw the circuit breaker in while this switch is closed. The feeder cables are half positive and half negative. A neutral connection is made from the rails to the neutral bus-bar.

Leading from the power house to the intersection of Penn avenue, and a portion to Liberty street, the current is carried underground through lead-covered cables of 1,000,000 c. m. cross section each. This distance is about 1,000 ft.; for 400 ft. the cables pass through a tunnel 7 ft. 4 in. high and 5 ft. wide made of concrete; the remaining distance they run through conduits. The reason for constructing the tunnel is that the new freight yards of the Pennsylvania road under which the cables had to pass, necessitated such a construction, so that the cables could be inspected if there was any trouble. At the intersection of Penn avenue and 20th street are four cable towers, and one block further south, at Liberty and 20th, are two more towers where the undergound cables connect with the overhead cables, which are 500,000 c. m. each. The length of the overhead cables is about 110 miles. The rails are connected to the neutral bus-bar of the power house by old girder rails, well bonded, 30 being placed in multiple. These rails run directly beneath the tunnel and are imbedded in the cement.

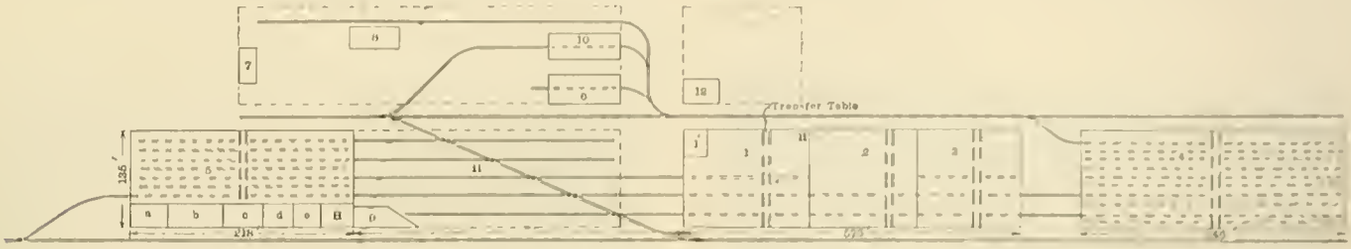
Three storage batteries are used to regulate the current at distant points from the power house; two of these batteries have a capacity of 500 ampere-hours each, and the third a capacity of 1,000 ampere-hours. The large battery is ventilated by air shafts; the other two have no special device other than windows for ventilation. Each battery has 250 cells and is adjusted so as to discharge when the voltage drops below 500 volts. Each battery is about four miles from power station. The locations of the batteries are indicated in the outline plan of the system by the letter "S."

The company has recently erected a large terminal station and extensive repair shops and car barns. These are known as the Frankstown shops and barns, and are located at point 16 on the map. The buildings are of red brick with steel frame-work, and the roofing of matched sheeting covered with tin. The shop building is 576 ft. by 135 ft.; the machine and blacksmith shops take up 216 ft. of this building. All the machines are belted to countershafts, which are driven by a 50-h. p. Westinghouse motor. A 10-ton crane, with a span of 44 ft. 4 in. and capable of lifting pieces 36 ft. from the floor, is provided for conveying heavy work from one machine to another.

One of the most used machines in the shop is the wheel press, by means of which the wheels may be driven on the axles without removing the gears. There are two Bryan car dismantlers, diagrams of which are shown. The process of removing parts from a car is as follows: The car is run upon the dismantling carriage and the truck and car body disconnected. The carriage, which is mounted on four wheels, drops into the pit with the truck, wheels and motors, the car body being supported at four points by sta-

tionary jacks. After the carriage settles to the bottom of the pit it is run out to a side or "L" pit, from "a" to "b" in the diagram, so that the wheels and motors are accessible to the crane; by this means a car can be dismantled in a very few minutes.

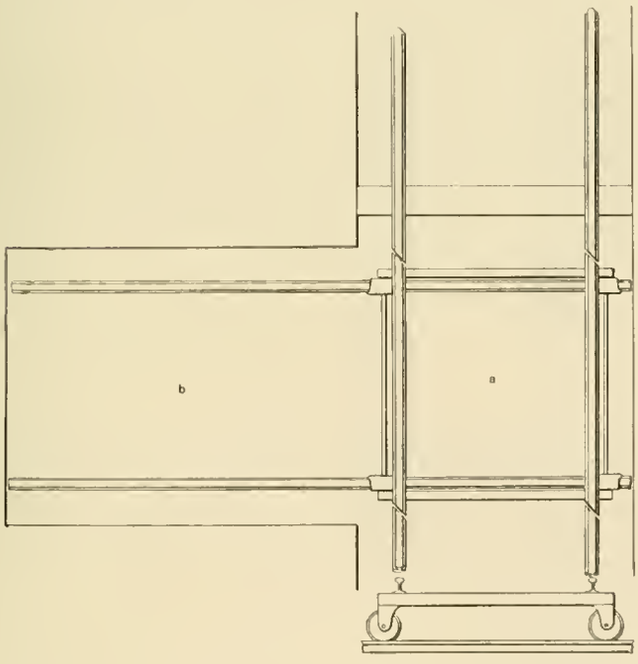
The carpenter shop occupies 180 ft. of the building next to the machine shop, and is equipped with the wood-working machinery made by J. A. Fay & Co. for car building and repairing. A 50-



FRANKSTOWN TERMINAL AND SHOPS.

1. Machine shop.
1'. Blacksmith shop.
2. Wood shop.
3. Paint shop.
4. Car storage house.
5. Operating barn.
6. Store room.
7. Oil and paint stores.
8. Coal and salt stores.
9. Coal, sand and salt.
10. Lumber shed.
11. Operating yard.
12. Boiler room.
a. Receiver's office.
b. Superintendent's office.
c. Lockers, trainmen.
d. Lavatory.
e. Lockers, barnmen.
H. Heating plant.

h. p. Westinghouse motor furnishes power for this machinery. The paint shop is of the same size, and these two, with the machine shop, are under one roof. On both sides of the tracks in the paint shops there are stationary posts with swing arms for platform supports for holding up the car bodies while the painters are working with them. The J. G. Brill Car Company inaugurated this system many years ago. The oil and paint storehouse is in a small building, 20 by 45 ft., and is isolated from the other buildings. This is



divided into three compartments for oil, paint and waste. As may be noted from the plan, there are transfer tables in each of the three above-named shops which greatly facilitate the work.

The storage barn is an immense building, 346 ft. long and 135 ft. wide, with an enormous car capacity. Here either the summer or winter equipment is kept when not in use. At the opposite end of the line of buildings is the operating barn, 218 ft. long. This is heated by the hot-air system of the Buffalo Forge Company. There are two heaters with engines and the requisite piping. Along the east side of the building are the operating offices of the company, the receiver's and the superintendent's, and a locker room containing 500 lockers and tables for the convenience of the conductors in making their reports. On this side is also a locker for the barn employes and a lavatory. The steam for heating the other buildings comes from an isolated steam plant, Weddell return tubular boilers, equipped with Murphy stokers, being used.

In the yard there is a supply house for coal, sand and salt. This building is 24 by 72 ft., with a capacity for six carloads of coal and six carloads of salt. The coal, salt and sand house for daily use adjoins the operating barn. The coal is used for heating the cars in winter. A lumber shed, 46 by 150 ft., for storing and seasoning timber, is separated from the other buildings. The operating yard, 382 ft. in length, intervenes between the machine shop and the operating barn. Each shop has a separate store room, small but complete, and these are arranged to be very convenient. The track outlay may be noted from the plan. It was carefully designed for the greatest convenience in running the cars about the yards, barns and shops. The company is now putting in 120 new equipments of General Electric 57 50-h. p. motors and electric brakes.

The Consolidated Traction Company realizes the importance of having first-class places of public amusement and recreation to

EXTERIOR DUQUESNE GARDENS.

stimulate street railway traffic. The demand for such a resort, it finds, is as great in the winter as in the summer season. Last year it had a hall at Schenley Park for amusements both in winter and summer, having a large skating rink for winter sport. This hall was burned last summer, and instead of constructing a new building, one of the car barns, which is located near the park, was fitted up for winter amusements, which it is expected will be used for concerts, etc., in the summer. The company was able to use this barn, as it was not needed after the Frankstown barns were built. The barn is one of the best buildings owned by the company, and especially adapted for a large skating rink or any other affair requiring large floor space. This resort is known as Duquesne Gardens, and is owned and operated by an independent company, char-

tered for $300,000, and has its own manager. The building is of brick with sandstone trimmings, and is 480 ft. long by 150 ft. wide.

The charms of the place do not fully appear until one enters the building and sees the splendid lay-out, and becomes acquainted with the perfect method of management. The main attraction at the present time is the ice floor, which is 272 ft. long, 90 ft. wide, covered with ice 8 in. thick. To freeze the ice and keep it in good condition is a complete ice-making plant located at the east end of the basement. The plant was put in by the Case Refrigerator

MAIN HALL—DUQUESNE GARDENS.

Company, of Buffalo, N. Y. The ammonia compressors, of which there are two, are driven by Westinghouse motors. These motors were used as generators in one of the street railway stations and are rated at 200 k. w. each. The plan of freezing the water is to have pipes running back and forth through the water, through which pipes brine is driven by a Dean duplex steam pump. There are 26 miles of this pipe in the floor. The brine enters the pipes at a temperature of 15° and returns to the cooling tank at 22°. A much lower temperature can be secured, but it is found that the

LADIES' PARLOR.

above temperature produces a tougher ice than can be produced by a colder brine.

At the east end of the building is a large stage where concerts are held each night. Back of this stage are 16 dressing rooms. The front part of the building is arranged for the accommodation of the people before they go on the ice. Here are check rooms for skates, coat rooms, ladies' parlor, ladies' private parlor, ladies' cloak room and toilet room, men's smoking room and toilet room, superintendent's office and clerk office. There are also two skate counters, where 2,600 pairs of skates are kept for men, women and children. It is the plan of the company to furnish all patrons with a pair of skates free, the patrons having only to pay a small entrance fee. There is also a large soda fountain, said to be the finest in the land; it cost $6,000, and is brilliantly illuminated by 255 incandescent lamps. The building itself is illuminated by 4,000 incandescent lamps and 40 arc lamps. The Traction Company furnishes the light from its 20th street power house. A large auxiliary storage battery is placed in the basement and used to keep

SODA FOUNTAIN.

the voltage constant. The battery is adjusted to feed into the light circuits when the voltage of the line drops below 500 volts. The large ice floor is surrounded by one row of boxes, back of which are three rows of opera chairs, and back of this is a promenade 8 ft. wide. There are seats for 3,800 people, beside the bench around the ice floor in front of the boxes for the convenience of the skaters. The management is very strict in keeping down any appearance of rowdyism. No drinks stronger than soda water are allowed in the building. The garden has proved very popular with the best class of people, being patronized by men, women and children, there being 4,100 people in attendance on the first night. The maximum number on the ice at one time was 2,200. The accompanying illustrations show the exterior of the building, the main hall, the soda fountain and the ladies' parlor.

ANNUAL REPORT OF CHICAGO CITY RAILWAY.

At the annual meeting of the stockholders of the Chicago City Railway Company, Joseph Leiter, second vice-president, was chosen first vice-president, and D. G. Hamilton was elected second vice-president. President Bowen and the other directors and officers were re-elected. The capital stock was increased $2,000,000. The report of operation for the year ending December 31, 1898, was as follows:

	1897.	1898.	Increase.
Gross earnings	$4,816,516	$4,832,806	$16,290
Operating expenses and taxes	2,908,982	2,926,490	17,508
Net earnings	$1,907,534	$1,906,316	$1,218*
Interest	207,877	207,877	——
Dividends	1,440,000	1,440,000	——
Depreciation, etc	50,000	90,000	$40,000
Per cent operating expenses	60.84	60.97	.13
Passengers carried, cable	41,444,646	38,482,628	2,962,018*
Passengers carried, horse	691,051	477,313	213,728*
Passengers carried, electric	53,485,425	57,032,173	3,546,748
Miles run, cable	12,562,610	11,678,020	884,590*
Miles run, horse	198,860	143,900	54,960*
Miles run, electric	11,616,530	12,563,380	946,850

*Decrease.

THE NIAGARA ICE BRIDGE.

The electric roads in and about Niagara Falls have had their incomes materially increased during the past month by travel to view the scenery in the gorge, which, so far as the ice bridge is concerned, has surpassed any previous formation. The Niagara ice bridges, or jams, close to the falls, where the river is very wide and the water at least 200 ft. deep, have a wonderful formation. Sunday afternoon, January 22, while people were crossing the river on the ice bridge, the jam started to move down the gorge toward the whirlpool rapids. Fully 100 people were on the ice, and at its first trembling they made for the shore. All but three succeeded in easily making their escape. One of the three, a young man, watched his chances and as he was being swept down stream leaped from the ice to the main span of the steel arch about 50 ft. out from the abutments of the New York side, a feat that was made possible by the piling of the ice up against the abutments and on the arch fully 80 ft. high. The other two persons on the moving ice, a man and a woman, ran across the current-caught mass toward the Canadian shore. Time and again the woman fell, but each time her companion helped her up, cheered by the crowds of sightseers. Finally they reached the shore, having been carried fully 1,000 ft. on the ice.

This sudden movement of the ice bridge was caused by high water and an immense flow of ice over the falls. It resulted in the formation of the greatest ice bridge ever known at Niagara. It stretched from the foot of the falls down the gorge fully a mile, a solid mountain-like mass. From the tracks of the Gorge Road the view of the ice bridge with the falls as a background is especially fine. Great crowds of visitors came to the Falls, and of this travel the electric roads have their share.

NIAGARA ICE BRIDGES IN 1899.

Niagara has this year inaugurated a winter festival, one of the main attractions of which is an ice palace. This palace is located on the riverway immediately opposite Prospect Park, within a few hundred feet of the stopping place of the cars of the Gorge road and the Buffalo & Niagara Falls line. It is but a short distance from the New York end of the upper steel arch, over which the cars of the Niagara Falls Park & River Railway run, the cars of this line stopping in full view of the palace. The palace has a frontage of about 120 ft. on the riverway and a depth of 50 ft. In the rear within an ice wall a skating rink has been built. On the Canadian side of the river close to the end of the steel arch a toboggan slide has been erected and travel between the palace and slide has been brisk, thus increasing the revenue of the electric car on the bridge and the bridge company.

For the first time in the history of the Niagara region the ice bridge has proved dangerous. The abutments of the new steel arch bridge are located close to the water's edge, but it was thought they were sufficiently high to be out of the way of any ice jam. On the New York side the ice crowded up into the steel work of the main span so that some of the girders were bent, the height of it being 80 ft. or more. Back of it, stretching up to the Horseshoe Fall was a mass of ice, pressed on by the 15,000,000 cu. ft. of water falling over the precipice every minute, making a force which nothing that man has ever built could withstand. The danger to the bridge was recognized and men were quickly put to work blasting the ice away from the abutments. They worked night and day and succeeded in getting the abutments released from the pressure temporarily. Again the ice jammed about the abutments and again it was blasted away, and this process will be repeated when necessary until the ice goes out. Should a sudden thaw come accompanied by a high wind across Lake Erie to drive the water into the upper river, raising it in the gorge and driving the ice down in a mass, great damage might result.

CANADIAN NOTES.

The Halifax Tramway Company is increasing its capacity, both track and equipment. Two box cars, two open cars, two box trailers and one snow sweeper have been recently ordered. The company has purchased adjoining property and erected an additional brick shed for cars 60 by 100 ft., in the basement of which are the stables; the offices have been enlarged by a new brick addition, and in the station much new machinery has been installed.

The Montreal Street Railway Company has declared a dividend of 2½ per cent for the quarter ended December 31. The total earnings for 1898 were $1,526,457, as against $1,397,383 for 1897.

Application has been made to parliament for an act to amend and consolidate the acts relating to the company; to authorize the increase from time to time of its capital stock to such extent as may be necessary for the purpose of its business; to ratify and confirm divers contracts entered into by it with different municipal corporations and railway companies; to authorize the extension of its line to any point within a radius of 10 miles from Montreal, and the operation of such lines, and for other purposes.

The directors have decided to concentrate its shops at the Hochelaga (a suburb) works. In the spring a brass foundry and an iron foundry will be built. The company will make all its own castings, including car wheels, in the future. The company will also make cars for the other Canadian roads controlled by it.

A trolley line to St. Lambert will be operated as soon as the new Victoria bridge, over the St. Lawrence, is completed—about May 1.

The Ottawa (Ont.) Electric Railway Company will apply for authority to extend its lines to various points in the townships of Nepean and Gloucester, and for permission to run cars on Sunday.

The directors of the London (Ont.) Street Railway Company were re-elected at the annual meeting; the board chose H. A. Everett, president, for another year. T. H. Smallman succeeded E. W. Moore as vice-president.

Work on the bridge that is to span the Niagara river gorge, between Lewiston, N. Y., and Queenston, Ont., to which we referred on page 47 of our last issue, has been suspended owing to the dangerous condition of the cliffs on both sides of the river. Nothing further will be done on the bridge until the weather makes the conditions better. There is no possibility of having the bridge ready for use until some time next spring. The retaining walls on both sides of the river have been finished, and the pier work is practically complete. As soon as work is resumed the superstructure will be put in place.

A project is on foot to build an electric railway between Westville, N. S., via New Glasgow, and Stellarton.

G. Whitaker, of Toronto, has been appointed assistant superintendent of the London Electric Street Railway.

The Nepigon Electric Railway Company has applied to parliament for power to run a line from Nepigon Station, on the Canadian Pacific Railway, to Lake Nepigon.

The Board of Trade, of Parry Sound, Ont., has recommended the construction of an electric railway to connect Parry Sound and Depot Harbor. The cost of the road is estimated at $25,000.

The Toronto Street Railway proposes to extend the system to Whitby and Oshawa, and Manager E. H. Keating has prepared a report on the advisability of building branches to Lake Simcoe and Oakville.

The largest driving pulley in the Ottawa Electric Railway power station burst a few days ago, and badly wrecked the interior of the station. The wheel was of iron, and weighed nearly four tons. No one was killed.

John Rowley, superintendent of the Montreal Belt Line Electric Railway Company, has been appointed manager of the Boul de l'Isle Hotel, which has recently been taken over by the Montreal Belt Line Railway Company.

The Mont de l'Isle Electric Railway (Que.), a suburban line, is to be utilized for carrying 500 carloads of ice from the Ottawa river into the city. This is only a beginning of the freight movement on electric lines in this part of Canada, but it will rapidly develop to great proportions.

George E. Kidd, of Ottawa, acting for a syndicate, will apply for a charter incorporating a company to construct an electric railway from Ottawa, Ont., to Meach's lake, with branches to Graham's bay, Aylmer and Hull, Que. As soon as the charter is issued work will be commenced on the construction of the same. The capital stock of the company is $500,000.

The Montreal Incline Electric Railway's fourteenth annual report showed a good cash balance on the right side. The statement showed that a quarter of a million passengers had been carried during the past year. The new board elected are Wm. Mann, President; F. B. McNamee, Vice-President; and directors, Murdock McKenzie, Fayette Brown and James Williamson.

The Niagara Falls & Lewiston Electric Railroad, better known as the Gorge Road, has changed hands, Capt. John M. Brinker and R. W. Jones having parted with their controlling interest in the company, but both remain large stockholders. The interest they sold was represented by bonds. The purchasers are stated to be New York parties, no names being mentioned as yet. Joseph R. Megrue, of New York, formerly manager of the Detroit & Lima Northern line, has been appointed manager, and has taken charge of the affairs of the road.

The St. Catharines & Niagara Central Railway has been purchased by an American syndicate, and is soon to be equipped for electric traction; power will be generated at some points on the Welland canals. The road now extends from St. Catharines to Niagara Falls, where it connects with the Buffalo and the Lockport electric lines. W. Caryl Ely, it is stated, has enlisted capital to extend his Lockport road to Rochester, 56 miles. It is proposed to extend the Canadian line 3 miles from St. Catharines to Port Dalhousie to connect with steamers for Toronto, and 12 miles to Beamsville to connect with the Hamilton, Grimsby & Beamsville. From Hamilton a line will be built 18 miles to Oakville, connecting there with an extension of the Toronto system.

The Metropolitan Elevated, Chicago, proposes to build an extension into the towns of Cicero, Proviso and Leyden.

HALF FARES.

The Milwaukee Electric Railway & Light Company has subscribed $3,500 to the Milwaukee Carnival Association.

February 3, a car became unmanageable and was derailed at the foot of the Leverington grade, in Philadelphia, making the third accident at that point within a year.

Some of the students of the San Francisco institutions affiliated with the University of California are in trouble for hazing a street car.

The Canton & Massillon (O.) Electric Railway Company has decided to require all its employes to give bonds from one of the surety companies.

The longest power transmission system in the world, that from Santa Ana river to Los Angeles, Cal., a distance of 80 miles, was completed January 26.

Elgin, Ill., has ordered certain of its streets to be paved with brick and directed the street railway company to remove its T-rails and substitute a tram rail.

The Springfield (Mass.) Street Railway Company has had the bridge over the Connecticut river, which is occupied by it, examined by experts, who found it perfectly safe.

The Cleveland Electric Railway has put on a large double truck car for trial, and President Everett states that such a type will probably be adopted eventually on all lines of the company.

January earnings of the Brooklyn Rapid Transit Company's system were $452,347; this is an increase of 14.2 per cent over January, 1898, and an increase of 20.2 per cent over January, 1897.

The cable line on San Pablo avenue, San Francisco, is to be superseded by an electric line; several car-loads of rails are on the ground and the work of rebuilding is proceeding rapidly.

The statement that the controlling interest of the Brooklyn Rapid Transit system is seeking to acquire the Long Island Railroad system and the two Brooklyn elevated roads, is strongly denied by all parties concerned.

The electric railway from Cairo, Egypt, to the Pyramids, which has been noticed in the daily papers of late, is the line, a description of which was given in the REVIEW for May, 1897, page 317.

January 29, two cars in Cleveland collided in a fog; no one was injured, and the cars would have been but little damaged had the shock not overturned the stoves in both cars, which caught fire and were badly wrecked before the fire department reached the scene.

The Lexington, Mass., authorities have granted the Lexington & Boston Street Railway franchises for a road in that town. This company proposes to connect Lexington and Waltham, also build a line completing the electric connection between Lowell and Boston.

The newly organized French Westinghouse Company has received the contract for the electrical equipment of the Paris Metropolitan Railway. This is one of the largest orders recently placed for a European road; the work will probably be done at the company's works at Havre, formerly the Heilmann locomotive works.

The annual meeting of the National Electric Light Association will be held in New York, May 23 to 25, inclusive, with headquarters in the Murray Hill Hotel. At this time the Electrical Ex-

hibition Company will have an exhibition in Madison Square Garden under auspices of the association and in connection with the meeting.

The Massena Street Railway Company of Massena, St. Lawrence county, N. Y., has been incorporated; capital, $100,000. Directors, Thomas H. Gillespie, H. A. Johnson, E. M. Statthers, Howard Hasbrough, Edward M. Nolan, Thomas D. Harris, Williard A. Esselstyne, James R. Jones of New York and Robert Swan of Massena.

S. R. Smith, superintendent of the Black River Traction Company, of Watertown, N. Y., was presented by the employes of the company with a silver mounted umbrella, and a handsomely engrossed testimonial bearing the signatures of his men. Mr. Smith responded in a felicitous manner to the employes when these tokens of respect and esteem were presented to him.

The Pacific Electric Railway Company has been incorporated for 50 years, with a capital of $1,000,000, to operate electric railways in Los Angeles, San Bernardino, Riverside and Ventura counties, California. The subscribers to stock are: I. W. Hellman, $96,500; Charles Seyler, James W. Hellman, F. M. Nickell, W. C. Patterson, Frank P. Flint and Frank A. Gibson, $500 each. The board of directors consists of all the stockholders except I. W. Hellman.

Assemblyman Hall has introduced a bill in the New York legislature which provides for reduced fares for children on railroads in cities of the first class. Each railroad company is compelled to issue coupon tickets for a round trip, which shall be furnished to the principals or head teachers of the public schools, who shall sell them to the pupils. The tickets, however, shall be good only between the hours of 8 and 9 o'clock in the morning, 12 noon and 1 o'clock in the afternoon, and 3 and 4 in the afternoon.

The Braddock & Homestead, the Homestead & Highlands, and the Braddock & Duquesne electric roads, near Pittsburg, Pa., have been merged into the Monongahela Street Railway Company. The new company has been operating for several months, though the new concern may be said to be as yet in its formative stage, since numerous improvements and extensions are contemplated. The company now operates 17 miles of double track. The car barn and operating office are at Rankin, Pa.; the general offices at 512 Smithfield street, Pittsburg.

A new time card has been arranged by Wm. Walmsley, superintendent of the South Chicago City Railway Company, giving the time the cars leave the terminals and pass transfer points. It is in the form of an eight-page folder, and is very conveniently arranged for the patrons of the cars. Under the name of each line the hours are printed in heavy-faced type, and in the space to the right the minutes are given so that the schedule of each car is readily determined. On one page is a map showing all the lines of the South Chicago and the Hammond, Whiting & East Chicago Electric Railway Companies.

There has been an unusually protracted spell of severe weather in Chicago during the latter part of last month and the first of this, which has been very trying to the street railway employes. In order to make the men more comfortable while at work on cold and windy days, Superintendent Geo. O. Nagle, of the Chicago City Railway Company, had sandwiches and coffee served to the motormen and gripmen. Bricks were also provided, which were heated in the car stoves, and placed so the grip and motormen could stand on them while on duty. The train crews greatly appreciated these attentions, for they added much to their comfort.

J. M. Shank, president of the Lebanon (Pa.) & Annville and the Lebanon & Myerstown Street Railway Companies, withdrew from the management of both companies on account of the press of other business interests. S. P. Light was elected president of both companies, H. H. Light, secretary, Frank H. Reinoshl, treasurer, and Charles H. Smith, superintendent. S. P. Light has long been known to street railway men as secretary of the Pennsylvania Street Railway Association. Superintendent Smith was complimented by the directors for his efficient management. A semi-annual dividend of 2 per cent was declared.

The horse car line in Niagara Falls, Ont., has sent a communication to the town council asking that it be allowed to change from horse to electric power on the present line and to build a branch down Bender avenue to Mowat gate of Queen Victoria Niagara Falls Free Park, and up Clifton Hill to Center street. Here the route would change, and instead of following Victoria avenue, as at present, it would continue out Center street to Ellen street and on to Ferry street. A line would also be built out to Lundy's Lane, and the right of way would be asked to Victoria and Culp streets, making a loop line to Falls View.

Several weeks ago A. M. Hall, of Buffalo, was appointed receiver of the electric road built by Rochester and Buffalo capital between the villages of Lima and Honeoye Falls, N. Y., and since that time he has been endeavoring to wind up the affairs of the concern. The capital of the company is $40,000. It was the company's intention to supply the two villages with electric light from the power house, which was built midway between the two places. The engines in the power house proved defective and an effort was made to operate them by gas, but this was an utter failure. The receiver found that to continue the road would necessitate $15,000, which has not been forthcoming. A motion was recently made before Justice Werner, in Buffalo, that the injunction order be modified so that the unpaid employes of the company could bring action against the stockholders to recover what is due them, as individual liabilities against the defendants. The motion was opposed and decision was reserved. At the same time the attorney for the receiver made application for leave to borrow $12,500, with which to continue the operation of the road. Decision was also reserved on this motion.

The Creaghead Engineering Company, of Cincinnati, have just taken the contract for all the overhead work for the new Dayton & Xenia Traction Company's 17 miles of track connecting these two cities. Creaghead flexible brackets and line material will be furnished.

W. F. Kelly, general superintendent of the Columbus (O.) Street Railway Company, has just ordered a new 1,200-h. p. cross-compound Wheelock engine, direct connected to a G. E. 850-k. w. generator. This road is now engaged in 15 miles of new rails. Lorain Steel Company's rails are used; they will be cast-welded.

The Consolidated Car Fender Company, of Providence, R. I., in a most unique announcement recently mailed, states that it has only one customer standing first in its esteem and encloses a likeness of that one. Our readers who have not yet received this card should write for one, and discover who the favored individual is.

The B. F. Sturtevant Company, of Boston, has recently issued a number of interesting circulars and pamphlets relating to induced draft for power plants. "Bulletin G" illustrates a generating set in which engine and dynamos are entirely enclosed, which is a design very desirable for use where machinery cannot be protected from dust. "Draft Without a Chimney" tells why the Sturtevant Company abandoned its tall chimney and substituted mechanical draft. A second and larger edition of the lecture on "Mechanical Draft," delivered at Sibley College, Cornell University, by Walter B. Snow, engineer for the Sturtevant Company, has been published by the company. The company makes generators and direct-connected sets for all purposes, as well as its well-known draft and ventilating and heating apparatus.

One of the cars of the Milwaukee, Racine & Kenosha Electric Railway Company was held up by two highwaymen at 8 p. m. February 4 in Racine. There were no passengers when the men boarded the car and when the conductor came to the back platform to attend to the trolley rope as the car rounded a curve a revolver was pushed in his face and $23 taken from him. The car crews have since been armed for such emergencies in the future.

Geo. C. Ewing, for many years connected with the electrical supply business in Boston, is now representing Elmer P. Morris in New York and vicinity. Mr. Ewing has just returned from Porto Rico where he was a member of the engineering staff of General Griffin.

George Pratt has opened a Philadelphia branch office for Elmer P. Morris, of New York.

The Globe Metal Company, of Fullerton, Pa., has appointed Elmer P. Morris, of New York, general eastern agent for the well known "Semi-steel" brake shoe.

The Johnstown Passenger Railway Company has ordered 16 new summer cars, which will be equipped with Johnson steel motors. This company will build a new car-barn 150 ft. x 50 ft. in the spring. It will be a modern building having solid brick walls and covered with a steel roof.

H. B. Westcott was on February 1 appointed general manager of the Cortland (N. Y.) & Homer Traction and Electric Companies.

The Cahall Sales Department, of Pittsburg, has found it necessary, owing to the very rapid increase in price of raw materials entering into boiler construction, to advance the prices of all boilers of its manufacture 20 per cent, to take effect March 1. It has delayed making this advance as long as possible, as it was hoped to get through the season without any advance, but materials have arisen so rapidly in price and continue advancing so sharply that it was obliged to take this step in order to come out even.

WRECK ON THE CINCINNATI & MIAMI VALLEY.

On the night of January 12, an interurban car on the Cincinnati & Miami Valley Traction Company was struck by a train on the Cleveland, Cincinnati, Chicago & St. Louis Railroad, at Dwyer Station, six miles south of Dayton, O. The Big Four train was the New York and Buffalo Fast Express due in Dayton at 11 p. m.

The rear truck of the electric car had become derailed at the crossing by reason, it is stated, of the conductor having allowed the

FIG. 1.

derail to open before both trucks were past the switch. After several ineffectual attempts to get the truck back on the track, they heard the approaching train and started down the track with a lantern to give the engineer warning. They did not get far enough from the crossing to stop the train in time to prevent a wreck; when stopped the last coach was just over the crossing. The electric car weighed 20 tons, and had the engine struck one of the trucks instead of the center of the car the wreck might have been disastrous for the train; as it was, the pilot of the locomotive was broken off and the extension front caved in. The electric car was

FIG. 2.

struck full in the center and the body thrown to one side of the track into the position shown dotted in Fig. 3.

Fig. 1 is from a photograph of the exterior and Fig. 2 from a

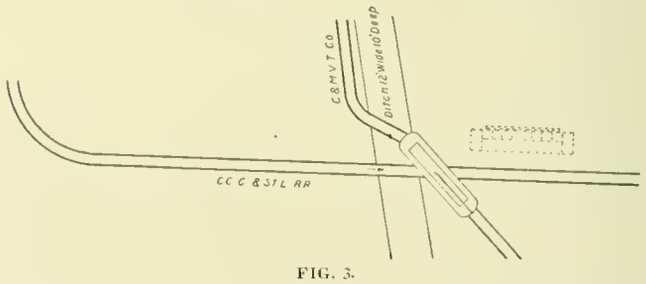


FIG. 3.

photograph of the interior of the electric car after the wreck. The passengers were warned in time to leave the car, and none of them was injured.

CLEVELAND ROADS CO-OPERATE.

The Cleveland Electric Railway Company and the Cleveland City Railway Company, locally known as the "Big Consolidated" and the "Little Consolidated," have agreed that the tickets bought of either street railway company shall be accepted on any car of either company. This led to the reports that the companies have been consolidated, but at present there is only a working agreement although a combination may be effected in the future. Transfer tickets are not interchangeable. It has been arranged that the power for the west side of the city will be supplied from the power stations of the Little Consolidated and the stations of the Big Consolidated will furnish current for all the east side lines. A number of loops are to be constructed so that more cars can be put in service and a new line is to be built on Euclid avenue.

It is quite probable that Fresno, Cal., will have a new electric street railway system, consolidating the present horse lines and extending out so as to give service to the vineyards.

General Manager J. B. McClary, of the Birmingham (Ala.) Railway & Electric Company, advises us that the company's East Lake Pavilion theater will open on May 29. The season continues for 14 weeks, closing September 3, and by arrangement with the Southern Amusement Syndicate, operating attractions for 11 southern parks, a new play will be put on each week.

PERSONAL.

Edward Rhomberg, secretary and treasurer of the Dubuque (Ia.) Street Railway Company, and Miss Mame Simones, of Dubuque, were married on January 9.

John Dolph, of New York, representing the Sterling Varnish Company, of Pittsburg, was in Chicago for a few days last month and while here called on the REVIEW.

C. S. Bidwell, formerly superintendent of the Trumbull Electric Railroad Company, of Warren, O., has been chosen superintendent of the Miami Valley Railway Company, of Piqua.

D. Mazenet, whom W. J. Clark succeeded as general manager of the foreign department of the General Electric Company, is now managing director of the Mexican General Electric Company.

W. S. Wright, general manager of the Wheeling (W. Va.) & Elm Grove Railroad, was recently presented with a jeweled watch-charm and cuff-links as a testimonial from the employes of their esteem.

L. D. Nelson, traveling salesman for the Sterling Supply & Manufacturing Company, of New York, called on the REVIEW a few days ago. He reports that the business in his line is all that could be desired.

F. P. Mooney, for several years superintendent of the Corning & Homer Traction and Corning & Homer Electric Companies, of Cortland, N. Y., has resigned. His successor has not been appointed at this writing.

Charles G. Burton, who has been with the Central Electric Company, for five years, is to be associated with E. B. Kittle, western manager of the Sprague Electric Company. Mr. Burton has been engaged in the electrical field for 15 years.

A. Johnson, formerly with the Joliet (Ill.) Railway Company, has gone to Quincy, Ill., to become electrician for his old superintendent, C. E. Rush, who was recently appointed superintendent of the Quincy Horse Railway & Carrying Company.

The management of the Canton & Massillon (O.) Electric Railway Company has undergone some changes. Second Vice-President H. C. Fogle is now manager, with Lawrence O'Toole as assistant. T. R. Catlin, for some years superintendent, has resigned.

Capt. Frank S. De Ronde, who served during the war with the Second New Jersey Volunteers, and later was ill with typhoid fever, is again fulfilling his duties as general manager of the sales department of the Standard Paint Company, and was a caller on the REVIEW when in Chicago on business last month.

W. B. Brockway, for some years assistant secretary of the Toledo, Bowling Green & Fremont Railway Company, Toledo, O., was at the last meeting of the company promoted, with the title of secretary and auditor. This is a well deserved recognition of Mr. Brockway's services and we extend our congratulations. Mr. Brockway has been secretary of the Street Railway Accountants' Association since its organization.

At the municipal election held in Port Arthur, Ont., in January, W. P. Cooke, chairman of the Town of Port Arthur Electric Railway & Light, was chosen electric railway and light commissioner for a term of three years. Mr. Cooke defeated the successful candidate for mayor, who was also a candidate for commissioner, by an overwhelming majority.

William J. Fransioli, general manager of the Manhattan Elevated Railway Company, of New York, resigned on January 17 to take an executive position with the American Air Power Company, in which Richard Croker and Joseph Leiter are heavily interested. Mr. Fransioli has been with the Manhattan road for 18 years, and was appointed manager in December, 1896. Alfred Skitt, lately chosen vice-president, will succeed as manager.

January 20, the annual meeting of the Provident Society of the London (Eng.) United Tramways Company's employes was made the occasion of presenting an illuminated address to J. Clifton Robinson upon the celebration of his silver wedding. Mrs. Robinson was presented with a diamond brooch. The address was in behalf of the officers and employes of the following companies, of which Mr. Robinson is managing director: London United Tramways Company, the Middlesborough, Stockton & Thornby Electric Tramways, Bristol Electric Tramways, the Reading Tramways, the Corris Railway.

ELECTIONS.

The St. Charles Street Railroad Company, of New Orleans, chose directors who will elect Albert G. Phelps president to succeed Alden McLellan.

Murray A. Verner succeeds B. F. Miles as president of the Mahoning Valley Railway, Youngstown, O. B. F. Miles, the old president, is still a director.

Spencer C. Gilbert and W. L. Gorgas have been chosen president and secretary, respectively, of the Harrisburg & Mechanicsburg (Pa.) Electric Railway Company.

F. M. Stearns has been chosen president of the Cleveland & Chagrin Falls Electric Railroad, succeeding V. A. Taylor, who has disposed of his holdings in the company.

The Chester (Pa.) Traction Company has chosen C. M. Clark president and C. Ford Stevens secretary. George B. Lindsay, formerly president, is a member of the board.

The Laconia (N. H.) Street Railway has chosen new officers as follows: President, A. L. Pierce; treasurer, C. T. Foster; clerk of corporation, Edmund Little; superintendent, L. S. Pierce.

Sharon (Pa.) street railway stockholders have chosen the following officers: President, E. A. Wheeler; vice-president, Simon Perkins; secretary, John H. Dynes, Cleveland; treasurer, Charles Hall.

At a meeting of the directors of a company proposing to build an electric road from Indianapolis to Logansport, Ind., officers were chosen as follows: President, George W. Mariott; vice-president, M. A. Jordan, Logansport; secretary, J. L. Light.

The Tuscarawas Railroad, connecting New Philadelphia and Uhrichsville, O., has been purchased by Cleveland parties, and David King, president and general manager of the Tuscarawas Electric Company, will succeed Mrs. Dr. Fletcher Douthitt as superintendent.

The stockholders of the Zanesville (O.) Electric Railway Company, reorganized, chose a new board of directors which organized by electing officers as follows: Thomas T. Robinson, president; John M. Graham, vice-president; W. B. Cosgrave, treasurer; Charles W. Foote, secretary and general manager.

The stockholders of the Bethel & Rochester (Vt.) Electric Railway have organized, and will place orders for material for use as soon as the ground opens for spring work. The officers are E. H. Edgerton, Rochester, corporation clerk; R. H. Tupper, Rochester, treasurer. J. R. Tupper was authorized to place contracts.

S. P. Light has been chosen to succeed J. M. Shenk as president and general manager of the Lebanon (Pa.) & Annville and Lebanon & Myerstown Street Railways. Mr. Light has for several years been vice-president of these companies, and he is well known also through his connection with the Pennsylvania Street Railway Association, of which he is secretary, and whose success is largely due to his efforts.

FOREIGN FACTS.

The proposed tramway line from Raiganj to Lahire, in the Dinajpur district, has been surveyed.

The Wrexham Tramways Company is planning to lengthen its lines from Wrexham to Johnstown and adopt the trolley system.

Last month the Prince's Park route of the Liverpool Tramways was opened for traffic and a dozen new American cars put in service.

The corporation of Southampton has agreed to adopt the overhead system for the tramways and build double track wherever possible.

The town council of Paisley proposes to acquire the tramways in that city, extend them and make connections with the street railway system of Glasgow.

The route for a proposed electric interurban between Blackpool and Morecambe has been surveyed. This will tap a rich agricultural country in North Lancashire.

The town council of Reigate has purchased a site for a power station and has applied for a permit to construct an electric tramway between the city and Redhill Junction.

The American engineers, Messrs. Cook and Childs, of J. G. White & Co., of New York, have taken charge of the work of building the tramway system of Perth, Western Australia.

A 40-year concession has been granted the Helois Company, of Ehrenfeld, Cologne, Germany, to construct a system of trolley tramways in Spezzia, Pertusola and San Bartolomeo, Italy.

The contract for constructing an electric railway between Pekin and Matschiapu to be in operation this spring, has been secured by the agents of Siemens & Halske Company, of Berlin.

A company in Milan, Italy, is planning to build an electric line between Palsana-Sopra and Revello, a distance of 10 miles. A tramway is also projected between Biella and Graglia.

A public adjudication of tenders will take place next month for the construction and working of new tramways. Particulars may be obtained from the Prefecture de Vienne, Poitiers, France.

The George street electric tramway, in Sydney, Australia, is now in operation, and it is anticipated that at an early date the work of altering all the steam tramways for electric traction will begin.

At Brussels the Compagnie Generale des Tramways Electricques has been organized with a capital of $2,000,000 to acquire the Madrid Eastern Tramways and the street railways of Barcelona and Soria.

The United States consul at Moscow states that the town corporation of Riga, Russia, has obtained from the Minister of the Interior the permission to negotiate a loan of $800,000 to construct a street railway system in that city.

The District Board, Patna, proposes a tramway line from Baktiarpur to Behar. The estimates and plans have been submitted to the Government of India for sanction. The undertaking is in the hands of Messrs. Martin & Co., Calcutta.

The Great Northern & Strand Railway Company proposes to equip the two tunnels from Wood Green station to King's Cross station, and from the latter station to the Strand, for electric traction. The capital authorized is $12,000,000.

It is reported that the branch line of the Canadian Pacific Railway from Aylmer to Hull has been purchased by the Hull Electric Railway Company for $100,000. The line is 7½ miles long, and has been leased to the latter company for the past two years, at a rental of $5,000 per annum.

The route for the circular railway at the Paris Exhibition has now been decided on. It will be a single line railway, running in a complete circle, the train starting from the left-hand side of the Esplanade des Invalides, and returning thereto, after a course of two miles. The traction will be by electric power.

A group of capitalists of Antwerp propose to provide a complete system of electric tramways. The syndicate has arranged with all the existing tramway companies to apply for one general concession for the whole of the lines. The same group is applying for a concession for a new line from the docks to the Gare du Sud, Antwerp.

The tramway system of Kingston, Jamaica, will be supplied with current from a waterfall about 20 miles distant from the city. Satisfactory progress is being made with the work. The enterprise, involving an expenditure of about $1,000,000, is backed by Canadian capitalists.

Motor omnibuses are to be introduced into Brussels. The route chosen is the difficult road from the Bourse to Ixelles by the Montagne de la Cour, which entails so much suffering on horses. The Tramway Company is making experiments with the new vehicles in the Bois de la Cambre, and the results obtained are apparently quite satisfactory.

Manchester proposes providing workshops for making its own cars, instead of buying the cars in Germany, America or elsewhere. The committee, however, intends to buy the first supply of tramcars, after which it proposes to build its own cars and do its own repairs, as there would not be time to build the first supply, for they had to be ready by the 27th April, 1901.

Consul Erdman writes from Breslau, January 9, 1899: I wish to inform our manufacturers of and dealers in street car rails, electric motors, wire and electric supplies that the street car company, of this city, which has been using horsepower, has been granted the privilege by the city authorities to employ electric motive power at the expiration of its present charter, which will be in 1902.

The electric tramways of Dundee, Scotland, are to be operated by the city, and in order to supply the current for traction purposes and the increased demand for lighting the power station is to be enlarged. About $75,000 is to be spent in improvements. The intention is to order four boilers 38 ft. by 8 ft., one economizer of 400 tubes, two engines of 450 h. p. each, and one engine and dynamo of 700 h. p.

The Blackpool & Fleetwood Tramway Company possesses a valuable property, as is indicated by the report at the end of its first six months' operation. A dividend of eight per cent is to be paid for the half year, and a considerable sum is carried forward. An issue of $150,000 additional capital stock was sanctioned to purchase rolling stock, the present equipment being entirely inadequate to handle the summer traffic.

Egypt is awakening to the advantages of the trolley, and the patronage to the lines already constructed in Cairo is on the increase, as is evident from an order for 14 additional trolley car equipments placed with the Westinghouse Electric & Manufacturing Company. It is now proposed to connect Alexandria and Cairo by an electric interurban, but this proposition is not likely to be fulfilled, as the cities are 75 or 80 miles apart.

Work will soon begin on a trolley line connecting Heidelberg Germany, with Nusslock, a small place eight miles south of the city, and an effort will also be made to extend the line farther to Wieslock. Current will be supplied from Heidelberg and Wieslock, and the villages between these two cities will be lighted from the trolley current. A freight car will be attached to each train to

carry baskets, produce, etc. The rate of fare will be 1 1-3 cents per mile.

The mileage of electric railways is increasing more rapidly in Germany than any other European country, as shown by the statistics for the past year. There are now in all 1,260 miles of track, with 5,318 cars in operation, which require power station machinery of 38,451 k. w. capacity. The trolley system is in general use, although there are two short lines of conduit in Berlin and Dresden, and mixed systems, combining the trolley and storage battery, in Hanover, Berlin, Hagen and Dresden.

The sub-committee, of the Dewsbury town council, reported that it had considered various schemes for electric tramways, and unanimously recommended as the best a route commencing at the borough boundary in Huddersfield Road, near to the Ravensthorpe Station of the Lancashire and Yorkshire Railway, thence passing along Huddersfield Road, Webster Hill, Old Westgate, Wellington Road, Halifax Road, and Birkdale Road, to the western end of Green Lane. The estimated cost was $98,900.

Special report prepared by the railway, tramways and electric lighting committee, of Dudley, recommended that it be an executive committee for carrying out the necessary work of constructing and equipping the generating station, and for the supply of energy; and further, that application be forthwith made to the local government board for sanction by the council of a loan of $37,500 on account of the expenses to be incurred in the construction of the generating station and work connected therewith.

The corporation of Glasgow has accepted the recommendation of the tramway committee to adopt the trolley system for all the street railways of the city. The electric conduit was discussed at some length, but it was decided that climatic influences were not suited to its successful operation, and the fact that a number of the routes crossed bridges presented serious obstacles to the conduit construction. It is intended to have all the tramways operated by electricity before the municipal exposition in 1901.

Another Alpine electric railway is in contemplation, which will start at Landeck and extend through the Vintschgau valley, by Reschenscheideck, Meran, Trafoi and Bormio, to Milan, Italy. It will be known as the Vintschgau Railway, and will be a competitor to the famous St. Gothard Railway. A tunnel 8,000 yds. in length will have to be cut through the mountains. Water powers are so abundant through this region that electric operation will be the most economic. This line will be the shortest route from Germany to Italy.

OBITUARY.

Milan C. Bullock, president of the M. C. Bullock Manufacturing Company, whose death occurred in Chicago January 12, has long been known as one of the leading manufacturers of mining machinery and engines for electrical installations. Mr. Bullock was a native of New York state, and was 61 years old at the time of his death. He was an experienced machinist and came to Chicago in 1875 and started his factory. He was also one of the pioneers in the electric lighting industry in Chicago.

It is announced that there is a good prospect for building an electric road from Port Huron, Mich., to Lexington, and ultimately to Bay City. E. L. Brennan, of Toledo, and Charles Montague and Fred S. Wheat, of Cairo, are interested.

The Omaha (Neb.) Street Railway Company in 1898 had the largest year's business in its history: this was due to the immense exposition traffic. Numerous improvements have been made during the year; a 1,200-h. p. unit and the necessary boilers were added to the power house and a new stack built; a new car house 124 by 380 ft. was built; 40 open and 20 closed cars were added to the equipment

ECHOES FROM THE TRADE

We have inquiry for address of companies having 10 or 12 second-hand open cars for sale. Letter addressed to Editor Street Railway Review will be handed party.

The Chase Construction Company, general contractor, making a specialty of electric railways and stations, has removed from 1113 to 1321 Majestic building, Detroit, Mich.

Hackett, Carhart & Co., of 422 Broadway, New York, who are very extensive clothing manufacturers, are making a specialty of uniforms for street railway employes, and invite correspondence.

Bion J. Arnold, consulting electrical engineer, of Chicago, made a personal exhibit of mechanical and electrical designs at the Trans-Mississippi Exposition, which was awarded a gold medal and diploma.

The Leschen-Macomber-White Company, of Chicago, which makes a specialty of wire, wire rope and cordage, and contracts for mine, quarry and railroad supplies, has sent a handsome desk calendar to its friends and customers.

Stone & Webster, of Boston, have placed an order with Wendell & McDuffie, of New York, the New York and New England agents of the American Rail Joint Company, for boltless joints sufficient for several miles of track.

The United States circuit court of appeals for Massachusetts has held, in the case of the Thomson-Houston Company against the Athol & Orange Street Railway Company, that the Walker motor is not an infringement of the patent held by E. W. Rice, Jr.

"The Westinghouse Standard Engine" is the title of a 60-page pamphlet published by the Westinghouse Machine Company descriptive of its "Standard" engine which has been on the market for 18 years. It is a very handsome piece of work typographically.

E. G. Long, vice-president of the Peckham Truck Company, sailed for Europe on February 3, where he will thoroughly inspect the street railways. The Peckham Company has a very large foreign trade, and Mr. Long is manager of the foreign sales department.

We have had numerous requests for the address of Paul and Henry Hirsch, formerly doing business as "bankers" and street railway bond brokers, with offices in Chicago and on Wall street. Any of our readers who can furnish the information will confer a favor in so doing.

The West End Traction Company, of Pittsburg, has added 15 new cars made by the Laclede Car Company, of St. Louis; they are mounted on Lord Baltimore trucks and equipped with Westinghouse No. 58 B motors. Ten cars for summer use have also been ordered from the Laclede Company.

Arthur W. Field, 53 State street, Boston, who is sole New England agent for the Peckham Truck Company, the American Car Company, Ruggles' rotary snow plows and Price's friction brakes, and also sales agent for a line of standard street railway supplies, has recently sent to the trade an attractive calendar.

The Falk Manufacturing Company advises us that it will immediately appeal the patent case, which was decided against it in January, to the United States court of appeals, and will also bring suits against the infringers of other patents owned by the company. The Falk Company feels assured of its ultimate success in this litigation.

"Modern Engineering Practice" is the title of a circular issued by the Famous Filter Company, of St. Louis, Mo., which is a practical up-to-date treatise on reliable, perfect and economical lubrication. These three adjectives describe the three important objects to keep in view in successful engineering. The pamphlet will be sent free to any address.

William E. Cooke, who represents the London syndicate controlling the tramways of Perth, Western Australia, is now in Perth converting the system to an electric one. Mr. Cooke states that Perth is an excellent street railway city because of the rough topography and large area of the city, the hot climate and the poor roads.

J. A. Fay & Co., of Cincinnati, O., have just sent us a large illustrated poster, printed in two colors, which shows over 100 of the company's new woodworking machines. The company's line of machines includes everything for working wood and the poster is most convenient for reference. They will be sent free on application; mention the Review.

The Columbia Incandescent Lamp Company, of St. Louis, at its annual election chose officers as follows: W. O. Garrison, president; A. C. Garrison, vice-president and treasurer; George P. Rex, acting secretary. A. C. Garrison will have the general management of the business, and Mr. Rex, formerly representing the company in Chicago, will now be in St. Louis.

The Simplex Electrical Company, Sidney and Franklin streets, Cambridgeport, Mass., which is sole manufacturer under the patents of the American Electric Heating Corporation, has sent out through its heating department a pamphlet entitled "Electric Heating," which will prove a revelation to those who have not followed the subject closely. The Chicago office of the company is 1173 Monadnock building.

The Hazard Manufacturing Company, of Wilkesbarre, Pa., has its copper wire plant in running order and reports that the business in this line is very gratifying. The reputation made by this company in its bare steel wire and cables makes it easy to place its copper products. Insulating machinery is now being installed and the company will be ready to fill orders for paper, rubber and fiber insulated wire about March 1.

The Ajax Metal Company, Philadelphia, states that it has had its trolley wheels tested in competitive trials, and that they have shown longer life and much more satisfactory service than those of the other makers. The company recently secured an order for 20,000 wheels, at a better figure than was offered by competing makers, and the order was given because it was thought that the Ajax wheels had showed 75 per cent better results.

The Jeffrey Manufacturing Company, of Columbus, O., which has recently taken up the manufacture of standard elevator buckets and spiral conveyors, reports a very flattering trade. Its facilities are such as enables it to supply high grade material at prices which secure for it a large trade for this class of machinery. Any one requiring material in this line will do well to secure The Jeffrey Company's latest catalog and prices, which will be cheerfully sent upon application.

The "Calendar of Masterpieces" for 1899, with the story of the pictures by Prof. H. Ward Rhodes, of the Museum of Fine Arts, Washington University, is one of the most pleasing things the new year has brought. The six photogravures are reproduced from the celebrated paintings "Neighbors," "Adagio," "Phoebe," "The Dancing Lesson," "Marianna," and "Consolation in Sorrow." The calendar was sent to the friends and patrons of the J. G. Brill Company, and it represents one of the highest types of fine art in advertising.

The American Vitrified Conduit Company, of New York, of which C. J. Field is general manager, has been awarded the contract for the entire electrical conduit system of the city of Baltimore, involving several million feet of the company's vitrified tile multiple duct conduits. The multiple conduits have from two to 16 ducts. The contract was awarded January 25, by the board of awards of the city, upon the recommendation of the chief engineer of the electrical commission, Charles E. Phelps, Jr., who carefully considered all the bids made.

H. A. Dorner has been appointed sales agent for the A. & M. (Allen & Morrison) brake shoe in the states from Indiana to Maine. The A. & M. brake shoe was developed, after a series of experiments extending over several years, by Messrs. Morrison and Allen, superintendent and master mechanic, respectively, of the South Side Elevated, Chicago, who were seeking a brake shoe that would prove perfectly satisfactory on their road. When placed on the market it proved a decided success by reason of its high frictional and slow wearing qualities.

The New Process Raw Hide Company, of Syracuse, N. Y., lost its entire factory and stock by fire on December 19, and immediately made every effort to get a new plant in operation by February 1. When the fire occurred the factory was running overtime on orders, its raw-hide pinions being in great demand. The new works are located at 305-309 North State street, Syracuse, the business office remaining at 348 West Washington street. We congratulate the company upon the fact of being again in shape to supply its products to the trade.

A. O. Schoonmaker, importer of India mica, 158 William street, New York, and 1563 Monadnock building, Chicago, reports that business in the mica line is exceedingly good. Mica is an absolute necessity to the electric trade and the furnishing of mica commutator segments is a business in itself. Mr. Schoonmaker carries stamped solid sheet mica segments for all the standard types of motors, and mica rings, in stock, and will cut and build up any pattern desired. Samples and quotations will be furnished by him or by his agents: Reger & Atwater, San Francisco; Hayes & Arthur, Cleveland; Central Union Brass Company, St. Louis.

The Metropolitan Street Railway Company, of Toronto, is building a long line to Lake Simcoe, and has placed a large order for Westinghouse apparatus. In the new power station at Bond Lake will be placed two three-phase 400-h. p. alternating-direct current generators, with transformers for raising the voltage to 16,500. Transformers and rotary converters will be installed in sub-stations about 14 miles from the power house. The car equipment provides for freight and passengers, the motors on the passenger cars being 50 h. p. each. A 45-ton Baldwin-Westinghouse electric locomotive will provide motive power for the freight traffic.

The Cleveland & Eastern Railroad Company is now in the market for power station machinery and car equipment. For the power station a 600-h. p. engine, boilers of 600-h. p. capacity, condensers, heaters, pumps and a steel self-supporting stack will soon be purchased. The new cars, for which bids are asked, are to be equipped with air brakes and four 50-h. p. motors to give a speed of 45 miles an hour. The road, extending from Cleveland to Chadron and Burton, 36 miles, will be in operation by May or June. Extensions will ultimately be made to Andover, 70 miles, and later to Meadville, Pa., 100 miles. W. C. Jones, 710 New England Building, Cleveland, is the engineer of the company.

The Frank Ridlon Company, of Boston, announces, under date of February 1, 1898, that Charles N. Wood has become a stockholder in the company and been elected a director and vice-president. The New England agencies Mr. Wood has controlled for so many years, viz., the R. D. Nuttall Company, the International Register Company, the Van Wagoner & Williams Hardware Company, the Bradford Belting Company, the Monarch Stove & Manufacturing Company, the American Electric Heating Corporation, Wilson, Thomson & Co. The Ridlon Company will establish under Mr. Wood's management a strictly street railway supply house. Mr. Wood will for the present continue at 31 State street, but the business is soon to be consolidated in one office.

Louis Duncan and M. K. Eyre, consulting engineers, under date of February 1, announce that they have formed a partnership under the style of Duncan & Eyre, with offices at 1514-15 Empire building, 71 Broadway, New York.

The Bates Machine Company, of Joliet, Ill., is a very extensive manufacturer of general machinery and heavy wire machinery; Corliss engines and feed-water heaters are among its specialties. In the field of wire machinery this company claims to be the pioneer, and it has built up its trade by trying to anticipate the demands of the times, and being at all times prepared to furnish the most durable, most economical and most perfect machinery that is on the market. It is prepared to furnish a complete outfit of all that is necessary for a wire mill and give the best of everything. The company has recently issued a new catalog illustrating its specialties. The Cookson feed-water heater made by this company was illustrated and described in the REVIEW for October, 1898, page 770.

The New York Switch & Crossing Company has made extensive additions to its Hoboken works during the past year and is able to turn out its special work with greater rapidity than ever. A large number of new special tools have been installed. The company reports an excellent business in both street and steam railway fields. Much special work has been supplied to the Union Railway Company, of New York; the Brooklyn Heights Railroad Company, of Brooklyn; the Hartford Street Railway, of Hartford, Conn.; the Consolidated Traction Company and North Hudson County Railway, of Jersey City and Hoboken; the J. P. McDonald Company, and the United States Government railways in the Brooklyn Navy-Yard and at Indian Head. Considerable special work, mostly for T rail, has been exported also.

The P. & B. electrical compound, of the Standard Paint Company, continues to be recognized as a standard article, and is specified by electricians of electric railway and light companies both in the United States and abroad. The business done by the Standard Paint Company in this and in its armature and field coil varnishes during 1898 was in excess of any previous year, in spite of the up-set conditions due to the Spanish war and other causes. The company's branch factory at Hamburg, Germany, has been busy ever since it was opened early in 1898; its product includes P. & B. preservative and roof paints; P. & B. building, sheathing and insulating papers and ruberoid roofing. The orders for the company's insulating tape have been very heavy for several months past, both for domestic and foreign consumption.

Willard A. Smith, of Chicago, who was chief of the transportation department of the Columbian Exposition in 1893, has been appointed director of the department of civil engineering and transportation by the commissioner-general for the United States to the Paris Exposition of 1900. Mr. Smith wishes to enter into correspondence with intending exhibitors at the earliest possible date, and such should address him care of the Chicago offices of the commissioner, Auditorium building. The limitations of space are such that only exhibits of the most desirable character can be provided for. This department covers (as at the World's Columbian Exhibition of 1893) railways, vessels and vehicles, and everything relating to the subject of transportation and civil engineering. It is hoped that the well-known pre-eminence of the United States in this department, among the nations of the world, will be so well illustrated at Paris that it will be a just subject of patriotic pride. From a purely commercial point of view its influence on the world's markets can hardly be overestimated.

Edward Wilhelmj, conductor of a North Chicago electric car, while his car was waiting at a railroad crossing, saw a 6-year old child fall in front of the approaching train, then 20 ft. distant; he promptly seized the child and jumped upon the pilot of the engine. When the train was stopped both were found to be uninjured.

Negotiations are pending between the projectors and Westinghouse, Church, Kerr & Co., for the building of an electric road from Lansing to Ann Arbor, Mich. C. E. Mapes and Dr. R. J. Shanks, of Lansing; Thomas Barkett, of Dexter, and others are interested. O. A. Stranahan, of Chicago, is the company's financial agent.

NEWS NOTES.

AKRON, O.—The Akron, Bedford & Cleveland Electric Railway has secured the right of way for the proposed eight-mile branch from a point above Cuyahoga Falls to Hudson. This work is to be completed by May 1. J. F. Sloat, superintendent.

ALTON, ILL.—Articles of incorporation have been filed with the secretary of state by the Alton & East Alton Railway & Power Company, with a capital of $100,000, to construct new lines for the Alton Railway & Illuminating Company. The incorporators are: O. S. Stowell, G. M. Ryrie and Henry S. Baker. J. F. Porter, president.

ANN ARBOR, MICH.—Westinghouse, Church, Kerr & Company have the contract for building and equipping the Lansing & Ann Arbor Electric Railway. The road will run from Lansing to Mason, thence to Dexter, and from Dexter to Ann Arbor. C. E. Mapes and Dr. R. J. Shanks, of Lansing, may be addressed.

ATLANTA, GA.—The Atlanta Consolidated Street Railway has petitioned for the right of way to build an extension along the east side of the East Point road to Oakland City.

ATLANTIC CITY, N. J.—The Atlantic City Trolley Company which proposes to build an electric railroad from South Carolina avenue to the Inlet has declined the franchise offered by the city because of too many requirements for street improvements.

BALTIMORE, MD.—The Baltimore Consolidated Railway Company has completed a survey along the Frederick turnpike from Elliott City to St. John's college, a distance of about six miles, for a proposed single track extension.

BELFAST, ME.—James Mitchell, a railroad contractor and promoter of Bangor, Me., is to build a five-mile electric railroad this spring between this city and Northport.

BLOOMINGTON, ILL.—The Bloomington & Normal Railway Company, incorporated in June, 1898, will build three miles of extension, that will require the building of two iron bridges with stone abutments. Eight open and 16 closed motor cars and three trailer cars will also be wanted. A. E. De Mange, president and purchasing agent.

BRADFORD, PA.—At the annual meeting of the Bradford Street Railway Company held on January 9, the directors authorized the purchase of 225 trolley poles, 13,000 ties and 10 miles of steel rails, to be used in extending the Congress street branch to Lews Run. Work will be begun as soon as the frost is out of the ground.

BRIDGETON, N. J.—The Bridgeton & Melville Traction Company; operating 18 miles of railroad, is preparing to build an extension from Fairton to Cedarville in the spring. C. H. Kuhn, president.

CHAGRIN FALLS, O.—J. R. Curtis, of Cleveland, O., has been awarded the contract for track laying on the Chagrin Falls & Eastern Electric Railway. Jay E. Latimer has the contract for overhead work. The proposed route is from South Newbury to Garretville, via Burton, Troy and Hiram, a distance of 26 miles. R. S. Hubbard, president, Cleveland, O.

CHICAGO, ILL.—The limit of time for the completion of the Northwestern Elevated Railroad has been extended by the city council from January to December 31, 1899.

CINCINNATI, O.—The Hamilton & Eaton Electric Railway Company has applied to the county commissioners for a right of way through about 12 miles of the turnpike roads in this county.

COLUMBUS, O.—The Westerville & Worthington Street Railway Company has secured the right of way between Delaware and Flint, a distance of about 15 miles. It is proposed to complete the road by July 1, 1900.

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The Toronto, Ontario, city council is considering the passage of a bill delegating to the city engineer power to determine what "is a comfortable load" and that no car shall be operated which is "not approved by the engineer." The engineer is also to arrange such a time table "as he considers proper."

If these powers are conferred, and the city engineer is not the "whole thing," he will be sufficiently near to it for all practical purposes.

The action of the supreme court of New York in allowing the Brooklyn Heights Railroad Company an allowance of $500 against the plaintiff in an unsuccessful damage suit is greatly to be commended and if the practice is followed in similar cases it cannot fail to greatly decrease this class of litigation. The greater number of personal injury suits against street railways are brought at the instance of unscrupulous attorneys who know that their clients have no case, but trust to arousing the prejudices or sympathies of juries or frightening the company into a settlement.

The representative of West Toronto, Ont., in the legislature proposes to introduce, or has already done so, a bill providing that passengers who are unable to secure seats in the street cars shall pay only half-fare. It is not proposed to limit the number of persons who may ride on a car, and the street railway companies will not be permitted to run by persons who wish to take a car, or to exclude them because the car is crowded. The author of the bill says: "Because a car happens to be crowded is no reason why a passenger should be excluded from it, as the passenger would be perhaps seriously inconvenienced if he waited for a car which contained room for him to sit down."

This is certainly a one-sided arrangement as the only effect of it would be to reduce the receipts of the company. We all know that people on this side of the Atlantic will not accept the European plan of rigidly limiting the capacity of public conveyances, because they are not willing to wait for one with plenty of room. This being true why should the impatient man get transportation at one-half the rate paid by one with more time to spend in waiting?

It is a solon of the Nutmeg State, evidently from the rural districts, who has conceived and is now trying to secure the passage of a bill for more light in darkest Connecticut. He proposes to solve the problem by an act which shall make it incumbent on all interurban lines to burn 100-c. p. incandescents every 400 feet, or a 1,200-c. p. arc light every 1,000 feet along the highways on which are laid electric railway tracks.

When one takes into consideration the hour at which most of the dwellers along these country lines retire, there would seem about as much need for such lights in the daytime as at night.

The ministers of Baltimore are trying to preach vestibules into the street cars of that city. This effort on their part to save the bodies as well as the souls of men is probably put forth in a spirit of kindness, although there does not seem any call for the extravagant and unbecoming language some of them used from their pulpits. But it would not seem to us that, with any attempt whatever on the part of the men to dress for outdoor work, that there is any need for vestibules in that latitude. There were undoubtedly several days during the extremely unusual weather of early February, when any outdoor labor was unpleasant, and even attended with more or less suffering; but for the few such days once in 10 or 15 years, there are months when the absence of the vestibule would conduce to health.

Chicago can claim to have been about as cold during the transcontinental storm as any of the large cities east of the Mississippi, and it was here accompanied by an intensely high wind. One day at an hour when the thermometer was 22° below zero, a stranger in the city—not a street railway man either—had occasion to use a cable car. As he came from a portion of the country where cold is unknown, his heart went out to the figure bundled up in a fur coat and gloves on the grip car, and expressed his sympathy. A hearty laugh was the response, and the gripman remarked he was the warmest man on the train, as he not only was accustomed to being out every day, but dressed for it. The investigation was continued to three other cable trains, with the same result. Not one had a frosted ear or hand; but had taken the precaution to dress properly. It is a well known fact in the employment division of each of the large roads in Chicago, that men who have occupied responsible positions in stores, at good salaries, beg for a position on the front platform as an almost certain road to recovered health. The writer has personally known cases where the pale-faced applicant had in less than a year brought his weight up to 180 lbs. and his strength and appetite in proportion. Hence the good brothers of Baltimore who, probably in good faith, have tackled a text not taught in their seminary, would do well to investigate a little on their own account before plunging into the sensational utterances they have voiced. In most cities the health of the men is anything but improved by closed vestibules.

When the plan of a subway in Boston for the use of street cars was first proposed the street railway officials advanced the argument that while a subway would greatly relieve the streets in the congested business area, the diversion of the street cars from the streets to the subway would surely result in the lowering of rents and the depreciation of real estate on the streets formerly used by the street railways. The merchants and property owners along the streets in question expected that they would become pleasure thoroughfares, and looked upon the arguments of the street railways as being prompted merely by self-interest.

The subway was built and the tracks of the West End Company in Tremont street removed. The unexpected result (unexpected by the merchants interested) was that the streets thus relieved of railway traffic were eagerly seized upon for all sorts of heavy teaming and they are now monopolized by trucks. Further, many of the people who formerly walked through Tremont street, now take cars through the subway and prefer to do their shopping at points more convenient to the subway stations. The loss to the retail stores on

Tremont street has been so serious that those firms have petitioned the legislative committee on street railways, and the committee has undertaken an inquiry. President Gaston, of the Boston Elevated, states that the company is willing to go to the expense of replacing its tracks in Tremont street in order to accommodate the merchants there.

The dissatisfaction caused by the subway so effectually relieving the congested streets of possible purchasers, has resulted in the plan of Mayor Quincy for another subway, to connect the Boston & Albany and the Northern stations, being received with remonstrances instead of the approval which greeted the plan for the present subway.

While not writing in any spirit of "I told you so," we cannot forbear allusion to the fact that it forcibly illustrates the difference in the value of the views of the city officials though perfectly honest in their belief, and those of the street railway officials. The former were based on theories which seemed good and sound; those of the railway men on fundamental principles arrived at as a result of years of careful study and observation of the transportation business. One diagnosis was that of the layman: the other that of the practitioner. The whole matter illustrates what would be the rule under a management by a municipality, and that the competent street railway manager does better for the individual than he with his pet plans would do for himself.

There are now pending in the legislature of Illinois eight, and possibly more, bills, any one of which, if it became a law, would greatly decrease the incomes of railroad and telegraph companies doing business in this state. These corporations being engaged in business which public policy will not permit to be suspended they must reduce expenses or operate at a loss when their incomes are cut down. Operation at a loss has but one end, a receivership and the eventful wiping-out of a portion or all of the capital stock; inasmuch as the management of a corporation represents the stockholders it will not run the business at a loss until all other remedies have failed. When the expenses must be reduced, and the various items going to make up the total are examined, it is soon discovered that the largest single item, and the only flexible one, is labor. On railroads the operating expenses are probably about 60 per cent of the gross receipts, and labor constitutes from 40 per cent to 60 per cent of the total operating expenses; that is, from 25 to 35 per cent of the gross earnings goes to pay for labor. Therefore, when earnings are reduced say 5 per cent through hostile legislation, the immediate result is that the employes will suffer a reduction in their wages of from 15 to 20 per cent.

These facts are, of course, known and appreciated by every one connected with the management of railways, but are often overlooked by others. This inevitable effect of hostile legislation has resulted in the organization of the "Railway and Telegraph Employes' Political League of Illinois." Next year it is proposed to have a national organization on the same lines. The objects of this organization is the protection of the interests of its members by political but non-partisan action.

On February 24, a mass meeting of railway and telegraph men in Chicago was addressed by Chauncey M. Depew, who in the course of an eloquent address pointed out the reasons for forming such a league and the power which it could exert. The steam railroad employes of the United States number about 800,000, and acting in concert have the balance of political power in their own hands. The total vote for president of the United States in 1896 was only 13,500,000.

The street railways of Connecticut employ about five men per mile of track, and if the same proportion holds everywhere the street railway employes of the United States number 86,000, a great political force. At the present time most of the organizations of street railway employes other than the benevolent and social associations are for the purpose of fighting the employers, and their management is in the hands of professional agitators who mislead the men they should advise, and try to blind them to that old, old truth of political economy—the identity of interest of labor and capital. Instead of attacking the cause of the disease, reduction of the earnings of corporations, they seek to treat the symptom, reduction of wages of employes. The symptom they seek to cure by means of a strike, which exhausts both the men and the company, and leaves the latter less able to grant the demands upon it than before.

We commend to our readers the consideration of the objects of this political league and also its methods. The leading men in it have learned in the school of experience that labor cannot better itself by strikes, and to guard against this association being made the tool of professional agitators such as have controlled other organizations of railroad men and led them to their ruin, its constitution provides that all officers and directors shall be what the name of the league implies—railroad employes, and not ex-employes.

One of the most important matters which affect interurban roads, and some of them to a very serious extent, is that of carrying freight. The question is already a live issue in some states and will have to be met and decided in all states within the next five years.

The steam roads, naturally, are on the defensive, as they look ahead a little way and see hundreds of trolley interurbans competing for the business they now monopolize. While they cannot altogether be blamed for assuming the antagonistic attitude they now occupy, we believe and have repeatedly expressed our belief that they are making a mistake. Transportation begets freight and creates business, and while in some cases the interurban will seek to divide the existing business between the two given points, at other places it will give more than it takes. The steam roads must soon awake to the fact that they cannot long bar the progress of country electrics, either by injunction where they seek to cross the steam tracks, or in the courts on the question of right to carry freight as well as passengers. There is no good reason why an electric road occupying streets and highways should any more be debarred from hauling freight over its rails than a company organized to do a general teaming business, which hauls the same identical merchandise over the same route in wagons whose wheels rest directly on the pavement or ground.

* * *

The movement of cars drawn by steam locomotives over streets is obviously an entirely different proposition, for to operate with any degree of economy the latter must handle many cars in a single train. The electric system permits of economical operation with a very few cars in a train, or even only one or two. These electric trains being short do not obstruct cross streets in passing, and can be brought to a standstill promptly. The chief objection to the occupation of a street or highway by a steam railroad has always been the danger to animal-drawn vehicles on account of the noise and escaping smoke and steam. The extermination of the steam dummy for street car work is a striking proof of this. In many cities operating street railway companies are allowed to use any practical motive power except such as is propelled directly by steam.

The movement of farm products and other merchandise upon our interurban roads will very soon be as great a convenience and necessity to the district served as is the transportation of passengers.

* * *

The steam roads lay great stress, and not without some reason, upon the condition that they are obliged to buy a right of way upon which to build and operate, where the electric railway is given free lease for a term of years. But there are two sides to this. In the first place the steam road requires as a prime condition the ability to move its trains very rapidly. Just imagine for a moment a steam trunk line between Chicago and New York laid all the way upon streets and highways. Where would be our Empire State expresses and fast freight lines, and how many through passengers or tons of freight would it move? The steam road train can only stop at intervals of several miles, while its fast expresses frequently make but four or five stops in as many hundred miles, and these partly for fuel and water. The electrics, on the other hand, adapt their operation to the convenience of everyone, and stop at every block if desired.

In the second place, the right of way, while paid for and owned by the steam road has frequently been partly or wholly paid for by the people. The Government has made liberal land grants, and properly, to encourage and assist the enterprise. As the country grew older, towns and counties voted a cash bonus and "bonded the town" to help on the good work. Even where a second and competitive steam road desired to invade an attractive territory, the people had frequently to bond themselves a second time in order to get relief by competition from rates which were excessive because a monopoly prevailed.

In the country electric line the citizens of the towns thus connected and served receive a much more frequent service, with stops at almost any point and lower fares than steam roads. The interurban line in no way lessens the original use and purpose of the highway, and makes of it a convenience never before possible.

There can be but one result in the end, and that permitting trolley roads to carry all kinds of freight. It may be found best to move certain classes of freight at night, but this only in cities of considerable size.

VIADUCT AT CLEVELAND DAMAGED BY FLOOD.

The Willson avenue viaduct over the Kingsbury Run valley, Cleveland, was partially destroyed by a washout, January 13, and from the half-tone illustration a good idea can be obtained of the extent and character of the damage. The viaduct was built on the top of an old embankment, 40 ft. high and 70 ft. wide at the crest, which was made in 1872 to extend Willson avenue across the valley. The viaduct was constructed by the New York, Chicago & St. Louis Railroad Company in accordance with an agreement made with the city for the privilege of building tracks across this and other streets. This agreement was made in April, 1882, but it was not until 1895 that it was enforced. The city built the approach at the north end and the railroad company built the south approach and the bridge.

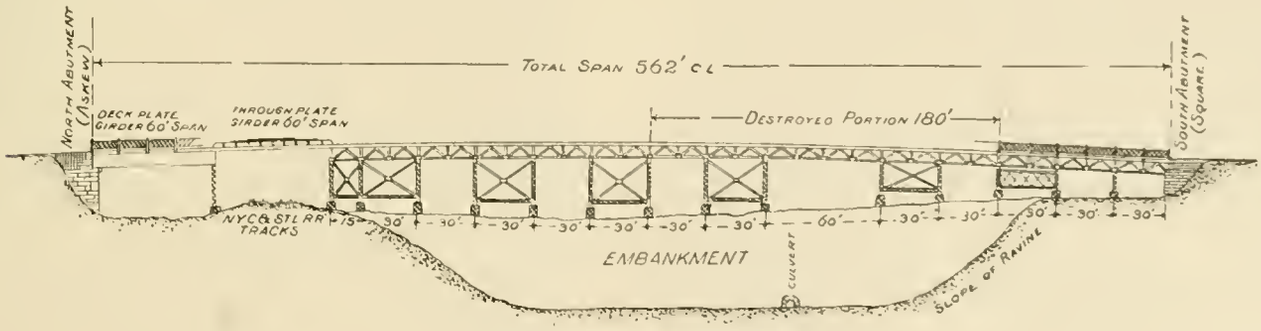
The metal portion of the bridge was 562½ ft. long, and carried a 45-ft. roadway and two 7½-ft. sidewalks. Its approaches were earth embankments 230 ft. and 345 ft. long respectively. A cross section of the valley with a profile of the bridge is given. The street railway crossing the bridge was the Willson avenue line, operated by the Cleveland Electric Railway Company. It is a cross-town line connecting with both the Big Consolidated and the Little Consolidated systems, and transfers from both companies are accepted on the Willson avenue line.

Through the embankment there was a culvert 9 ft. in diameter and 200 ft. long to carry the stream, which with its tributaries drains a valley several miles in length. The embankment consists almost entirely of sand, and the foundation of the piers upon which the structure rested were not carried to any considerable depth into the embankment. A heavy rainfall increased the flow of water through the run, and this together with the breaking of an 8-in. water pipe in the embankment caused it to give way, and the four pedestals of the 60 ft. span to sink, but the adjacent spans held up the structure for 10 hours afterwards, then it gradually settled and broke apart, leaving a gap of 180 ft., as shown in the cut. James T. Pardee, bridge engineer, of Cleveland, informs us that the city has let a contract for a temporary wooden trestle leading around the broken portion of the viaduct, to accommodate street cars and other traffic until the structure is permanently repaired by the railroad company.

CONSOLIDATION AT LEBANON, PA.

The Lebanon & Annville and the Lebanon & Myerstown Street Railway Companies have been consolidated and plans are on foot for the improvement and extension of the combined lines. John A. Rigg, president of the United Traction Company, of Reading, is associated with the new company, and is represented in the board of directors by his son, Dr. Walter A. Rigg. The Annville line will be extended westward to Palmyra and the Myerstown line eastward to Womelsdorf, connecting there with the Reading & Womelsdorf system. This will form a continuous interurban electric railway 37 miles in length. A new power station will be constructed in the spring. The officers of the new company are: S. P. Light, president; H. H. Light, secretary, and F. H. Reinoehl, treasurer.

WILLSON AVENUE VIADUCT, CLEVELAND.



GENERAL DIMENSIONS OF VIADUCT.

It is reported that on the night of February 17, current from the trolley line of the Cleveland, Berea, Elyria & Oberlin Railway was utilized in breaking open the vaults of the Oberlin Bank Company, at Oberlin, O.

Legal Victory for the Aurora & Geneva Railway.

The Illinois Supreme Court Holds that an Interurban Electric Railway may Leave the Highway and Condemn a Right of Way through Private Property when it is "Expedient" or "Reasonably Convenient to Do So"—The Conclusion of a Hard Fought Contest.

Probably no case recently passed upon by the courts is of deeper interest to those connected with interurban electric railways, than is that of the Aurora & Geneva Railway Company against Jennie D. Harvey and others upon which the supreme court of Illinois passed last month. The opinion was filed on February 17, 1899, and we give it in full; it contains a detailed statement of the facts and circumstances and a full history of the previous litigation. The affidavits quoted will be clear after an examination of the diagram of the routes in controversy. The court said:

This is an appeal from the decision of the circuit court of Kane County in a proceeding under the act in regard to horse and dummy railroads of this state, instituted by appellant, (the Aurora & Geneva Railway Company) against appellees, Jennie D. Harvey, et al., to condemn the real estate described in its petition. The parties interested in this appeal have been before this court at a former term, (see Harvey v. Aurora & Geneva Railway Company, 174 Ill. 295), and as two of the disputed questions now presented grow out of the construction and effect to be given to our opinion rendered in that case, it will be proper to briefly restate the facts and proceedings then before us:

"The Aurora & Geneva Railway Company, appellant, was organized under the general incorporation law of the state, entitled 'An act concerning corporations,' approved April 18, 1872. In the application to become incorporated the purposes for which the corporation was organized are stated as follows: 'The object for which it is formed is to build, construct, maintain and operate street railways, horse and dummy railroads and tramways in the county of Kane, in the state of Illinois, to be operated by electricity or by any other motive power excepting steam, for the purpose of carrying passengers, express matter, mail and baggage; also for the purpose of generating and supplying others with electricity, in any form, for power, heat, light and for any other purpose.'

"The certificate of organization bears date July 29, 1896, and the purpose of the corporation was to construct a street railroad from Aurora to Geneva, the county seat of Kane county. Soon after the organization of the company, it constructed an electric street railway over certain public streets in Aurora and along the public highway from Aurora to Batavia, which was about two-thirds of the distance from Aurora to Geneva. On the eighth day of September, 1896, appellant petitioned the board of supervisors of Kane county to grant to it, and to its successors and assigns, for the period of twenty years, the right to lay down, construct, maintain and operate during said time its railway and tracks, with necessary sidings, appurtenances, poles, wires and other equipments, for the purpose of operating its railway and carrying out the purposes of its incorporation in, upon and along that part of the public highway in the townships of Batavia and Geneva, in said Kane county, Illinois, which runs along the westerly bank of Fox river, extending from a point on said highway connecting with Batavia avenue, at the northerly city limits of the city of Batavia, to the southerly city limits of the city of Geneva. The board of supervisors, after due consideration, granted the prayer of the petition. From the northern limits of the city of Batavia the railway company proceeded to construct its street railway along the highway, the use of which was thus granted to it by the supervisors of Kane county for the distance of about one-quarter of a mile, to a point less than one thousand feet south of where the right of way of the Chicago & Northwestern Railway Company crosses the said highway. At this point the managers of the road determined to deflect from the highway, pass under the Northwestern Railway and construct the road over private property from the point indicated to near the terminus of the road, a distance of one mile. Under this arrangement the managers undertook to leave the highway altogether and run over private property along the banks of Fox river, which lies at a distance east of Batavia avenue varying from eight hundred to fifteen hundred feet.

"The railway company, not being able to procure land for right of way from the owners, filed a petition in the district court of Kane county to condemn a strip fifty feet in width and about a mile and a half in length over private property, claiming the right to do so, under 'An act in regard to horse and dummy railroads' (Rev. Stat. Chap. 66), and the Eminent Domain Act. (Rev. Stat. Chap. 47.) Appellees, land owners, appeared, and entered a motion, supported by affidavits to dismiss the petition filed against them. The motion was predicated on the ground that unlimited power was not conferred on railway companies incorporated under the general incorporation act as horse or dummy railroads, but that the power of condemnation which is given by the Horse and Dummy Act is purely ancillary and incidental to the proper purposes of a street railway. Thus it was contended that the power given to condemn might properly be exercised by a street railway when it became necessary to take private property in order to render the use of the highway practicable and efficient,—when, for example, power houses, switches or turn-outs demanded such use, or when some practically insurmountable obstacle necessitated a slight deflection from and return to such highway,—but that it could not be exercised for the purpose of enabling a street railway to cease to be a street railway; that it could not, in other words, be exercised to enable the road to leave the highway over which it had the privilege of going between two points a mile and a quarter apart, and to make for that mile and a quarter an exclusive right of way for itself over the private estates of individuals. On the other hand, the petitioning railway company asserted that right, and claimed that power was given to it by the Horse and Dummy Act to select its route over private property and condemn the lands so selected. The court denied the motion to dismiss the petition."

Appellees excepted, and prepared a bill of exceptions containing the motion and affidavits in its support, which was signed and sealed by the court. Cross-petitions were then filed by appellees, and on a hearing before the court and a jury damages were awarded for the lands taken, and appellees sued out the writ of error upon the hearing of which the opinion above referred to was rendered. The question then presented for our decision was whether this appellant (then defendant in error) had the right, by virtue of the provisions of the act in regard to horse and dummy railroads to exercise the same right of eminent domain as is permitted to railroad companies organized under the Railroad Act. In the following language we held that the right of eminent domain conferred by the Horse and Dummy Act is a limited and not a general right, as was contended by petitioner:

"It is clear that section 2 of the act of 1874 confers power upon a street or horse and dummy railroad company to take private property, but the power is a limited one, as is apparent from the language of the section. It declares: 'When it is necessary for the construction, maintenance or operation of such road, or the necessary sidings, side tracks or appurtenances to take or damage private property, the same may be done.' Giving this language a strict construction, which, under the uniform decisions of this court, must be done, can it be said that defendant in error was at liberty, in the construction of its road, whenever it saw proper to leave the highway upon which it was authorized by the board of supervisors of Kane county to construct its road, and take private property against the will of the owner? We think not. If, in the construction of the road in the highway, difficulties or obstructions were encountered which rendered it impracticable to construct the road in the highway, a necessity might arise, within the meaning of the law, which would authorize the company to leave the highway and go upon private property until the difficulty encountered was overcome, when a return could be made to the highway; or if sufficient land could not be had in the street for side-tracks, turn-outs or stations, and the same were necessary for a successful operation of the road, under the statute the company would have the right to resort to private property. The power conferred by section 2 of the act is not general. It is limited to a case where it becomes necessary to resort to private property, and that necessity must be shown in the peti-

tion to condemn. What is said in 119 N. Y. supra, applies here: 'Section 13 of the act of 1850 allows any corporation organized thereunder to obtain by condemnation such land as is "required for the purpose of its incorporation." The power is not general or unlimited. The company cannot condemn what it pleases, but only such and so much land as the proper execution of its corporate purposes shall require and render necessary.' Here no reason whatever was shown by the petitioner for leaving the highway nor was any evidence introduced on the hearing of the motion to dismiss, showing a necessity for leaving the highway and resorting to private property."

Whether, under this construction of the statute and the facts of the case as they might appear, the company would be entitled to condemn the property taken was there neither considered nor decided. The opinion concluded in these words: "For the error indicated the judgment will be reversed and the cause remanded." The remaining order issued from the clerk's office contained the language, "further proceedings in conformity with this opinion."

The original petition for condemnation alleged, in general terms, that for the construction and maintenance of its railroad it would be necessary for the petitioner to enter upon and appropriate the private property therein described, following substantially the form usually adopted by railroads in condemnation proceedings. Upon the re-instatement of the cause in the circuit court after its reversal and remandment by this court, appellant asked and obtained leave to file amendments to its petition, setting out the facts which it claims constitute the necessity for taking the private property in question. Appellees moved to dismiss the petition as amended averring that by the opinion and mandate of this court filed in the cause the circuit court was required to dismiss the petition, and that by the opinion and mandate the petitioner was precluded from amending its petition and the court from receiving any amendment thereto, and averring further that the facts alleged did not show any necessity for the proposed condemnation. In support of their motion and contention they filed eighteen affidavits from civil engineers and others. In opposition thereto appellant filed affidavits by twenty-seven civil engineers and several others to the effect that the proposed route necessitating the condemnation is the only safe, feasible and practicable one. These affidavits are all the evidence offered by either party on the hearing and determination of the motion to dismiss, and thereupon the court ordered that the petition be dismissed at the petitioner's cost. From that order the appellant now prosecutes this appeal.

Mr. Justice Wilkin delivered the opinion of the court:

This appeal presents three questions: First, were amendments to the petition properly allowed on the reinstatement of the cause after reversal and remandment by this court; second, what interpretation is to be given to the word "necessary," in the Horse and Dummy Railroad Act; and third, has such necessity been shown as will warrant the condemnation of the property in question.

First:—It is strenuously insisted on behalf of appellees that the circuit court erred in permitting appellant to amend its petition on the re-instatement of the case after its reversal and remandment by this court. The rule is well settled that when a decree is reversed and the cause is remanded without specific directions the judgment of the court below is entirely abrogated and the cause then stands in the court below precisely as if no trial had occurred, and the lower court has the same power over the record as it had before its judgment or decree was rendered, and may permit amendments to the pleadings and the introduction of further evidence, so long as the same are not inconsistent with the principles announced in the court of review, and do not introduce grounds that did not exist at the hearing in the court below. (Palmer v. Woods, 149 Ill. 146; Chickering v. Failes, 29 id. 294; Perry v. Burton 126 id. 599; Cable v. Ellis, 120 id. 136; Rush v. Rush, 170 id. 628.) And further, it is well understood that when a cause is reversed and remanded with direction to proceed in conformity to the opinion then filed, and it appears from the opinion that the grounds of reversal are of a character to be obviated by subsequent amendment of the pleadings or the introduction of additional evidence, it is the duty of the trial court to permit the cause to be redocketed and then to permit amendments to be made and evidence to be introduced on the hearing, just as though it was then being heard for the first time. (Washburn & Moen Manf. Co. v. Wire Fence Co., 119 Ill. 30; West v. Douglas, 145 id. 164.) In the opinion heretofore filed the only point in fact decided is, that the petition for condemnation should have stated facts showing the necessity for appropriating the lands in question. This defect was easily cured by amendment, and the circuit court committed no error in allowing the amendment. In fact, it was the duty of that court to permit the amendment and to admit evidence in proof of the facts alleged in the amended petition. It is only when the merits of the controversy and the ultimate rights of the parties are decided in a court of review that a reversal and remandment will deprive the court below of the right to allow amendments to the pleadings and hear other evidence and the authorities cited by counsel for appellees go no farther than this.

Second:—Counsel for appellees contend that the "necessity" required by the statute in relation to horse and dummy railroads, means an "absolute necessity,"—a necessity so great that in the case at bar, if it is physically possible for appellant to construct and maintain its railroad upon the highway there is no right to condemn. We do not think such a strict interpretation should be placed upon the language of the statute. In the former opinion herein referred to we said: "If, in the construction of the road in the highway, difficulties or obstructions were encountered which rendered it *impracticable* to construct the road in the highway, a *necessity* might arise, within the meaning of the law, which would authorize the company to leave the highway and go upon private property." And again: "In the construction of the road, if a necessity existed for making a deflection from the highway in order to avoid a heavy grade which would prevent a successful operation of the road, defendant in error would no doubt have the right to take and condemn private property to obviate the difficulty." The safety, comfort and convenience of the traveling public require protection, and the policy of the state must be to compel railroad companies to so build their roads as to conserve the safety of its citizens to as high a degree as is reasonably attainable in view of the character and exigencies of that mode of transportation. In the construction of the statutes relating to the taking of private property the word "necessary" should be construed to mean "expedient," "reasonably convenient," or "useful to the public," and cannot be limited to an absolute physical necessity. This, we think, was certainly the intention of the legislature when the act was passed. The view here expressed seems to be well supported by the authorities. Hays v. Briggs, 3 Pitts. 504; Comrs. of Parks v. Moesta, 51 N. W. Rep. 903; Pettingill v. Porter, 8 Allen 1; Coates v. Mayor of New York, 7 Cow. 585.

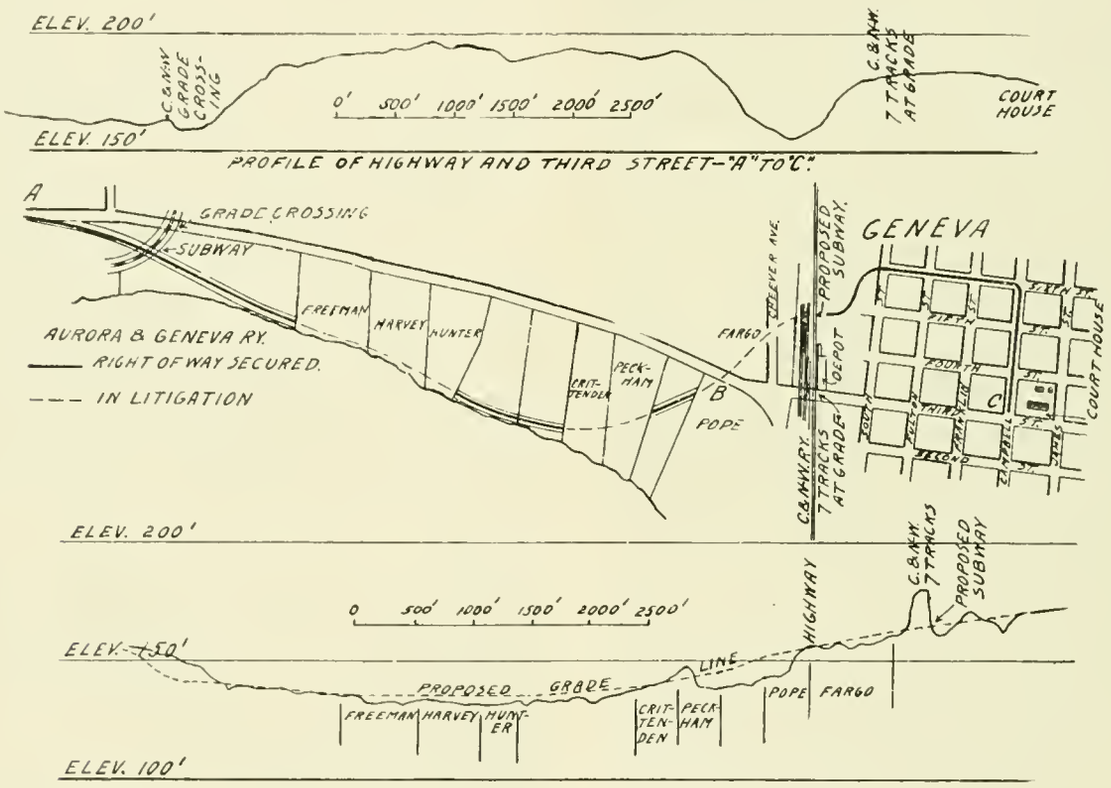
Third:—Keeping in mind the character of the necessity which must be shown to warrant the condemnation of private property by a corporation of this character, has any such necessity been shown to exist here? The evidence adduced on the hearing of the motion to dismiss the petition in the form of affidavits is very voluminous. The following facts are, we think, clearly proved by the petitioner and substantially admitted by appellees:

The Aurora branch of the Chicago & Northwestern Railway crosses the public highway onto private ground at an acute angle on a four per cent curve, and on a grade of 68 to 70 feet to the mile; that the elevation of the outer rail over the inner one, measured in the line of the highway, is five inches; that the railway company runs trains over and across this public highway at a high rate of speed at intervals of not to exceed 30 minutes from six o'clock in the morning until late at night, on each and every day; that from a point on the south side of said crossing it is extremely difficult to see a train coming from the north until it is practically crossing the public highway; that immediately north of this branch crossing of the Chicago & Northwestern, and between it and the main tracks of that company in Geneva, is a hill that rises to the height of 40 feet above the level of appellant's road; that commencing a few feet north of the branch crossing of the Northwestern Railway the hill rises at a gradient of four feet to the hundred feet for a distance of between eight hundred and twelve hundred feet, and then, after a number of sharp undulations, reaches the crest of the hill and then descends the same at a grade of five per cent to the hundred feet for a distance varying from eight hundred to a thousand feet; that the foot of the hill is in a hollow made by a ravine which crosses the public highway at this point and extends to the left of the highway in a northwesterly direction for a long distance, and the Chicago & Northwestern main tracks cross this low depression, made by the ravine, a distance several hundred feet west of the highway in question; that to the right of the highway, at the foot of the hill, the

ravine extends in a southeasterly direction to Fox river; that this depression is only a few hundred feet in width, and the public highway begins to rise at gradients of five or six per cent until it reaches the center of the main tracks or yards of the Chicago & Northwestern railway at this point,—a distance of probably eight hundred feet from the point where appellant in its proposed route crosses the public highway from Fargo' ground onto the premises of appellee Pope; that over the five per cent, eight hundred or one thousand foot grade, on the hill above mentioned, there is heavy foliage, and that at certain seasons of the year the dropping of leaves upon the track would seriously interfere with the operation of a car on the same and would render it dangerous to passengers riding on such car; that this grade upon this part of the hill is made even more dangerous by the character of the macadam, which under the traffic becomes a fine powder, and when moistened by the rain becomes an oily paste on the rails, which would greatly increase the difficulty of controlling the car; that there are seven main and side tracks of the Chicago & Northwestern Railway that cross the public highway at the top of the second elevation, which is reached by a grade of from five to six per cent from the low depression of ground last above mentioned; that the yards of the Chicago & Northwestern railway are over and across the public highway at this last mentioned point, and that freight and passenger trains pass and repass this public highway over said tracks at intervals of every ten or fifteen minutes on each and every day, and that at this point there is much making and unmaking of trains crossing the highway; that the yards of the company are unusually wide, and for the electric road to cross them it would have to cross practically the center of the yards over the highway at this point, and would have to cross these seven railroad tracks with the conditions of making and unmaking of trains and passing and repassing of freight and passenger trains at frequent intervals, as above indicated; that the route proposed by appellant in its amended petition avoids the crossing of the Aurora branch of the Chicago & Northwestern Railway by a subway already constructed by appellant; that it avoids the obstacles and dangers of ascending and descending the hill above mentioned between the Aurora branch and the main tracks of the Northwestern, by skirting around the foot of the hill next to Fox river on almost a perfect level, and, on reaching the public highway, following the ravine up from Fox river; that it extends to the left of the highway and follows the low land made by the ravine over Fargo's property, and escapes the dangers of the grade crossing on the seven main tracks of the Chicago & Northwestern railway by a subway, which appellant proposes to construct at the west extremity of the passenger depot of the Chicago & Northwestern, and then, by easy grades, connects with its Geneva end of the road already constructed to the court house.

In support of their motion to dismiss, appellees filed affidavits of twelve persons, experts in the location, construction and operation of electric railroads such as the appellant is building, only four of whom, however, were familiar with the premises described in the petition. Of these four, the affidavit of William P. Harvey, one of the appellees, his wife being the real party interested, will be quoted at length, as being at least as favorable to the contention of appellees as any of their witnesses. It is as follows:

"I, William P. Harvey, of Geneva, Kane county, Illinois, being duly sworn, on my oath say that I am by profession a civil engineer and was actively engaged in work as such from the year 1886 until the year 1895, and during the last five years of that period my work was in the construction and operation of electric railroads. I have



PLAN AND PROFILES OF HIGHWAY AND OF PROPOSED ROUTE.

made a survey of Batavia avenue at and near the point where the right of way of the Aurora branch of the Chicago & Northwestern Railway Company crosses it, a little north of the point where the proposed route of the petitioner in this proceeding coming northward would leave said highway; and I have also surveyed said Batavia avenue at and near the point within the city limits of Geneva where the proposed route of the petitioner herein would emerge from private grounds and cross said highway. I have also carefully examined without the necessity of a formal survey, the said avenue between the two points at which I made formal surveys as aforesaid. The construction of the petitioner's line in the highway, and crossing the Aurora branch of the Chicago & Northwestern Railway aforesaid at grade and up the hill immediately to the north of that crossing, would involve a gradient to be surmounted of not to exceed three and one-half feet in a hundred, or what is known to engineers as a three and one-half per cent gradient. If it should be considered necessary or desirable to go under the track of the Chicago & Northwestern Railway, this could be done without leaving the highway and without exceeding a four per cent gradient of a total length of about one thousand feet. If it should be found necessary, for any unforeseen reason, to leave the highway for the purpose of going under the track of the Chicago & Northwestern Rail-

way, it would be possible for the line of said petitioner to follow its present contemplated route from where it leaves the highway to the northeast side of the Chicago & Northwestern Railway right of way, from which point it would be possible to return to the said highway, intersecting the east line of the same at a point about three hundred and ten feet north of the center of the Chicago & Northwestern track and continuing on up the before mentioned hill, without exceeding a three and one-half per cent gradient of a total length of about twelve hundred feet. My survey at this point was specially intended to determine what such gradients would be. The construction of the petitioner's line along the highway between the southern city limits of Geneva and the northern end of said highway, which end is at the fork of the roads just south of the main right of way of the Chicago & Northwestern Railway Company, would involve the surmounting of a gradient not greater than five and one-half per cent and about one thousand feet in length, as the highway is at present graded, which percentage, with a little alteration of the road, could be easily reduced to five per cent. This I determined also by actual survey. The highway in the space between the two surveys made by me as aforesaid has none but trifling undulations, none of which would present the difficulty of a grade as great as either of these concerning which I have specially commented in this affidavit."

The other three engineers who examined the premises make substantially the same statements, except that they estimate some of the grades a little higher. The remaining eight affiants on behalf of the appellees confine their statements to the question of the safety and practicability of steep grades, and state that grades of four, five, six seven and even as high as eight per cent are not objectionable and constitute no serious obstacles to the successful operation of an electric railroad, and are not such serious elements of danger as to be worthy of consideration. On the question of grade crossings of electric and steam railways, five of the twelve witnesses concur in the statement that such crossings are always undesirable and ought to be avoided if possible. Two or three witnesses also say, in a general way, that such crossings can be made safe by a system of interlocking switches.

In opposition to the motion to dismiss the petition, appellant filed affidavits of twenty-seven civil and electrical engineers who have had varying experiences extending from seven to forty years,—all men of experience in the location, construction and operation of electric railroads. As in the case with the affidavits offered by appellee they can neither be set out nor specifically noticed within the reasonable scope of an opinion, nor would any good purpose be served by attempting to do so. That of William A. Lynch, whose connection with electric railroads appears to have commenced with their introduction and continued to the present, and who seems to be disinterested and impartial, covers all the questions involved in this branch of the case. After stating his experience with electric railroads he says:

"My attention was first called to the electric railway between Aurora and Geneva three or four years since, and I made an examination of the line, not only between those points, but between Geneva and Elgin, with a view to becoming interested financially in the enterprise, but as nothing was done at the time I did not become interested in the road and have no present interest in it. In going over the line I followed the highway between the points named and made such lateral examinations of the country as suggested themselves to me as I passed along the highway. My attention has been invited to the location of this railway lately, and I have made a somewhat careful examination, so far as seems to be involved in this controversy, at the city of Geneva and extending my observation thence south, first along the highway and then along the line of the company's proposed location over private property. I have also examined the plan and profiles in this case as prepared by the company's engineer. These plans show the plan of the country, with profiles showing the present surface lines both upon the highway and upon the company's location over private property.

"The first question involved in the location is, naturally, the proper exit from Geneva southward. I understand the important point to be reached in Geneva is the court house, and I find that the company has already located and constructed its line beginning at the court house, running on Campbell avenue to Sixth street and thence on Sixth street to South street. Taking this line as the fixed position in Geneva I endeavored to ascertain the most suitable exit from the city to the south. After doing that I somewhat widened my inquiry without having in mind the fixed position in Geneva by tention was called to two suggested lines of outlet, which are the the railway as actually constructed and in that connection my atonly two lines that it seemed possible could be considered other than the company's proposed line of exit. Of these two lines proposed the first is upon Third street, which involves crossing over the tracks of the Chicago & Northwestern Railway very close to its depot at Geneva, and, in fact, involves the crossing of its yards, which are occupied by the main tracks and the side tracks, necessarily much used for switching, making up of trains, station service, etc. There are, as I remember, seven tracks at this street crossing. This line would involve a grade crossing over these tracks. No one who notes the frequent and almost constant use of these tracks can fail to see that a crossing of an electric railway over them would be highly dangerous. As against any other line which could be obtained at any reasonable increase of cost, I have no hesitation in saying that this grade crossing is highly inadmissible, and in my opinion there is no manner in which that crossing could be rendered safe and practicable.

"My attention has been called to affidavits in this case on behalf of the property owners, and noted statements therein that an electric railway crossing at this point could be made safe by the employment of devices, among others, interlocking switches. I am familiar with all forms of interlocking devices in use upon steam and electric railways,—at least I have examined a great many,—and I can say that I do not know of any interlocking device that could be employed at this point that would make this a safe and practicable grade crossing. I know that interlocking devices are used at steam railroad crossings, and can be so constructed and operated as to very much diminish the dangers attendant at such crossings,—in fact, practically prevent them. They can be so constructed at steam crossings as to render it physically impossible for two trains on different railroads to reach or to occupy the crossing at the same time. But that is not the case with any interlocking device in use where electric railways cross steam roads. At such crossings the practice is to lock the electric road against the crossing and to give the steam road the right of way, so to speak. At this crossing it will be seen that it would be impossible to construct interlocking switches which would prevent the engines and trains of the Chicago & Northwestern Railway from reaching and occupying this crossing at the same time with an electric car. I do not mean that it would be physically, but that it would be practically impossible. The introduction of interlocking switches at this point would deprive the railway of the use of its yards, and would cause no end of inconvenience and annoyance in the use of its passenger and freight station. It would be possible to put in interlocking devices so that the electric car would not reach the crossing unless and until some one had gone upon the steam railway or across it, which is the common method, and there operate a device which would permit the electric car to pass upon or over the crossing. This plan has frequently been used so as to insure a man going from the electric car upon and across the steam railroad, being a precaution that the operators of the car are obliged to take in order to get across, and in a very considerable degree lessens the danger at such crossings, but it cannot be said that this would render the crossing absolutely safe. On the contrary there are elements of danger in connection with the crossing of electric cars over steam railroads which even this precaution does not lessen. It is a well known fact that the operation of electric cars requires the transmission of current from some central station, and it is equally well known that the interruption of this current is of frequent occurrence, and takes place constantly from any one of a thousand causes which cannot be wholly prevented, and absolutely without warning notice to those operating the car. It is absolutely instantaneous, and when it takes place the operators of the car are absolutely without power to propel it. This fact introduces or constitutes an element of great danger, and as a steam road always claims and exercises, and must claim and exercise the right of way over a crossing, and does not assume and cannot assume to guard itself or the electric railroad against a danger of this character, the electric car is subject to this danger. This danger of the interruption of the current is increased by a number of tracks, and from the time that is taken in going over the crossing of so many tracks from the first track to the last track.

"There is another danger of some considerable moment which exists from the fact that the crossings of electric railways with steam railroads are apt to be and are somewhat rough,—that is, the car experiences a considerable shaking up, no matter how well constructed; and it is a matter of common observation that in cases where electric cars pass along rough track the trolley is more apt to get off the wire than where the track is smooth, and hence we frequently see that at railroad crossings trolleys do leave the wire, thereby depriving the car of its means of propulsion. This can be prevented, or at least mitigated, by extra care at these points, but the danger cannot be entirely avoided.

"After considering the whole matter of this crossing I desire to express the opinion that I consider it a very unsafe one, and the road should not be constructed thereon if other possible line can be obtained.

"The other means of exit called to my attention by way of First street, under the tracks of the Chicago & Northwestern Railway and thence by Bridge street to the highway leading south of the city. If I understand the situation correctly, this is the only exit from the city to the south available for public travel, except Third street across the seven tracks of the Northwestern, to which I have above referred, making this one of the most important highways, inasmuch as it provides the only route from the city south for the general public. To place an electric railway in this street through this subway under the Northwestern tracks would be to impose a burden upon the traveling public and upon the citizens of Geneva which should not be permitted if there is any possible way to avoid it. This under crossing is not a straight one. On the contrary, a pretty sharp curve occurs in the highway just at that point, and extends to the south where the street swings around into the public highway. The abutments at the subway cut off the view both ways,—that is, the view of a person traveling on the road going south and approaching the subway would be cut off as against an electric car approaching the subway from the south, and vice versa. I would regard the construction of an electric railway along First street, through the subway and along Bridge street as a very serious burden upon the traveling public along the street.

"Leaving the whole question of the exit of the railway from Geneva, I am of the opinion that the location selected by the company is the only proper one and the only feasible and practicable one, having in view the successful operation of the railway, and especially having in view the rights of the traveling public either upon the cars of the company or upon the street.

"There is another railroad crossing a short distance south of Geneva where the highway passes over what is known as the Aurora branch of the Chicago & Northwestern. It is a single track road, which I observed to be in constant use by trains. This crossing is especially dangerous because of the fact that trains approaching the crossing from the west round a sharp curve which cuts off the view, and a person standing at the crossing or near it cannot see approaching trains from that direction. I observed at that point there is a heavy grade upon the steam road, which would be an additional element of danger. While I do not consider this crossing nearly so dangerous as the one in Geneva, I consider it highly objectionable, and if any other way is possible I would say that it ought to be selected, even though it should involve considerable extra cost to the railway. In fact, I may say that while grade crossings are used and are obliged to be used in cities and to some extent in the country, past experience shows that the dangers attendant upon such crossings should be avoided wherever it is possible to do so. In cities ordinarily it is not possible and the danger must be met as well as can be by the employment of care in the use of such crossings; yet we know that it is impossible to expect the employment of care always and under all circumstances, and whatever may be said theoretically about such crossings, we know that practically they are very dangerous.

"Looking over so much of this location beginning at Geneva and going southward, as seems to be involved in this present inquiry, I do not wish to be understood as saying that the grade crossing of the seven tracks at Geneva and the grade crossing of the Aurora branch of the Northwestern alone necessitates the deflection of the location from the highway, but coming now to that portion of the highway lying between those two points the questions involved in the location are very plain. The location in the highway involves the use of a grade of five feet to the hundred, or thereabouts, for some seven hundred feet, and if the grade crossing were to be avoided, and the Bridge street line is also to be avoided, as in my opinion they should be, it further involves the introduction of a curve, with a radius of from one hundred and twenty-five feet to one hundred and fifty feet, just at the foot of this grade. After going over the highway and looking into the matter carefully, I am of the opinion that the only feasible and practicable route between these two points is the one selected by the company. Grades of five per cent are in frequent use upon electric railways. I am operating a railway with heavier grades than that, but their use is very dangerous, especially under certain conditions of the track, generally dependent upon the state of the weather. A grade of that kind, in and of itself, is a very objectionable part of an electric railway. No system of brakes has yet been introduced which will absolutely prevent a car from sliding upon such a grade. While this sliding often happens without causing injury, yet it is liable to result in serious injury, and frequently does so. But with the introduction of a sharp curve at the bottom of such a grade the danger is greatly increased. If a car should get beyond control on such a grade, (as might often happen and does often happen, owing to the failure of the brakes to act, or, in acting their failure to hold the car, and owing to the failure of the current and inability to reverse the car, or, even if all should work properly the car, under certain conditions, might easily and often does slide) it would leave the track at the curve. The surface of the ground at this point is broken by a ravine and the sliding of a car down that grade and its leaving the curve would doubtless precipitate it into the ravine and cause serious damage. It seems to me that the location of this grade, with a curve at the foot, under the conditions existing at this point, makes that location inadmissible.

"I have examined the two proposed locations,—the one proposed by the railway company over private grounds, avoiding the two railway crossings, and the other along the highway,—and looking at the question, considering the effect upon the owners of private property, and also with reference to the convenience and safety of the public using the highway, and the convenience and safety of the public using the electric railway, I have come to the conclusion that the line proposed by the railway over private property is the only proper and practicable location from these different points of view. The gradients are excellent. No sharp curves are involved. It will be entirely safe and free from avoidable danger."

The statements made by this witness are fully and repeatedly corroborated in the affidavits of the other twenty-six witnesses for appellant, half of whom, at least, have made actual inspection of the premises and the others have familiarized themselves with the location by the examination of the map and profile in evidence, the correctness of which is not disputed. On the question of excessive gradients and grade crossings of electric and steam railroads the witnesses on behalf of appellant are unanimous in their condemnation of both when they can possibly be avoided, and the evidence as to the dangerous character of grade crossings is corroborated by five of the witnesses for appellees. The evidence of expert witnesses is always more or less argumentative,—perhaps more so when, as in this case, it is given in the form of ex parte affidavits; but from the facts stated and the opinions given by all the witnesses it is impossible to escape the conclusion that by the clear preponderance of the evidence such a necessity for the condemnation of private property by street car companies as is contemplated by the statute has been established by the petitioner in this case.

The point is made by counsel for appellees that even if a necessity for the departure from the highway has been shown, it does not appear that a return thereto cannot be made, and thereby the condemnation of at least a part of the land in question be avoided. With the legal ground of the proposition we fully agree. That is to say, if under our construction of the statute a necessity for departing from public streets or roads arises in the construction of street railways, a return to the public highway must be made as soon as the same can be practicably done. The facts in this case, however, show that a return to the highway was impracticable, and we are unable to agree with counsel in the contention that the evidence fails to show that a return to the public highway, after leaving it could not reasonably be made.

We are of the opinion that under the evidence in this case the petitioner below, appellant here, established its right, under the law, to condemn the property sought to be taken, as described in its petition and that the circuit court erred in its judgment denying it that relief. That judgment will accordingly be reversed and the cause

will again be remanded, with directions to proceed in conformity with the views herein expressed.

Reversed and remanded.

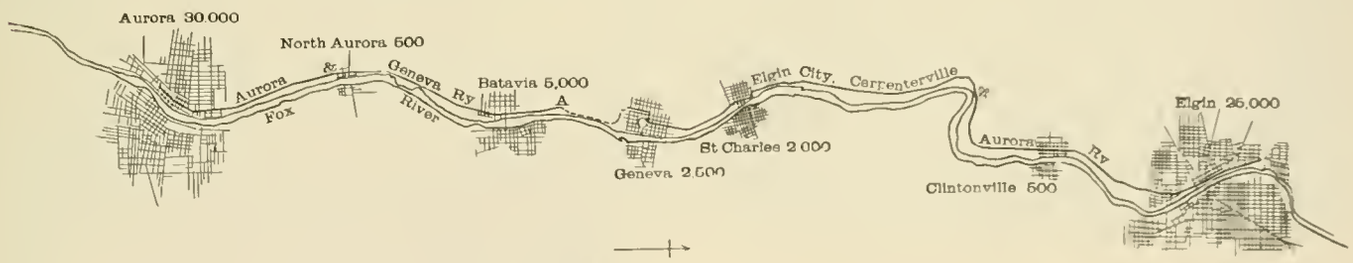
Mr. Justice Magruder: I dissent from this opinion in toto—both the reasoning of the opinion and the conclusion reached by it.

The success which has finally crowned the efforts of the Aurora & Geneva Railway Company in its endeavor to condemn a right of way through private property in order to enter Geneva by a safe and practicable route, is greatly due to the perseverance and energy of D. A. Belden, general manager of the company. From an examination of the map of the portion of the right of way in dispute it is easily seen that it was good business policy for the company to engage in a long and expensive legal contest. The work necessary in preparing the case has fallen largely upon Mr. Belden and he as well as his road deserves the thanks of all the many street railway men whose own projects will be greatly aided by this important decision.

D. A. BELDEN.

Mr. Belden entered the employ of the Aurora Street Railway Company in 1891 as assistant secretary and treasurer; a year later he was appointed manager and on the organization of the Aurora & Geneva Railway Company became manager of it also. In the latter capacity Mr. Belden secured the necessary franchises and right of way, and built the road; no part of the work was let. The numerous extensions of the Aurora Street Railway made since 1891 have been in his charge.

The sketch showing the towns, with their respective populations, in the Fox river valley will make clear the importance of the short section of the Aurora & Geneva line which has been in litigation. This road which is owned by the same parties as is the Aurora line, and really a branch of the latter, runs from Aurora through North Aurora and Batavia to the point A and in Geneva to the court house, marked C on the map. At the point C it connects with the Elgin City, Carpentersville & Aurora Railway running through St. Charles and Clintonville to Elgin. The portion of the road which is uncompleted because of this litigation is indicated by the dotted line beginning at A.



INTERURBAN LINES IN THE FOX RIVER VALLEY.

ELECTRIC BOARD FOR BUFFALO.

A bill has been introduced in the New York legislature providing for a Buffalo Board of Electricity Commissioners, to regulate the wiring in that city and prevent the employment of incompetent men in such work. One member is to be a practical wireman of at least six years' experience, one a member of the Board of Fire Underwriters, and the third an electrical engineer of good repute.

A motorman in Providence, R. I., was arrested last month for running his car faster than six miles per hour, the limit by ordinance; in taking a switch the conductor was thrown from the car and injured which was the reason for the question of speed (if it really was too high) being raised.

ALUMINUM VS. COPPER FOR ELECTRICAL CONDUCTORS.

The production of copper in the United States during the past year amounted to 546,367,000 lbs., valued at $64,000,000. This output exceeded that of any other year, and the value of the product was greater than that of any other metal except iron. With such great mines as those in the upper peninsula in Michigan, from which the pure lake copper is taken in its native state, those in the Anaconda district of Montana and those in Arizona, it is hard to realize that there could be any scarcity. The Lake Superior mines produced 158,233,000 lbs. of copper last year, but it requires much time, money and labor to develop them, and the output of this district cannot respond quickly to any enhanced demand. The Arizona district has doubled its output in three years, and during 1899 will likely produce 75,000 tons of copper. About two-thirds of the copper supply of the world comes from the United States.

Yet this enormous production is inadequate to the demand occasioned by an increase in all lines of electric industry during the past year, so that copper quotations have steadily increased. The European demand has for some time past been extraordinary, and with an expanding consumption in the United States, this condition has been brought about. The stock, particularly in Europe, has been slowly decreasing, and the price has risen 30 per cent in the last three months. Recently copper was sold as high as $365 a ton in England and Scotland, and in New York copper is quoted at 17 cents per lb.; compared with 11 cents a year ago, this is an increase of over 50 per cent. Apparently this advance is only partly due to speculation and largely to a very great consumption at home and abroad, much in excess of the production.

It is a serious problem to users of copper to know if there is any means of relief from such a rising market. The street railway companies are among the largest purchasers, for copper is employed in nearly every part of their equipments. The rise of 50 per cent has enormously increased the cost of trolley wire, feeders, bonds and affects motors, generators and fittings in the power station and on the cars. There is but one metal which can be economically substituted for copper for conducting electric currents, and that is aluminum. With the present price of copper, aluminum seems to have a decided advantage as far as cost is concerned, except, perhaps, where the wire has to be covered with insulation.

Copper has a specific gravity of 8.93 and a tensile strength of 16,500 lbs. per sq. in. when pure, but for commercial work it has a purity of about 98 per cent, and in the form of hard drawn copper wire has a tensile strength of 65,000 lbs. Aluminum has a specific gravity of 2.68, a tensile strength of 26,000 lbs. in pure soft wire and 40,000 lbs. per sq. in. in the form of hard drawn wire. According to the above copper is 3.332 times as heavy as aluminum, volume for volume. A series of careful experiments, made by E. F. Northrup, upon the relative conductivity of the two metals showed aluminum to have 61.5 per cent of the conductivity of copper. To compare the costs of the two metals we may use the expression $gCp \div GcP = 1$, where g, c and p are specific gravity, conductivity and price, respectively of copper, and G, C and P for aluminum. Substituting the values given above we get $(8.93 \times 61.5 \times 17) \div (2.68 \times 100 \times P) = 1$. From this the cost of aluminum of equal conducting power would be 34.83 cents per lb. to correspond with copper at 17 cents. The Pittsburg Reduction Company has stated that it will sell rods, bars, plates and wire drawn not less than No. 12 B & S in large special orders for electrical conductors at 29 cents per lb., and guarantee the conductivity higher than that given above. This is equivalent to copper at 14.14 cents per lb.

Properly drawn aluminum wire is as tough, and will stand bending as severely without breaking, as soft copper wire. On account of having but 48 per cent of the weight and 60 per cent greater cross section than copper wire, longer spans can be constructed between poles and insulators. The following table gives the comparative area, diameter and gages of equivalent copper and aluminum wires:

Sizes of Copper Wire.			Sizes of Aluminum Wire Having Equal Electrical Conductivity		
B & S Gauge	Size Each Number Diameter Inches.	Area Square Inches.	Area Square Inches.	Size Each Number Diameter Inches	Nearest B & S Gauge.
0000	46000	166190	2659040	582	—
000	40964	161794	2588704	574	—
00	36480	104528	1672448	461	0000
0	32486	082886	1326176	4109	000
1	28930	065734	1051744	3659	00
2	25763	.052130	0834084	3259	0
3	22942	041332	0661212	2901	1
4	20431	032781	0525056	2585	2
5	18194	025996	0415936	2301	3
6	16202	020617	.0395720	2253	3
7	14428	016350	0261600	1825	5
8	12849	012967	0207472	1625	6
9	11443	010284	0166144	1454	7
10	10189	.0081407	.01302512	1336	7
11	.090742	0064674	01034784	1185	9
12	.080808	0051288	.00820608	1022	10
13	.071961	0040771	00652336	0911	11
14	.064084	0032255	00516050	0810	12

One of the chief drawbacks to the use of aluminum is the difficulty of soldering or brazing, which is on account of the high heat conductivity and the surface of the metal cannot be cleaned with ordinary soldering salts. There is a thin film of oxide over the surface which prevents the solder from amalgamating with the aluminum, but this can be removed by scraping or by a solution composed of one part hydrofluoric acid, 10 parts nitric acid and 50 parts water. Soldering is a much more difficult and slow operation than with copper, but the facility with which it can be done depends very much on the skill of the workman. At best the soldered joints are not strong and are subject to electrolysis.

Several forms of mechanical joints have been successful; perhaps the most satisfactory form consists of thin aluminum sheets being wrapped and twisted about the joint, which can be left smooth on the outside when desired and can be made stronger than the body of the conductor. Another method of making joints is to roll a thin aluminum sheet about 6 in. wide into two cylinders from opposite edges of the sheet and the ends of the wires are joined by inserting them in the cylinders from opposite ends, and both the wire and sheet twisted with pliers until a firm joint is secured which is strong and impervious to air and water.

In reference to the general use of aluminum for electrical conductors, A. E. Hunt, president of the Pittsburg Reduction Company, the largest manufacturers in the world, writes:

"Aluminum has been used very largely for electrical conductors for some time past. The Pittsburg Reduction Company has had 10,000 h. p. of electrical current transmitted over an aluminum line for the last two years. The Niagara Falls Hydraulic Power & Manufacturing Company has a considerable amount of this material about its plant at the lower works of the Pittsburg Reduction Company. We have furnished some 80 miles of aluminum wire for electrical conductors at Snoqualmie Falls, for the transmission of power from the falls to Seattle and Tacoma. We have furnished the Standard Electric Company, of California, with a considerable amount of wire for electrical conductors; also the Pennsylvania Railroad Company with some aluminum wire, and have very satisfactory reports regarding it from the superintendent of telegraph.

"The following is a copy of a letter received some time ago from D. H. Fitch, manager of the telephone exchange, Cazenovia:

"'In regard to the further use of aluminum wire, I shall have need of a little for special work this spring. All thus far has served its purpose splendidly. I was a little apprehensive of the last, on account of being so soft, but it has stood the storms thus far without the least impairment. The last wire put up had about 450 ft. spans. The long span (nearly 600 ft.) has now stood through two winters and is in perfect condition—just where I put it—and has not stretched or sagged. I have an inquiry from Canada, which I herewith enclose. I have said to him that my use of aluminum is most satisfactory, and if I had this exchange to build today, I would use aluminum wholly for line work.'

"We have furnished the Bell Telephone Company with aluminum conductors for foreign business; also have furnished considerable aluminum for conductors in Japan and other foreign countries.

"We are not recommending aluminum for electrical conductors where it is necessary that the material should be soldered, but we are now arranging for suitable joints which will entirely avoid the use of solder to give satisfactory lines.

"We are now putting in two 14-in. and four 10-in. mills, with two continuous drawing benches, so as to draw aluminum wire as cheaply as copper wire is drawn, and we shall have as large facilities as any mill in the country for doing this work.

"We intend in the future to be in the market with aluminum wire as against copper, although there are many places where we will not compete with copper where insulated covering and soldering are necessary, as in switchboard work.

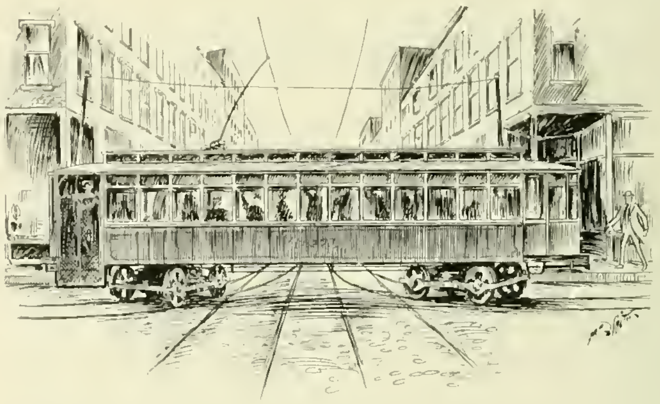
"We do not mean to claim that aluminum is to replace copper by any means, but what we maintain is that a large amount of work can be done with aluminum as well as copper, and this we shall endeavor to secure. We can furnish aluminum at a price to make it cheaper than copper, for many purposes. It is our intention to later on push for the street railway business."

SHALL MOTORMEN BE EXAMINED BY THE STATE.

A bill providing for the compulsory examination of all street railway motormen now pending in the Michigan legislature is severely criticised by managers on the ground that it requires that the motorman have a knowledge of the apparatus he uses which is entirely unnecessary and may (because a little knowledge is dangerous) prove a real disadvantage to the company. As one manager put it, the experienced motorman knows about as much of the inside workings of his motor as does the business man about his watch, and has about the same need of such knowledge. Companies do not give men charge of cars until they are competent to handle them.

THIS CAR WAS FOR EXPANSION.

A rather unusual incident in street railroading is reported from a western city. The corner of A and B streets is a junction point, and interurban cars leave B street at this corner, turning to the left into



A street. On February 15 the switch point slipped after the forward truck had safely taken the curve to the left, and when the rear truck reached it the switch was set for the right hand curve with the result that the car soon reached the position shown in the accompanying sketch. Of course no damage was done and after a few minutes' delay the car was sent on its way.

OWNER OF WAGON PAYS FOR COLLISION.

Some time ago a car of the Atlanta (Ga.) Railway Company was run into by a team and wagon, and one of the horses struck an employe of the company who was on the front platform, though not on duty at the time. The employe was severely injured and sued the owners of the wagon for damages sustained. The case was tried last month and the injured man given a verdict for $250. This is an unusual result from a collision in which a street car plays a part.

Pleasure Resorts in 1899.

Plans of Street Railways for the Entertainment of Patrons During the Coming Season—New Features in the Way of Attractions—Amusement Circuits—Vapor Launches for Lakes.

At all the meetings and conventions of street railway operating officers since last summer there have been discussions as to the advisability of providing amusements of various kinds. The advice in nearly all instances was that very expensive attractions should be avoided. Companies which introduced grand opera and other high class music, and elaborate special exhibitions found them expensive experiments. Vaudeville performances, to which a small charge is made, are by all odds the best paying entertainments at the theaters. Band concerts, generally given by a local brass band, with a liberal share of purely popular airs on the programs, also draw a large patronage. The late war furnished many ideas for marine and

CELERON PARK—JAMESTOWN STREET RAILWAY, JAMESTOWN, N. Y.

pyrotechnic displays which drew enormous crowds to many parks, and these will doubtless be even more popular this coming summer. One novelty of this year will be golf links which may be a drawing card in some localities which have the golf craze. A number of companies find that zoological gardens on a small scale are popular and deservingly so.

The summer resorts are generally being improved for this coming season and many new ones laid out at great expense. A large number of street railways having fine parks are publishing pamphlets and booklets handsomely illustrated with half tone views in the parks and along the routes. These are distributed throughout the city and adjoining territory. They are placed in racks or handed out in the railroad stations and hotels so that the attention of strangers in the city will be called to this means of recreation; also mailed to clubs, orders, societies, Sunday schools and other church organizations which generally give annual picnics. By this means pleasure travel is increased to a marked degree. The street railway companies are performing a service in the various cities where they maintain parks which is of incalculable value and this good work is being appreciated. In some of the larger cities the street railway resorts rival the municipal parks in area and beauty, and in many of the cities of secondary importance the companies have provided the only breathing spots and pleasure grounds.

JAMESTOWN, N. Y.

Jamestown is admirably situated for summer attractions, being at the outlet of Chautauqua Lake, and it is but natural that the Jamestown Street Railway Company should have one of the finest parks in New York. Celeron park includes a zoological garden with bear pits and a monkey house, a gravity railway, bowling alleys, a Moorish palace, shooting galleries, a miniature railway with 12 coaches, a water toboggan the end of which is shown in one of the views, the Phoenix wheel which was modeled after the Ferris wheel and exhibited at the Atlanta Exposition, and a cycle boat which affords a unique way of enjoying the lake. There are tables and seats for picnic parties, swings and sand piles for the children. In the afternoons and evenings open air band concerts are given free of charge and on special occasions there are fireworks and balloon ascensions. The auditorium and convention hall is an enormous building having a seating capacity of 8,500; in summer dances are given in the building and in the winter it becomes a skating rink. The Celeron theater is a handsome building holding 2,000 people. During this season the attractions will be the Tommy Shearer Repertory Company, Barlow Minstrels, Waite's Comic Opera Company, "The Spooners" and high class vaudeville. The company will erect several new buildings for concessions and will build quarters for the water animals. General Manager Maltby states that all the attractions were very successful last year.

ASHLAND, KY.

The special exhibitions at Clyffeside park which is owned and managed by the Ashland & Catlettsburg Street Railway Company have been described and illustrated in the REVIEW. There are swings, trapeze, croquet, see-saws, facilities for boating and vaudeville for the pleasure of the patrons. The company has found the park a profitable investment. The refreshment privileges are rented and an entrance fee of 10 cents is charged visitors who are not pas-

sengers. Picnics and conventions are found to be very desirable and this coming season there will be an encampment of the State College cadets in the park. President Ringo says that the company expects to build a casino this season.

BIRMINGHAM, ALA.

One of the most progressive companies in the pleasure resort business is the Birmingham Railway & Electric Company. General Manager J. B. McClary writes: "We have been running parks and park attractions several years with great success. The STREET RAILWAY REVIEW is the cause of this, having drummed this idea into street railway manager's heads for several years. We acted on your suggestion and won." Boating, bathing, fishing, merry-go-rounds, side shows and band concerts on Sunday draw large crowds. Everything is under the management of the company and no admission is charged. Last season theatrical performances drew crowded houses every night when the weather was good, and for such entertainments a fee of 10 cents is charged. A contract has been signed for vaudeville, drama, specialties and other attractions of the "roof garden" nature for 14 weeks of the season beginning May 29 and extending to September 3, with the Southern Amusement Syndicate. The agreement is in part as follows, the syndicate being the party of the first part and the street railway company the second party:

"Said party of the second part agrees to furnish for theatrical attractions or companies of the Southern Amusement Syndicate for the above time the.....lighted, heated, cleansed and licensed; attaches to work front theater and stage, usual orchestra and advertising in daily papers, tickets and ticket sellers, bill posters and distributers, currents for all electrical effects; to furnish the resources of the theater in scenery, set stuff, furniture and appointments and imperishable property, and to furnish transportation to and from theater to members of companies; employes of theater to assist in carrying scenery and baggage to and from stage door and to the stage and dressing rooms, and deliver same outside of the stage door immediately after the last performance of each company.

"Said party of the first part agrees to furnish full acting companies to faithfully perform at the above theater from time to time, for the above stated periods, and will not allow said company to appear previously at any other place of amusement in said city during the continuation of this contract, furnishing entire stage entertainment, and to conform to rules and regulations governing said place of amusement.

"For the faithful observance and fulfillment, by said party of the first part, of each and all of the above conditions, the said party of the second part agrees to pay him, or his representatives, the sum resulting from the following terms: The receipts from all ticket sales, cash collections at the door, and....per cent of all excess fares, for the six days of each week.

"Prices of admission to be fixed by party of the first part.

"It is further agreed, that for the mutual interests of parties of the first part and second part, and the honest and faithful fulfillment of this contract, that party of the first part shall furnish good and legitimate attractions for the amusement of the public, and the party of the second part will furnish such transportation facilities as the public may demand for the comfortable transportation of passengers to and from said place of amusement."

This contract is altered to suit conditions and in this case the company pays salaries and does not work on the percentage plan.

DULUTH, MINN.

The Duluth Street Railway Company rents its park together with all the concessions, and admission is free to everyone, no distinction being made between passengers and others except when theatrical entertainments are given. The park is finely situated on a bluff, access to which is gained by an inclined railway. No decision has yet been reached for the line of attractions this season.

SENECA FALLS, N. Y.

The Geneva, Waterloo, Seneca Falls & Cayuga Lake Traction Company manages Cayuga Lake park but has rented the cafe, refreshment and merry-go-round privileges, the latter on the percentage plan. No admission either to the park or entertainments is charged to passengers, but other visitors pay, and some revenue is derived from bicycle riders by a charge for checking wheels and 10 cents admission to the entertainments. Passengers are given tickets to the theater. The vaudeville performances are conducted on a stage on the lake about 50 ft. from the shore, the pavilion being the only place from which a good view can be obtained. The attractions last year were quite profitable and the prospects for this season are very favorable, a number of picnics and conventions having already been booked. There are good facilities for bathing, fishing and boating and for the latter the company owns and rents 25 row boats.

MT. VERNON, O.

Mt. Vernon is a prosperous Ohio city located in the Kokosing valley, 45 miles northeast of Columbus. By a ride of 2½ miles on the park cars of the Mt. Vernon Street Railway Company a passenger arrives at the entrance of Lake Hiawatha Park. The resort covers a track of 50 acres which is naturally very beautiful but it has been made more attractive by landscape gardening, the arrangement of artistic floral designs, broad lawns, terraces, and fine walks and roadways. The rustic architecture of the improvements such as bridges, seats and shelters of various kinds is very artistic. Lake Hiawatha, which gives the park its name, is a pretty sheet of water fed by springs and wells from which the water is pumped by electric power. The outlet to the lake is by the falls of Minnehaha partially shown in the illustration. There is a boat house on the lake shore and a large number of row boats which are rented by the company. A bath house having 20 apartments is nearby and spring boards, swings, water toboggan and marine trolley are provided for the enjoyment of a swim or plunge in the lake. Besides the summer sports there is fine skating on the lake in winter. The company encircles the lake with arc lamps and provides band music during the skating season and large crowds are attracted to enjoy the healthful exercise.

A baseball diamond, tennis courts, croquet grounds and a half-mile bicycle track have been laid out and three bowling alleys built for the pleasure of athletically inclined visitors and not infrequently contests in these sports are held. Besides a merry-go-round there is a pony livery to cater to the tastes of the children. The building, together with a number of little ones about to take a ride, is shown in the illustration. Another view is of a little rustic shelter and the Dairy Kitchen where ice cream, soda water, cigars, candy and dainty lunches are served. The company has built an auditorium, 80 by 100 ft., with a seating capacity of 3,000. A stage with suitable scenery is also provided, so that all kinds of theatrical and musical entertainments, conventions and large meetings of all kinds can be held.

The park "Zoo" is one of the notable features. The bears are confined in a combined pit and cage built of iron and stone. The deer are in a two-acre wire enclosure with a log barn for winter-quarters; there is a prairie dog village, a den of foxes, beavers, several coons, coyotes, alligators, monkeys, badgers, wild cats, mountain lions, minks, gophers, golden eagles, owls and ground hogs on exhibition.

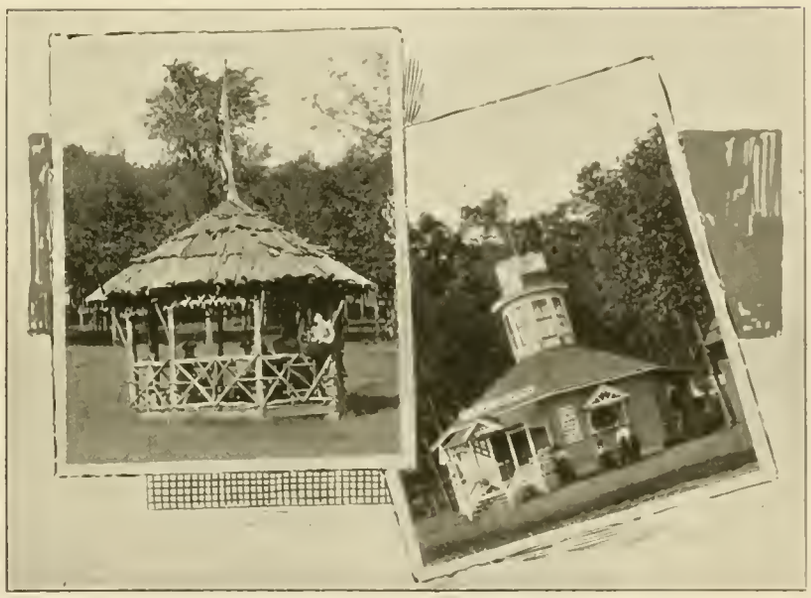
One feature which is rather unusual in a street railway park is the summer cottage. There are a number of them, each bearing an Indian name as Mackinac, Cheyenne, Kaw, Minnehaha, etc., and overlooking Lake Hiawatha. These cottages are finished in hard wood, the floors covered with Japanese mattings, and furnished ready for occupancy except bedding, linen and towels. A cottage may be rented for $6.50 a week or $20 a month. Adjoining the cottages is a dining hall where meals can be purchased for 25 cents or board at $4.50 per week. There are telephone and telegraph connections at the park, two free mail deliveries to the cottagers daily, and the park has its own complete system of water works and electric lighting. No intoxicating liquors are sold or permitted to be brought upon the grounds and the boat house and all places of amusement are closed on Sunday. In event of rain the buildings in the park will shelter 10,000 people, or the entire population of Mt. Vernon.

The park is owned and managed by the company. For four seasons theatrical entertainments, principally vaudeville, have been given and an entrance fee of 5 cents is charged. Secretary D. K. Bird states that the results have been satisfactory, and that many picnics from out of town come to the park.

KANKAKEE, ILL.

The Kankakee Electric Railway Company rents a park in which it has built a theater, boat and bath houses and a pavilion for

THE CASCADE—MT. VERNON STREET RAILWAY PARK.



PAVILION. DAIRY KITCHEN.

THE PONY LIVERY—MT. VERNON STREET RAILWAY PARK.

dancing. During the summer dramatic productions are given by a stock company six nights in the week. An admission of 10 cents is charged to all but no bicycles are allowed on the grounds. Picnics and conventions are profitable and the company solicits this patronage.

DETROIT, MICH.

In Detroit there are no street railway park attractions. The Detroit Electric Railway Company formerly maintained the Boulevard park, but this was abandoned two years ago and since then no effort has been made to stimulate traffic by this means. Thousands, however, use the cars to reach Belle Isle, the city park on an island in the Detroit river.

SEDALIA, MO.

The Sedalia Electric & Railway Company owns and manages its park and has already built a theater, shoot-the-chutes, boat and bath houses and will erect two pavilions this year. Large crowds attended the performances last year. An entrance fee of 5 cents is charged to others than passengers.

SHEBOYGAN, WIS.

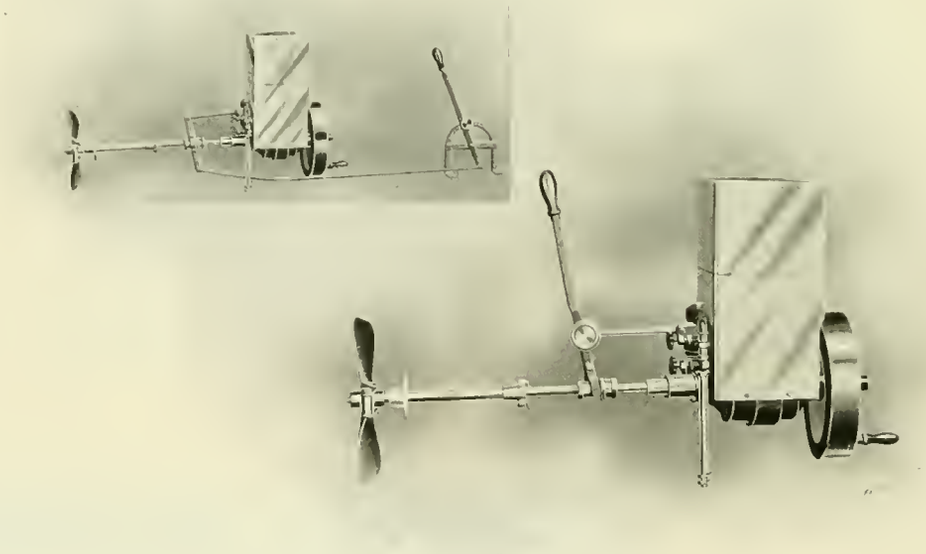
The Sheboygan Light, Power & Railway Company owns and manages its park which is free to its patrons, but 5 cents admission is charged to others. There is every facility for boating, bathing and fishing, a large pavilion for dancing and picnic parties; a fine summer hotel is also on the grounds. Entertainments are given in the theater three nights a week for 14 weeks during the summer as well as band concerts on certain occasions. For four years the company has maintained a menagerie in connection with the park and it is liberally patronized and no special effort is made to secure picnics and other large gatherings.

FT. WAYNE, IND.

The Ft. Wayne Consolidated Railway Company owns and manages Robinson Park, letting only the refreshment and boating privileges. The park is free to passengers, 10 cents being charged to others. The park has facilities for boating and bathing, merry-go-rounds, a theater and other popular attractions; all the buildings have been constructed by the company. Vaudeville shows proved very successful last year. For this season the new attractions will be a bicycle track and a zoological garden.

PITTSBURG, PA.

The Monongahela Traction Company has purchased a 150-acre tract on the west bank of the Monongahela river opposite Braddock, Pa., and will improve it as a first class summer resort. It is alongside one of the company's lines from Homestead to McKeesport, and is 12 miles from Pittsburg, five from McKeesport, and two from Homestead and Duquesne. A summer theater is to be built, a dancing pavilion 72 by 100 ft. encircled by a 20-ft. promenade, a club house bowling alleys, a band stand and a large dining hall with kitchen. A baseball diamond, tennis courts, a bicycle track and perhaps a race track will be laid out for summer sports. Excavations will be made for a lake 500 by 600 ft. which will be fed by large springs on the grounds. The outlet will be by a waterfall into the river. On top of the hill two observatories are to be constructed overlooking the river 1,200 ft. below. A contract has already been closed for a brass band to furnish music for the entire season from May 30 to September 30. The work is being rushed with vigor so that it may be opened on Decoration day. It will be known as Kennywood Park.



TRUSCOTT MOTORS AND PROPELLERS.

the result has been very satisfactory. The new feature for this year will be a golf link.

NEW HAVEN, CONN.

The Winchester Avenue Railroad Company has found by experience that the best plan is to lease the entire park with concessions to one party, the company only retaining the right to exercise control of the character and conduct of the place and amusements, also the privilege of presenting vaudeville and theatrical entertainments. All the buildings and improvements were built by the company. No entrance fee is charged to anyone, but wheelmen are compelled to check their wheels before entering the grounds, at two large stands accommodating 700 bicycles; the charge for checking is 5 cents. The chief attractions are band concerts every afternoon and evening, the electric fountain and fireworks at least once a week. As this is the only resort of its kind in a city of 100,000 inhabitants

OTTAWA, CANADA.

After comparing the results of managing its own resort in 1897 and leasing it in 1898, the Ottawa Electric Company will manage its park this coming season with the exception of the refreshment rooms in the auditorium, which will be rented. Admission to the park is free to all, but seats in the auditorium during vaudeville entertainments are 10, 15 and 25 cents. Swings and merry-go-rounds add to the attractions of the grounds, especially for picnics, which were found particularly profitable last year.

HOLYOKE, MASS.

The Holyoke Street Railway Company owns and manages the celebrated "Mountain Park" which covers 400 acres. In addition

to the beautiful scenery, shady nooks and pleasure grounds there are look-out towers, the deer park, open air stage, merry-go-round and gravity railway all of which were constructed by the company. Good vaudeville performances will be given for 14 weeks beginning with June 15. The charge is 5 cents for a seat to such attractions and last year the results from such attractions were very satisfactory. The company employs a manager for the park whose duty it is to book desirable attractions and entertainments. Picnics and conventions at the park have not proved particularly advantageous to the company. The restaurant privileges only are rented. Admission to the park is free to all, but a charge of 5 cents is made for checking wheels.

TRUSCOTT VAPOR LAUNCH.

Some bright young man observed that all cities are located on or near a body of water; the same individual, had he been making observations today, would have noted that street railway parks are similarly situated. Boating either by launch or row boat is one of the great attractions for any resort, but the majority of pleasure seekers do not care for the vigorous exercise of rowing. Where a light draught, mechanically propelled and easily handled boat can be secured it proves a great drawing card. One of the illustrations shows a boat which is admirably suited for such work. It is 40 ft. long, 9 ft. beam and draws only 28 in. of water when loaded to its capacity. There were 36 passengers crowded to one side of the boat to get a place in the picture. This same boat has carried 70 persons at a speed of nine miles an hour with an equipment of 8 h. p. of machinery. This type of launch can be procured from a row boat size 16 ft. in length to a 60-ft. cruising yacht. Considering the kind and popularity of the service and the capacity for carrying passengers they are not expensive. The Columbus Street Railway Company has had a 20-ft. launch of this kind in Olentangy park and was so well pleased with the results that it ordered in addition a 30-ft. vapor launch which is called the "Wyandotte."

The boat can be finished in any style with any kind of power, but the builder, the Truscott Boat Manufacturing Company, of St. Joseph, Mich., has developed a vapor motor or engine which experience has taught is best adapted to the work. Another illustration shows the motor, propeller wheel and shaft with reversing gear. The motor sets far back in the stern of the boat and is easily controlled; in fact, by reversing the motor the boat can be stopped within its length. In the bow of the boat is a tank of gasoline which is carried through a brass tube in vapor form to the motor. It requires about one pint of gasoline per h. p.-hour, and the tank is of sufficient size to run the boat about 400 miles. The exhaust which escapes under the after deck is muffled. Water is circulated about the cylinder and cylinder heads for cooling purposes. An aluminum jacket completely covers the motor and it is impossible to catch clothing or throw oil or grease. The motor is the acme of simplicity, absolutely safe and requires no licensed pilot or engineer to operate it. There is nothing about it which can easily get out of order and so simple a child can operate it.

WORKING AGREEMENT IN MILWAUKEE.

The Milwaukee, Racine & Kenosha Electric Railway Company has always operated its cars over the tracks of the Milwaukee Electric Railway & Light Company from South Milwaukee to the city hall terminus, and its employes were under the jurisdiction of the latter company when in the city limits. This arrangement has been unsatisfactory in some respects, and a new agreement was made, taking effect March 1, under which the Milwaukee Company has responsible control of the operation of the entire interurban line, though the ownership of that line is not changed. It is the intention to have a terminal superintendent of the Milwaukee Company at Racine, as it has for the Waukesha line.

This agreement with the Milwaukee, Racine & Kenosha is another step in the establishment of an electric railway system that will connect with Milwaukee the cities of Oconomowoc, Fond du Lac, Oshkosh, Neenah, Appleton, Kaukauna, De Pere, Green Bay, to the west and north, and Kenosha, and eventually Chicago at the south.

CHICAGO CONSOLIDATED TRACTION COMPANY.

The Chicago Consolidated Traction Company has been incorporated with a capital of $15,000,000, for the purpose of effecting the consolidation of the outlying Yerkes roads in Chicago, as recommended in Mr. Yerkes' annual report. There are nine companies which it is proposed to consolidate. They are as follows: North Chicago Electric Railway, Cicero & Proviso Street Railway, Chicago North Shore Street Railway, Chicago Electric Transit, North Side Electric Street Railway, Evanston Electric Railway, Chicago & Jefferson Urban Transit, Ogden Street Railroad and Suburban Railroad. The aggregate capital is $13,900,000, and the bonds $8,061,000. These companies have over 260 miles of track.

At the annual meeting of the Citizens' Passenger Railway, one of the Norristown, Pa., street railway properties operated by the Schuylkill Valley Traction Company, a dividend of 3 per cent was declared on the stock. This action was something of a surprise, as the stock has recently sold as low as $8 per $50-share.

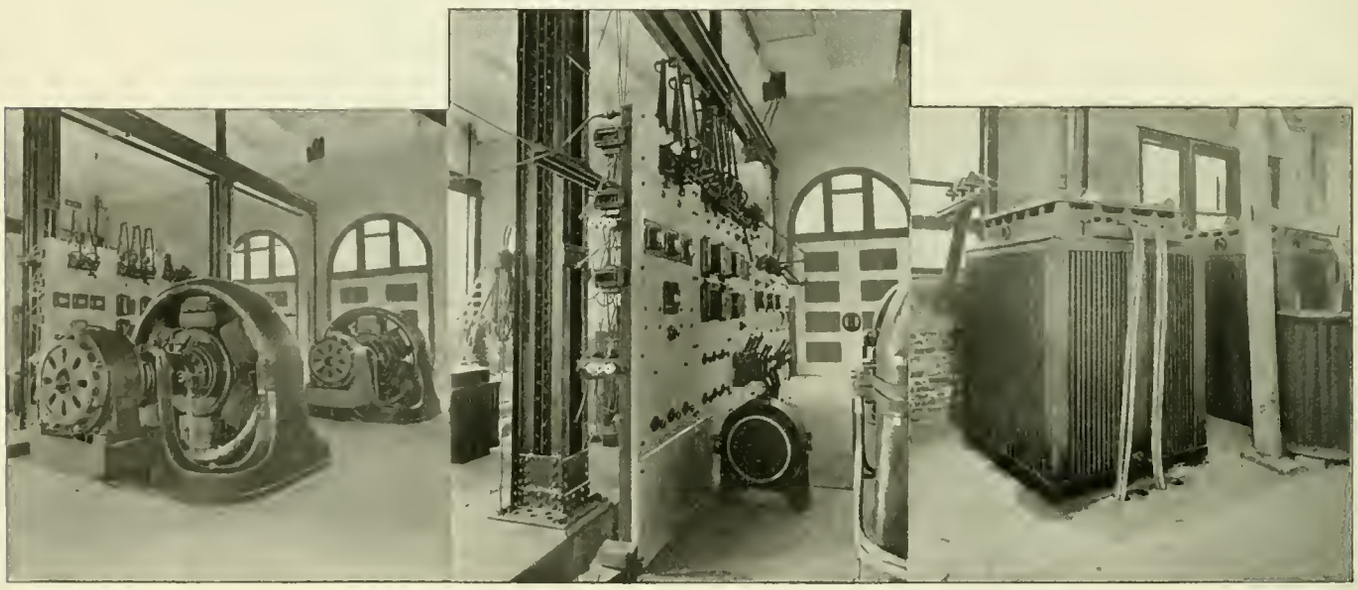
NEW TRANSFORMER STATION AT TONAWANDA.

The recently organized Tonawanda (N. Y.) Cataract Power Company has completed its new transformer station on Robinson street, in North Tonawanda, and current is now supplied from the apparatus there installed. This company was organized for the purpose of acting as distributing agent for Niagara power in the town of Wheatfield, and the city of North Tonawanda, Niagara County, and in the town of Tonawanda and village of Tonawanda, Erie County. The erection and operation of this station has made it possible to operate the Buffalo & Niagara Falls and the Buffalo & Lockport electric roads entirely by electric power generated at Niagara Falls, for it forms a new source of supply that will allow the Buffalo & Niagara Falls road to dispense with its power house in Tonawanda. Current from this new transformer station operates the cars of the Buffalo & Niagara Falls road from the car barns to the Buffalo city line, and also on the Buffalo & Lockport road to a point at or near Pendleton Center. The Buffalo & Lockport line also receives a supply of current from the sub-station in Lockport; the Buffalo & Niagara Falls line is also supplied current from the rotaries in the central station of the Niagara Falls Power Company at Niagara Falls. While running in Buffalo the cars of both roads, it will be recalled, are operated over the tracks of the Buffalo Railway Company, and therefore the supply of current there is furnished from the Niagara street station of the Buffalo Railway Company.

This new transformer station of the Tonawanda Cataract Power Company is another substantial addition that has been added to the buildings of Western New York as a result of the Niagara power development and its transmission throughout Erie and Niagara Counties. The building is of brick and iron. There is nothing temporary about it, but in every part it bears the stamp of the men who by their work in the development and application of Niagara power, show that they are building for years to come. The structure is about 60 ft. by 80 ft. at the foundation, and is a story and half high. The transformer room is undivided. The floor is of granolithic pavement.

The apparatus so far installed consists of two 500-h. p. rotary converters, four 500-h. p. static transformers, switchboard, etc.; it is all of Westinghouse make. The building stands close to the Buffalo-Niagara power transmission line, which is tapped for the station's service. The alternating current enters the building on the east side, passing through high tension circuit breakers on the second floor at a voltage of 11,000 and three phase, and then down to the static transformers, where it is reduced to 375 volts, at which it is fed to the rotary converters. These converters have small motors on one end for use in starting.

The present installation is given space in the east half of the transformer room, and space has been provided for two more rotary converters. The west half of the building is to be devoted to a lighting station. The switchboard is of white marble and has eight panels, with the necessary apparatus for controlling the various currents. From this station power is to be supplied throughout the field above referred to for commercial purposes, and thus it will place North Tonawanda and Tonawanda in close touch with the current from the big generators at Niagara Falls. The industrial conditions in and about the Tonawandas are very flattering, and there is no doubt that very soon a large amount of Niagara energy will be used there.



CONVERTERS. SWITCHBOARD. TRANSFORMERS.

SALT ON ASPHALT PAVEMENTS.

Replying to an inquiry as to the effect of salt on asphalt paved streets, "Municipal Engineering" for February says that the bad effects from sprinkling salt on asphalt pavements in winter arise not so much from the salt directly as from the water produced by the melting of snow and ice, which would find little opportunity to drain off if grades were light. It is further said that the injurious effect of the salt water, which has a temperature very near zero as long as there is snow or ice to melt, upon horses' feet, should prevent the use of salt as described. This last is not a well settled point. Some years ago the manager of a large horse railway system stated at a meeting of the A. S. R. A. that he stood his horses in a salt bath when they suffered from sore feet.

NEW ELECTRIC RAILWAY MAP.

All our readers who attended the Boston convention of the A. S. R. A. will remember the excellent "Street Railway Guide to Massachusetts," published by Robert H. Derrah, and will be pleased to learn that Mr. Derrah has recently published a map of Massachusetts, Connecticut and Rhode Island, showing all the existing and projected street railway lines as well as the steam railroads in these three states. Like Mr. Derrah's former work, this has been carefully prepared. To those who have not kept in close touch with the electric railway development in New England, this map is a revelation. The roads now operating in these three states aggregate 2,157 miles in length, and in 1898 some 90,000,000 car-miles were run; the number of passengers carried was over 400,000,000.

The aldermen of West Superior, Wis., have refused to pass an ordinance providing that no member of the council shall make use of a street railway pass.

THE GLASGOW ELECTRIC TRAMWAY.

While the municipal tramways of Glasgow are widely known, to bring them and other municipal undertakings to universal notice, the city is to hold an international exposition in 1901. The attention which has been attracted by this tramway system is rather out of proportion to its importance or magnitude, for the facilities for rapid transit have at no time equaled those of any American city which approaches Glasgow in population and commercial importance.

It may be of interest to trace briefly the history of the tramways in the Scottish metropolis. In May, 1871, the Glasgow Tramways & Omnibus Company made an agreement with the corporation to lease the tracks for a period of 23 years, ending June 30, 1894. The first line was opened August 19, 1872, and by the end of the year nine miles of track were in use; other lines were authorized and constructed until the total length of single track became 73 miles. In 1891 the council resolved to operate the tramways when the lease of the company expired in 1894. An amicable agreement between the company and municipality could not be reached regarding the sale of the tramway plant, and so the corporation had to secure a new equipment throughout. This was the opportunity for Glasgow to make a record and adopt electric traction. The unqualified success of the trolley had been demonstrated in many cities of America, but instead of this the corporation purchased over 3,000 horses and 240 new cars, which were as obsolete as stage coaches for city transit.

The first year of municipal ownership ended May 31, 1895, and the financial results were gratifying. A committee was appointed later in the same year to investigate mechanical traction, and it went to Brussels, Hanover, Hamburg, Berlin, Dresden, Budapest, Vienna, Milan, Genoa and Paris. The report was that "the overhead system of electric traction is the best we have seen, and can be made quite applicable to any part of the city." Again a committee visited the cities on the Continent, and Coventry and Bristol, in England, and the previous report was corroborated: "The overhead system is the simplest, cheapest to construct and operate, most accessible for maintenance and repairs, and on the whole the most efficient system of mechanical traction which has yet been demonstrated by practical working." Even this was not conclusive for the hard headed Scotsmen, and John Young, general manager, and William Clark, engineer of the tramways, were sent to America. An exhaustive report in favor of the trolley was submitted, and at last the council, in May, 1897, decided to equip the suburban line from Mitchell street to Springburn for overhead traction. In November, 1897, a contract was closed with the Westinghouse Electric & Manufacturing Company for the entire electrical equipment.

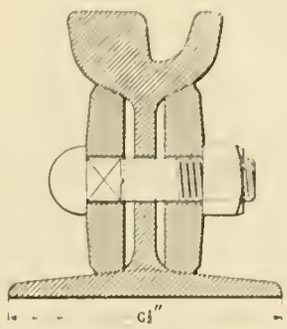


FIG. 1.

The length of the route is 2½ miles, double track the entire distance. The route is for the most part winding and hilly, the steepest grade being 5 per cent and the sharpest curve having a radius of 37 ft. 6 in. The roadbed was designed to meet the condition of


FIG. 2—ROUTE IN BUSINESS DISTRICT.


FIG. 3—ROUTE IN SUBURBS.


FIG. 4—OPENING DAY.


FIG. 5—AMERICAN CAR.

heavy traffic and is of the most substantial construction. The roadway was excavated to a depth of 13 in. and Portland cement 6 in. thick was laid, and upon this the rails were placed; between the rails and for 18 in. on either side the roadway is paved with granite blocks.

tervals of 7 ft. 6 in. steel tie-bars $\frac{3}{8}$ in. by 2 in. are employed. Drain rails are laid at intervals. The rails are connected by No. 0000 B. & S. copper bonds 2 ft. $4\frac{1}{2}$ in. long, and in addition are cross-bonded at intervals of 135 ft.

The span wire suspension, which is generally employed on the

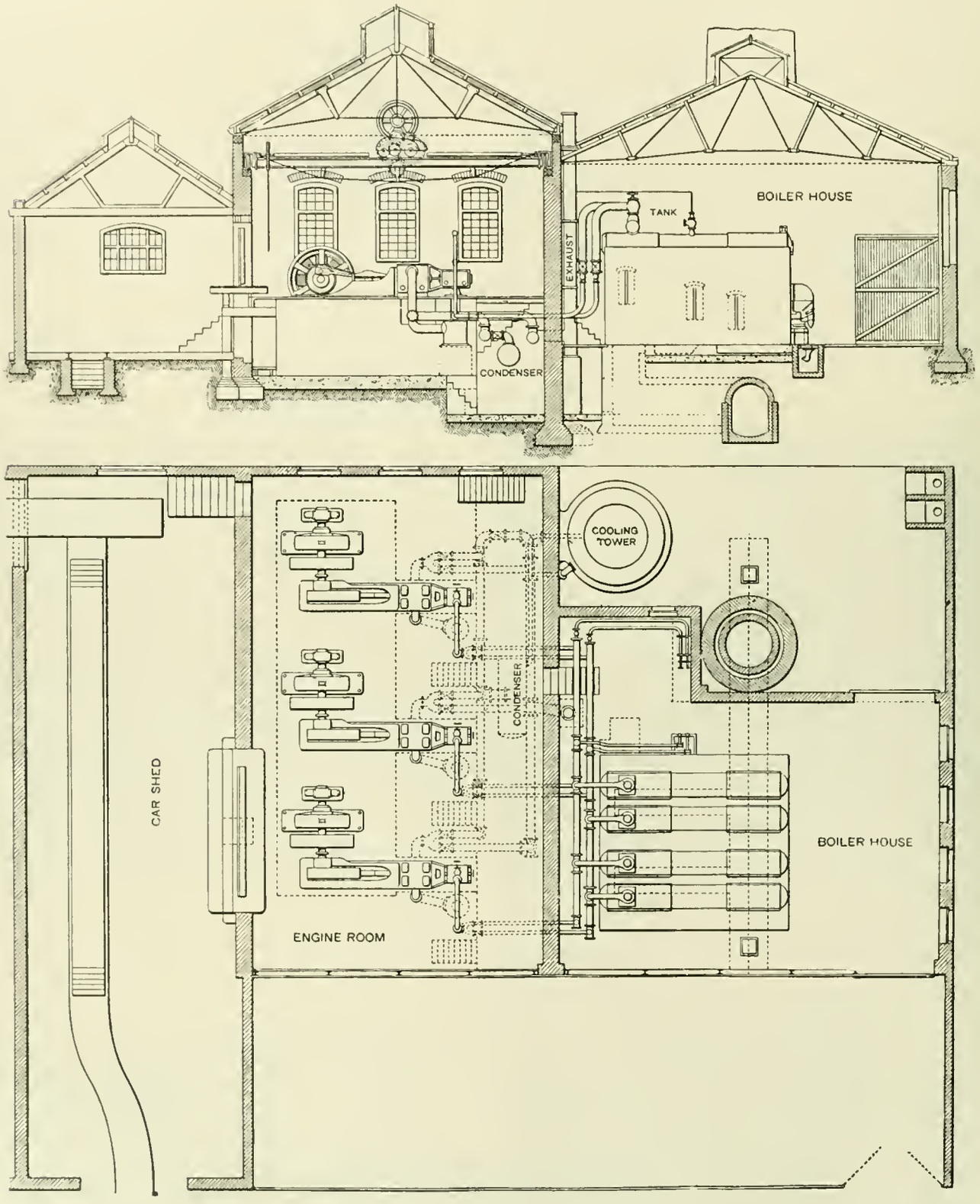


FIG. 7- PLAN AND SECTION OF POWER STATION.

Fig. 1 shows the shape of the 100-lb. girder rail which was laid. Its depth is $6\frac{3}{8}$ in., the width of head $1\frac{7}{8}$ in., on roll $3\frac{3}{4}$ in. over all, and the base is $6\frac{1}{2}$ in. wide. The rails are in 45 and 60-ft. lengths, and are held together by steel fish-plates weighing 48 lbs. per pair. They are 24 in. long and provided with six 1-in. bolt-holes. At in-

Glasgow line, is a great novelty in the British isles, but seems to meet with general approval. By reference to the first group of pictures an idea can be formed of the line and track construction. Fig. 2 is from a view along one of the main thoroughfares of the city, and shows the span wire suspension with guard wires above the trolley

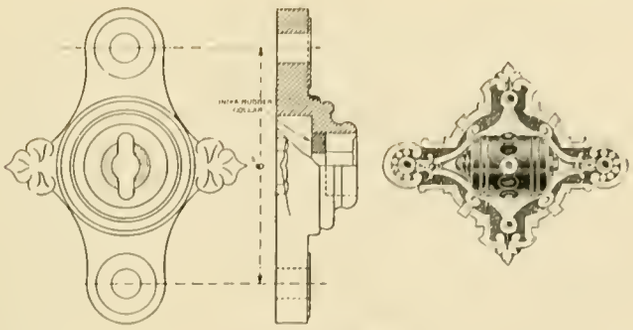


FIG. 6—ROSETTES.

wires. The type of center-pole construction is indicated in Fig. 3. The inspection cars, with municipal and tramway officials and other distinguished Scotch gentlemen, are shown in Fig. 4. The smooth and even paving along the road-bed may be noted from Fig. 5.

guard wires are of No. 6 iron wire and are supported by separate span wires about 6 in. above the trolley. To conform with the Board of Trade regulations, the trolley wire is divided into half mile sections, a cast iron section box containing feeder switches, telephone and lightning arresters being placed at each division. The feeders are placed underground and are about 625,000 c. m. section.

The power station is situated a half mile from the northern or Springburn terminus of the line. The power house is a brick building, one of the end walls being only temporary, and sheathed with corrugated iron so that extension can be added at any time. A plan and section of the station is shown in Fig. 7. The boiler room is 33 by 46 ft. and contains two 250 h. p. Babcock & Wilcox water tube boilers (Fig. 8). They have a heating surface of 2,530 sq. ft. and a grate area of 51 sq. ft. All the steam piping is in duplicate and is carried under the engine room floor. A smoke stack 100 ft. high has been built, and is of ample capacity for the present equipment and any additions to be made in the near future. The two steam feed pumps are the horizontal duplex type.

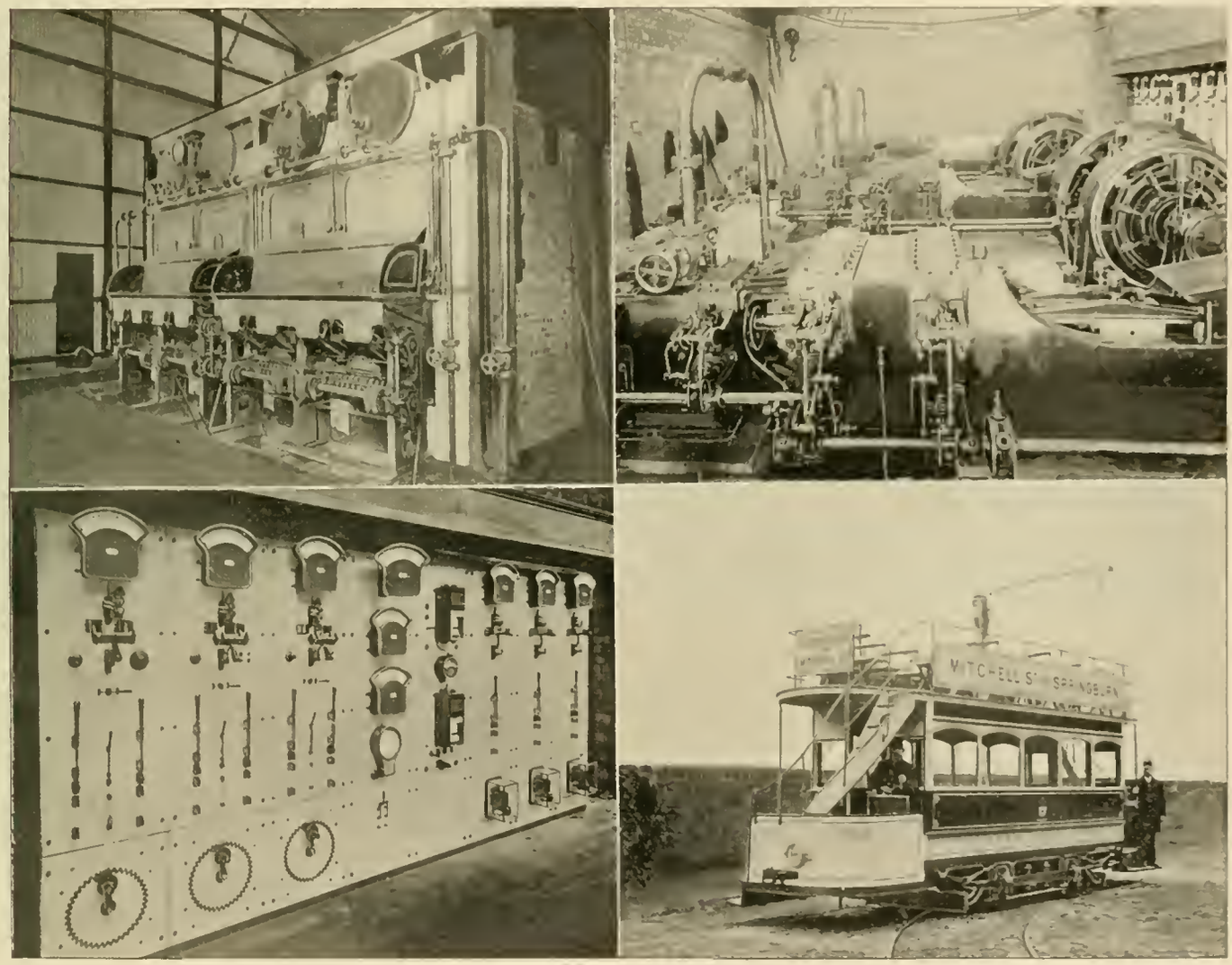


FIG. 8—BOILER ROOM.
FIG. 10—SWITCHBOARD.

FIG. 9—ENGINE ROOM.
FIG. 11 DOUBLE DECK CAR.

Ornamental iron poles, 31 ft. long and planted 6 ft. 6 in. deep, are spaced at intervals of 120 ft. They are of extra heavy mild steel pipe, divided into three sections. A rake of 8 in. is allowed for the strain on the span wires. At certain points along the route the side poles are displaced by ornamental rosettes (Fig. 6), attached by four bolts, but insulated from the buildings.

The trolley wire is double, and consists of No. 00 B. & S. gage, with an ultimate tensile strength of 6,000 lbs. and a conductivity of 98 per cent. The trolley ears are 18 in. long and are soldered. The

The engine room (Fig. 9) is 36 ft. by 61 ft. and contains three large units. McIntosh & Seymour horizontal compound engines are direct connected to Westinghouse generators and develop 300 h. p. at 200 r. p. m. The high pressure cylinder is 11 in. in diameter, the low pressure 22 in. and the stroke is 2 ft. A fly-wheel governor gives very close speed regulation. To the exhaust pipe are fitted two Blake-Knowles automatic relief valves. The exhaust steam passes into a Worthington condenser, which has water circulating around it and is then conducted to the cooling tower. The

tower is 12 ft. in diameter and 31 ft. high and filled with vitrified fireclay pipes. An air draught is produced by a 7-ft. fan driven by a 10-h. p. Brotherhood steam engine. The current of air passing up through the tower comes in contact with the warm water descending from the distributer at the top and cools it. The water supply for the boilers and condensers comes from the city mains.

The Westinghouse generators are the eight-pole railway type, with a circular yoke carrying inwardly projecting pole pieces of laminated soft steel. The field castings are divided vertically and

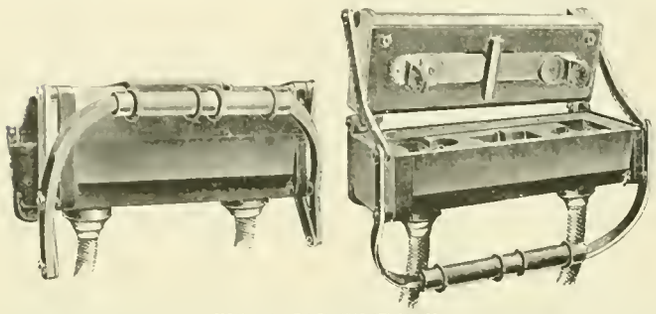


FIG. 12 CAR FUSE BOX.

set upon ways on an independent bed plate. This vertical division of the fields affords every facility for inspection and removal of field or armature coils without dismantling any part of the engine. These generators are over-compounded, so that the voltage increases about 10 per cent from no load to full load, the speed being constant. The shunt and series coils are separately wound and easily removable. The series coils are composed of forged conductors of rectangular section. The armature core consists of punched discs of annealed steel with cast steel end pieces and held together with bolts. The armature coils are carried in slots, and are made from bars of drawn copper forged into shape, and insulated by mica and fuller board. The generators have an efficiency of 94 per cent and are guaranteed to run on an overload of 50 per cent for half an hour.

The switchboard (Fig. 10) is also of the Westinghouse standard railway pattern, and consists of marble panels built into a frame-

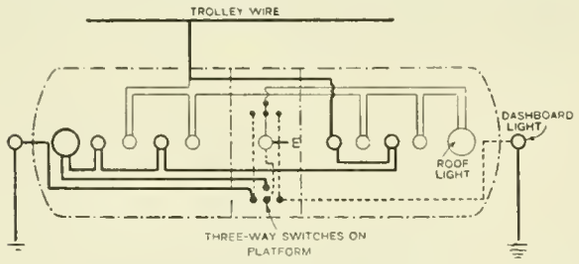


FIG. 13—CAR LIGHTING CIRCUITS.

work in one of the walls of the building. It has eight panels, three of which are for feeders, three for the generators, and the two in the center are for the Board of Trade and main recording instruments. At the back of the board the busbars are so arranged that any addition can be made without alteration of the present connections. There is no woodwork or combustible material in contact with the board, the instruments being mounted on marble slabs in a frame of angle iron.

The present equipment of rolling stock consists of 25 cars, 21 of which are the single-deck American type, four being provided with outside seats and Brill single trucks, as shown in Fig. 11; of these four two are American cars and two of English make. The majority of the cars are 33 ft. 6 in. in length, with central entrances and double trucks. One of the two compartments is reserved for smokers. The cars are 7 ft. 9½ in. in height inside and are ventilated by a monitor roof with side windows. There is seating capacity for 50 passengers. The double trucks have a 4-ft. wheel base and 30-in. wheels. The car equipment was supplied by the Westinghouse Company, the motors, two to a car, being each of 35-h. p. capacity.

The car fuse box is shown open and closed in Fig. 12. The fuse is a copper wire and is connected in the circuit when the lid of the box is closed. When the fuse is blown the lid of the box is opened and can readily be replaced. There is a special arrangement of circuits for lighting the cars, as shown in the diagram, Fig. 13. This provides for two circuits for the lamps of each car, there being two three-way switches so connected that the head-light can be put in either circuit, depending upon the direction of the car. The switches are worked from one handle and are locked so that the same lamp cannot be put on both circuits at the same time.

The cars run on a headway of 2½ minutes and an average rate of seven miles an hour, which will doubtless be considerably increased when the possibilities of rapid transit are better known. The fare for a single trip is 3 cents and there are four 1-cent section fares.

CONSOLIDATION OF BUFFALO AND OTHER LINES.

An important consolidation has been effected of the electric railroads in the vicinity of Buffalo and Niagara Falls. All the railways of the city of Buffalo, the lines connecting that city with Niagara Falls and Lockport, the electric road of Niagara Falls and the Niagara Falls Park & River Railway, on the Canadian side at Niagara, all fall into the possession of a syndicate capitalized at $25,000,000. While there is yet much believed to be back of the plans of the syndicate, it is known that it is proposed to retire all the stock bought with an issue of new bonds, while there will also be a new issue of preferred and common stock.

The companies to be consolidated are the Buffalo Railway Company, the Buffalo Traction Company, the Buffalo, Bellevue & Lancaster Railway Company, the Buffalo & Niagara Falls Electric Railway Company, the Buffalo & Lockport Railway Company, the Niagara Falls & Suspension Bridge Railway Company, and the Niagara Falls Park & River Railway Company. But in addition to these electric roads the new syndicate become the possessors of two of the great Niagara bridges, one of them the fine new upper steel arch, owned by the Niagara Falls & Clifton Suspension Bridge Company, and the other the proposed new suspension bridge now in course of erection across the Niagara gorge at Lewiston. These bridges will afford crossings for a belt line about the gorge, while the possession of the Buffalo & Niagara Falls road gives trackage facilities from Buffalo to the falls on the New York side. As the Niagara Falls Park & River Railway now controls a franchise for a line from Fort Erie to Chippewa on the Canadian side, it will be seen that the new company has all the rights for a belt line skirting the Niagara River on both shores from Lake Erie to Lake Ontario. Much of the stock of the several railway companies was bought below par, but it is understood that the stockholders of the Buffalo Railway Company will receive par. Also that about 75 cents was paid for stock of the Buffalo & Niagara Falls road, and about 50 cents for the Buffalo & Lockport road.

The amounts involved in the purchase of the various interests are about as follows:

Buffalo Railway	$15,215,000.00
Buffalo Traction	3,858,000.00
Buffalo & Niagara Falls Railway	2,250,000.00
Buffalo & Lockport Railway	1,500,000.00
N. F. Park & River Railway	1,000,000.00
Lewiston & Queenstown Heights Bridge	285,000.00
Total	$24,108,000.00

The statement above given is exclusive of the property of the Niagara & Clifton Bridge Company's property.

Further announcements as to the ultimate scope and purpose of the consolidation may be expected to follow soon. The bonds of the Niagara Falls & Clifton Bridge Company are out to the extent of about $400,000, and are understood to be equally divided between Canadian and United States capitalists.

TO BUILD STREET RAILWAYS IN JAPAN.

Dr. W. Delano Eastlake, in an interview recently published in a Seattle, Wash., paper, states that he and his brother, Dr. F. Warrington Eastlake, who is now in Japan, had succeeded in interesting American capitalists in a project for building electric railways in Japan. The syndicate, it is said, will invest $40,000,000 in Japan, but the business will be conducted through Japanese companies.

SPECIAL CAR FOR BALTIMORE.

We present herewith engravings showing the interior of the special directors' car recently built by the American Car Company, of St. Louis, for the Baltimore City Passenger Railway Company, of Baltimore, Md., which is undoubtedly one of the most elaborate street railway cars ever built.

The body is of the swell and concave panel type; it is 30 ft. over corner posts with 5-ft. platforms, and is mounted upon high speed double motor trucks. The smoking compartment is 10 ft. in length and the ladies' parlor 20 ft. The doors leading to either compartment from the platforms are of the twin automatic type. The eight side windows are double sashed and glazed with beveled crystal polished plate; two windows at the center have large observation lights. Between linings on the inside the car is 8 ft. wide in the clear.

The wood for the interior finish is a finely figured East Indian mahogany, known to the trade as Padouk, and was specially imported by Uptegrove & Co., of New York, for this car. It is solid throughout, and a few beaded mouldings and delicate carvings stand out, clear cut, in bold relief on the smooth polished surface, accentuating the rich amber and vermilion tints natural to this species of wood.

AMERICAN CAR COMPANY'S CAR FOR BALTIMORE CITY PASSENGER RAILWAY.

The interior lines of architecture are plain, modest and neatly elaborated into the colonial and empire style. The upper deck being very broad is recessed into a secondary dome, from which the opalescent center electroliers depend; these latter surrounded and bordered by a large number of lamps with translucent globes incased in bronze gilt husks.

The curtains are of green, silk-faced, pantasote mounted on spring rollers with Acme holding devices. The over-hangings, portieres and upholstery are of a luxuriant texture in soft green tints harmonizing nicely with the Royal Wilton floor rugs. The Reed furniture of fantastic designs is stained and tinted to match the general color scheme. The cheval mirrors, set in massive frames, at the farther end of the ladies' parlor are useful and ornamental adjuncts that add greatly to the interior effects.

Every convenience conducive to comfort and luxury has been admirably placed and planned. The appointments include adjustable tables for games and refreshments. A folding lavatory and ice cooler as also a cosy buffet closet, find place in the smoker's den. The refrigerator, supply chests and tables are carried beneath the car body, being suspended between the trucks.

Twelve electric Gold car heaters are planted in the side walls and a regulating switch, turned to any one of three points, provides a varying degree of radiant heat. A system of electric call bells is arranged to conveniently summon either porter or conductor, and the latter signals to his motorman by touching a push button. The other motor car accessories are of the latest and best types in use and were specially manufactured for this car.

The hardware trimmings, coat and hat hooks, and parcel racks are gold bronze. The electric headlights are 14 in. copper silvered reflectors incased in solid bronze frames.

The platform gates are solid gold bronze of the grille folding type and the dashers are capped with bronze and ornamental scroll designs. The exterior decorations of this car are in entire harmony with its interior furnishings. The color is a rich olive, the striping and ornaments gold; the lettering is trim and neat. The car is named "Maryland."

PROPOSED TRANS-ILLINOIS ELECTRIC LINE.

The Wabash & Mississippi Construction Company, of Salem, Ill., has been incorporated to build an electric railway from Vincennes, Ind., to East St. Louis, Ill., a distance of about 150 miles. The officers of the Construction Company are: D. D. Haynie, president; C. H. Neff, vice-president and secretary; W. C. Irwin, treasurer; A. N. Rooks, superintendent of construction and right of way.

Mr. Rooks states that the road will follow the old State road and be almost parallel with the Baltimore & Ohio Southwestern Railroad, passing through the many towns and cities, such as Olney, Clay City, Flora, Carlyle, Trenton and Lebanon. There are many reasons for believing that the road will be a paying investment and a great accommodation to the people. There is not very much grading to do, since the line will be built on the old Vincennes dirt road; over 100 miles are now ready for the rails. In low lands the road will require some grading, but on the whole this will amount to very little. The bridges will have to be strengthened and kept in repair.

ACCOUNTANTS' BLANKS AND FORMS.

The secretary of the Street Railway Accountants' Association of America, W. B. Brockway, Toledo, O., announces that the progress already made with the collection of blanks and forms is extremely satisfactory, and that it is hoped to complete it within 30 days. All members of the Association who have not already sent copies of the forms used by them to the secretary as requested in his circular letter of November 15, 1898, are urged to do so within this time. This department of the Association's work gives promise of becoming a very important one, and it is hoped that prompt attention will be given to these requests. The collection is also to include samples of tickets and transfers, for which a later call has been issued.

The collection is, of course, for the exclusive use of members of the Association.

THE DAYTON & WESTERN INTERURBAN.

The interurban line of the Dayton & Western Traction Company, extending 25 miles westward from Dayton, O., through the fertile sections of Montgomery and Preble counties, and connecting the city with the towns of New Lebanon, Johnsville, West Alexandria and Eaton, is a fine type of the latest interurban practice. Although as a rule there is less difficulty in securing franchises for interurban than city systems, yet this company had the unusual experience of being received with "open arms" at every point. There was no direct railroad connection between these cities, and to go from one to another involved a roundabout trip of 20 to 30 miles out of the way. There was not a single injunction to contend with in building the line. Such a peaceful and welcome beginning was a happy augury for the future, which is already in a fair way to be fulfilled.

FIG. 1. FIG. 2. FIG. 3.

Furthermore, the road follows a section line and is almost as straight as an arrow, having no sharp curves. There are five grades on the line, the maximum of which is 4 per cent, being 2,000 ft. long. Fig. 1 is from a view of the reverse curve and grade going east from the bridge at West Alexandria. The road penetrates a rich farming country, as may be seen from Figs. 2 and 3. The latter was taken looking towards the Dayton Soldiers' Home on the right. This is the largest of the national homes for disabled volunteer soldiers of the civil war. Thousands of visitors and friends of the old soldiers come each year to go through the beautiful grounds or to see some of the 5,000 inmates.

There are several streams to cross along the route and at each point a steel bridge has been constructed. In one instance a steel bridge was built at the side of an old covered bridge on the highway, shown in Fig. 4. Another bridge along the line may be seen in Fig. 5. The rolling stock consists of six cars made by G. C. Kuhlman Company, of Cleveland, and is of two types—the double-truck passenger car shown in Fig. 4, and the combination car, Fig. 5. The passenger car is 42 ft. long and has a seating capacity of 50. The motor equipment consists of two G. E. 57, 50-h. p. motors, and the controllers are G. E. 23. The motors are suspended on Peckham double trucks. Johns' electric heaters keep the cars warm in winter. The New Haven car register is used for recording fares. One fitting, which is rather unusual in electric cars, is the arrangement of package baskets along the inside as in steam railroad coaches. Portable telephones are carried on each car and these may be plugged in at intervals of 1,000 ft. along the line, insuring communication with the offices and power station in case of accident or change in schedule. Along part of the route the speed is as high as 45 miles an hour, and the average speed outside of Dayton, including stops, is 25 miles per hour.

The power house is located at West Alexandria, 17.3 miles from Main street in Dayton and six miles from Eaton, the western terminus. It is a brick structure (Fig. 6) of plain but substantial design, and having a composite roof of asphaltum. The boiler room (Fig. 7) is 47 ft. 6 in. by 53 ft. 6 in. inside dimensions, and 23 ft. 8 in. high. The engine room (Fig. 8) occupies the same floor space, but is 28 ft. 6 in. high, and in addition has a recess 27 ft. long, 6 ft. 3 in. deep and 15 ft. high for the switchboard. The advantage of this construction is that it gives the same span for the roof trusses, thus making the building symmetrical, and the recess enables the switchboard, busbars and cables to be placed out of all danger from the chains of the traveling crane, or from anything falling from above.

The water supply is obtained from two wells 16 in. in diameter driven at the foot of the bank upon which the power station is built. The water comes to the surface in these wells, but is 28 ft. below the level of the engine room floor, and the suction valves 36 ft. below the same level. In order to be sure of a suction at all times a pit, 10 ft. 3 in. by 30 ft. inside, and 19 ft. deep, was dug beneath the engine room near the boiler room partition. In this the two condensers, the service pump and the make-up pump are placed, and the two feed pumps and the heater are in the boiler room. These auxiliaries consist of two Wheeler surface condensers, each rated to condense 8,000 lbs. per hour with the water at 70° F.; one 6 by 4 by 6 in. duplex outside packed plunger pump for service use; one 3½ by 2 by 3 in. duplex piston pump for make-up water; and two 6 by 4 by 6 in. duplex piston pumps for boiler feed, all furnished by Stil-

FIG. 4.

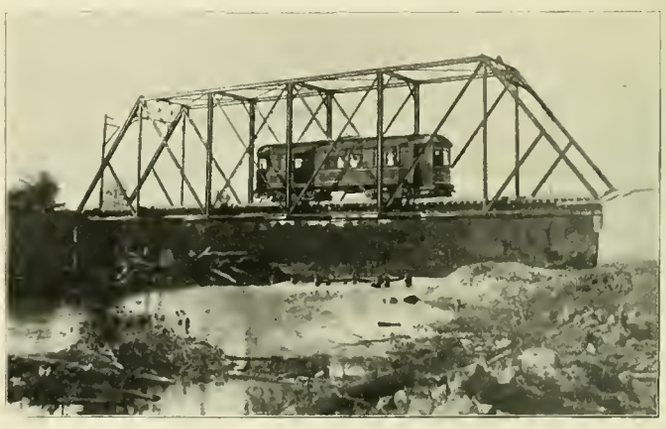


FIG. 5.

well-Bierce Company. There are three 250-h. p. boilers of the B. & W. type made by the Aultman & Taylor Company, of Mansfield. Fig. 10 is a view on top of the boilers, showing the headers and bends.

There are two 400 h. p. Buckeye engines running at 150 r. p. m. having cylinder dimensions 15¼ and 28½ by 30 in., each with a flywheel 11 ft. 6 in. in diameter. All the live steam pipes are drained by the Holly system, and Cochrane live steam separators are above each engine cylinder, and the Bundy steam trap takes the oil and water from the Cochrane exhaust separators. Direct connected to each engine is a Siemens & Halske generator, and belted to the line shaft as shown in the foreground of Fig. 8 is a 75-k. w. booster. A view of the switchboard, showing the two generators, the station and four feeder panels, is given in Fig. 11.

On account of the great length of line east of the power station it was necessary to make some provision to keep up the voltage near that terminus, and E. P. Roberts & Co., consulting engineers of the company, planned the booster installation. The trolley line has a circuit breaker and switch on a pole (see Fig. 2) 9 1-3 miles from the station, and the booster feeds from there to the Dayton city limits, a distance of 5.95 miles. The switch at the trolley break is open continuously, but can be closed and help the direct feed, or if it is necessary to shut down the booster the whole line can be operated by direct feed. This portion of the line contains the heaviest grades on the road, there being about four miles of uneven roadway, the grades ranging from 2 to 4 per cent. When four cars are running between the power station and Dayton, the car running on this part, fed by the booster, receives current at from 500 to 600 volts, while on the portion fed direct from the generators the voltage is from 450 to 575, the voltage on the booster end, averaging about 550, only running to 600 momentarily when the current is shut off.

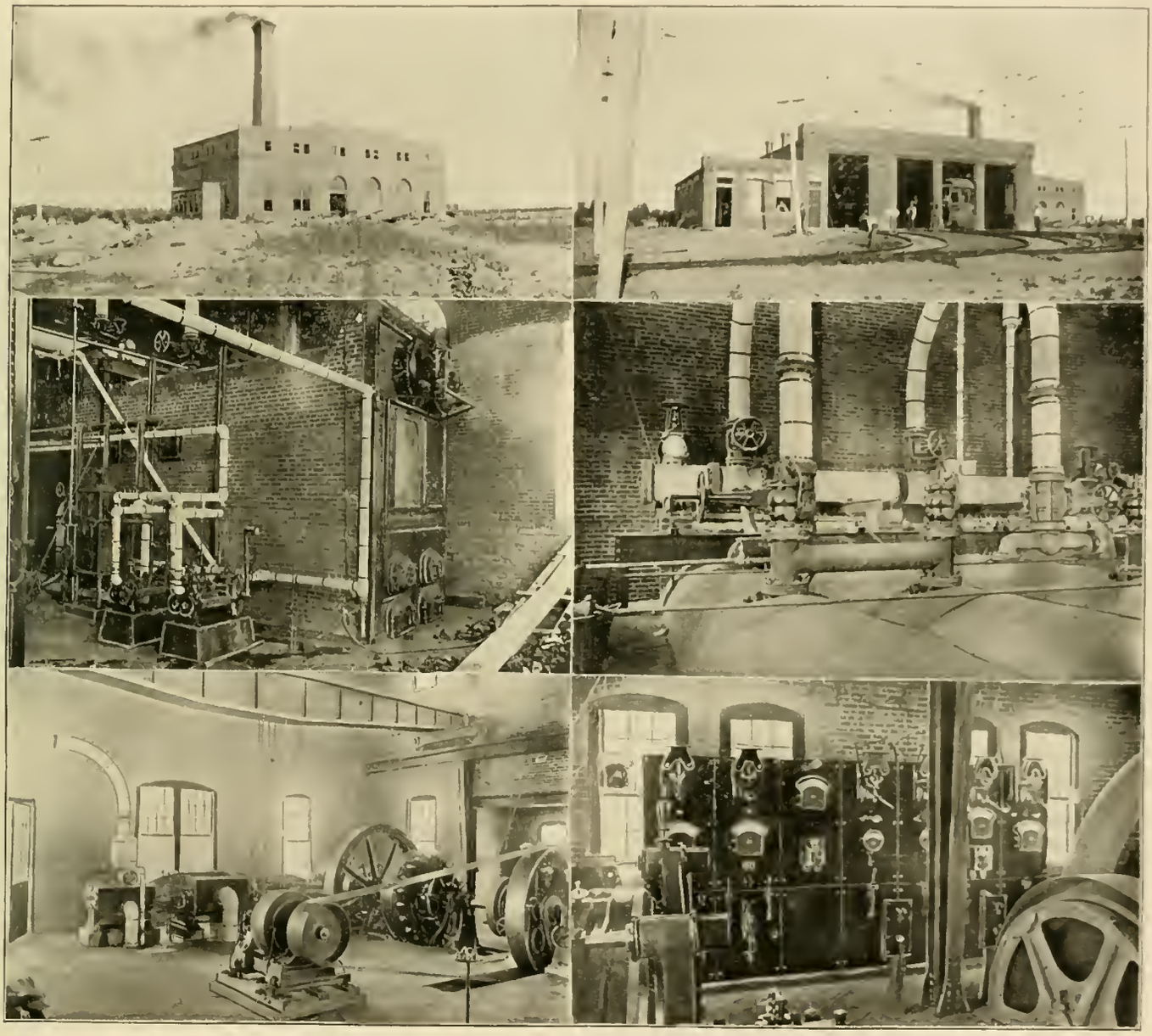


FIG. 6—POWER HOUSE.
FIG. 7 BOILER ROOM.
FIG. 8 ENGINE ROOM.

FIG. 9—CAR BARNS AND OFFICES.
FIG. 10 TOPS OF BOILERS.
FIG. 11—SWITCHBOARD.

The booster raises the voltage about one volt per ampere of current taken.

Two figure 8 No. 00 trolley wires are strung along the entire length of the line, doing away with all overhead switches, and the feeders are of 300,000 c. m. bare copper wire. Cedar poles, with 10-in. butts and 6-in. tops and 35 to 40 ft. long, are set at intervals of 100 ft. The bracket construction is clearly shown in Figs. 2 and 3, and the poles having two cross-arms and carrying two feeders. The entire length of track is 25½ miles, and is laid with 70-lb. T-rails, 60 ft. long, from the works of the Lorain Steel Company. These are laid on oak ties 5 by 7 in. by 7½ ft., spaced 2 ft. between

centers. All the switches and frogs were supplied by the Cleveland Frog & Crossing Company. Washburn & Moen horse-shoe bonds form the electrical connection between the rails.

A general view of the car barn and offices of the company is shown in Fig. 9, covering a space 61 by 100 ft. Three of the tracks in the barn are for car storage and the fourth is for repair work. The office occupies a portion of the building 20 by 55 ft., and contains the superintendent's and general offices, the treasurer's room and the storage room.

The officers of the Dayton & Western Traction Company are Dr. J. E. Lours, president; J. E. Feight, secretary and superintendent; and Oscar Sheppard, treasurer. The capital stock of the company is $400,000. The splendid construction and the fine equipment of the road indicates that the management is in the hands of able men. Its operation thus far leaves no doubt as to its success.

Since the above was written there has been a transfer of stock of the company to a syndicate of Dayton capitalists—J. H. Winters, V. Winters, C. B. Clegg and D. B. Corwin, all street railway men. J. H. Winters is the new president and V. Winters general manager.

COLLISION BETWEEN STREET CAR AND SALVAGE WAGON.

Judge Toney, in the Jefferson (Ky.) circuit court, on Feb. 7, directed the jury to find for the defendant in the case of Flynn against the Louisville Railway Company, and his instructions will prove of general interest, as they discuss the right of way of fire trucks, etc., a question that has arisen rather frequently of late.

Flynn was the driver for the Salvage Corps, and was injured in a collision between his wagon and an electric car.

The court said:

The defendant, on the close of the plaintiff's testimony, moved the court for a peremptory instruction to the jury to find for it on the ground of contributory negligence by the plaintiff. The effect of this motion is to admit the truth of all of the competent evidence adduced to the plaintiff, and all just inferences which can properly be drawn therefrom. This motion is quite analogous to a demurrer to a pleading. It may be conceded for the purposes of this motion that the defendant's motorman in charge of the electric street car, in running its car at the place and time of the collision, was guilty of negligence in going at the rate of speed shown by the evidence. It was the duty of the motorman to slow up the electric street car as it approached the intersection of Third street and Jefferson street so as to be able to check and halt it, if necessary to prevent collisions with passing vehicles, and to prevent crushing pedestrians at that crowded intersection of those two thoroughfares of the city; and it was equally his duty to keep a vigilant lookout to prevent such actions as he approached such intersections.

It may be admitted, I say, that the defendant's motorman failed in both these duties, and was therefore guilty of such negligence as would render the defendant company liable in damages to any one, not in like fault, injured through such negligence. The plaintiff was in charge of the salvage wagon that collided with the said street car at the west crossing of Third street, at said intersection from which he was thrown and injured. The undisputed evidence is that the said wagon was being driven at the rate of from ten to fifteen miles per hour at said intersection. The horses were in a run going out to a fire on Third and Breckinridge streets. The driver and motorman came in sight of each other at the same time. The driver of the wagon could not check up his horses to prevent the collision; the motorman could not check up his street car in time to prevent the collision. They were both too near to the intersection, and were too near to each other when each discovered the other, to prevent collision at the rate of speed at which both were going.

The twelfth section of the charter of the Salvage Company, to which the wagon and horses belonged, and whose agents the plaintiff and driver were, gave it the right of way along the streets of the city; but this right of way through the streets did not authorize or justify the Salvage Company, or its agents in charge of its teams, in approaching and crossing such intersections as Third and Jefferson streets, where street cars were liable to be passing at any moment in close proximity to its path, and where pedestrians were passing to and fro, to drive at such a reckless rate of speed as to make it physically impossible to check up its teams to prevent crushing into vehicles, or colliding with street cars that might suddenly come upon its path at said intersection in ignorance of their approach and proximity.

As was said by Hooker, judge, in Garrity v. The Detroit Citizens' Street Railway Company, 70 Northwestern Reporter, page 1019, in a case on all fours with the case at bar in many of its salient features: "It is manifest that a fire truck" (that was a case where the collision was between an electric street car and a carriage or truck of the fire department, in which the fireman was thrown from his truck by the collision and killed, and his widow sued the street car company for damages), "approaching a street upon which is a street railway, is liable to find cars in any degree of proximity to its pathway either with or without fault of motorman, so close indeed that to stop would be impossible. A collision involves danger to life and limb to those upon the car as well as those upon the truck; and while the exigency of fire may well require dispatch, it is not so essential as to justify taking unnecessary chances of collision dangerous to life. Furthermore, collisions do not conduce to dispatch, but cause delay, and the public service is advanced by avoiding them; so we think that both the prevention of life and expedition in getting to the fire require caution in approaching streets where cars are likely to be encountered as an abstract provision; then we think that the approach to a street car line which must be crossed, without having the horses under such control as to permit of stopping, is negligence; and the proof shows that the driver was culpably negligent in approaching this street. Had the car been a little nearer, or responded as quickly to the efforts to stop it, the pole of the truck would have crushed into it, and the consequences of such an accident are frightful to contemplate."

How applicable, how apropos to the facts of this case as established by the plaintiff's own witnesses, is the language of the learned judge of the supreme court of Michigan just quoted. Had the driver of the wagon in this case had his horses under control as he approached the intersection of Third and Jefferson streets so as to have been able to stop them, as was his duty, can any one say that this collision would have occurred? The proof shows that his team was not under his control, and he was close to the intersection and first saw the defendant's electric car. If the car had been at such a distance from the intersection, when the driver of the wagon first saw it approaching, as to justify an ordinarily prudent man in attempting to drive a wagon like the one on which the plaintiff was across the street in front of it, the fact that the driver was going at too great a rate of speed would not impair or have his right of recovery for injuries resulting from such a collision weakened, because it could not be said that the negligence of the driver contributed to the accident in such a state of case. This is the deflection of the case at bar from the Michigan case.

In the case at bar it is established by the plaintiff's evidence that the street car, at the first moment the driver of the wagon discovered it, was too near to the intersection to be stopped in time to avoid the collision, although the proof is that the motorman at once, on discovering the salvage wagon on approaching said intersection, did all in his power to check his car and prevent the collision. The motorman and the driver of the wagon owed certain duties to each other and the public. They were both under legal obligation—a legal duty in approaching the intersection of Third and Jefferson streets, two crowded thoroughfares of the city, and to adopt and move at such a rate of speed as would enable each and both of them respectively to keep their street car and wagon under their control.

The negligence of one cannot neutralize the negligence of the other, and a collision and consequent personal injuries, the joint result of the negligence of both, cannot support an action by either. It is right that the salvage company of a fire department should have the right of way through and along the streets and thoroughfares of the city, and it is the duty of every vehicle, street car and pedestrian to use every effort to get out of their way and to God-speed them on their perilous mission in defense of life and property against destruction by fire; but the rights and lives of people traveling on street cars are as much entitled to protection as is property which is in danger of being destroyed by fire; and the brave men who drive the salvage wagon and fire trucks through the streets of the city are bound in law, are legally bound, when approaching the intersection of crowded thoroughfares traversed by street cars

and pedestrians, to keep their teams under such control as to make it profitable for them by the exercise of diligence to avoid collisions and calamities such as the proof in this case discloses.

Suppose the motorman had been injured by the collision, or the pole or tongue of the wagon had crushed through the sides of the street car and injured or killed several passengers on board the same, and they had sued the Salvage Company for damages, alleging that the said injuries had been caused by the reckless driving or rather negligence, and the proof in support of said action had been the same as that now before the court, in the absence of a plea of contributory negligence in such an action, can any one doubt their right of recovery?

I think the plaintiff in this action has the burden of proof. He is the laboring oar—he must make out this case. Concede that he has shown negligence on the part of the motorman in charge of the defendant's street car, by the same witnesses and the same evidence he has established negligence on the part of his driver which is unprofitable to him, as he was in control of and directing the driver, which negligence on the said driver's part contributed to the production of the collision, and without which negligence the collision would not have happened. In such a case the plaintiff cannot recover unless it be affirmatively shown by the evidence that notwithstanding the plaintiff's contributory negligence, the defendant's motorman discovered, or by the exercise of reasonable care on his part could have observed the plaintiff's imperilled or dangerous situation in time by the exercise of reasonable care to have avoided the collision.

The evidence introduced by the plaintiff clearly and overwhelmingly established that the motorman did not discover the approach of the wagon until it was too late and impossible to avoid the collision, and that it was a physical impossibility, at the gait at which the wagon was moving and the direction in which the street car was moving, for the motorman to have discovered the wagon and driver until it was too late to prevent the collision. Under this state of facts there is no reason to submit this case to the jury and request them to wander through fields of conjecture and guesswork as to what might or might not have been done under other and different circumstances by the motorman or by the driver.

I have considered this motion upon the assumption (and which is only on assumption) that the motorman was guilty of negligence; conceding that he was, the plaintiff's own proof shows that the plaintiff's wagon was being driven at a reckless rate of speed and under circumstances that clearly establish contributory negligence, which is a bar to this action. For the foregoing reasons the defendant's motion for a peremptory instruction to find for defendant is sustained.

THE FEBRUARY STORM.

Street railway lines in the eastern and New England states had to contend last month with the second severe snow storm of the winter. The blizzard struck on February 13, and the heavy fall of snow, high winds and intense cold combined to stop nearly all steam and street railway traffic east of the Allegheny mountains as far south as Virginia and Maryland. The storm last November coming so early found many street railways with their snow plows and sweepers in repair shops and unprepared for immediate use; last month the plows and sweepers were put in service as soon as snow began falling, but the high winds carried the snow back on the tracks and in nearly every place rendered futile the attempts to keep lines open.

In New York the conduit lines stopped running cars about 5 o'clock on the afternoon of the 13th; the horse car lines soon followed; the cable lines kept running with only occasional blockades. On the electric lines snow prevented the wheels from getting a grip on the rails, and in some places the snow drifting into the conduit through the slot made further trouble.

The ferry boats and steamships were almost as effectually blocked as the street railways, and traffic on the Brooklyn bridge on the morning of the 14th was the heaviest since trolley cars began to run over it. The bridge cars were not interrupted and no accidents to persons were reported.

The underground trolley lines continued to be badly crippled during the 14th, and until late that night cars on the 2nd and 4th avenue lines did not attempt to run below Astor place, which is about two miles from the Battery, though north of Astor place regular trips were made. Eighth avenue was cleared between 14th and 16th streets on the morning of the 14th.

Most of the horse car lines ran cars on the 14th but at long and irregular intervals, and on several lines there were four and six horses to each car. The cable lines were open, but the cars were frequently delayed by trucks and wagons which used the cable tracks because that was the only portion of the street cleared for traffic. The elevated trains ran on schedule time on the 14th.

In Brooklyn many of the surface lines were fairly well opened for traffic during the 14th; the service to Flushing was not resumed until late on the 15th. Transportation to Coney Island was abandoned and no attempt made to open a route till the 15th when a large force of men was put at work.

Traffic in Jersey City and Hoboken was conducted under great difficulties and many of the lines were abandoned on the afternoon of the 13th.

Throughout New England the snow storm of February 13 blocked nearly all the steam and trolley lines. At Hartford the street railways found it easier to clear their tracks than after the storm in November; all lines were running by the night of the 15th.

At Boston the lines of the Boston Elevated were kept open by extraordinary efforts. In recognition of this work the executive committee of the board of directors sent a letter to C. S. Sergeant, second vice-president, and other officers and employes in the bureau of surface lines which was concluded as follows:

"You all deserve and receive high praise for your unprecedented success in keeping open all the lines and in running the cars, thereby enabling the company to serve the public at a time when its service was especially appreciated."

The Palmer & Monson Street Railway, of Palmer, Mass., was able to keep all but one of its lines open all the time during the storm; the exception was the line to Bondsville which was blocked for half a day. The superintendent of the company, C. D. Shepard, worked with the snow plow almost continuously for 48 hours, and persisted in his efforts to keep the lines open though the other officials of the company thought the task hopeless and advised him to cease the attempt. When thrown from the track the snow was banked up several feet deep on both sides so that teams could with difficulty break through. That the public is sometimes ungrateful is shown by the fact that in this instance complaint was made that the snow was not promptly removed from the streets, and notwithstanding the Palmer road was open for traffic when nearly all others in that part of the country were effectually blocked.

In Washington the roads were compelled to stop running cars as in other eastern cities. When the officials after the most strenuous efforts succeeded in partly opening the lines again and were congratulating themselves on the result a sleet storm came and interfered with traffic almost as badly as the snow had done. By a liberal use of sand the cars were run over the icy rails, but not on schedule time. On the afternoon of February 16 the rain became warmer, melting the snow which had previously fallen, and the tracks were deluged with slush and water. In many places the water was above the car steps.

In Philadelphia the Union Traction Company had great difficulty in opening up its 450 miles of track. Snow plows were followed by sweepers, but the snow was so tightly frozen that the sweepers were of but little use. The sweepers were often blocked and had to be dug out with picks and shovels. The greatest difficulty was the cars which became blocked during the storm and had to be abandoned; when a plow reached such a blocked car it could not proceed until the car was dug out by hand. The men on the plows worked during Monday and Tuesday and got but little rest until Tuesday night; that night other men were put on the plows, but on Wednesday, the 15th, the experienced men returned to duty ready for another 48 hours' fight.

Wednesday about 20 of the most important lines were open, and the following day forces were put at work on the suburban and interurban lines. More than a thousand extra men and 500 carts were at work on the 14th and this force was increased where possible and kept at work till the lines were cleared. The loss to the company by reason of the storm is estimated at $50,000. The Fox Chase line was still closed beyond Franklinville on the 15th.

The Pennsylvania Traction Company, of Lancaster, Pa., which operates a number of interurban lines, some 63 miles of track in all, was forced to abandon all but its city lines and the one to Columbia; these were kept open by constant use of snow plows. On the

Millersville road the car was replaced by a large sleigh. On the Lititz line both cars were snowed in.

Several other roads in Pennsylvania had cars snowed in and in some instances at points so remote from dwellings that passengers prepared to spend the night in the car.

The cost of this storm to the Chester (Pa.) Traction Company, which has 20 miles of track, was very nearly $4,000, about one-half of which was for labor in cleaning the tracks.

In Baltimore all street cars were forced to stop running on the afternoon of February 13, after the men had been fighting hard all day to keep the lines open. The heavy fall of snow and the high wind made it impossible to keep the cars running, as the way cleared by a snow plow would be quickly filled again. At one point a broken water main resulted in a sheet of ice 18 in. deep forming across the entire street and effectually blocked car traffic. Other routes were blocked by the armatures in the sweeper motors burning out, leaving the sweepers stranded.

During the fight to keep the lines open both the Consolidated and the City Passenger managements saw to it that the men were given food and warm coffee at frequent intervals.

PROPOSED ELECTRIC RAILROAD LAW FOR NEW HAMPSHIRE.

There is now pending in the New Hampshire legislature a bill providing for building electric railways in country highways by consent of the towns (townships).

Section 1 provides that the general corporation law shall be amended by removing the restriction against electric railways, and that any five or more persons may organize a railway company. Section 7 contains the repealing and emergency clauses. The other sections are as follows:

Sec. 2. Before any such corporation shall construct such electric railroad, it shall present a petition in writing to the selectmen of the town, or to the mayor and aldermen of the city, through which said railroad is intended to be built, asking for a location for the same in the public highways or streets of said town or city.

Sec. 3. Upon receiving said petition the selectmen of the town or the mayor and aldermen of the city shall give notice by publication in some newspaper published in the vicinity, of a time and place of hearing upon said petition, said notice to be published once each week for three successive weeks, the last publication to be ten days, at least, before the day of hearing, at which hearing all parties may be heard on said petition.

Sec. 4. If at said hearing it shall appear that the public good requires it, the selectmen of the town and mayor and aldermen of the city shall grant a location for the same in the public highways, which location shall be filed in the office of the clerk of the town or city through which said road is located, and also in the office of the secretary of state.

Sec. 5. After said location has been granted and filed as aforesaid, said corporation may construct and operate such railroad in accordance with, and subject to, all the laws now existing relating to the building and operating of electric railroads.

Sec. 6. The location given by the selectmen of towns and mayor and aldermen of cities shall be conclusive upon the question of public necessity.

LITIGATION OVER QUINCY (ILL.) ROAD.

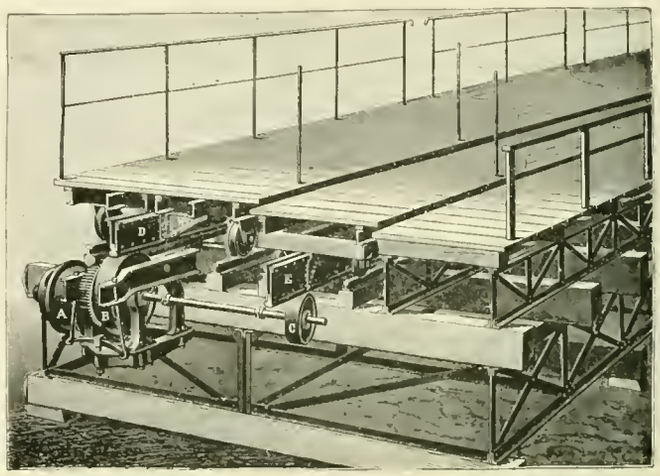
There is now pending, and soon to be heard, in the United States circuit court for the southern district of Illinois an interesting street railway case. The complainant is the Quincy Horse Railway & Carrying Company and the defendant the J. C. Hubinger Company, an Iowa corporation (Mr. Hubinger is president of the Keokuk Electric Street Railway & Power Company also).

The parties have agreed on a statement of facts which will greatly facilitate the trial of the case. The old company has expended $399,000 for construction, equipment, etc.; it has paid dividends each year varying from 1 to 7½ per cent, the average being 5.4 per cent; the new company on April 7, 1898, was granted a franchise for an electric line in Quincy, and given the use of some streets already occupied by the old one and of other streets in which the old company wishes to build extensions; the building of a new line will deprive the old company of gains and profits.

TWO-SPEED TRAVELING PLATFORM FOR PARIS.

One of the transportation features of the Paris Exposition in 1900 is to be a two speed electric-driven traveling platform connecting the Esplanade des Invalides and the Champ de Mars. The plan of M. de Mocomble was accepted and request made that preliminary trials be made early in this year. These trials have recently been made and the accompanying illustration from "La Nature" shows the arrangement of the apparatus.

There are three platforms, one stationary and two which travel; the latter are made in sections and jointed for turning curves. The



TWO-SPEED TRAVELING PLATFORM.

slower moving platform travels at the rate of 2.4 miles per hour, and the other at double this speed. While there are tracks and wheels to guide the platforms, the greater part of the weight is on the rails D ad E, placed under the center of the two platforms. These rails are carried on pulleys such as B and C, placed at intervals. The two pulleys are of different diameter and on the same shaft which is geared to three-phase electric motors, A; the movement is solely due to adhesion and the fixed connection between B and C secures the proper relative speeds of the two moving platforms.

OPENING OF A NEW MICHIGAN INTERURBAN.

February 14 the Detroit, Plymouth & Northville Railway was opened for traffic. This line runs from Wayne, Mich., a station 18 miles west of Detroit on the Detroit, Ypsilanti & Ann Arbor Railway, about 12 miles north through Plymouth to Northville. By an agreement with the Ann Arbor road a 30 cent rate to Plymouth and a 35 cent rate to Northville from Detroit is made. The equipment consists of four 30-ft. interurban cars. The power house is at Plymouth. The officers of the road are C. W. Casgiani, president; H. P. Wickham, secretary; J. A. Russell, treasurer.

The district opened up is not now given good transportation facilities by the steam railroads, which now run but four trains per day each way from Plymouth, and three trains from Northville to Detroit. The new line will give hourly service from 6 a. m. until 11 p. m., and half-hourly service will be installed if business shall warrant it.

COLD WEATHER STOPS TRAFFIC.

February 9, the Sandwich, Windsor & Amherstburg Railway, of Ontario, was tied up by the breaking of trolley wires caused by the contraction due to the unusually low temperature. The wires broke in many different places, and just at the time when the cars were heavily loaded with workmen on their way to the factories. Passengers were obliged to leave the cars and walk to their destinations. After several hours the breaks were repaired and traffic resumed.

MANUFACTURING FOR EXPORT.

From an address read before the Chicago Trade Press Association by John K. Allen, Editor "Domestic Engineering."

Let us take it for granted that a manufacturer in any line is desirous of increasing his export trade, and consider for a moment what he should do in order to build a good foundation for this new departure in his business. In the first place, I cannot speak too strongly of the importance of manufacturing goods which the foreigner needs and with which he is familiar. Too many manufacturers in the United States have attempted to force the goods which they manufacture for consumption here into current use abroad with disastrous results, and, finding their goods left on their hands in foreign countries, have decided that it is foolish to attempt to build up an export business. Had the manufacturer studied the markets a little in advance and discovered the lines of goods which were actually being used in those markets, and had he conformed his manufactures to the type of goods already in use, I have no doubt that the results would have been quite different.

In some goods, of course, it is quite possible to introduce into a foreign market exactly the things which are used in the United States. This is true under my observation with certain novelties, and with certain types of goods, such as radiators. Even in this class of goods, however, special patterns have to be made in many cases. I therefore advocate most strongly a study of the markets previous to beginning a foreign business. It is almost certain that, taking any English article in the production of which machinery plays an important part, the American manufacturer can reproduce the articles already in use in the English market at a much lower price and still make a good profit. As an illustration of this, let me cite the instance of a well-known manufacturer of his line of goods in the United Kingdom, who had large and excellently planned works in Scotland, with water transportation to London, say 250 miles, who found it more profitable to close his factory, send his patterns to the United States, and have his goods made in Detroit, and delivered to him in London than to produce his own goods in his own works in Scotland, and ship them by water to his London warehouse. This illustration proves the positive side of my statement, and it can be proved on the negative side by citing one or two other illustrations.

The firm whose business I am somewhat familiar with, purchased very largely of a certain kind of goods in the United States, their purchases being divided among four houses, all of whom manufactured a standard line of goods, which could be sold in the English market without trouble. A fifth house desired some of the trade and received a large order. These goods were not discovered to be below the standard in weight until they reached their destination in London, when it was found that they were not so heavy as the goods which were consumed in the English market, nor as heavy as the goods which had been received from the other four American manufacturers, and the result is that these goods are lying in the London warehouse, without being of any benefit to anybody, and the fifth house, which made these goods not up to the standard weight, is very much dissatisfied with their experience in the export trade. Had their goods been up to the standard there would have been no trouble whatever in their increasing their business very largely.

In another case, a firm manufacturing water closet seats took the liberty of changing the specifications slightly, and instead of having a hinge on the side of the seat placed it upon the top, thinking it really made no difference. The result is that they have about six or seven hundred dollars' worth of goods in the London warehouse which will not be paid for, and which are of no good to anyone whatever simply because they do not conform to the English pattern. I could cite a number of instances on both sides to demonstrate the correctness of this position, but these two are, I think, quite sufficient.

I have often been asked by friends of mine as to what line of goods could be successfully introduced into the English market. In response to this, I think it worth the while for any manufacturer who has goods that contain a very large element of machine labor, and a small element of human labor, to investigate the foreign markets, and the same remarks will apply to the manufacturer who has goods which contain a small proportion of raw material in comparison to the amount of labor.

It is much better for the manufacturer of American goods to form a connection with some reputable foreign house already engaged in introducing a similar line of goods than it is to endeavor to handle the market himself.

Secondly, it is almost necessary, in my judgment, that stocks of goods should be carried in foreign centers, as, so far as I have been able to observe, buying stock for future delivery is not satisfactory to the foreign buyer. The delays in transmission are so various and so exasperating that in many cases orders have been cancelled and goods left upon the agent's hands in Great Britain, because the transportation lines were too crowded to take care of them properly.

Thirdly, the manufacturer should select a thoroughly reliable house, financially, and make it purchase goods outright rather than attempt to handle credits from this side of the water.

Fourthly, goods should not be placed in foreign markets upon consignment unless one is positively acquainted with the character of the firm with which he is doing business.

Fifthly, one cannot be too careful in packing and shipping. For heavy goods one must use a great deal of crating or very heavy boxing in order to place goods in a satisfactory condition. Bear in mind that in some foreign markets the timber which is used in crating and packing is often sold at a profit. This is true in England, so that one need not be sparing of timber in packing.

Sixthly, the quality of original samples must be kept up to the standard. The foreign buyer is shown a sample very carefully polished, very beautiful to look upon, packed in cotton and carried around by traveling salesmen who are able to show it off to the very best advantage. He gives an order based upon the appearance of this sample. The goods come to him ordinarily packed, with brown paper around them, and, if of metal, they may have been exposed to the action of the salt air in transit, and be pretty badly rusted, with a result that when they arrive at their destination they no longer compare with the sample which was shown to the buyer. The result is cancellation of the order. A case came under my observation recently where a line of goods, thoroughly up to the sample, were packed one in a box, the wood from which the boxes were made not being thoroughly dry. There was enough moisture left in the box to rust the machines, so they were not salable when they reached the other side. Lastly, if possible, secure American salesmen for American goods. Patriotism goes a long way, and pride in country often assists skill in selling.

It is attention to such details as these which will permit the American manufacturer to build up a thoroughly satisfactory and constantly increasing export business.

REORGANIZATION OF THE BROOKLYN ELEVATED.

One of the final steps in the reorganization of the Brooklyn Elevated Railroad Company was the appointment on February 16 of J. Edward Swanstrom as referee to take the accounts of Frederick Uhlmann, receiver and president of the company. Mr. Uhlmann has devoted his entire time to the work, attending to the duties of treasurer as well as those of the two above named offices. The receipts have been $3,935,149, and disbursements, $3,699,455, and the actual operating expenses from March 25, 1897, have been $2,254,400.

CAN STREET CARS CARRY FREIGHT?

A suit brought by Aaron De Grauw, of Jamaica, N. Y., against the Long Island Electric Railroad Company, the Brooklyn Heights Railroad Company, the Brooklyn, Queens County & Suburban Railroad Company and the National Express Company, to determine the rights of an electric railway company to carry freight and express matter, is now pending in the supreme court of New York. The railway and express companies have entered into an agreement to run cars for carrying such matter, and this action is brought to restrain the defendants from running trolley express cars along Washington street in Jamaica, on which the plaintiff is an abutting property owner.

W. E. BAKER GOES TO NEW YORK.

W. E. Baker, who has been general superintendent of the Metropolitan West Side Railroad Company, of Chicago, since its origin has resigned to accept the position of general superintendent and chief electrical engineer of the Manhattan Railway Company, of New York. This signifies beyond a doubt that the electrical equipment of the Manhattan elevated will proceed, and under Mr. Baker's skillful guidance it will become as fine an example of a model elevated railway in electrical equipment, train service and management as the Metropolitan is today. The selection is a wise one, for a more experienced man in electric elevated construction and operation could not be found.

Mr. Baker was born in Springfield, Mass., in 1856, and was graduated from the engineering school of Lafayette College in 1877, and later found employment on the civil engineering staffs of the St. Paul & Pacific, the Northern Pacific and the Canadian Pacific rail-

W. E. BAKER.

roads. After doing pioneer surveying work for two years in the Rocky Mountains he was engaged as resident engineer in steam road building for the International & Great Northern in Texas. In 1883 on a trip to St. Paul Mr. Baker met Miss Griffin from New York who was visiting Governor Merriam, and she afterwards became his wife.

In 1888 he went to Boston and associated himself with the Thomson-Houston Co. and here gained his first electrical experience. The West End Street Railway was the first large railway system to be equipped for electric traction, and Mr. Baker had ample opportunity to demonstrate his ability as superintendent of the surface roads in Boston. After finishing his work there the General Electric Company secured his services for a time. The Intramural Railway of the World's Fair was constructed and operated under his supervision and it was demonstrated in service that the third-rail system was practical for elevated railways. The many innovations in this system, including the largest generators and motors ever built at that time, were carefully worked out by Mr. Baker. Little need be said about his connection with the Metropolitan West Side Elevated Railroad Company for its unequaled excellence in every department is largely due to Mr. Baker's efforts. Mr. Baker goes to New York to take entire charge of the installation of the electrical equipment and to assist and advise Alfred Skitt, vice-president and general manager of the Manhattan Railway Company.

On the evening of March 6 a farewell dinner was tendered Mr. Baker by a number of friends, at the Union League club. While Mr. Baker's removal to New York is a positive loss to the electrical fraternity of Chicago, he carries with him the warmest regard and best wishes of all.

During the latter part of February the cable roads of St. Louis experienced some difficulty in running because of the cable slots contracting. The trouble was due to the sudden freezing of the material between the paving blocks forcing the slot rails together. The trouble is one inevitably incident to all conduit construction.

DOUBLE-TRACK ELECTRIC RAILWAY FROM BUTTE TO CENTERVILLE, MONTANA.

From a paper by Francis W. Blackford read before the Montana Society of Engineers and published in the Journal of the Association of Engineering Societies.

The city of Butte and the town of Centerville, one of its suburbs, were connected, in the year 1897, by a cable passenger railway, which did service until about a year ago, when plans were made to substitute therefor electric traction and to make the necessary changes in the alignment and grades.

The cable was run in an almost direct line between the two places. It overcame an elevation of 390 ft. between Park street, Butte, and Center street, Centerville, a distance of 0.9 mile, and had grades as steep as 14 per cent.

The plan of the new enterprise was to construct a double-track electric railway, if possible, upon grades not exceeding 5 per cent,

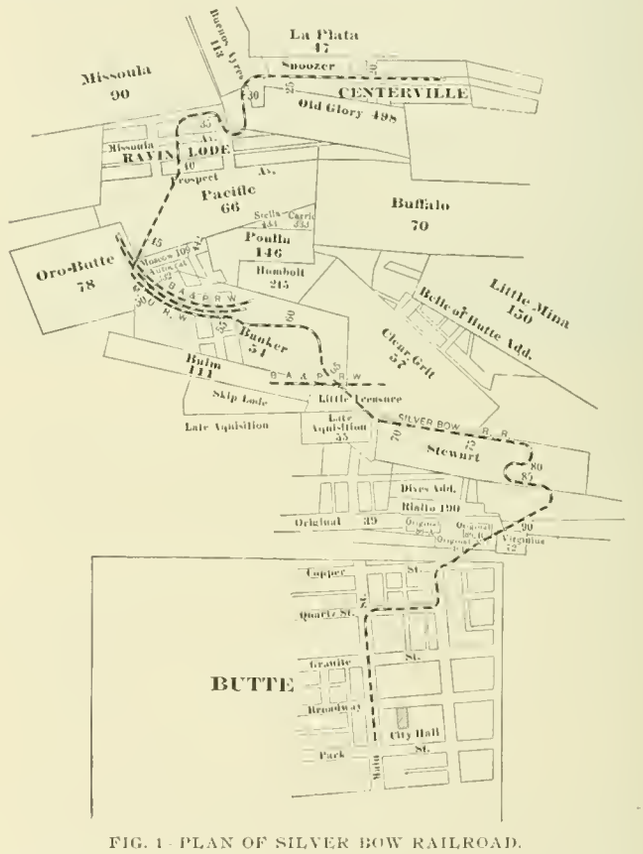


FIG. 1 - PLAN OF SILVER BOW RAILROAD.

and located so as to accommodate the greatest number of people residing in the several settlements lying between the two places.

In pursuance of this plan a number of lines were run in the summer of 1897 by W. H. Harrison, C. E., under the general direction of the writer, and the possibilities were pretty well understood before the final location was begun. In these preliminary location lines complete circles of radii to suit the conditions were used in development, and many interesting engineering features were introduced to overcome the elevation and avoid expensive or objectionable places. It was, however, found to be impracticable to adhere to a grade of 5 per cent, and in the final location grades of 6 and 7½ per cent were introduced in places, with rates varying from level up to these, as shown by the profile, Fig. 2.

As the location progressed it was found that the right of way was the paramount question, and of greater importance than the physical difficulties to be overcome. While farm and town or city property has a pretty well-established value, easily determined by testimony before a commission, the determination of the value of a piece of undeveloped mining property is a very different and a very difficult matter. The owner of such property can often prove the value of his surface ground, for use in the development of the mine, to be so great in a single instance as to practically kill such an en-

terprise; and the only thing to do in such cases is to avoid the property, or at least that part of it which is likely to be used for developing the mine.

The company's charter gave power to condemn land for a right of way, but, for the reasons stated, it was thought best to locate the line upon ground which could be purchased at reasonable prices; and the location was so made, the right of way therefore becoming one of the controlling features of the location.

The crossings of the three steam railroads were made overhead upon steel spans or plate girders, the other crossings, four in number, were wooden bent trestles. While the latter contain no unusual features, the plans were prepared especially for this work. They were planned to carry "Jumbo" cars of 15 tons weight, with a load of 180 persons, or a total weight of 30 tons. The elevation of the track on curves was computed for a speed of 12 miles per hour, and on the bridges was obtained by means of a false cap.

The curves vary in radius from 64 to 143 ft., with transition curves at the ends increasing to 1' every 10 ft. upon the lighter curves and to 1' every 5 ft. upon the heavier ones.

No compensation of grade on curves was made because the power supplied to the cars was ample to enable them to ascend much steeper grades, the objection to the heavy grades being the difficulty in safely descending them. Upon this line, which overcomes an elevation of 416 ft., and has 13¼ miles of almost continuous grade, the safe descent is the special feature of its operation.

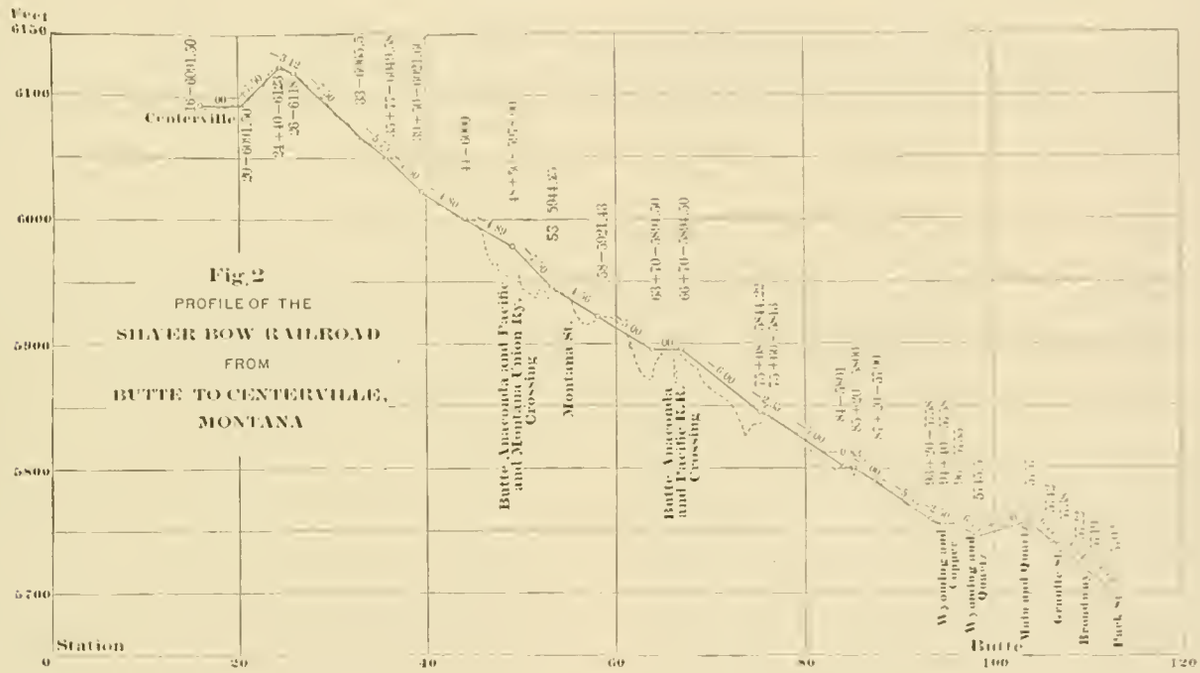


Fig. 2
PROFILE OF THE
SILVER BOW RAILROAD
FROM
BUTTE TO CENTERVILLE, MONTANA

Except on the paved streets of Butte, the road is laid throughout with 52-lb. second-hand steel rail that had been in use on the Oregon Short Line Railway. The rail was but little worn, and it makes an excellent track.

The rails are bonded with the Atkinson horseshoe bond, No. 0000 cross-bonded every 600 ft.

The power is transmitted by the usual overhead wire, supported by cedar poles on each side. The feed wire, however, does not follow the meanderings of the road, but runs straight up the hill and feeds at the crossings and at the end of the line.

The line is equipped with 16-ft. single truck cars, with 30-in. wheels and two 35-h. p. G. E. 1,000 motors on each car.

In addition to the usual chain brake, the cars have the General Electric electric brake, the latter being used as an emergency brake only. They also have the G. E. K-10 controller.

The trip from the corner of Park and Main streets, Butte, to the corner of Center and Main streets, Centerville, a distance of 13¼ miles, is made with ease in 15 minutes, each car making two round trips per hour.

The line has been in successful operation since August 7, 1898, and no accidents or runaways have occurred. In only one instance has the emergency brake been applied.

LAND DAMAGE SUITS IN CHICAGO.

It is stated that the owners of property abutting on the streets occupied by the Union Elevated Railway, of Chicago, have pooled their interests and have secured William G. Peckham, of New York, who won many land damage suits against the Manhattan Elevated, and other eminent counsel to prosecute the suit of the Chicago Office Building Company against the Lake Street Elevated Railroad Company set for March 1. The case will be important as a precedent. The damages alleged are the hampering of free ingress and egress, cutting off light and air, the creation of noise, dirt, and vibration and the casting of shadows.

BROOKLYN RAPID TRANSIT INCREASES CAPITAL.

The following statement of the action taken at a recent meeting of the stockholders of the Brooklyn Rapid Transit Company has been issued by Mr. Rossiter:

"The special meeting of the stockholders of the Brooklyn Rapid Transit Company called to consider the proposed increase of the capital stock of that company from $20,000,000 to $45,000,000 was held at the office of the company. All the stock was represented, and the vote was unanimous in favor of the increase.

"In addition the holders of 149,386 Central Trust Company's certificates of beneficial interest gave their consent to the proposed increase. No other business was transacted at the meeting."

Ex-Governor Flower is authority for the following statement: "The reason for increasing the capital stock was to enable the company to buy the stock, rights and franchises of the Nassau Electric Railroad Company. The negotiations for the purchase are now well under way, and I believe it will be effected within thirty days. After that the absorption of the Brooklyn Elevated Railroad Company may follow."

Rumors of negotiations for the purchase of the Bay Cities Consolidated Railway Company's property by the Saginaw (Mich.) Valley Traction Company are denied by S. L. Nelson, manager of the Bay City lines.

By an arrangement with the local authorities the plans for a new bridge over the Connecticut river at Hartford are to be modified so that the Hartford Street Railway Company may lay a double track over it. The cost of the bridge, which was not to exceed $500,000, will be increased about $75,000 because of the change and this will be borne by the railway.

THE MOORE TRUCK.

A motor truck has been developed in the shops of the Chicago City Railway Company, which presents a number of new and commendable features. About a year and a half ago a truck was constructed with wooden sills, and placed under an 1,800-gallon sprinkling car. Its operation was so satisfactory that it was continued in service and a record kept of its performance. Alterations and improvements were made from time to time, under the direction of C. E. Moore, master mechanic of the company. Designs were prepared for motor car trucks and a few of them placed in service. The result was so satisfactory that an order was given for 35. Later, Superintendent Nagle decided to put this style of truck under the 100 cars now being built by the Stephenson Company.

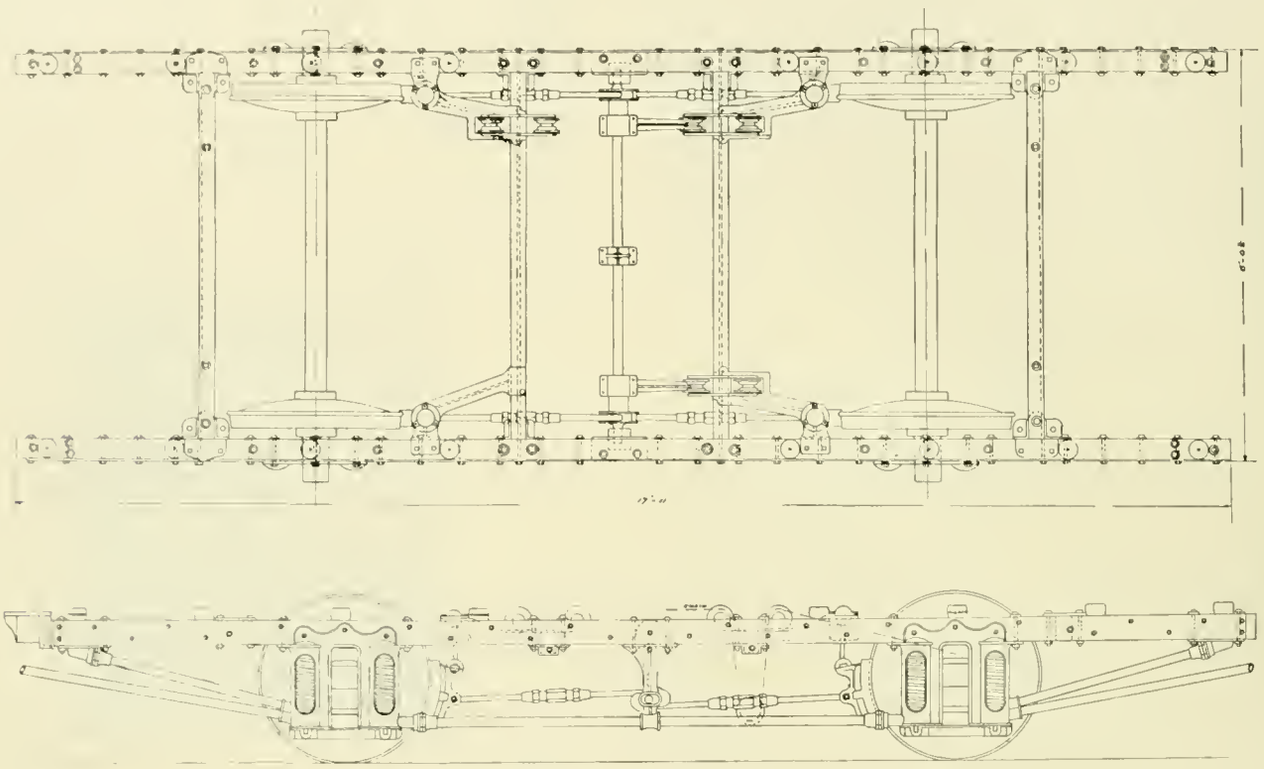


FIG. 1—PLAN AND ELEVATION OF THE MOORE TRUCK.

As may be seen from the side elevation and top view, Fig. 1, there are two longitudinal wood sills of yellow pine, 3½ by 4½ in. by 17 ft. 11 in. long, reinforced on the outside by ⅜-in. steel plates. The cross tie pieces and motor supports are of seasoned oak. Bolted to the sills are four pedestals, each holding two springs 4⅞ in. in diameter and 11 in. long. Two large pedestal bolts extending down through the springs hold the pedestal binder at the bottom in place. This is so arranged that by loosening the nuts the binders may be removed, the pedestal dismantled, and the wheels taken out without interfering with the car body, trusses or other parts. This is a great advantage when repairs are to be made or wheels removed.

The oil boxes are supported in pedestal jaws in such a manner as to allow a perfectly free lateral movement of 1¼ in. in each direction, providing a swing motion of 2½ in., which is brought into play in rounding curves. The journal brasses are cupped shape at the top, with small holes leading down through the brass to the inner or bearing surface. This cup is packed with a mixture of plumbago and tallow, which melts at an abnormal temperature and trickles down through holes, lubricating the bearing, effectually preventing hot boxes. The oil box cover is provided with a leather washer around its inner edges, and is held in place by a bolt in the center, making a dust-proof box, and also prevents oil from leaking or slushing out.

To each sill, midway between the wheels, is a center truss support, which also carries a tumbling shaft, being the only beam or bar connecting the brakes. The brake shoe hanger has an adjustable ball and socket joint attachment, both at the truck and brake head, permitting perfect freedom of movement. By means of a turnbuckle each shoe can be separately adjusted. An eccentric toggle at each end of the tumbling shaft forces the shoes against the wheels.

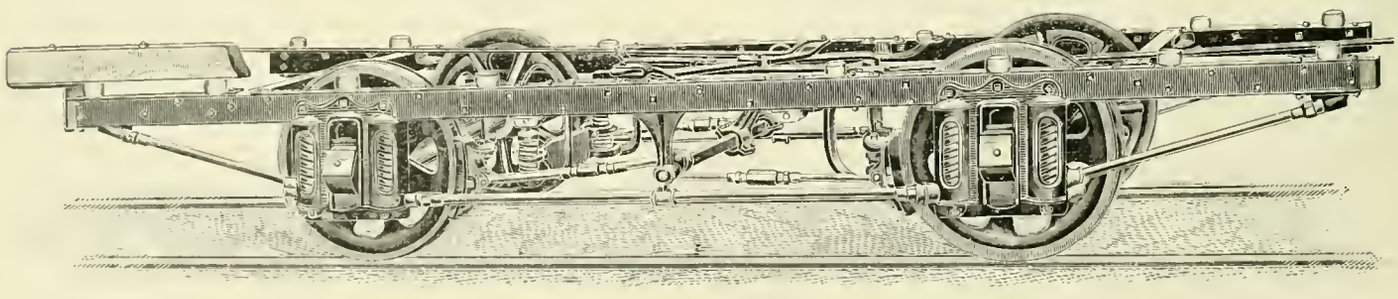


FIG. 2.

In each center truss support is an equalizing slot, 1⅝ in. x 3 in. long, which carries the tumbling shaft when the brakes are applied. This equalizing slot allows the tumbling shaft to adjust itself, thereby insuring a perfect equality of shoe pressure at the wheels. The brake shoes, on account of the ball and socket joint, adjust themselves under all conditions to the wheels, thereby insuring a uniform wear at all points of contact between shoes and wheels. The

shoes bearing near the center of the wheels, obviates the tendency to compress the springs when brakes are applied, as is the case where shoes are carried on the outside and near the track. The compression of springs in applying brakes, means more slack in the brake chains, consequently longer time in attaining the maximum braking power. The brake shoes are of cast iron, held in Christy heads, and can be easily removed at any time. The brake can be operated either by brake handles or friction disks.

The method of mounting the car body on the truck is shown at the right, in Fig. 2. Along each truck sill are eight cylindrical rubber insulators, $2^1/_4$ in. in height and $3^5/_8$ in. in diameter, with concave surfaces, top and bottom, held in place by wooden pins. The weight of the car body, compressing these insulators, forms a vacuum, which assist in holding the car body to the truck. By this means the truck sills support the car body along its entire length.

A socket padded with sheet rubber is slipped over the end of each sill. On the top of this socket is a serrated plate which fits into a corresponding plate on the sill of the car body. The socket is pushed into the proper position and held in place by a bolt extending down from the car body through a slot in the socket plate; the plates, and not the bolts, take the stress. There is no metallic contact between the track and car body, which largely accounts for the noiseless operation and the easy motion of the cars. The arrangement makes the changing of the trucks an easy matter. Four nuts have to be loosened, the sockets slipped back, the controller cables disconnected, the car body jacked up and the truck run out, which requires only a few minutes' work.

It will be noted that on account of the inside brake mechanism both ends of the truck are free from any parts which would interfere with fenders, life guards and track cleaning devices. With the exception of the oil box links and pedestal bolts, there are no forgings about the truck, strong and light malleable iron castings being employed. The swing motion in the pedestal jaws allows the use of a long wheel base and permits the truck to round sharp curves without undue stress on the truck or wear on wheel flanges.

The service tests of this truck under the cars of the Toledo Traction Company and the Sheboygan Light, Power & Railway Company, as well as the Chicago City Railway Company, prove it to be cheap, durable, noiseless and easy riding. Arrangements have been completed for its manufacture and sale by the Dorner Truck & Manufacturing Company, of Cleveland.

SAFEGUARDS IN EXPORT SHIPPING.

From an address before the Chicago Trade Press Association by F. B. Smith, of G. W. Sheldon & Co.

There is much to be done before the world-business can be intelligently and skillfully controlled by our manufacturers:

We must go after the business.

We must get the business.

We must hold the business.

To accomplish the first named requisite, our trade journals are doing a magnificent service, their circulation reaching the most remote known points where business is carried on. A second and similar help to the introduction of American goods abroad are the elegant catalogs issued by our large mail order houses. The establishment of trade expositions of raw and finished products in our midst, and at the principal capitals of other nations, will bring comparisons and inquiries, which cannot but result to the benefit of our commerce. The personal solicitation of orders by sample and by catalog is steadily going on, and in ever increasing amounts.

But after all is done, the business gained, the orders filled, there still remains the third requisite:

How are we to hold the business?

The representation has been good, the articles are satisfactory in themselves, but they must be quickly and cheaply transported to their destination, and here the shipping agent may contribute his link of the chain. Nothing can be more annoying to a waiting customer, nor to an eager and progressive manufacturer, than the delays and expenses due to errors in shipping and clearing goods. To the shipper for export, it may be said that a few simple precautions taken before his goods have gone forward, will result in a smooth delivery, whereas, these matters neglected, result in confusion, delay and loss, perhaps in a total suspension of orders from a given source.

In the main, the necessary requisite for a satisfactory export shipment should be the preparation of a duplicate invoice, setting forth the component material, size, and weight of each item detailed, and a manifest or skeleton description of the export, stating gross and net weights of each package, and its height, breadth and length, and marks, numbers, addresses and value. This document should accompany the duplicate invoice. It is not necessary in exports to many countries, but it is required by some, and is a most useful adjunct to an invoice, when handled by custom house officials abroad.

These documents should be handed to the forwarding agents at point of origin, with a request to secure a through rate to ultimate destination. This can usually be obtained at a lower rate than the sums of local, inland charges, and ocean freight would amount to, if a contract be made at time of shipment. If delivery be made by shipper at seaboard, or f. o. b. departing vessel, shipper and consignee share the reduced rate in proportion.

Goods for export should be plainly marked on cases or packages with full name and address of consignee, and these marks repeated in a letter of instructions to the forwarding agent, enclosing the invoice and manifest above referred to, stating clearly whether insurance is desired or not, particulars of collection of freight charges and giving instructions for disposal of the bills of lading.

As a matter of interest to most shippers for export, it may be stated that through bills of lading may be obtained from your forwarding agent at point of shipment, either for use as evidence of shipment to accompany invoice, or as negotiable documents to be exchanged for ship's bill of lading on arrival at the port. It is scarcely necessary to say that shipments for export should be invariably packed in strong cases well packed. If crated, crates should be so heavy as to prevent possibility of being shaken apart or broken by rough handling.

If these simple precautions are taken, the shipper may feel that nothing has been left undone on his part to insure his property a safe and speedy delivery to destination.

Rates of ocean freight are usually quoted by measurement, and in quoting rates, steamship lines reserve the privilege of applying a weight or measurement rate to the whole or any part of a given shipment. A rate of 20 shillings per ton weight, therefore, would mean 2,240 pounds for $4.80, or $22^1/_2$ cents per 100 pounds, while a rate of 20 shillings measurement may mean, if goods weigh 500 pounds to 40 cubic feet, 96 cents per 100 pounds, or, if weight be 1,000 pounds to 40 cubic feet, it would mean 48 cents per 100 pounds. To secure a through rate, therefore, shippers should always specify the weight and measurements of representative cases of their product, especially reporting any pieces of over two tons in weight, as rates on such heavy pieces are higher than for ordinary goods, and include charges for hoisting and for lighterage. Information regarding duties on shipments to foreign countries should be obtained from the resident consul of such country. It is true that a number of consular offices at Chicago are at present poorly informed as to the tariffs of their respective governments, but this condition will doubtless be remedied in the near future, as the need of information of this nature is persistently represented to the home offices of the various diplomatic representatives.

CAR BARN DESTROYED.

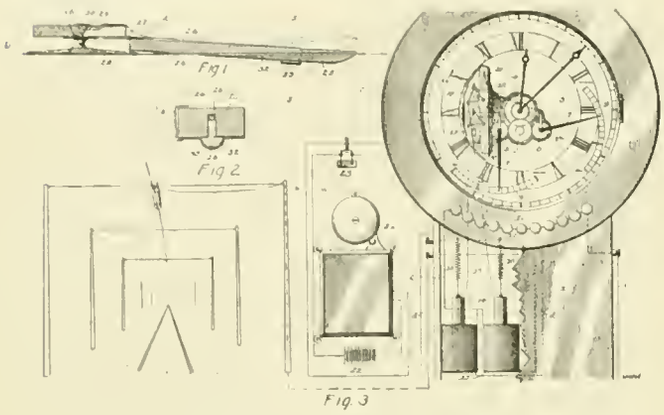
February 10, the car barn of the East Bridgewater (Mass.) & Brockton Street Railway Company, an iron roofed brick building 90 ft. by 50 ft., located a short distance from East Bridgewater, was destroyed by fire. A good fire had been built in the furnace to prevent water pipes freezing, but it is not thought that the fire caught from the furnace.

Five cars and one snow plow, together with a quantity of tools, belonging to this company were destroyed and also three cars belonging to the Brockton, Bridgewater & Taunton Street Railway Company, which were in the barn. The loss was estimated at over $23,000.

There is a city ordinance in East St. Louis compelling all street cars to be equipped with fenders, but the St. Louis, Belleville & Suburban Electric Railway Company has not yet complied with it. Superintendent Mayo and eight of the employes were served with summonses to appear for trial in a justice court for violating the law.

CAR TIMING SYSTEM FOR TROLLEY CARS.

The timing mechanism for trolley cars described below was patented last month by Henry Garrett after it had been in successful operation for several months. Although not suited to the short headway of cars on the large city lines, it is applicable to suburban and interurban routes. It is essentially an ordinary clock for automatically keeping check on the cars and indicating at the office



GARRETT CAR TIMING SYSTEM.

whether cars are on time in passing a particular point on the line, and, if not, to indicate how late they may be.

There is an indicating hand for each line, and while only two are shown in the figure any number of hands may be grouped around the gear, one for each branch line operated. At the extremity of each hand is a split hub having a frictional slip fitted on the spindle of the gear which is sufficiently tight so that the rotation of the gear will swing the hand in one direction, while at the same time permitting it to be swung back automatically. The latter movement of the oscillatory pointer is effected by the action of an electro-magnet. The bell circuit is open, but is closed by any abnormal movement of the pointer and the bell rings as a warning.

The electrical connections and the arrangement of the mechanism are shown in the diagram. At certain intervals along the line are trip-arms, Fig. 1, an enlarged cross section being shown in Fig. 2. The trolley wheel strikes the arm and brings the plate on it in contact with the trolley wire, which completes the circuit down the pole, to the office and through the clock solenoids, Fig. 3, to the ground, and the hand is swung back to the starting point. Should the car be late the hand will move on until it strikes a contact whose position has been predetermined, and the bell will ring.

When cars are operated on a schedule there is no difficulty in telling when any one is due at a given point, and all other cars on that line are at certain intervals ahead or behind. As long as the alarm gong does not ring there is assurance that there are no blockades, dead power, wires down or disabled cars. Should a car fail to pass a trip-arm and the allotted time is past, the bell will indicate that something is wrong and the attention of the emergency crew is needed.

ELECTRICAL EQUIPMENT AND DRAINAGE OF BOSTON SUBWAY.

In the Review for August, 1898, was published a brief illustrated description of the Boston Subway. This work was begun March 28, 1895, and completed, so far as the Transit Commission was concerned, on July 5, 1898. The fourth annual report of the Boston Transit Commission, for the year ending August 15, 1898, has been issued, and contains details of the work done during that year and a summary of all the work of the engineering department from the beginning. In appendices are given interesting data on the changes in pipes, sewers, conduits, etc., made because of the subway and of the equipment of the subway. From these appendices we extract the following:

There were 1,036 ft. of sewers of various sizes removed and 3,842 ft. built; 7,736 ft. of water pipes were removed and 9,105 ft. laid; 10,296 ft. of gas pipes were removed and 10,744 ft. laid; 31,800 ft. of lighting, telegraph and telephone conduits removed and 27,300 ft. laid. In addition numerous manholes, hydrants, junction boxes, etc., were removed and replaced.

The tunnel is 9,498 ft. long, and has 5.3 miles of track (measured as single track) laid with 85-lb. T-rail; the track rails are protected by 43-lb. guard rails. In equipping the overhead lines the following material was used:

Trough construction for trolley wire	23,625 ft.
Figure 8 trolley wire	23,362 "
No. 0 and No. 00 trolley wire at entrances and loops	7,055 "
Ground return, 500,000-c. m. cable, about	5,000 "
Ducts in conduit in subway alone	81,905 "
Barn hangers and insulating bolts	3,093
Insulating joints	17
Feeder switches	35
Manholes	63

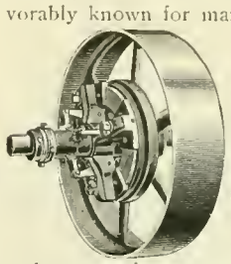
Four independent sources of light supply, in addition to the lights in the cars, are provided. At present there are installed in the entire length of the subway 1,235 incandescent lamps and 175 enclosed arcs.

The leakage into the subway, which nearly all comes through the small drains in the invert leading from hollows left in the side walls, was measured at the end of an unusually wet season, and found to be about 81 gallons per minute. This, together with the rain water entering from the open inclines, is collected in reservoirs and thence lifted from 12 to 18 ft. to the city sewers. There are four pump chambers equipped with motor-driven pumps, and the motors can be driven either from the circuit of the Boston Elevated Railway Company or from that of the Boston Electric Lighting Company.

The pumps are automatically operated. When the water rises to a certain level it raises a float that is connected by means of a chain with an automatic rheostat, that starts one motor direct connected to a vertical submerged centrifugal pump that removes the water, and when the water has fallen to a certain level the float descends and stops the motor. If it should happen that the first motor did not start, the water on rising a little higher would start the reserve motor, and if that should not work and the water continue to rise, an alarm bell at the center of distribution will ring and give warning that something is wrong. Duplicate pumps, each of 300 gallons per minute capacity, direct connected to 5-h. p. motors, are installed in each pump chamber.

FRICTION CLUTCHES.

The advantages of friction clutches for operating machinery in factories and repair shops is almost universally acknowledged. They are necessary where perfect control is desirable over the machinery in every part of the shops. The Frisbie clutch, which has been favorably known for many years, is now made by the Eastern Machinery Company, of New Haven, Conn. Thousands of these clutches are in use in every part of the country and under every condition of service. The simplicity of the design, as may be noted in the cut, and good workmanship have resulted in nearly all cases in long service. Letters have been received stating that clutches were in daily use for as long as 13 years with no repairs and apparently as good as new, and in one case a clutch was returned to the factory for repairs, the first time in 18 years of continuous use. The sizes range from 1.6 to 1,400 h. p. In some instances it is desirable to have a quill and hollow shaft connection between the engines and generators in the power station and for this purpose the clutch has been especially adapted. Many of the Frisbie clutches are now in use for driving generators in electric light and power plants.



The Cleveland Street Railway Employes' Association gave its annual masquerade ball on February 21; over a thousand persons were in attendance.

The gross earnings of the West Chicago Street Railroad Company for the week ending February 26, were $71,375, which is an increase of $5,347 over those for the corresponding week last year.

SOME DETAILS OF STREET RAILWAY CONSTRUCTION.

Read before the Illinois Society of Engineers by W. H. Rosencrans, City Engineer of South Bend, Ind.

The subject of street railway construction is a constantly broadening one, and, in my opinion, will soon overshadow in importance that of the steam railroad. I wish to speak of a few details of street railway construction, and in doing so will describe briefly the street railway systems and interurban railroad lines in and about South Bend, Ind. The city proper has at present about eight miles of street railroad, all of which was rebuilt in the summer of 1898.

Outside of the city there is a line running along the brow of the St. Joseph river bank, in a southeasterly direction to Mishawaka, a distance of four miles, its present terminus being in the center of the town. There is another line which leaves South Bend on the east and runs in a direct route to Mishawaka, on the north side of the river. Both roads follow the highway the entire distance, but are constructed on the sides of the road wherever it is possible to do so.

The same company has also acquired the Elkhart street railroad and the Goshen street railroad, and during November and December, 1898, connected these lines by a 10-mile interurban line along the Lake Shore & Michigan Southern Railroad right of way nearly the entire distance, on private right of way.

A line is located between Elkhart and Mishawaka, a distance of 10 miles, and will be constructed early this coming spring, together with many extensions to other towns in the vicinity of South Bend.

The city lines were constructed, with the exception of curves, entirely of T rails, weighing 70 lbs. to the lineal yard of the high girder rail form, furnished by the Johnson Steel Company, using section No. 70-264. All rail used was in 60-ft. lengths. The old lines of South Bend were first torn up and all old material removed. Then the street was excavated a sufficient depth below sub-grade to allow the placing of one foot of gravel below the base of ties, and excavated to a width of 8 ft. This sub-grade was rolled thoroughly with a 5-ton steam roller, having a compression of 500 lbs per sq. in. The track was then laid in the prepared trench, the rails, ties and splice bars having been previously distributed along the gutters. The gravel ballast was then distributed along the line and the lining and grading of the track was done in a most painstaking manner, using bar and pick tamps to give the finishing touches. The track was brought to exact line and grade. The spaces between the ties were then thoroughly tamped with hand tamps until

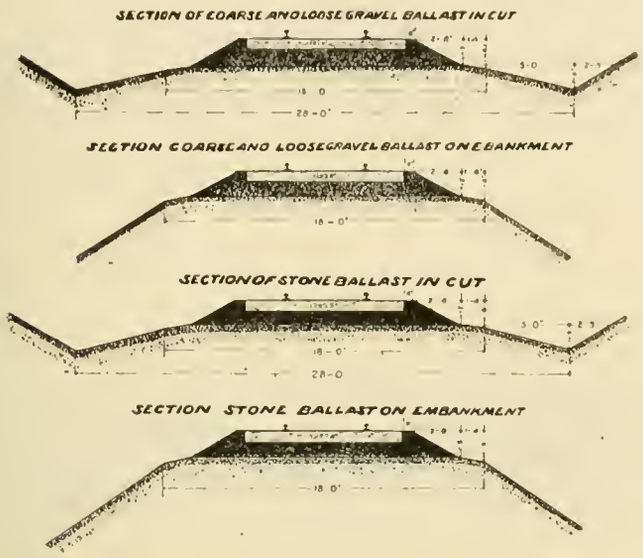


FIG. 1.

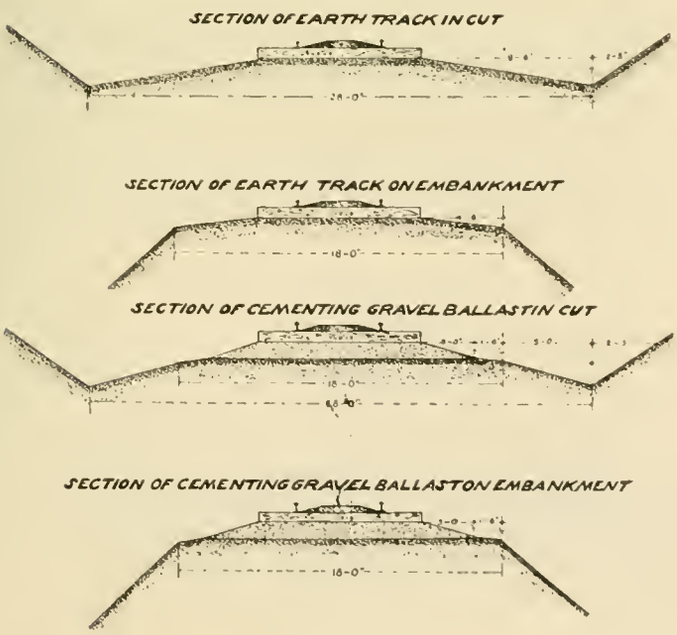


FIG. 2.

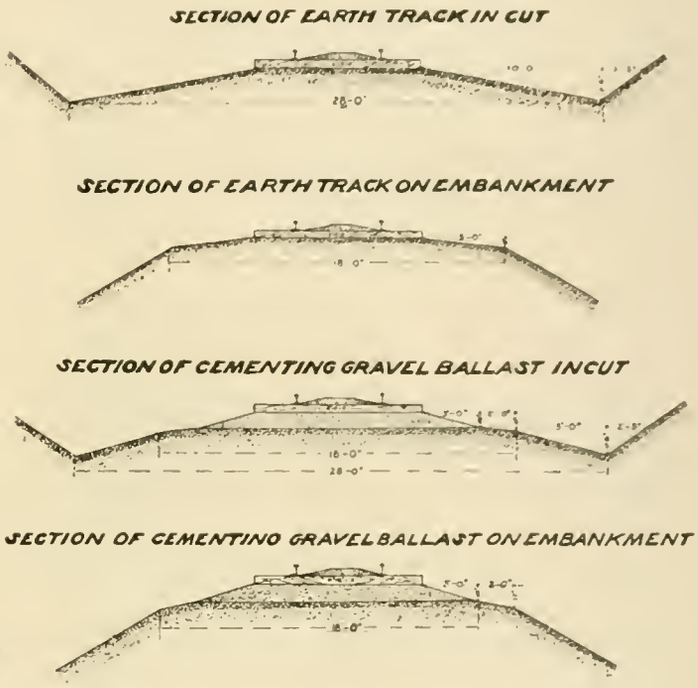


FIG. 3.

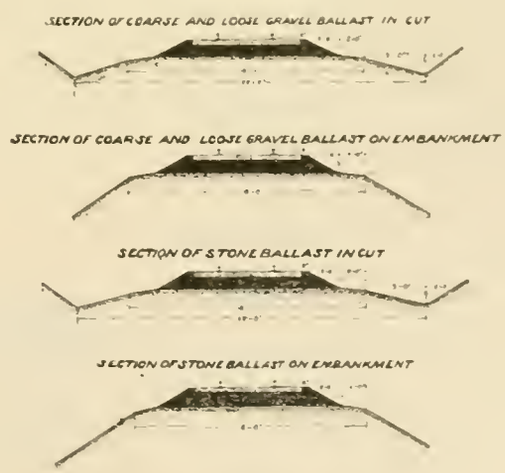


FIG. 4.

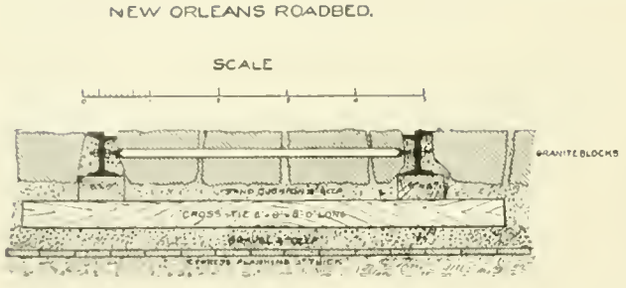


FIG. 5.

the gravel was brought to an even hard surface and at the level of the base of the ties. Great care was required in the construction and putting together of the joints. Splice bars 36 in. long were used, having drillings for three bolts in each rail. The splices were all sent to the shops of the company and all iron coatings, rust and scales removed. The ends of the rails were also thoroughly inspected, and while tightening the bolts the heads of the same were required to be tapped with a heavy hammer, as a safeguard to insure that all joints were tight.

On all the city lines the joints were double bonded, first inside the splices with short, many stranded, arched bonds, and outside with a single heavy copper rod running on the inside of the rail clear of the splice bars at both ends, and having about ½ in. of slack.

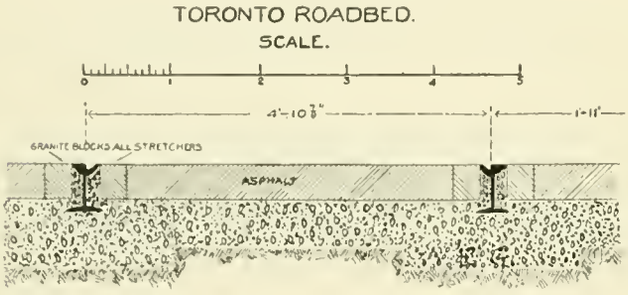


FIG. 6.

Tie rods were also used at intervals of 10 ft., drillings for them being made in the center of the web of the rail.

The street railway company is required to pave 3½ ft. on either side of the center line of its tracks, and also all space between double tracks, curves and switches. It was therefore decided to pave the space between the rails throughout the city, and repave in a permanent manner the entire strip which the street railway company was required to maintain.

The following plan was followed: Cement concrete was placed between the ties and to a height of one and one-half inches above them, on all brick paved streets, but care was observed to have no concrete laid on the ties. The space between the rails was paved with brick, laid at right angles to the track and having 1 in. crown in the center. A special form of brick was designed, a cut of which I herewith present, designed to fit beneath the head of the rail, and against the web, leaving a groove for the flange of the car wheel, which groove is curved or flared so as to allow a narrow-tired vehicle to slip out of the groove easily, if it should drop into it. These brick were made in such lengths that no chipping whatever was necessary, except at special work. On asphalt paved streets the paving was constructed with two lines of stretchers outside the rail and one row of headers of this special form of brick on the inner side. I have prepared a drawing showing this section, which I have made the standard shape for asphalt paved streets. In both the brick paved and the asphalt streets the space between the head of the rail and the base on the outer side of the rail was filled with cement grout, in order to bring it flush with the head of the rail and afford an even bearing for the paving surface.

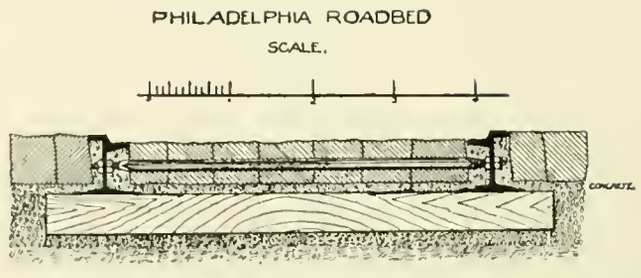


FIG. 7.

I have been able to prepare sections of street railway roadbeds, showing the methods of construction followed in a number of cities, which I believe represents the general practice in paved streets, which I wish here to present for your consideration.

In interurban street car lines the requirements become nearly the same as of a first-class steam road, and I have prepared sections of different classes of roadbed, which I think represent the best modern railroad practice. If 60-ft. lengths of rail are used, particular care should be observed to leave a proper allowance at joints for expansion. This is so important that I wish to quote from Ganot, who gives the co-efficient of expansion of steel due to a change of one degree F. as .000006.

The Pennsylvania Railroad Company made a series of tests to de-

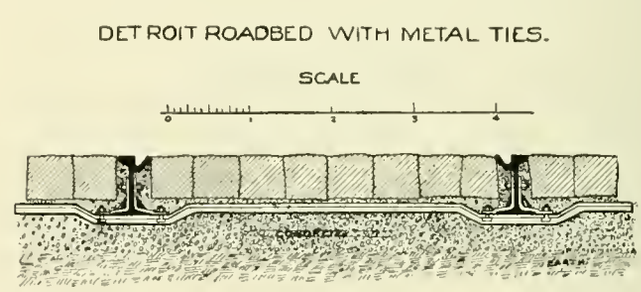


FIG. 8.

termine the rate of elongation of a steel rail, when subjected to a tensile stress within its elastic limit. The average was found to be .00006 in. per 1,000 lbs. per sq. in. Dividing this by the temperature co-efficient gives 114.6 lbs. as the stress per sq. in. in a rail, due to a change of 1° F., of 11,460 lbs. in a change of temperature of 100° F., which latter is equal to about one-fifth the elastic limit and one-ninth the ultimate strength of steel rail. However, it is probable that 5,000 lbs. represent the greatest stress due to change of temperature. This brings out a very vexatious question, that of the proper allowance for expansion when laying 60-ft. rails. I have obtained

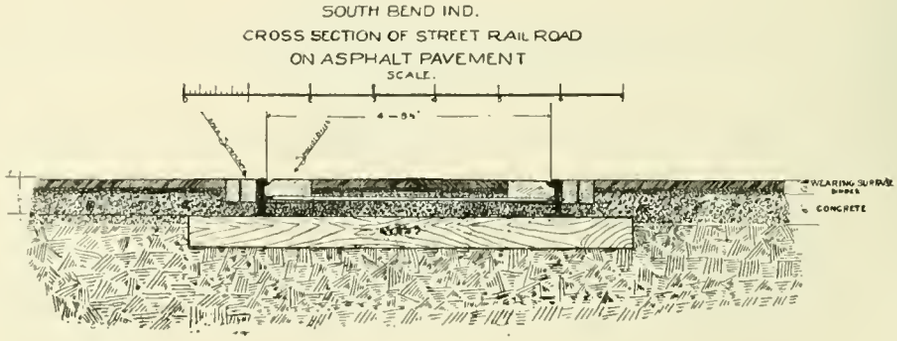


FIG. 9.

the best results by the use of a Fahrenheit thermometer when laying track, used as follows: At a temperature of 0 degrees a space of 5-16 in. was allowed, always using an iron shim. At 50°, 3-16 in. space, and in extreme summer heat, say 90° to 100° F., allow 1-16 in. space.

On the other hand, 60-ft. rails laid in paved or graveled streets and covered to their full depth may be laid closed joints; that is,

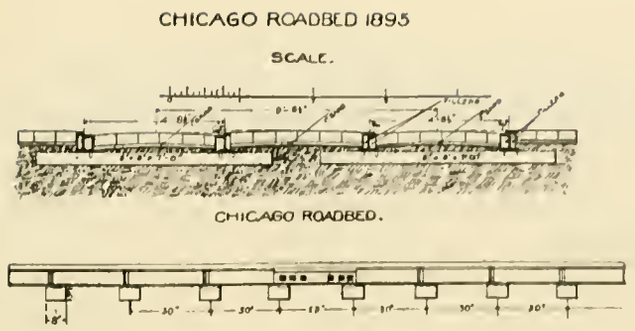


FIG. 10.

without any opening at the ends of the rails for expansion. Very good results are thus obtained, as we practically avoid the disagreeable pound due to passage of a wheel. "The worst enemy to good track is water, and the further it can be kept away from the track, or the sooner it can be diverted from it the better the track will be

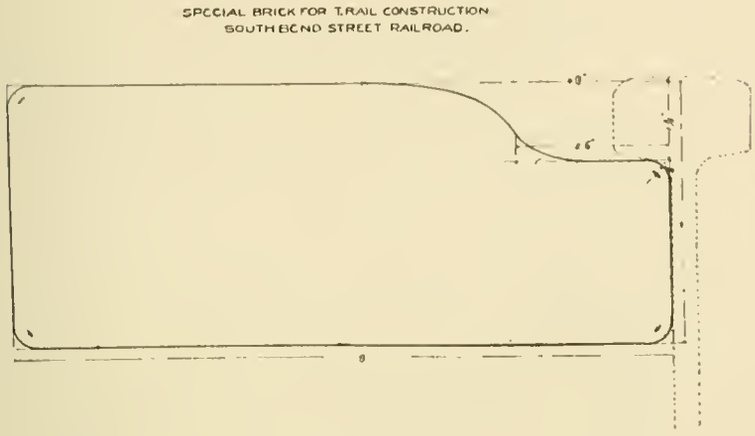


FIG. 11.

protected. Cold is damaging only by reason of the water which it freezes, therefore the first and most important provision for a good roadbed, and consequently good track, is drainage."

In the construction of the road and in its maintenance, this matter should receive the most careful attention of the engineer. I once had to clear a railroad wreck in a sand cut, thirty feet above the level of water in the adjacent creek, which was caused by water washing down a shallow depression which skirted the very crest of the sand hill, caving in the sand from the brow of the bank to a depth of five feet and clear across the track and cut, a distance of some 50 feet. The conditions were frozen ground followed by a

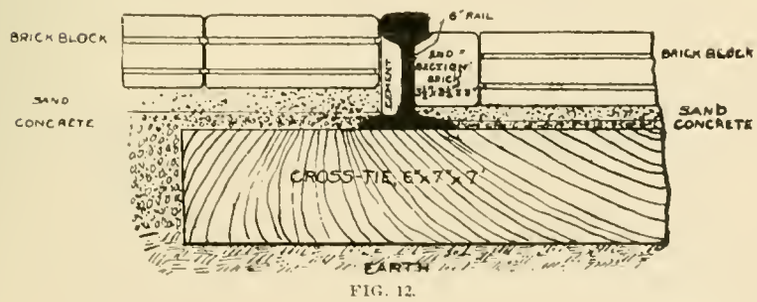


FIG. 12.

January thunder storm. This road had been operated 15 years, with no previous indication of trouble at this point.

In concluding I wish to say that street railway construction is yet in its infancy, and what is generally considered good engineering practice today may be looked on with as much circumspection in a few years as what was considered good street railroad construction ten years ago would be now considered.

The importance today of the interurban railroad is not questioned by the most skeptical. Six hundred miles of interurban railroad is a low estimate of the amount which will be built in Indiana alone during the year 1899.

With no limit to the field, and the brilliant promises of the electrical engineers in their special department, I believe we are entering an era of development more extended and far-reaching than any we have yet experienced, and one in which the engineer and the surveyor will play a most important part.

BILL TO LICENSE PUBLIC ACCOUNTANTS.

A bill for an act to regulate the profession of public accountants in the state of Illinois has been introduced at Springfield, whereby it is proposed to authorize the University of Illinois, at Champaign, to examine public accountants of this state and grant certificates to such as pass the examination, permitting them to designate themselves "certified public accountants." This bill is strongly indorsed by many prominent citizens of Illinois, and the public accountants of the state and their friends and clients are working to secure its passage. It is recognized that should this bill become a law, it would in time be very beneficial to the commerce of this state. A similar law has been in force in New York for two years, and has considerably benefited the legal, banking and business communities in the east. The proposed law for Illinois is not at all prohibitive; it only provides a body of recognized professional public accountants to choose from. It provides that the trustees of the University of Illinois may, at their discretion, waive the examination of any persons possessing the qualifications prescribed in the bill, and who shall have been continuously for more than five years before the passage of the bill practicing as public accountants, two years of which shall have been on their own account, in this state, and who shall apply in writing for such certificate within one year after the passage of the act.

A NOVELTY IN DAMAGE SUITS.

In the case of one Herman Schinauer against the Brooklyn Heights Railroad Company for $10,000 damages for personal injuries alleged to have been received in a trolley car accident the jury found for the defendant. It is the practice of the New York courts to grant the plaintiff an extra allowance of 5 per cent in event that he is successful, but it is unusual to grant a similar allowance to the defendant if the plaintiff fails. In this case, however, the court did grant the defendant an allowance of $500. Fortunately for the company the plaintiff is responsible and the company can collect the amount.

We trust that this precedent will be followed because if plaintiffs in the event of success are entitled to an extra allowance there would seem to be much better reason for the courts granting an extra allowance to defendants in case of their success, especially in view of the fact that much of the litigation of this nature is brought by attorneys who, knowing they have no case, expect to get money for themselves and their clients by appeals to the sympathies of juries or by frightening the railway company into settlement prior to suit.

PROPOSED FRANCHISE LAW IN CALIFORNIA.

A bill is pending in the California legislature providing for the sale of franchises by municipalities and the minimum compensation is fixed at 3 per cent of the gross receipts, but in the event that the franchise is for a branch line or extension of a street railway, the gross receipts are deemed to be the receipts from passengers getting on the cars on such branch lines or extensions. No governing body shall offer or advertise the renewal of any franchise until within one year of its expiration, unless previously surrendered by the operating company and accepted by the municipality. Should the bill pass the 3-per cent clause cannot fail to greatly delay the proposed construction of new roads, especially in the smaller cities.

Chester W. Chapin, receiver of the Consumers Electric Light & Street Railroad Company, of Tampa, Fla., has a large force at work restoring the dam which was destroyed by dynamite some months ago.

IN THE POWER HOUSE

This department is devoted to the construction and operation of electric railway power houses. Correspondence from practical men is specially invited. Both the users and makers of power house appliances are expected to give their views and experiences on subjects within the range of the department.

In a paper recently presented before the Northeast Coast Institute of Engineers and Shipbuilders (England), T. Messenger described an effective method of strengthening copper steam pipes by placing on them a series of bands. The bands are made in halves with cottered connections. In one instance cited by the author, a 12-in. pipe carrying steam at 110 lbs., the bands had a section 2 in. by 3-10 in. and were spaced 6 in. from center to center. By arranging a special design of flanges and bands this mode of strengthening the pipes can be applied at branches. This plan is of advantage in localizing the rupture of the seam in brazed piping; with bands spaced as above, the seam opening cannot exceed 4 in. in length, whereas on a pipe without such reinforcement the seam would probably open along the entire section of pipe.

Commodore G. W. Melville, engineer-in-chief of the United States Navy, calls attention in his last annual report to the improvements made in the materials for marine machinery. He states that nickel-steel engine forgings have been brought to a high degree of perfection, and the only regret is that so few companies have undertaken to do this class of work, but the prospect is that in the near future several more steel companies will begin to make them.

Seamless drawn steel boiler tubes have been furnished during the year for all classes of our boilers of a degree of excellence undreamed of a few years ago, and in consequence the lap-welded tube makers have been compelled to correspondingly improve their product both in material and workmanship.

The securing of a suitable material for steam and feed pipes in the destroyers and torpedo boats became a vital question, owing to the fact that at the temperatures, corresponding to the high pressures carried, copper and brass, which have hitherto been employed, lose a large percentage of their strength. The difficulty has been overcome by the advent of seamless drawn-steel pipes, with wrought-steel flanges welded on which are now made with a degree of perfection which makes them absolutely safe.

When it was decided that the new battleships should be practically identical with the Alabama class and that no hull changes would be made, it became necessary to find a way to reduce the thickness of the shell plates for cylindrical boilers. The shell plates in the Alabama class had reached a thickness of 1 7-16 in. in material having a tensile strength of over 65,000 lbs., and elastic limit of over 35,000 lbs., and an elongation of 24 per cent in 8 in. for longitudinal specimens.

Experiments have been made on a higher carbon steel, oil tempered and annealed, which has a tensile strength of over 74,000 lbs., and elastic limit of over 40,000 lbs., and elongation of over 21 per cent, with a very satisfactory transverse cold bending test. Such material allowed a slight reduction in thickness from that used in battleships Nos. 7, 8 and 9, although the boilers were designed for the higher pressure called for in the new battleships.

Nickel steel bracing and rivets have been made and tested and found suitable for use with this high-grade compound boiler plate, easily reaching the requirements of the Bureau's specifications.

Experiments have also been made with nickel steel to fill the high-grade shell-plate requirements, which gave very satisfactory physical results, with a surface much better than that furnished for the boilers of the Chicago, but not as perfect as that of the high-grade steel just described.

* * *

IMPROVEMENT IN CAST IRON FLY-WHEEL DESIGN.

Some time since the writer, having occasion to design a fly-wheel to meet rather unusual conditions, investigated the question of fly-wheel design and considered some changes that might easily be made and what the benefits of such changes would be. There are a great many fly-wheels built by the makes of medium and low speed engines that are made in halves with the joints placed midway between the adjacent arms, and these wheels are often run at a higher rim speed than are the larger built-up wheels, which as now generally made have the joints in the rims at the ends of the arms. Many excellent papers have been written upon the subject of fly-wheel design, in which it is shown that the joint when placed midway between adjacent arms is in the worst possible position; as Professor Benjamin, in his recent paper before the A. S. M. E. stated it, to put a joint midway between adjacent arms is like putting a joint in the middle of a girder.

The radial centrifugal force acting uniformly round the rim like a fluid pressure tends to separate the rim, and the joints, no matter where placed, must resist this stress. The centrifugal force of the portion between the arms acts to load that portion as a beam and thus additional stresses are introduced. The point in this portion at which the joint is placed greatly affects the stress placed on the joint.

Considering the solid segment in Fig. 1, we have a beam fixed at both ends and uniformly loaded. The maximum bending moment under such conditions is WL ÷ 12, where W is the total uniformly distributed load and L the distance between supports. This maximum bending moment occurs at the two supports; midway between the supports the moment is WL ÷ 24. There are two points, about one-fifth way from each support, where the moment is zero, these being the points of contrary flexure.

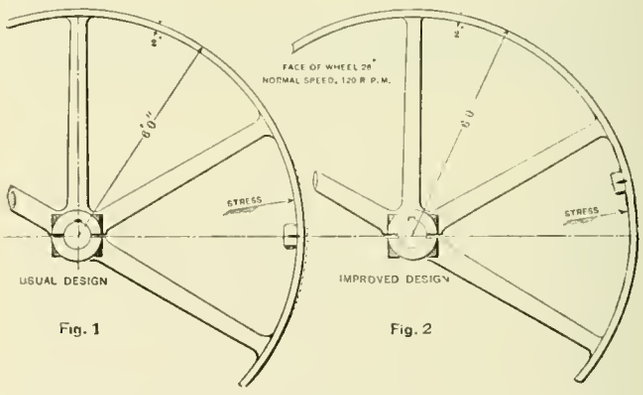


Fig. 1 Fig. 2

If we place midway between the arms a joint of the type shown (with inward projecting lugs to receive bolts) in the cut, we practically have two beams fixed at one end. The maximum bending moment in each of these beams, fixed at one end and uniformly loaded, would be WL ÷ 8, where W is the total load on both beams and L is the total length of both beams. This, it is seen, is 50 per cent greater than in the solid segment.

If the joint be placed, as shown in Fig. 2, about one-fifth from the end of the segment at the point of contrary flexure, the bending moment at that joint has to resist only the stress tending to separate the rim in halves. That this is true may be easily demonstrated by considering the longer portion of the segment as a beam fixed at one end and supported at the other by the shorter portion, and the shorter portion as carrying a concentrated load (the reaction at the end of the longer portion) in addition to its own uniformly distributed load; the result is the same as for the solid segment, i. e., the maximum bending moment is at the adjacent arms and is WL ÷ 12.

Changing the position as here suggested does not add in any way to the cost of manufacture, nor does it make the joint as strong as

COST OF POWER FOR ELECTRIC RAILWAYS.
Output Measured by Wattmeter in Each Case.

Station.	Month.	Monthly Output, Kilowatt-Hours.	Cost of Electrical Output per Kilowatt-Hour Cents. Fuel.	Labor	Supplies, Oil, Waste, etc.	Water.	Repairs.	Total.	Gals. Cylinder Oil per 10,000 k. w. h.	Gals. Lubric't-ing Oil per 10,000 k. w. h.	Lbs. Water per Lb. Coal.	Lbs. Fuel per k.w.h.	Price of Fuel per Ton of 2,000 Lbs.	Kind of Fuel
1	Nov.	1,562,756	.273	.150	.034	.026	.044	.527	3.62	6.39	9.29	2.59	2.11	Bituminous
3	"	181,645	.533	.324	.054	.008	.001	.920	3.9	5.03	.....	5.01	2.13	"
4	"	324,240	.411	.193	.032	.003	.007	646	2.33	4.3	.....	3.81	2.16	"
5. Metropolitan Elevated, Chicago.	"	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
10 Central Av., Metropolitan, Kansas City, Mo.	Oct.	365,221	.273	.124	.014	.009	.040	.462*	1.37	3.00	.....	4.42	1.24	Bituminous
10	Nov.	345,592	.302	.133	.008	.006	.003	.458**	1.54	3.05	.....	4.88	1.24	"

*Miscellaneous .002. **Miscellaneous .006.

the solid rim, nor does it eliminate the stress the rim bolts are generally computed to stand, that of holding the two halves together; but as the joint lugs are usually made, placing them nearer the arms lessens the stress in the section of rim where the joint occurs, conduces largely to cause the wheel to revolve at a high velocity as a true circle (instead of as an ellipse, with the joint on the major axis), and reduces the stress in the bolts from the joint "giving" or "opening" slightly, as is so often the case.

The common practice of placing the bolts very near the inner edge of the joint lugs which often results in an enormous stretching action in the bolts, and in some cases which the writer has seen has undoubtedly been the cause of the difficulty experienced in keeping the rim bolts tight; not because the bolts were not of sufficient section to stand the ordinary pull, as generally computed (like the stress of a boiler shell), but the additional stress caused by the wheel rim springing out, as shown in Fig. 1, and there slightly opening the joint on the outside of the wheel, against the resistance offered by the bolt with the leverage of the short side of the lug, which, of course, resulted in stretching the bolts in the bottom of one or two threads; and subsequently upon stopping the wheel the bolts would be found looser than when the wheel was put in motion, or the bolts last set up tight; and in connection with this matter we must remember that the usual and accepted methods of calculating the section of rim bolt make no allowance for this springing and stretching action, which can be entirely avoided by placing the joint as shown in Fig. 2, in which case the only stress coming on the bolts from the joint is one of small shear if the joint is planned, but if the wheel is cast whole and afterwards split, even this shear is taken up by the roughness of the fractured surfaces on the inner and outer edges of the joint lug.

F. W. Salmon.

* * *

ENGINE AND BOILER TESTING.

Abstract of a paper read before the Engineers' Club, of Philadelphia, by Henry W. Spangler, and published in its "Proceedings" for January, 1898.

In these days of elaborate codes for the testing of engines and boilers we are apt to lose sight of the reasons for making such tests, and to attempt to fulfill certain requirements that are entirely foreign to the reasonable purposes for which such tests are made.

Generally, all such can be divided into two classes—first, the so-called scientific tests; and, secondly, commercial tests. The first of these are such as are carried out by so-called original investigators, whose facilities are generally of the best, but applied in many cases to impossible apparatus in a commercial sence. The objects of such tests are, nominally, to get at the real facts, on the basis of which greater advances in steam engineering are to be made. Unfortunately, the advance has seldom been made as the result of tests of this kind, and it is doubtful if scientific tests of the kind here referred to which will bear the sharpest scrutiny have been made by more than one investigator in a generation. By impossible apparatus, in a commercial sense, I mean that the self-imposed conditions are those which are very different from, and in many cases the direct opposite of, the conditions which actually prevail in apparatus intended for practical use. A concrete example will illustrate: In the proposed code for boiler testing now under revision by a committee of the A. S. M. E., a scientific test of the boiler may be commenced by hauling the fire.

Many of the so-called scientific engine tests have been made on engines designed to be used for many different purposes, and the numerous by-passes, pockets, etc., required to fulfill the various functions leave the results obtained always open to criticism.

The second class of tests stands in an entirely different position, and it is on the results of these tests, intelligently carried out, that practically all the engineering advance is made.

Commercial testing has for its object the determining of one of two things—first, whether the apparatus is doing the best that can be done by it; or, secondly, whether a certain guarantee has been fulfilled.

These two tests are usually made by different persons and in the sequence above given, as in these days of sharp competition the guarantees furnished by the maker require for the fulfillment that the apparatus should be in first-rate condition. The result is that, generally, the engineer or the maker is called on to make the first of these tests, while the engineer, who stands between the maker and the owner, is called on to make the second. Much the higher grade of engineering is required for the first. The duty of the engineer in the first instance is not only to determine the facts, but to so modify the regimen of the apparatus that as many as possible of the unfavorable conditions may be eliminated and the favorable conditions made still more so. The business of the engineer in the second case is to report on the facts only. It is evident that the character of the tests made will differ in the two cases. In the one case all the facts, or as many as possible, must be obtained, while in the other only such as pertain to the guarantee.

In making the first set of tests the data obtained must be correct, or the object of the test will not be attained; in making the second set of tests the data should be as honestly obtained as in the first. The position of the engineer is quite a different one in the two cases: in the first he must be honest with himself, and he has the confidence of his employer or client; while in the second case, if acting alone, he is liable to be looked on as the servant of the party who first suggested him, or, if acting with others, is very likely to be considered as a partisan. When the engineer finds that the latter is his position—as, I am sorry to say, some do—he is too likely to be a quibbler, straining every point that his employer may come out ahead; and one does not wonder that many so-called tests are looked on with suspicion. The position of the engineer in a case like the last is not at all an enviable one, and he must first know what is right and then do what he knows to be right.

The actual testing of boilers and engines is really a very simple matter. Direct methods of measuring the quantities to be dealt with are always to be chosen rather than indirect ones, and care should be taken to see that the apparatus in use is as nearly correct as can be obtained.

As tests of the second class above referred to are entirely covered by the first one, it is with that one alone that we will deal.

We will first take up a boiler which has been erected and is about to be tested. The maker wants to know whether it is in the best possible condition, and he wants to be able to tell this in the least possible time. There are usually two things required—first, that the boiler shall be able to do a certain maximum amount of work; and,

secondly, that under certain definite conditions—as, for instance, when evaporating some part, say 75 or 80 per cent, of the maximum amount—it will do so with a given economy—as, for instance, utilizing 65 or 70 per cent of the heat in the coal, and using a certain grade of coal. Unfortunately, it is not a very easy matter to state these conditions in such a way that they are entirely definite, and in many cases the results will vary with the meanings and limitations set to the terms of the contract.

For instance, if the contract says that 70 per cent of the heat in the coal is to be utilized, what does this mean? and how is it to be determined? Is the moisture in the coal to be determined during the test by actually drying a large quantity, or by the chemist's method, using a few grams? If by the first method, is it to be done by placing in the hottest part of the boiler room or over a slow fire? It is safe to say that any one of these methods will give a different result and a correspondingly different value to the amount of heat that must be utilized.

Again, is the evaporation of this water to be allowed for or not? How is the heat in the coal to be determined—by chemical analysis or by actual burning in a calorimeter? Is the heat to be counted down to the initial temperature of the coal, which is the value usually obtained from the ordinary formulae, or by the calorimeter, or only to the temperature of the steam? If by the first method, the lower the boiler pressure, the lower the actual efficiency; and if by the second, the greater.

It is clear that if the basis on which the efficiency is based is clearly stated, there can be no such questions arise; but, ordinarily, they are all open questions for the engineer to decide.

As what we are after are the exact facts, it is probable that they will be most nearly reached by methods that lie between those ordinarily in vogue. That is, the amount of moisture in the coal should be determined by the chemist's method—heating to something over 212° F.—but on much larger samples, and before they are crushed for chemical analysis.

The heat in the coal is probably most nearly exactly determined if the coal is burned. The constants in the formulae we have are not determined for the class of coals we use, and there is a considerable difference in opinion as to what the terms mean, anyway.

Knowing what we have to work with, the results obtainable in the actual boiler depend partly on the fireman. The latter factor is the one that makes the boiler tests unsatisfactory as compared with an engine test. Bad results may be obtained from a good fireman, but the reverse is seldom the case. It has not been possible until within a short time to measure the efficiency of the fireman as one of the factors in a boiler test, but it is believed that such data will soon be available. Assuming that a proper fireman has been selected to do the work, it is sufficient simply to know the quantity of coal and water fed to a boiler, together with the minor data usually taken, as we supply the boiler with many more pounds of air than we do of coal and water combined, and it is possible that a boiler is inefficient because of its air supply in more cases than most of us dream of. Ordinarily, we supply one pound of coal, say eight pounds of water, and twenty pounds of air; and it is as necessary to have a check on the air supplied as on the coal or water. It has not been possible to keep a very close watch on this until a method of continuously gaging the air was perfected, but it looks now as though such an apparatus is at hand.

The amount of air supplied increases the quantity of heat carried to the chimney for a given temperature; or, if the air supply can be reduced, allows a higher stack temperature with less loss, which would mean a greater capacity with the same economy, or the same capacity with greater economy.

To come down to details, the water should be weighed, and it is, perhaps, worth noting that, except for rough tests, the tank should never be allowed to fill to a certain mark, and the number of such tanks recorded. One of the most celebrated series of tests ever made is under the cloud of being worthless because of an incorrect tally of water tanks used on the test. The noting of the time at which anything is done is a good check on errors of this kind.

It is a wise plan to keep the time that water passes a definite mark in the lower tank, as this gives the rate at which the water is fed into the boiler, and allows a test to be started or stopped at any time.

Coal and ashes should, of course, be weighed, and when a number of boilers are being tested, it is worth while keeping separate accounts to locate any difficulty that may arise.

The only feasible way of determining the air supplied to a boiler is by the use of such apparatus as an econometer. The method of testing flue gases chemically is slow, and does not show the momentary changes taking place, and has always been found to be unsatisfactory.

This apparatus also enables us to determine the quantity of air in the flues at various points of their length, thus telling whether the air comes in at a proper place or not.

There are two other pieces of apparatus of value in testing boilers, but ordinarily their use is perfunctory; these are the stack thermometer and the draft gage. Generally, these readings are taken and set down and nothing further done with them. The thermometer should give the total pressure available for forcing air through the fire, and the draft gage the amount required to overcome the resistance of fire and passages, and to give the air velocity. There is not, necessarily, any relation between the quantities. With a stack 150 ft. high, and with an outside temperature of 60°, the pressure due to the height of the chimney would vary with the temperature. Thus, with an inside temperature of 600° the total pull of the chimney is .91, while with 400° it would be .71 in. of water. I mean that with this temperature in the stack, and with the grate entirely closed so that no air could get to the chimney, this would be the pressure shown by a draft gage. This pressure is actually used up in overcoming the grate, fire and flue friction, and in giving the air velocity. In a good boiler with a 150-ft. stack these quantities might have the values of 1 for the flue friction, 12 for the grate and fire friction, and 1 for the portion required to give the air its velocity. As the opening through the grate is increased, the draft-gage reading will fall, until, finally, if all the resistance to the entrance of the air to the bottom of the stack were removed, the draft gage would read substantially zero. A high reading, therefore, means practically that the resistance to the passage of air through the grate is high and nothing more.

The volume of air which a chimney will deliver will, therefore, not increase with the readings of the draft gage, but will increase with the temperature of the flue, and probably decrease with the increased reading of the draft gage, which differs from the ordinarily accepted ideas.

One other point worth remembering in boiler tests is the desirability of keeping conditions constant. It is surprising how nearly this can be accomplished with care on the part of the operator. One buys a boiler to deliver so much steam at a definite pressure. Ordinarily, this is understood to be the average an hour for, say 10 hours. For a single boiler this seems to be a mistake. For power purposes one does not want 3,500 lbs. of steam one hour and 2,500 lbs. the next from a 100-h. p. boiler, but 3,000 lbs. each hour; nor does one want a boiler which will blow off just after cleaning fires, and have the steam pressure drop from 100 lbs. to 60 lbs. while fires are being cleaned. To the user the latter condition is surely not satisfactory.

It is not a difficult matter, when testing more than one boiler, to keep the conditions substantially uniform. With a given steam pressure a steam pump can be made to deliver practically the same quantity of water each five or ten minutes. With a reducing valve, or by hand, the pressure on a boiler can be kept practically constant and the water level can be kept practically at the same point for the same condition of the fire.

There is one more detail of boiler testing that is worth speaking of, and that is the method of starting and stopping a test. The method of hauling fires at the beginning and end of a test is simply barbarous; and when one attempts to decide that there are so many pounds of combustible in the material hauled from the fire, he is, perhaps, unconsciously straining his judgment. Whenever one "judges," he guesses, and that is outside the province of the class of tests here spoken of. The other standard method is by judging the fire at the beginning and end of the test, and allowing the difference. In a capacity test the allowance makes little difference, but in an economy test the greater the allowance, the greater the economy.

There is a third method which has been practiced for many years which is fair to both boiler and prospective owner, and has been well thought of by some boiler-makers. It is much more tiring on the engineer conducting the test; but that he can charge for, if he pleases. The scheme is this: Suppose we have a 100-h. p. boiler to test for capacity, test to run from 8 a. m. to 6 p. m. The coal is such that the fires are to be cleaned twice in the test. Fire should be on the boiler 24 hours before the test begins. Beginning at 2 a. m., the

boiler should be fired at about its capacity. Roughly, 400 lbs. of coal should be burned each hour from 2 a. m. until 7 a. m. It is not necessary that any account should be taken of water, nor any other data for test purposes. All we want is heavy, dirty fires at 7 a. m. At 6.30 the water level is brought to the point at which it is to be carried, and is kept there, and all conditions brought to running conditions. At 7 begin cleaning fires. Put, say, 400 lbs. of coal on the floor and allow the fireman to use it to the best advantage. Note the time he begins using the next lot of coal. Say this is 8 a. m. This is the time at which the test really begins. At 5 p. m. clean fires again and weigh out 400 lbs. of coal, the same amount as in the morning. See that it is all used up by 6 p. m., when the test ends. The fire at the end of the test will then be as nearly in the same condition as at the beginning of the test as it is possible to make it, barring the fatigue of the fireman.

This seems more intricate than the standard methods, but neither the boiler nor the results can be jockeyed.

In this connection emphasis should be put on keeping the water level constant. This is particularly necessary at the beginning and end of the test, and unless the person making the test stands over the pump at this time, it is not likely to be done. We have all seen the water level kept below the mark, and at the end of the test the pump started as fast as it will go to bring the level to the right place; and we have all seen the feed-pump stopped at the beginning of the test, to bring the water down to right starting-point. The result is that at the beginning of the test the boiler had the least weight of water in it, and at the end the most, the difference being apparently evaporated, but in reality being in the boiler.

In engine testing very much the same character of tests are made. One is to determine whether certain results are obtained or not; the other to determine whether the economy of the engine can be improved—that is, to put the engine in its best shape. As in boiler testing, these tests are ordinarily made by different persons, and the second requires much the greater engineering skill.

We are all sufficiently familiar with indicator cards to know that all they give is the relation between the pressure in the cylinder and the volume swept through. The horse-power, the general conditions of the distribution of steam, can be determined, but the economy of the engine is still an unknown matter. It is absolutely impossible to tell how much steam is being used by the engine from the cards. The volume, or weight, actually in the cylinder in the shape of steam can be determined, but it is well known that there is a large amount of moisture in the shape of water actually passing through the cylinder, and this may be from 25 to 40 per cent of all the steam used, if the engine is known to be tight.

To determine the weight of steam used there is only one thing to be done if satisfactory results are desired, and that is to weigh the steam after it has passed through the engine and been condensed in a surface condenser. This credits the engine with all leaks between the engine and condenser; but this can not be avoided. It often happens that this is not practicable, and we must weigh the water fed to the boiler. As the steam line is generally much longer and much more complicated than the exhaust line, the error against the engine this time is much greater than the error in its favor when a condenser is used.

It is often suggested that the line leakage can be determined by shutting down the engine and noting the difference in water level in the boiler some time after the test is ended. One does not try this experiment very often, as, from what has been said on the question of water level in boilers, it is easily seen that for a long time after the plant has been shut down the water level is as likely to go up as to go down; and the going down, when it does occur, is as likely to be due to a cooling boiler as to leaks.

To analyze the heat losses in the engine with a view to improving the economy, recourse is had to Hirn's analysis, or to the entrophy-temperature diagram first put in practical form by S. A. Reeve; these methods were described by the author.

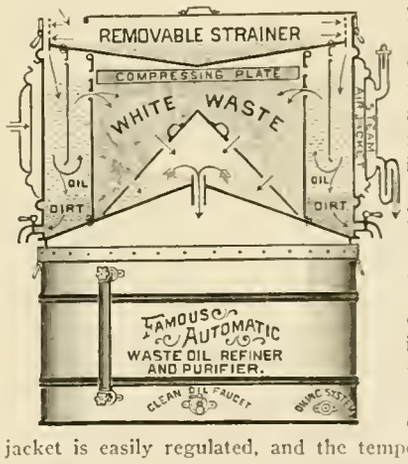
Another point often desired in engine testing is to determine the regularity of speed. In the use of some engines this is a matter of moment, while with others it is not. In specifications one finds such a clause as "the speed shall not vary over 3 per cent"; in others the same clause, but the additional words "from the rated speed." Both are clear, but the additional words double the possible variation. Of course, a continuous record would be desirable; but, generally, records of this class are qualitative rather than quantitative, and the calibration of the apparatus is not at all convenient, and, finally, the calibration comes down to some system of counting. Practically, we can conveniently count the number of turns and separate them into intervals as small as we please. The average for each such time-interval is usually taken for the speed during that interval. With a well-regulated engine, the variations in the speed taken in this way are not great, do not occur suddenly, and do not have a very great effect on the running of the plant. For lighting purposes especially, the variation in speed, due to sudden changes of load, is of more moment. Probably the best way to judge of the effects of such a change in speed is by the indicator. By opening a switch to throw off any desired proportion of the load and, at the same time, throwing in the indicator, a series of diagrams will be traced showing the rapidity with which the governor acts. Cards taken just before and just after such a change in load will locate on the varying card the initial and final conditions which, with a hunting governor, are not generally the greatest and least diagram drawn.

The net horse-power delivered by an engine is often desired. There is only one way of properly determining this, and that is by using a Prony brake. Up to, perhaps, 150 or 200 h. p. this can be satisfactorily managed; but for larger engines, and for engines directly connected to the apparatus driven, the thing usually done is to run the engine light and assume that this is always the work used up in friction. This is not always a safe course, however.

* * *

THE FAMOUS FILTER.

The accompanying illustration shows the construction and operation of the "Famous" oil filter which is made by Famous Filter Company of 314 North Main street, St. Louis. The one illustrated is the latest of the company's designs and is known as the "99" type. The waste oil to be purified is poured into the removable strainer which retains all of the coarser impurities; from this strainer it passes down through the settling and refining chamber, being kept away from the filtering material by the shield hanging in this chamber. The oil is heated by a steam jacket (using either live or exhaust steam); between the oil chamber and the steam jacket is an air jacket through which air circulates; by screwing bushings of different sizes into the air outlets at the top of the jacket the volume of air passing through the jacket is easily regulated, and the temperature of the oil thereby controlled, and limited to the maximum suitable to the grade of oil filtered. The oil being rendered fluid by thus heating it, dirt, water, and other impurities readily settle and are drawn off through the faucets near the bottom. After being thus settled the comparatively clean oil rises on the inner side of the deflecting shield and as shown by the arrows passes through the filtering chamber which is filled with compressed white waste. The bottom of the filtering chamber is a perforated cone covered with white waste.



It would be difficult to imagine a more perfectly arranged oil cleaning apparatus; the oil is first strained and settled, thus removing by far the greater portion of the impurities, and finally filtered by the capillary action of cotton waste.

On January 28, a 58-in. pulley of 38 in. face, mounted on a 6-in. shaft, in the power house of the Consolidated Electric Light Company, Birmingham, Ala., burst, bending the shaft and wrecking the line shaft foundation. Six generators, aggregating 920 k. w., were run from this shaft. Repairs could not be made in less than a week, and one result of the accident was that the Birmingham Railway & Electric Company, which rents power from the Light Company, was greatly inconvenienced.

Designing Boilers for a Small Street Railway Plant.

BY WILLIAM KENT, M. E.

PART II.

QUALITY OF COAL.

Of the several variable elements which enter into the problem of estimating the probable evaporation from and at 212° per pound of coal, which as above stated may range from 12 down to less than 5 pounds, the first to be considered is the quality of coal. We may consider all coal as containing three constituent substances, two of them being useless or worse than useless, viz., moisture and ash, and one useful, the combustible.

Moisture is of two kinds: 1st, surface moisture which may be derived from water in the mine or from rain, and which may be dried out by exposing the coal to an ordinarily dry atmosphere, and 2nd, inherent moisture, which exists in a lump of apparently dry coal and which may be entirely expelled from the lump by heating it to a temperature of 240° or upwards. The quantity of this inherent moisture varies from less than 1 per cent in anthracite to as much as 14 per cent in some Illinois coals. This moisture is contained in the coal as it is in wood, and if it is dried out by heating to a high temperature it will be absorbed again from the atmosphere upon long exposure.

The ash in marketable coal may also be of two kinds: 1st, that existing in the lumps of coal, and which may be found only by burning the coal, and 2nd, that which comes from seams of clay, slate, iron pyrites, etc., between the seams of coal or from the top or bottom of the coal seam. The quantity of this latter kind of ash depends largely upon the care with which the coal is prepared at the mine. Some of it may be removed by screening, jigging or washing.

The combustible portion of the coal may be divided into two subdivisions: 1st, volatile matter which may be driven off by heating the coal to a red heat, and 2nd, fixed carbon, which is burned away by air at a very high temperature. A lump of coal which has all the moisture and all the volatile matter driven off becomes coke, which contains the fixed carbon and the ash.

Finally, both the percentage of the volatile matter and its nature vary according to the geographical location of the coal mine. The quantity, expressed as a percentage of the total combustible (that is the coal after subtracting the moisture and ash) varies from 2 or 3 per cent in the hardest anthracites to over 50 per cent in some western coals and lignites. The quality of the volatile matter varies from being almost entirely a hydrocarbon, similar in composition to marsh gas, CH_4, containing 3 parts by weight of carbon to 1 of hydrogen, in those coals containing less than 25 per cent of volatile matter in the combustible, to a combination of hydrocarbon with oxygen, in coals containing larger percentages of volatile matter. Generally the relative proportion of oxygen increases with the increase of volatile matter, but it does not follow any fixed law, varying with the location of the mine.

Sulphur, in the form of iron pyrites, a very objectionable constituent of marketable coal, comes usually from thin seams of pyrites in the mine. Its quantity varies from less than 0.5 per cent in some anthracite and semi-bituminous coals to upwards of 4 per cent in some bituminous coals. It is found in the greatest quantity in the slack, or screenings, of soft coal, from which it may to some extent be removed by jigging. It is objectionable because it is the chief cause of the formation of clinkers on the grates, the iron left after the volatilization of the sulphur combining with the silica and alumina of the ash to form a fusible slag or glass which chokes the air supply and diminishes the coal-burning capacity of the furnace.

Coals are classified according to their general character into anthracite, semi-anthracite, semi-bituminous and bituminous coals. Anthracites are distinguished by containing less than 7½ per cent volatile matter in the combustible and by being low in moisture. The ash and sulphur vary in different mines, and with the sizes into which the coal is divided by screening. The dirt, slate and iron pyrites are screened and picked from the larger sizes, which are commonly used for domestic purposes and for locomotives and steamboats, and not for stationary boilers, for which they are usually too high priced. The smaller fragments of dirt, etc., are therefore found in the smaller sizes of coal, and usually the smaller the size of the coal the greater quantity of ash it contains.

The semi-anthracites are found in a limited district of Pennsylvania. They contain from 7½ to 12½ per cent of volatile matter, and since this volatile matter has a higher heating value per pound than fixed carbon, they are worth more per ton than the anthracites, provided they have the same ash moisture and sulphur, but these vary with different mines.

The semi-bituminous coals contain from 12½ to 25 per cent volatile matter in the combustible. They are mined over a large territory, chiefly east of the Allegheny mountains, from Pennsylvania to Virginia, and include the Clearfield, Broad Top, Somerset County and Cambria County coals in Pennsylvania, the Cumberland coals in Maryland, the New River coal in West Virginia and the Pocahontas coal in Virginia. These coals are all usually low in moisture, ash and sulphur, varying, however, in different mines and according to the care taken in mining and preparing for shipment. They are all characterized by high heating value per lb. of combustible, since the volatile matter is low in oxygen and has a heating value of much higher per lb. than the fixed carbon. These coals are by far the best steam coals in the United States, and rank with the best coals in Europe. They are very free burning, and those that are low in ash may be burned at rapid rates of combustion without clinkering the grates.

The bituminous coals, which contain from 25 to 50 per cent volatile matter, referred to total combustible, are of a great range of quality, depending upon the district in which they are mined, which covers most of the coal-bearing areas of the United States west of the Allegheny mountains. Generally speaking, the amount of volatile matter increases as we go westward and northward from the Alleghenies, and as the volatile matter increases so does the percentage of oxygen in that volatile matter, thus making it of lower heating value. To this rule, however, there are some exceptions, as of two coals containing the same percentage of volatile matter in the combustible, one may be higher in oxygen and therefore lower in heating value than the other. The percentage of inherent moisture also generally increases as we go westward, ranging from less than 2 per cent in some coals mined near Pittsburg to 12 per cent or 14 per cent in some coals in Illinois.

If we have an ultimate analysis of a coal we may calculate its heating value, within a probable limit of error of 2 per cent, by means of Dulong's formula, viz.: Heat units per lb. $= .01\ [14{,}600\ C + 62{,}000\ (H - O \div 8) + 4{,}000\ S]$ in which C, H, O and S are respectively the percentages of carbon, hydrogen, oxygen and sulphur in the coal.

If we have a proximate analysis, giving the moisture, volatile matter, fixed carbon and ash, we may calculate the probable heating value within a limit of error of not over 3 per cent, except as stated below, by reference to the following table:

APPROXIMATE HEATING VALUE OF THE COMBUSTIBLE PORTION OF COAL.

Composition		Heating Value per pound	Equivalent water evaporated from and at 212° per pound combustible
Fixed Carbon	Volatile Matter	Heat Units	
97	3	14,940	15.47
94	6	15,210	15.76
90	10	15,480	16.03
87	13	15,660	16.21
80	20	15,840	16.40
72	28	15,660	16.21
68	32	15,480	16.03
63	37	15,120	15.65
60	40	14,760	15.28
57	43	14,220	14.73
55	45	13,860	14.35
53	47	13,320	13.79
51	49	12,420	12.86

The figures in the last column are obtained from the figures of the preceding column by dividing by 965.7, the number of heat units equivalent to the evaporation of 1 lb. of water from and at 212°.

By "combustible" here is meant what remains after subtracting the moisture and ash. Thus if a coal contains .4 per cent moisture, 6 per cent ash, 72 per cent fixed carbon and 18 per cent volatile matter, the fixed carbon in the combustible is 72 ÷ 90 = .80 per cent, and the volatile matter 18 ÷ .90 = .20 per cent, and its approximate heating value is .90×15,840 = 14,256 heat units per lb.

The above table may be considered accurate within 1½ per cent for those coals containing over 72 per cent fixed carbon in the combustible, and within 3 per cent for coals containing from 72 per cent to 62 per cent, but below 62 per cent it is apt to have an error of 4 or 5 per cent, since of the coals containing over 38 per cent of volatile matter in the combustible, the quality of the volatile matter may vary greatly, being much higher in oxygen in some coals than in others.

It has been shown, however, by the recent researches of Professors Lord and Haas, of Columbus, O., that the highly bituminous coals of any given seam mined in one district have a remarkably uniform heating value per lb. of combustible, so that knowing the average heating value per lb. of combustible of the coal of any given seam and district and the percentage of moisture and ash in a given lot of such coal, we may calculate the heating value of that lot by multiplying the average heating value of the combustible by the percentage of combustible, that is 100 per cent minus the sum of the percentages of moisture and ash.

The heating value per lb. of combustible of coals of different districts may be taken approximately as follows:

	Heat Units per pound combustible	Equivalent evaporation from and at 212°
Anthracite, Pa.	14,900	15.42
Semi-anthracite, Loyalsock and Bernice, Pa.	15,500	16.05
Semi-bituminous, Broad Top, Clearfield, Cambria and Somerset, Pa.; Cumberland, Md., New River, W. Va., and Pocahontas, Va.	15,750	16.30
Bituminous, Connellsville, Pa.	15,300	15.84
Youghiogheny, Pa.	15,000	15.53
Pittsburg, Pa.	14,800	15.32
Upper Freeport Seam, Pa. and O.	14,800	15.32
Middle Kittanning Seam, Pa.	14,500	15.01
Thacker, W. Va.	15,200	15.74
Jackson Co., O.	14,600	15.11
Hocking Valley, O.	14,200	14.70
Big Muddy, Ill.	14,700	15.22
Streator, Ill.	14,300	14.80
Mt. Olive, Ill.	13,800	14.29
Lignites, Ia., Wyo., Utah, Ore.	11,000 to 12,900	11.39 to 13.35

The heating value of the coals may be found by multiplying the heat units per lb. combustible by the proportion of combustible in 1 lb. of coal, that is 100 per cent less the moisture and ash. The ash will vary from 4 or 5 per cent in a carefully prepared lot of semi-bituminous coal to 25 per cent or more in some lots of western bituminous slack coal. The fine sizes of anthracite will contain from 12 per cent of ash in washed coal or yard screenings to 25 per cent in culm or in poor lots of buckwheat and rice. The surface moisture in fine sizes of anthracite may be from 6 to 8 per cent in wet weather, the inherent moisture in lumps of anthracite being usually below 1 per cent, and that in semi-bituminous coal will vary usually between the same limits. In the bituminous coal the inherent moisture varies with the district, ranging from 1 to 2 per cent in Western Pennsylvania coals, 4 to 7 per cent in Ohio coals, and 7 to 14 per cent in different varieties of Illinois coals, the surface moisture varying from 0 in lump coal in dry weather to 6 or 8 per cent in fine slack in wet weather. The range of heating values of different coals mined east of the Mississippi is between that of a semi-bituminous coal containing say 4 per cent ash, 2 per cent moisture and 94 per cent combustible of 15,840 heat units, or .94×15,840=14,890 heat units, to that of a poor grade of Illinois slack containing say 25 per cent ash, 15 per cent moisture and 60 per cent combustible of 14,000 heat units, or .60×14,000=8,400 heat units per lb. of coal. The relative heating value of the two coals is in the ratio of 1 to 1.77, but this is not a fair measure of their commercial value for use in steam boilers. It may be easy to obtain in the steam as much as 75 per cent of the heating value of the better coal, in any well proportioned boiler, but it may not be easy to obtain more than 70 per cent of the heating value of the poorer coal. The relative commercial value of the poorer of the two coals will therefore be not greater than the ratio of .50×8,400 to .75×14,890 or 1 to 2.66, as compared with the better coal.

Published analyses of western bituminous coals are apt to be in error as regards the moisture, since it has only recently been discovered that the inherent moisture cannot be determined by heating the coal to 212°, as was formerly the custom of the chemists, and that a temperature of from 240° to 280° is required to drive out the moisture from a lump of coal.

Having determined the heating value of the coal which is intended to be used in the proposed boiler plant, the next thing to be considered is the percentage of that heating value which may be utilized by the boiler in making steam, or what is known as the "efficiency" of the boiler and the furnace. With anthracite of large size, such as egg coal, it is barely possible, with a slow rate of driving and with the most careful firing, to reach an efficiency of 80 per cent, but 75 per cent is rarely exceeded. With the smaller sizes 70 per cent is as much as can be expected, and this figure is greatly reduced with small sizes and with ordinary firing. With semi-bituminous coals 75 per cent is about the maximum that may be expected, and with bituminous coals it is not easy to obtain 70 per cent, on account of the difficulty of burning all the volatile matter, which difficulty increases with the percentages of volatile matter and of moisture. Perhaps 50 per cent is an average figure for the efficiency of a boiler provided with an ordinary furnace, using a poor grade of highly bituminous coal in everyday practice, and driven, as is usual, at an irregular rate. With careful and steady firing this may be increased to 55 per cent, and it is possible with well-designed fire-brick furnaces or mechanical stokers, with expert handling, to raise it to 65 per cent or even 70 per cent, when the boiler is not driven beyond its most economical rate.

RELATION OF ECONOMY TO RATE OF DRIVING.

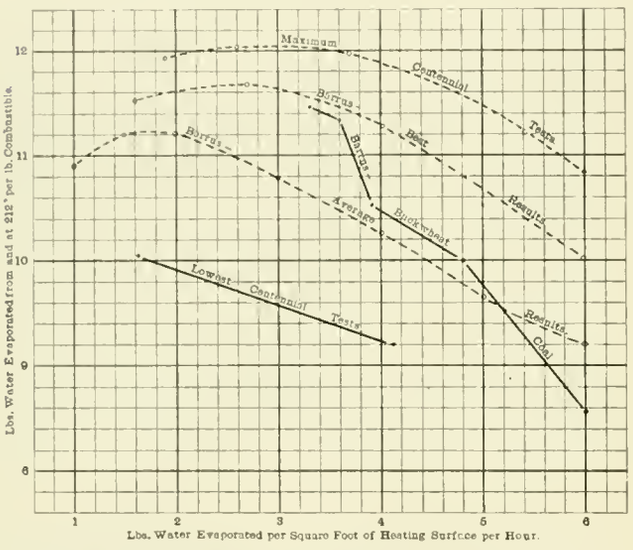
With a boiler properly designed and proportioned, and with a furnace adapted to burn coal to the best advantage, it is generally found that the highest economy of coal is obtained when the boiler is driven at a rate equivalent to the evaporation of 3 lbs. of water from and at 212° per hour per sq. ft. of heating surface. When driven at a slower rate than this the economy decreases on account of the loss by radiation becoming a greater percentage of the whole amount of heat generated in the furnace and to the difficulty of burning the coal properly with diminished draft. When driven at a higher rate the economy usually decreases on account of the increased temperature of the chimney gases, due to the extent of heating surface being insufficient to absorb the additional heat generated. Apparent exceptions to this rule, showing a higher economy at a rate of driving in excess of 3 lbs. evaporated per sq. ft. of heating surface per hour may be due either to more perfect burning of the volatile gases of the coal at high rates of combustion, or to such a design of the gas passages through the boiler that the gases are apt to be "short-circuited" at the slower rates of driving, their volume in transit to the chimney being insufficient to fill all the gas passages, and the gases choosing certain paths of least resistance.

The relation of economy to rate of driving with anthracite coal is well shown by the accompanying diagram. The upper line shows the highest results that were obtained at five different rates of driving, with five different boilers, in the tests made with good anthracite egg coal at the Centennial exhibition in 1876. These results have never been surpassed with anthracite coal, and they represent the very highest results that can be expected with any boiler with that kind of coal. They may be increased, measured in pounds of water per lb. of combustible, from 5 to 8 per cent with the best semi-bituminous coal, with furnaces especially adapted to burn the volatile matter and with expert firing.

The lowest line shows the results obtained by two boilers in the Centennial tests, using the same coal. The low figures are not easily explained, but may have been due to improper firing. The two lines marked "Barrus, Best Results," and "Barrus, Average Results," are plotted from figures given by Mr. George H. Barrus, in his book on "Boiler Tests," representing the figures obtained in many tests of different boilers with anthracite coal. The line marked "Barrus, Buckwheat Coal," is plotted from tests made with the Stirling water tube boilers at the mines of the Lehigh Coal Co.

Wilkesbarre, Pa. The lines on the diagram all show a falling off of economy with a rapid rate of driving. Comparing the points on the curve corresponding to 3 and 6 lbs. of water evaporated from and at 212 per sq. ft. of heating surface per hour, the maximum Centennial tests show a falling off of about 11 per cent, Barrus' best results about 14 per cent, Barrus' average results 15 per cent, and the buckwheat coal tests, 26 per cent. The lowest result is explained as being due to unskillful firing and to uneven adjustment of the air spaces in the grate bars. The temperature of the waste gases in this test was always above 800° F, and during part of the time flame issued out from the top of the stack.

Comparing the line joining the two lowest Centennial tests with the line of the maximum Centennial tests we find that at a rate of



RELATION OF ECONOMY TO RATE OF DRIVING—ANTHRACITE COAL.

2 lbs. per sq. ft. of heating surface per hour the former is 17 per cent below and at 4 lbs. 22 per cent below the latter, showing what a large difference of economy may occasionally be found between different boilers at the same rate of driving and using the same coal.

No similar series of curves representing the performance of different boilers with bituminous coal has yet been published, but there is every reason to believe that the same law of falling off of economy with rapid driving will be found to be true with bituminous as with anthracite coal, but with many apparent exceptions, as before stated, due to more perfect combustion of the coal at higher rates of combustion, and to the flues or other gas passages being proportioned better for fast than for slow driving.

It may be expected therefore that with any kind of coal the evaporation per pound of coal will be in the neighborhood of 15 per cent less with a rate of evaporation of 6 lbs. of water from and at 212° per sq. ft. of heating surface per hour than at a rate of 3 lbs., the rate for maximum economy.

(To be continued.)

It is announced that all-night street cars are to be run in Baltimore, which has heretofore been about the only large city in America without them.

The Barney & Smith Car Company has recovered a verdict of $21,731 against the Rapid Transit Railway Company, of Syracuse, and W. R. Kimball, vice-president, for cars bought while the road was in the hands of a reorganization committee.

The Altoona (Pa.) & Logan Valley Electric Railway Company is making a substantial addition to its power plant, and will install new G. E. 500-k. w. generator direct connected to a 750-h. p. Allis engine before the summer season opens. New shops are also contemplated.

STORAGE BATTERIES AND RAILWAY POWER STATIONS.

BY ROBERT M'A. LLOYD.

An abstract of a paper read before the American Institute of Electrical Engineers.

The average load on a railway power station for a given period is much less than the maximum load occurring during that period and much more than the minimum, but it is not generally understood that the maximum load for the same period is apt to be far below the capacity of the generating plant in operation. As an illustration of this fact I show in Fig. 1 some data on a typical railway plant when 35 cars were running. We have not discovered any railway plant where this is not true, and I believe that the data on most of the railway plants of this country will confirm my statement. The first explanation of this would be that such a surplus capacity is necessary for reserve to meet emergencies, but I do not find it to be a useful reserve, and shall refer particularly to Fig. 1, taking this station because, from the standpoint of the manager, engineers and attendants, it is dangerously overloaded and has no reserve. In fact, it was necessary to add to the capacity at once to make it safely operative.

I obtained these data on the day of heaviest travel in the whole year. It will be noticed that the highest point reached was within the capacity of the main station, and yet it was necessary to start up an auxiliary station. The central solid line shows the average load, and the upper and lower lines show the limits of the fluctuations occurring from moment to moment. The method pursued in getting these curves was to divide the day into half hours, and during the first five minutes of each half hour take the highest and lowest ammeter reading in each minute; these readings are plotted in the upper and lower curves; also to take ammeter readings every five seconds, and obtain the average of these readings as the point in the curve of averages. Another convenient method of obtaining the curve of averages is by wattmeter readings. Among some of the interesting features in this diagram may be noticed the fact that the nominal capacity of the generating apparatus was about 400 k. w. in excess of its maximum output occurring at about 8 o'clock in the evening, and that the average output at this time was about two-thirds of the maximum. The excess of nominal capacity was not so great at 7 o'clock in the morning, or two in the afternoon, when other high points occurred, but as it was known that the morning peak would be of short duration, the engineer decided to run through it without the auxiliary station, and in the afternoon the load increased more rapidly than was expected, and the auxiliary was not ready to go into operation on short notice, consequently obliging the main station to groan under a dangerous load for an hour or so.

It will doubtless occur to some that this station apparatus has been overrated, or that the engineer was incapable or over-cautious, but the fact remains that similar data are obtained in very many stations, and that in many cases the apparatus has been subjected to satisfactory tests before acceptance by the purchasers. It may be possible to build engines which regulate at all conditions of load and at the same time use steam satisfactorily at maximum load, but I do not find such engines commonly in use. Further than this there are many very good engines in use which cannot be safely operated at anything like maximum load if that load is liable to sudden variations. I realize that you may suggest all sorts of schemes for getting a better output from the plant illustrated by this curve, and you may wish to ask some questions about this apparatus, but experience convinces me that the men who are most likely to be consulted about such a station will recommend more generating plant, and the truth is that there are so many good salesmen pushing engines and dynamos that station managers frequently fail to get full duty from the machinery which they are operating already. It is not merely that the storage battery has been neglected, but any of us can see in railway power houses throughout the country, where the managers have been persuaded to increase their generating plant when attention to a few details such as steam piping would have brought their output up to requirements. Assuming, however, a station equipped with the best obtainable apparatus, and operated under the most advanced laws of station practice, in the absence of a storage battery, there would still be much more apparatus running than would appear necessary from the load diagrams.

The generator salesman says in reply to this proposition that his apparatus is cheap, and that it is good to have plenty of it, but one generally finds that where there is plenty of apparatus available, the engineer is tempted to keep too much of it running, and therefore running at low efficiency.

Of course railway power stations have individual characteristics, and it will not do to assume that they all need storage batteries, but there are certain features of railway power requirement, which are common to the problem everywhere, and which invite consideration for the storage battery.

In my endeavor to point out some of the uses for a storage battery I shall take as a typical station that shown in Fig. 1. It is located in a Pennsylvania town of 50,000 inhabitants. The railways radiate from the center of the town to distances of three to nine miles. There are six branches and the power station is located two miles out on the longest branch. It has railroad and water frontage. The small auxiliary power house is the result of a recent consolidation and is close to the main house. There are three distinct ways of using a storage battery with this power plant. Taking up the figure we find first the great fluctuation between night and day load; second by the fluctuations occurring from moment to moment. We shall call a battery of sufficient capacity to level off the night and day fluctuations "large;" a battery for levelling the hour to hour fluctuations "medium," and a battery to level the momentary fluctuations "small." It will be seen at a glance that the small battery will reduce the requirements of the generating plant to a capacity sufficient to meet the demands of the average load shown in curve A. The battery must be able to discharge at 650 amperes for momentary periods, but its capacity in ampere hours is unimportant. It will cost less than generating capacity for the same work, and a large part of the excess of capacity over requirements shown in the diagram will be saved. It will save some depreciation on the generating apparatus, and its own depreciation will not cost more than the depreciation of generating apparatus of similar capacity. It will have sufficient storage capacity to run a few night cars and lights when the engines are shut down. If located at a point nearer the center of feeder distribution than the location of the generating station, a saving in copper will be effected. Inasmuch as the investment will not be increased by including such a battery in this railway outfit all the saving in fuel due to a steadier load and the operation of less generating machinery will be clear gain to the credit of the battery.

Line B at 810 amperes shows the average load for 18 hours of the day and a " medium" battery to reduce the load to this straight line would have a capacity of 1,300 ampere hours. It will cost about twice as much as a "small" battery, but will not add enough to the cost of the installation to bring the investment up to the total now in generating apparatus alone and presumably necessary if no battery is used. This battery will have all the advantages of the small plant with wider limits of operation. The station circuit breakers may be set 650 amperes higher, and there will be greater convenience throughout the station in operating at a fixed load. There will be a marked effect on the efficiency of all departments of the station, and all the apparatus will yield a higher output in proportion to investment and cost of operation.

Line C at 650 amperes shows the average load for 24 hours, and a "large" battery capable of leveling off this load will have a capacity of 3,000 ampere hours. It will cost approximately twice as much as the " medium" battery, and will have all of its advantages. It will cost as much as the generating machinery displaced by it. It will add largely to the flexibility of the station. This battery could be discharged momentarily at 3,000 amperes, which will put the circuit-breaker limit of the station at about 3,600 amperes, instead of 2,300, with all the present apparatus. It may be discharged at 1,500 amperes for one hour, which will be sufficient to cover load peaks that would stall the 1,150-k. w. generating plant completely.

In cases of extreme necessity the entire system might be carried by this battery for several hours. The ability to carry sharp peaks is a distinct addition to the earning power of the system. Such peaks often signify the collection of fares, which would be lost if the system were not flexible, and some managers keep up enough station capacity to carry a few holiday crowds, while for 99 per cent of the whole year it is earning nothing. Other managers do not attempt to carry special crowds. The large battery will give the manager an opportunity to get all the money that can be made out of such business without feeling that he has made any investment for the purpose. Of course, the capacity of the system is limited also by the investment in copper, but in many cases the battery may be located so as to facilitate the distribution of power.

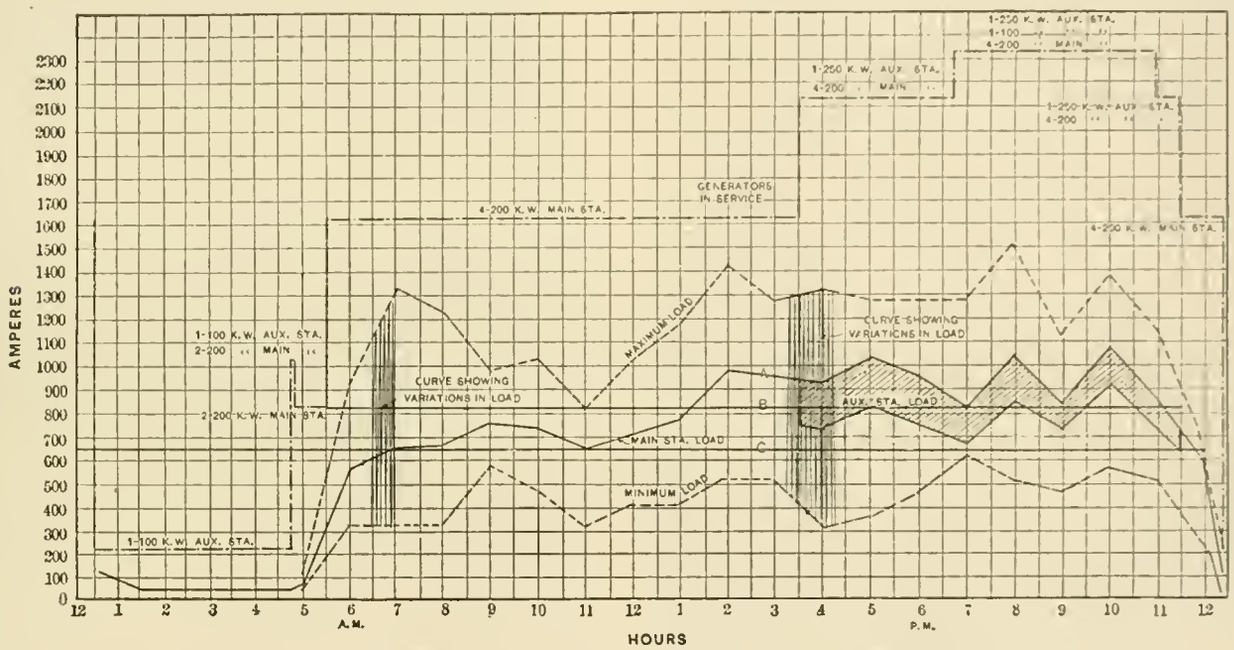


FIG. 1—CURVES SHOWING VARIATION OF LOAD ON RAILWAY POWER STATION.

There is no reason why a railway power station of this capacity, running night and day at a constant load, should not attain a fuel economy as high as that of the well-known Chestnut Hill pumping station, at Boston, which would be equivalent in electrical work to 557 watt-hours per pound of coal. Curve A, Fig. 1, shows for one day's work 7,800,000 watt-hours, which required at the above rate seven tons of coal, and, assuming that the battery would only have 75 per cent efficiency, and that 25 per cent of the entire day's work would go through the battery, one-half ton of coal would be added to this consumption, making 7½ tons of coal a day for this plant running with a large battery.

The battery efficiency in such service as this has been found in most cases much higher than 75 per cent, and in same cases over 90 per cent, so my estimate is clearly on the safe side.

On the day when these data were obtained 15 tons of coal was

burned, or twice as much as would be necessary with the battery outfit. The battery would therefore save, at $2 a ton, $5,474 per annum in coal alone.

The number of men in the station is now the same night and day, and there would certainly be no increase in the labor item, whereas it is probable that one man on each shift might be dispensed with if the plant were reduced by the battery, in which case there would be another saving of $1,200 per annum. The battery would also save water, oil, waste, etc., and there would be minor advantages, such as more constant potential on the line, less annoyance from circuit-breakers, no fear of sudden demands on the generating apparatus and the disagreeable possibilities incident thereto.

In the following table some figures are tabulated for the purpose of comparing four different layouts to meet the requirements of the railway system referred to in Fig. 1:

TABLE REFERRING TO FIG. 1.

	Lay out with	Cost of generating apparatus.	Cost of storage battery.	Total cost of station plant.	Cost of coal per day.	Cost of coal per annum	Saving in coal.	Sav. in coal and sav. in int., 5 p. c.
1	No battery..	$115,000	$.....	$115,000	$30	$10,950	$....	$....
2	Small bat'ry	60,000	20,000	80,000	25	9,125	1,825	3,575
3	Medium "	50,000	35,000	85,000	20	7,300	3,650	5,150
4	Large "	40,000	70,000	110,000	15	5,475	5,475	5,525

CONTINUATION OF TABLE

	Cost of real estate and buildings.	Repairs and depreciation.	Saving in labor per annum.	Saving in water, oil, waste, etc.	Total saving	Estimated addition to receipts.	Net advantage in operation
1	All the same.	All the same.	$.....	$.....	$.....	$	$
2			.....	100	3,675	.....	3,675
3			.....	200	5,350	1,000	6,350
4			1,200	300	7,025	5,000	12,025

I have assumed $100 per kilowatt as the cost of complete station apparatus without batteries. This figure might have seemed high a year ago, but in view of the rising prices of such material I think it is only conservative.

In regard to the "small" battery, there is no doubt of its advantages in many cases, but for new installation it is not always the most economical battery. It seems to me hardly worth while in laying out a new station to put in a battery for the purpose of reducing the railway-power curve to the characteristics of electric light practice, when by going a few steps further it may be refined to a practice comparable with marine engineering.

It might appear at first thought that a battery of sufficient capacity to insure a full load for the generating units at all times would save as much fuel as a battery large enough to level off the 24-hour service, but it is very difficult to follow the power requirements from hour to hour in such a way as to make ideal use of a battery, whereas, with a "large" battery, it would be possible for the ordinary station engineer to adjust his load so as to operate all of his apparatus to the best advantage all the time.

I have carefully analyzed the figures in R. W. Conant's very interesting paper, before the A. S. R. A., and am compelled to differ from him at some points, and refer to them in order to meet in advance any criticism of my paper which may be based on his tables. In the first place, he assumes that his standard station can be worked all the year round with a load factor of 33 1-3 per cent, which is entirely too high; 20 per cent, or 25 per cent, would be more normal. I suspect that Mr. Conant's load factors have been obtained by indicator cards, instead of wattmeters. In Mr. Conant's table none of the stations shows a better figure for coal than three pounds per kilowatt-hour, while his standard station is put down for 2.2 pounds, without any intimation of the process for attaining such a good result. The question as to how the cost of repairs and depreciation of the entire plant would be affected by a large battery is particularly debatable ground. Mr. Conant allows 2 per cent for depreciation beyond the normal running repairs. He estimates the entire plant, including buildings, to last 50 years. His statement that the machinery now being installed will last much has nothing to back it up except faith in the promises of the builders.

I propose to allow 10 per cent per annum for repairs and depreciation on the entire station apparatus, including batteries. I have not seen any boilers that are likely to last 50 years, and there is plenty of evidence that all the best engines and boilers in this class of service today will go to pieces in a life of from 10 to 20 years. The particularly hard usage to which most of them are subject is not only steadily wearing them out, but producing a state of constant danger and not infrequent accidents. I am sure this is becoming well understood among railway men, and some of the best man-

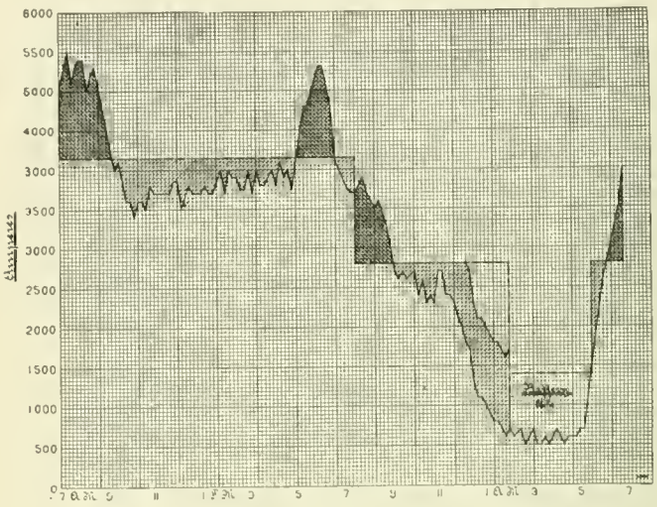


FIG. 2 BATTERY REGULATION ON BUFFALO RAILWAY.

agers are writing off to depreciation 10 per cent per annum. Moreover, who can say that improvements will not be made in the next 10 years, as in the past, and that engines and boilers may not be out of date before they are used up?

It is, of course, well known that whatever the rate of depreciation may be without batteries, it will be lowered by giving the generating apparatus a constant load; my belief is, therefore, that the storage battery will not increase the rate of depreciation for the entire plant. If it can be shown that interest and depreciation for a plant of given load dimensions are practically equal, with or without a large battery, it is evident that the great saving in fuel alone will determine the superiority of the battery system.

I have so far considered the battery only at the central generating station, so that all the advantages due to locating it at proper points in the distribution system are additional arguments in its favor. In

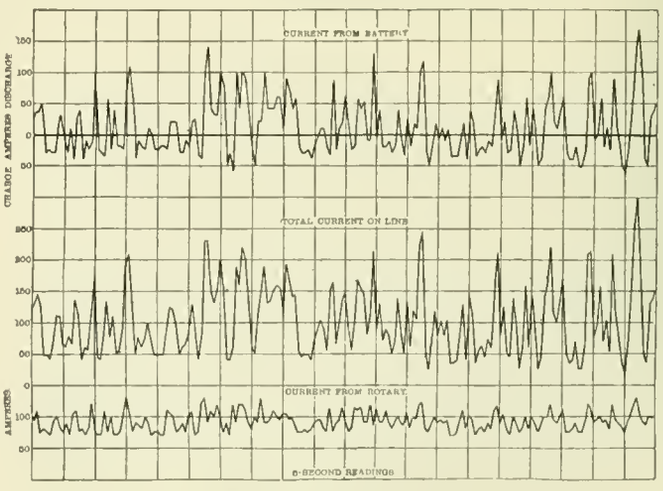


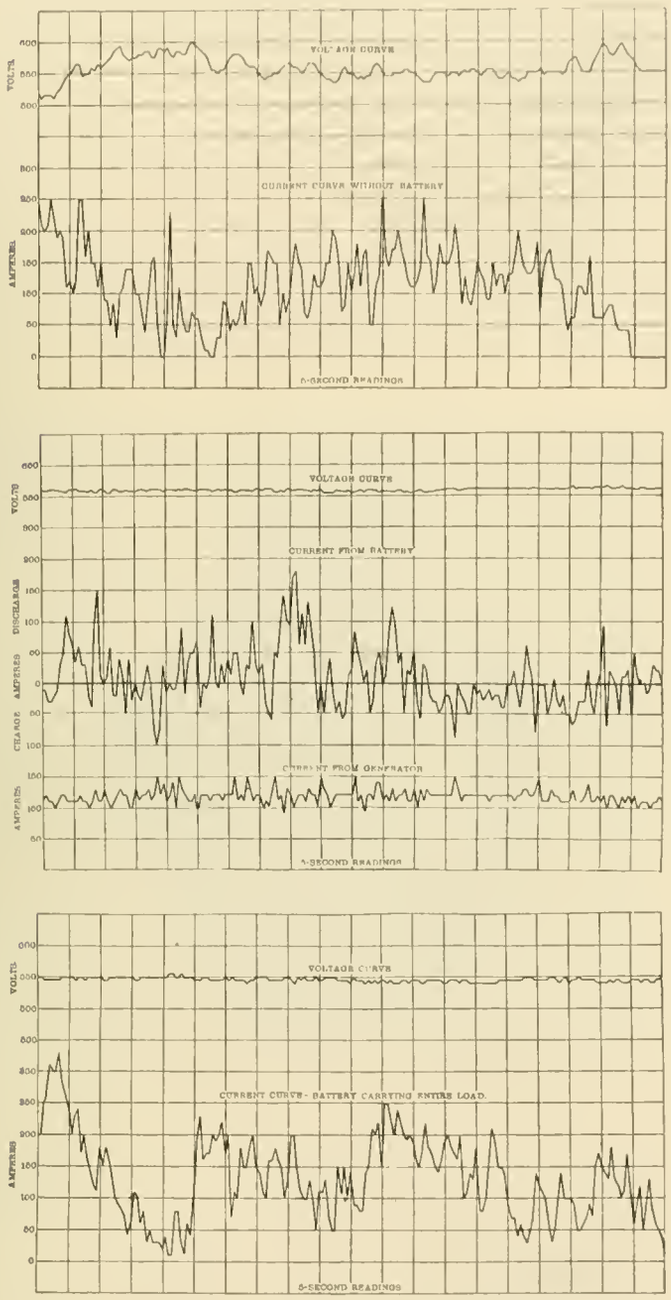
FIG. 3—BARRE-MONTPELIER TRACTION COMPANY.

many cases the saving in copper may be greater than the sum invested in the battery, and the flexibility of the system improved in places where it would not pay to install sufficient copper to meet the irregular demands of travel.

The reserve qualities of the storage battery are unique. It might be supposed that a mere reservoir which is quickly drained would be of little value compared to a lot of extra generating apparatus standing idle, but experience is demonstrating every day, in exist-

ing plants, that the reserve which is needed most is the reserve which is not only ready for emergencies, but actually alive to any demand without the direction of a human mind.

Most of what has been said of the storage battery, as applied to the power station illustrated by the curves in Fig. 1, is true of its application to railway power stations in general. The use of water power introduces a factor in the problem more variable than fuel,



FIGS. 4, 5 and 6—WOONSOCKET ELECTRIC MACHINE AND POWER COMPANY.

and I shall not attempt the discussion of it. Alternating currents lend themselves readily to the development of storage battery applications on account of the mutually helpful combination of battery and rotary at sub-stations. Up to the present time, each of the large batteries installed for railway work has been obliged to meet different conditions and requirements, but they are all serving their respective purposes well, and showing many different fields of usefulness.

Most of us feel that the electric railway and electric lighting interests are destined to get into closer relations, and the generating station of the future may be required to furnish all the electricity used within large areas for every purpose.

Coming, finally, to a problem which has been the subject of some newspaper discussion of late, I trust you will pardon me for treating of work with which I have no connection. Electricity has so many advantages over any other medium for transmission and storage of energy that I assume its use to be firmly established, and cannot conceive of any lasting rivalry by the other contestants now in the same fields. Further than this, without saying anything for or against monopolies, I believe that all the energy supplied by means of electric currents to consumers of every nature in the Greater New York should radiate from two or three central stations, and that these should be electrically tied together. The sub-stations would naturally consist of rotaries and storage batteries. It may not be possible to lay out each sub-station so that the rotaries would run at a constant load for 24 hours a day, but it seems to me quite probable that such an arrangement would eventually be reached, and this would, of course, give the generating stations a constant load.

At the present time the load curves of the electric railways are very uncertain, and peaks are likely to occur at almost any time of day, while the addition of the peak due to electric lighting in the early evening would not add in large proportion to the railway peak, but electric lighting is capable of more general application, and it is possible that within a few years the distribution in the borough of Manhattan may reach from three to five hundred thousand kilowatts at the highest part of the lighting curve, which will probably be as great as the railway load when the elevated railway and the underground rapid transit are included. These peaks will often occur at the same time of day, and so there is no possibility of improving the load factor of either system by splicing the two together. It follows, therefore, that what is true of the relation of a storage battery to the economy of the generating station for power or light separately will be true of the resultant of their combination.

The railway and light people recognize the importance of leveling up some portions of their load curves, but I estimate that the greatest saving is to be obtained by operating for a constant load 24 hours per day. However high would be the economy of such large stations, I am sure it would be higher with large batteries than without. Certainly the economy of the Boston pumping station as to fuel consumption should be surpassed. It must not be assumed that a high load factor for the system is an advantage. It is all right for the generating plant and for the copper feeders, but the kilowatt-hours that bring in the most money may spoil the looks of the load diagrams and kill the load factor. What is required to earn dividends is a profitable load factor outside of the stations, whether high or low, and the highest possible load factor at the dynamo terminals. The large storage battery meets these two requirements perfectly. A load factor of 100 per cent may be maintained at the dynamo and current may be sold to the consumer regardless of the time of day.

With a million kilowatts in view for the borough of Manhattan, it would be necessary to generate an approximately constant force of 300,000 k. w. A million kilowatts in station plant, without the battery factor, would cost $100,000,000.

The same capacity, including the proportion of battery now deemed advantageous by some of the engineers in touch with these problems, would be divided as to cost into $70,000,000 of generating plant and $30,000,000 of battery plant. Finally, the same capacity, if divided in the proportions which seem to me most productive for the investment, would cost $30,000,000 in generating plant and $70,000,000 in battery. This is quite a large battery plant, and as there would be more than two parts battery to one part generator, I am fearful of the jealousy which such a reversal of engineering practice would create.

In conclusion, I wish to state that nothing in this paper should be regarded as emanating, officially or unofficially, from the company with which I am connected. The accompanying diagrams, Figs. 3 to 6, inclusive, show railway power curves, with and without batteries. If they do not indicate attainment of perfect results by the battery, it is not because perfect regulation is impossible, but because the engineer is well pleased with what he has, and does not strive for greater refinement. Fig. 2 shows the application of storage batteries to a large railway installation, in which part of the power is generated at a waterfall. It shows what may be done by what I have called a "medium" battery.

The Southbridge (Mass.) & Sturbridge Street Railway Company is attaching vestibules to its cars.

A "SLOW FEED" CONTROLLER HANDLE.

There are hundreds of devices on the market to save fuel and labor in the power station, and street railway managers eagerly accept any scheme to reduce the coal bill, but nearly every one has as yet overlooked the consumer, i. e., the controller. W. G. Wagenhals, general manager of the Millcreek Valley Street Railway Company, of Cincinnati, has been among those who have been seeking for some means of compelling the motormen to handle their con-

FIG. 1.—WAGENHALS CONTROLLER HANDLE.

trollers properly. After a careful study of the subject for the past ten years he has invented a handle which serves the purpose admirably.

The average motorman will feed the current into his motors in such a manner as to cause heating, breaking down the insulation of the windings and making the deterioration of street railway apparatus a constant nightmare to the manager. The motors not only suffer, but the generators as well. The ordinary series-parallel con-

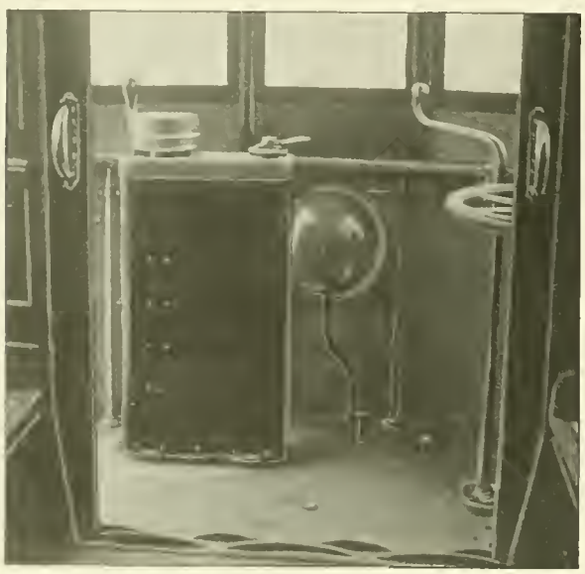


FIG. 2.—CONTROLLER WITH SLOW FEED HANDLE.

troller has nine points, and the average motorman will cover these in from four to six seconds. At this rate something must suffer, and it is the motors. With this device it is in the hands of the manager to regulate the number of seconds in which the motorman shall feed his controller to the last notch, 8, 10 or 20 seconds, just as he wishes to set it, and when once set it can not be tampered with.

The construction of the handle is such that all wearing surfaces can be taken up and the clutch which regulates the feed and its pawl are made of case hardened steel. There is no possibility of any of the mechanism interfering with the shutting off of the controller; any number of notches can be left open for free use as with the ordinary handle. The first and second notches have been so arranged on the controllers of the Millcreek Valley cars. In using the handle the motorman presses a button on top of handle with his thumb and when the clutch clears the notch he passes over the same before he can pass to next notch. The clutch drops automatically so that he must repeat the operation in order to pass over the next notch. A simple mechanism controls the time from one notch to the next. The whole device is composed of a few parts, with nothing that is liable to get out of order.

Another feature which will be advantageous, and that is, no alteration is necessary to adapt it to the use of a controller. The old handle is lifted off the post and the new handle put on, and this has the same movement as the ordinary one, with the exception of the button on the handle.

With handles of this kind in use on a road, instead of the fluctuating current consumption so noticeable in street railway work, there is a steady even load. Tests have been made which show that with the ordinary arrangement of the controller handle as high as 250 amperes would flow in the motor circuits, whereas with the

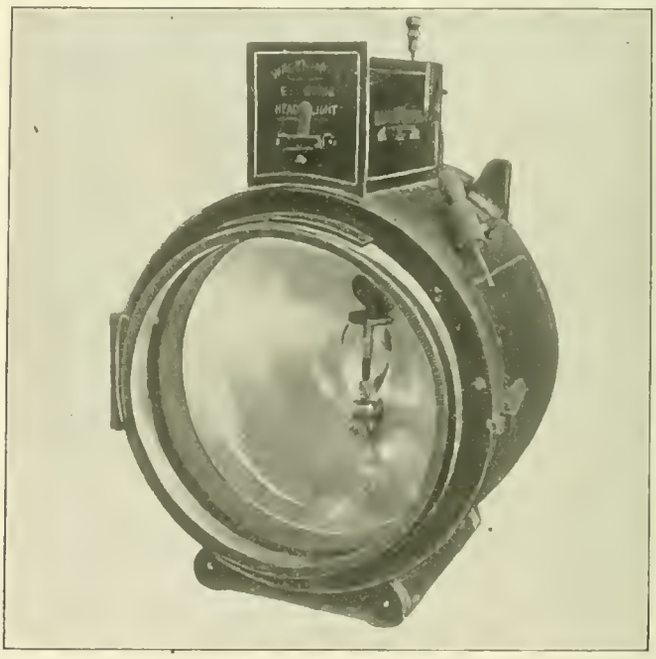


FIG. 3.—WAGENHALS HEADLIGHT.

"slow feed" handle no more than 125 amperes could be used. This would indicate that nearly double the number of cars could be operated from the same sized station on account of the even consumption of current. Fig. 1 shows the controller handle before it is placed on the controller, and Fig. 2 shows it in position.

Mr. Wagenhals has also designed an electric headlight which is especially adaptable for suburban and interurban cars on account of its great brilliancy. It consists of an enclosed arc light in a parabolic reflector. The connections to the car circuit are readily made at the dash. The appearance of the headlight may be noted from Fig. 3.

The Wagenhals Manufacturing Company has been organized in Cincinnati to place these specialties on the market. The company is under the direction of Mr. Wagenhals, but he does not propose to leave his present position, and will turn over the active business management to his associates.

John L. Williams & Sons, of Richmond, and Mittendorf, Oliver & Co., of Baltimore, have purchased control of the Piedmont Traction Company and the Virginia Electric Company, which own the street railway at Petersburg, Va., and will at once proceed to rebuild and give Petersburg a modern electric railway system.

RECENT STREET RAILWAY DECISIONS.

EDITED BY J. L. ROSENBERGER, ATTORNEY AT LAW, CHICAGO.

$15,941.25 FOR A CHILD'S LEG.

Kalfur v. Broadway Ferry & Metropolitan Avenue Railroad Company (N. Y.), 54 N. Y. Supp. 503. November 22, 1898.

Not being prepared to say that a verdict of $15,941.25 was excessive compensation for the loss, pain and suffering which had to be endured by a boy who was so negligently injured when 18 months old that his leg had to be amputated above the knee, the second appellate division of the supreme court of New York affirms a judgment for that amount, entered in behalf of the plaintiff in this case, notwithstanding the trial judge evinced the feeling that it was too much, and seemed afraid to exercise his discretion to reduce the amount. Goodrich, P. J., dissents.

DENIES DECIDING THAT DERAILMENT OF CAR DOES NOT INDICATE NEGLIGENCE.

Stevenson v. Second Avenue Railroad Company (N. Y.), 54 N. Y. Supp. 815. December 9, 1898.

The first appellate division of the supreme court of New York takes up here the suggestion that, contrary to other decisions, it had held, in Hastings v. Railroad Company, 7 App. Div. 312, 40 N. Y. Supp. 93, that the mere derailment of a street car is not sufficient proof, prima facie, of negligence; and it declares that it did not so decide. What was there said in regard to the derailment of a street car, it explains, had reference to the claim made by counsel that the ruling in Edgerton v. Railroad Company, 39 N. Y. 227, was applicable, namely, that proof that a car left the track is prima facie evidence of negligence. Its criticism in the Hastings case, it says, was as to the pertinency of the Edgerton case as a controlling authority, and what followed was merely to illustrate why the rule as to railroads operated by steam should not in every case, and as a matter of law, be applied to a street car leaving the track.

AS TO WITNESSES TALKING WITH COUNSEL AND BEING PROMISED PAY FOR LOST TIME.

North Chicago Street Railroad Company v. Anderson (Ill.), 52 N. E. Rep. 21. October 24, 1898. Rehearing denied December 9, 1898.

The supreme court of Illinois holds that, the trial judge being asked to instruct the jury that "the fact that a witness has been promised pay for time lost while attending the trial of this case does not in any wise tend to impeach his credibility as a witness," it was not prejudicial for the judge to modify this by an addition advising the jury that they might consider the fact that the witness had been promised pay, together with all the other facts in evidence, in determining the weight of the testimony of the witness. It thinks that this is a matter to be treated much as it would be proper to treat the fact that a witness had talked with an attorney representing one of the parties in the case. It says that it is perfectly proper for counsel to interview witnesses, but it also holds that such fact may be shown and considered by the jury, together with all the other facts in evidence in determining the weight of the testimony of such witness.

LIABILITY FOR MOTORMAN'S INVITATION TO LEAVE CAR BY FRONT DOOR.

Sowash v. Consolidated Traction Company (Pa.), 41 Atl. Rep. 743. November 14 1898.

Two separate actions were brought against the traction company, the plaintiffs being husband and wife. These two cases were consolidated into one, and tried at the same time and before the same jury. There was evidence that the motorman opened the front door of the car, and invited Mrs. Sowash to leave the car from the front platform. She testified that she followed his direction, and descended to the ground from the steps of the front platform. That ground was broken, and the night was dark, and Mrs. Sowash testified that, within a very few steps, she caught her foot in some way, and fell to the ground, and sustained her injuries.

As there was no proof of any contributory negligence on her part, the supreme court of Pennsylvania says that if the jury believed her story, she was entitled to recover damages, and her husband also. The case, it holds, must necessarily have been submitted to the jury, and could not have been taken from them without error. So it affirms judgments for the plaintiffs.

BOARDING OF CARS AT PLACES OF OBSTRUCTION.

Dean v. Third Avenue Railroad Company (N. Y.), 54 N. Y. Supp. 490. November 22, 1898.

The second appellate division of the supreme court of New York suggests that it would hardly do to hold that the persons operating street cars in our great cities are not under some obligation to anticipate that intending passengers may get on board, or attempt to get on board, when the cars are stopped by reason of temporary obstructions, or for any other cause, at places where stops are not ordinarily made.

This was brought out by the contention of counsel that, recognizing the rule that a street railway company must give an intending passenger a reasonable time to board a car, this applies only to regular stopping places or crossings, and to cases in which the employes of the company have actual notice that there is an intending passenger who is attempting to board the car.

The trial judge had instructed the jury, in substance, that liability might be imputed to the defendant if the conductor, in the exercise of reasonable care, ought to have seen whether or not any one was about to get on the car while it was temporarily stopped by reason of the obstruction in front of it, and not have let it start too soon for the person, which view the appellate division seems to adopt, when it not only refuses the company a new trial but makes the intimation above set forth.

PROPERTY RIGHTS IN RIGHTS OF WAY.

Birmingham Traction Company v. Birmingham Railway & Electric Company (Ala.), 24 So. Rep. 368. August 15, 1898.

The supreme court of Alabama holds that a [street] railroad corporation, in possession of and owning a right of way, has such property rights and interests that the crossing of it by another [street] railroad corporation is the taking of property, within the meaning of the state constitution and laws, which require just compensation to be paid "before such taking" to the owner, and it insists that the payment of the money before the taking is a condition precedent.

The court further holds that whenever any person, corporation, or authority, vested with the power of eminent domain, undertakes to exercise such power, by appropriating private property to its own use or benefit, with first compliyng with the constitution, a court of equity has jurisdiction to enjoin such undertaking, until compensation has been first paid to the owner, his title or interest being admitted or clear, and that without regard to the solvency or insolvency of the party or corporation proposing to exercise such authority.

Moreover, the court holds that the refusal of a [street] railroad company whose right of way it is wanted to cross to consent to any proposition, or agree to any amount, does not authorize another street railroad company to proceed across its right of way without condemnation proceedings and payment of compensation.

SUFFICIENT CONSENT TO SUSTAIN RIGHT OF COMMON TRACKAGE.

Staten Island Midland Railroad Company v. Staten Island Electric Railroad Company (N. Y.), 54 N. Y. Supp. 598. November 22, 1898.

Assuming that the control which the board of supervisors exercised over county roads made its consent necessary to the operation

of a railroad upon a county road within a village, the second appellate division of the supreme court of New York holds that the action of the board in question in adopting a resolution granting a franchise to the defendant upon conditions providing for common trackage in favor of a connecting company situated like the plaintiff, and the subsequent action of the board in granting to the plaintiff authority to construct its railroad to the very head of the street where were the tracks of the defendant on which the plaintiff desired to exercise the right of common trackage, must be regarded as constituting a consent that the plaintiff should operate its line over said street.

Moreover, upon the ground that if the defendant could give its consent afterwards, it could give its consent in advance of the construction of its own line, authorizing another company to operate its railroad in a certain street over the same tracks, and that being what it deems that the defendant did by entering into a certain contract and stipulations with the municipal authorities, the court holds that the conditions in such contract would not be void but would be available to the plaintiff or any other corporation coming within the terms of the contract.

ADMISSIBILITY OF EVIDENCE AS TENDING TO SHOW RIGHT TO RIDE ON TRANSFER.

Woods v. Buffalo Railway Company (N. Y.), 54 N. Y. Supp. 735. December 9, 1898.

In an action brought to recover damages for a personal injury alleged to have been inflicted in the ejection of the plaintiff from a car for refusal to pay his fare, where the conductor maintained that the transfer offered had expired, the fourth appellate division of the supreme court of New York holds that it would undoubtedly have been competent to prove that the plaintiff told the conductor at the time that he took the first passing car after receiving his transfer; and if a witness had been produced who knew that fact, it would have been competent for him to testify that he told the conductor that the plaintiff took the first passing car after receiving his transfer. This, it says, would have been competent, as tending to show that the plaintiff was acting within his right, and for the purpose of showing that the defendant's agent had notice that the plaintiff claimed to be acting within his right. But this, the court holds, falls far short of rendering it competent for the plaintiff to testify that an unknown person standing by told the conductor that the plaintiff took the first passing car, which related to a past transaction. This, it maintains, would not be a statement of a third person characterizing an act occurring at the time, but a statement of an alleged past act, and the defendant would not waive its objection to this incompetent evidence by showing that no such statement was made by a man sitting or standing near the plaintiff. Moreover, it holds that the evidence would be wholly incompetent as mere hearsay.

MUST LOOK CAREFULLY AND NOT CARELESSLY FOR CARS.

Jewett v. Paterson Railway Company (N. J.), 41 Atl. Rep. 707. November 4, 1898.

The court of errors and appeals of New Jersey thus summarizes this case: The plaintiff, at a little after 9 o'clock on a dark night, was approaching on foot a trolley road having a single track, which he intended to cross. His line of approach was northwesterly, and diagonal to the track. When he had somewhat more than 50 feet to walk before crossing the track, he saw a car somewhat more than 250 feet south of the place of crossing. He testified that, when from four to six feet distant from the track, he turned his head, looked for the car south along the track 75 or 100 feet, and did not see it; that he was then going diagonally across; that, the first thing he knew, the car was on him, and knocked him down; and that he was about the middle of the track when he was struck. The track to the south was straight for more than 250 feet, and the view of it was unobstructed.

The court holds that facts within the knowledge and observation of the plaintiff, who must be assumed to have moved at the rate of an ordinary walk, made it probable that the car, coming from a quarter towards which his back was partly turned, would be dangerously near to him before he got across the track; that it was therefore his duty to look for the car before he attempted to cross; that the car, moving at any rate of speed that was attributable to it under the evidence, must have been so near to the plaintiff, when he looked for it before going on the track, that if he had not looked carelessly, he would have seen it, and have been warned of imminent danger; that his failure to receive warning was therefore due to his own negligence; and that a nonsuit was properly granted.

TOO VAGUE AN ACT TO REGULATE GRANTING OF FRANCHISES.

State v. West Side Street Railway Company (Mo.), 47 S. W. Rep. 959. November 16, 1898.

The supreme court of Missouri says that the attempt at legislation manifested in the Missouri act of April 9, 1895, wherein the method of granting franchises of many different kinds was sought to be regulated by one general provision, is so indefinite and uncertain, by reason of the effort to regulate the disposition of a great number of franchises by one general rule, that it must hold it incapable of practical operation and enforcement, and, consequently, void.

This act declared that the privilege of constructing railroads, street railways, electric light plants, gas works, waterworks, telegraph and telephone lines and extensions thereof, "above, across, along, beneath or through any highway, road, avenue, alley, park, square, street or other public land" must be sold at public auction to the responsible party who would give the largest percentage yearly of the gross receipts derived from such use and occupation.

It will be seen, at a glance, says the court, that it is utterly impossible to give this act any reasonable or sensible construction as applied to railroads. There cannot be any competition, in the very nature of the case, for the privilege of constructing and operating that part of a continuous line of railroad located within the limits of the highway or streets, as distinct from the entire road, which may extend over many miles. And much of what is to be said about railroads, the court considers, applies with equal force to "extensions" of street railways, etc. The privilege of making an extension can only be conferred upon the owner of that which is to be extended. If granted to any one else, it must necessarily be an independent enterprise.

Then, too, the court says, an extension of a street railway gives an increased distance over which people may be carried for a single fare, and the act, as in case of railroads, gives no rule by which to determine the amount of the gross receipts to be credited to the new portion of the line.

The court further finds an insuperable obstacle in the way of any attempt to enforce this act, even as against a new street railway, in that it seemed to contemplate that the bid should be a percentage only of the receipts derived from the use and occupation of the public property, but failed to state how and by whom the proper proportion of the gross earnings that should be attributed to such use and occupation should be determined.

Again, the percentage was to be increased in "each period of five years" "to correspond with the increase in the value of the land thus occupied and used," and the court criticises the act for giving no intimation by whom or in what manner this increase was to be settled and determined, adding that there was painful obscurity, too, as to what was meant by the "increase in the value of the land thus occupied and used," so that it declares that it could not be stated what meaning should be ascribed to this part of the act.

Thus does the court show that the provisions of this act were so obscure as to make it impossible to ascertain and declare their proper meaning.

Flooded streets in Chester, Pa., have caused the Chester Traction Company to lose at least $1,000 by the burning out of motors.

The city council of Nashville, Tenn., is engaged in a discussion with the Nashville Street Railway and the Nashville & Suburban Railway Companies as to whether two or three tracks shall be laid over the Broad street viaduct, recently built. The former company permitted the latter to use its tracks when the city decided to use the viaduct, and has found by experience that the joint use of the tracks causes inconvenience and delay.

C. S. KNIGHT BECOMES MANAGER OF SIEMENS-HALSKE.

C. S. Knight, one of the best known men in the electrical fraternity, has been elected vice-president and general manager of the Siemens-Halske Company, of America, and has entered upon his new duties in the general offices in the Monadnock building, Chicago.

The appointment of Mr. Knight is the inauguration of a new and vigorous business policy on the part of his company, which, while it has been doing a quite extensive business, and steadily making itself felt in the quality of its products, has not endeavored to secure business to any great extent outside of certain lines. As our readers may know, the company has the use in America of all the data, patents and patterns owned by the parent company in Berlin, which has the most extensive electrical works in the world, and which also stands at the head in the quality of its products. It is one of the cardinal principles of the home company never to allow a piece of apparatus to go on to the market until it has been tested in private to an extent which warrants the makers to absolutely guarantee what it will do. Hence the name Siemens-Halske has long since become a synonym for the best.

C. S. KNIGHT.

With extensive manufacturing facilities in Chicago which enable the production of its machinery to great advantage, and a corps of highly experienced men both in its administrative and mechanical departments, it will now become one of the leading factors in the production of electrical apparatus. Many of its present installations are of national renown, and with the record of the past, and present facilities, it will from now on take a front rank. The sales department has been reorganized, and includes some of the strongest men in the country. Certainly no better selection could have been made for general manager.

Mr. Knight was born at Columbus, Ohio, and passed his early life there; he entered the service of what are now the Pennsylvania lines west of Pittsburg in 1860, and continued in the transportation department of the railroad until 1881. After this he was for five years engaged in the gas business at Ft. Wayne, Ind.; at the end of that period Mr. Knight became interested in the Ft. Wayne Electric Company. When this company was thrown into the hands of a receiver in June, 1894, and the Ft. Wayne Electrical Corporation organized for the purpose of operating the business under contract with the receiver, Mr. Knight was chosen a director of the new concern. This connection continued until February 1, of this year, when he resigned the vice-presidency of the corporation. He is a broad gaged, progressive man, with a very wide acquaintance in the electrical and street railway field, and has hosts of friends, all of whom will wish him a full measure of success in his new work.

THE ALLEN LAW REPEALED.

The Illinois legislature on March 2 passed an act repealing the Allen law, and this was approved by the governor on March 7. The repealing act restores the horse and dummy law of 1874, with slight modifications to include electric and cable power, thus limiting the terms of franchises to 20 years. The Allen law was not the vicious measure its traducers claimed it to be, and the action of the republican legislature was doubtless taken at the instance of the leaders of that party in Chicago, who feared that their opponents would seek to make the non repeal of the Allen law an issue in the coming city election.

The Allen law, while permitting a 50 year grant, placed no limit on the amount which the city could demand for new franchises. One feature only of the law remains, and while even this is somewhat in doubt, we believe it will be found to be still in force, though the supreme court may have to pass on the question. It is the section in regard to consents, and reads as follows:

"The city council or board of trustees shall have no power to grant the use of or the right to lay down any railroad tracks in any street of the city to any steam, dummy, electric, cable, horse or other railroad company, whether the same shall be incorporated under any general or special law of the state now or hereafter in force, except upon the petition of the owners of the land representing more than one-half of the frontage of the street, or so much thereof as is sought to be used for railroad purposes, and when the street or part thereof sought to be used shall be more than one mile in extent, no petition of land owners shall be valid unless the same shall be signed by the owners of the land representing more than one-half of the frontage of each mile, and of the fraction of a mile, if any, in excess of the whole miles, measuring from the initial point named in such petition, of such street, or of the part thereof sought to be used for railroad purposes."

VIRGINIA STATE ASSOCIATION.

The Virginia Street Railway and Electric Association, which was organized last December, has already got down to work, and Secretary Woodson, of Lynchburg, has made the assignments for papers to be read at the first annual meeting which is set for May 16, 1899, at Richmond. There are nine members to date, which is an excellent start. The papers and assignments are:

"Care of Car Equipment and Their Repairs," E. J. Willis, general manager, Richmond Traction Company.

"Park Attractions and Amusements," E. R. Williams, president Richmond Traction Company.

"Track Bonding," R. D. Apperson, general manager, City Street Car Company, Staunton.

"Methods of Improving the Electric Lighting Business," H. P. Woodson, secretary, Lynchburg & Rivermont Street Railway, Lynchburg.

"Road Bed and Its Maintenance," D. W. Flickwin, receiver, Roanoke Street Railway.

The indications are for a good meeting.

The new officers of the Virginia Street Railway & Electrical Association are as follows: President, R. D. Apperson, general manager of the City Street Car Company, of Staunton; vice-president, E. Randolph Williams, president of the Richmond Traction Company; secretary and treasurer, H. P. Woodson, president of the Lynchburg & Rivermost Street Railway Company. The executive committee consists of the officers named above and R. L. Williams, of Norfolk, and D. W. Flickwir, Roanoke.

VESTIBULES IN NEW YORK.

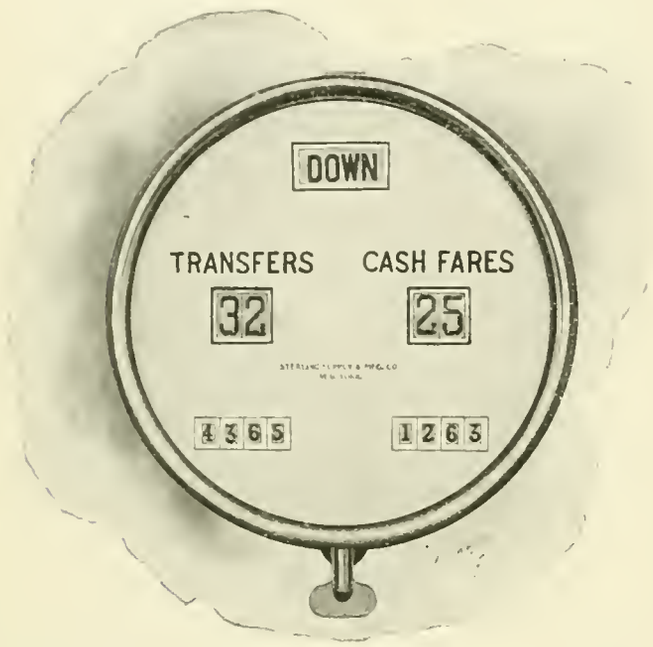
The street railway employes of Binghamton, N. Y., are seeking to have the railroad law of the state amended so as to require all street cars (except trailers) to be equipped with vestibules between November 1 and May 1. The penalty suggested is $25 per day per car. Up to the present time they have not succeeded in securing the introduction of their bill in the legislature

The Fitchburg (Mass.) & Leominster Street Railway Association gave its third annual concert and ball in Fitchburg on February 8.

THE STERLING DOUBLE REGISTER.

In buying fare registers many purchasers consider quality first and the price second, but some see no difference in registers and the initial cost alone governs their selection. The latter soon learn that a cheap register is dear at any price and that the first cost is greatly augmented by the cost of maintenance.

The Sterling Supply & Manufacturing Company owns several of the oldest as well as many of the latest patents on fare registers and there is no necessity for any intricate mechanism to avoid other patent claims. The Sterling register is notable for its simple and scientific construction. The accompanying illustration shows the latest model of the Sterling double register which has the following salient features: It is strictly a double register; two distinct registers in one case. It is operated through a train of gears and not entirely by springs. The gear connection between the trip and totalizer wheels is positive, no cams or dogs being employed. Every working part is a carefully tested steel casting and all parts are interchangeable. The indicators are very plain and easily read from a distance. The inner mechanism is complete and simple and the outer finish and appearance is durable and handsome. The parts are all carefully made of the very best material and is the result of mechanical ingenuity and skill.



STERLING DOUBLE REGISTER.

FALK COMPANY ABSORBS WESTERN GEAR.

The Falk Company, Milwaukee, has dropped the word "manufacturing" from its corporate name, and has secured the plant and business of the Western Gear Company, of that city. All the officers and skilled employes identified with the Gear Company are now transferred to the Falk, which will continue the manufacture of gears and pinions on a larger scale than before. It will also engage in the manufacture of steel castings by the open hearth process and is now erecting its foundry for that purpose. The new works will also afford enlarged facilities for the special work in switches, frogs and crossings. The company will also contract for the construction of electric railways, and of course give a large share of attention to the Falk cast-welded joint. With its greatly increased facilities and the same strong administration the Falk Company cannot fail to continue to grow and become each year a stronger factor in its special lines.

Congressman Charles L. Henry, of Anderson, Ind., president and general manager of the Anderson Electric Street Railway Company, has filed a petition with the commissioners of Marion county for a right of way over Pendleton pike for an electric line from Anderson to Indianapolis.

NEW COMPANY AT INDIANAPOLIS.

A syndicate headed by Hugh J. McGowan, of Kansas City, has purchased the stock of the Citizens' Street Railroad Company, of Indianapolis, and also acquired the interests of the City Railway Company, and will consolidate these companies, concerning the rights of which there has been so much litigation and legislation, into the Indianapolis Street Railroad Company.

The details of the organization and the agreement which will be made with the city have not yet been completed, but it is announced that H. P. Wasson, of Indianapolis, will be president of the company, and H. P. Wasson, Dr. Henry Jameson, Harold B. Hibben, Hugh J. McGowan, of Kansas City, and Randall Morgan, of Philadelphia, directors.

As a result of this sale by the old company the argument of the street railway case now pending in the United States Supreme Court was postponed.

RHODE ISLAND STREET RAILWAY LAW.

June 15, 1898, the Rhode Island legislature passed an act providing for a tax on street railways, the provisions of which are in substance as follows:

Section 1. Street railway companies accepting the provisions of the act are to pay a state tax determined as follows: If the annual dividend on the capital stock outstanding is 8 per cent or less, the tax shall be 1 per cent of the gross earnings. If the dividend is in excess of 8 per cent on the capital stock the tax shall be equal to such excess, but in no case is the tax to be less than 1 per cent of the gross receipts. This tax is in lieu of all other state taxes of every kind, but the act does not affect the taxing power of municipalities, nor any obligations of the municipalities or street railways now existing by virtue of agreements.

Section 2. Companies accepting the provisions of this act shall have the right to operate all the lines operated at the time of the acceptance of the act or acquired later, provided that "every street railway company accepting the provisions of this act shall, so long as it continues to enjoy the rights, privileges and franchises aforesaid, continue to pay to the several cities and towns, notwithstanding the expiration of any existing contracts or agreements, such sums as are now or may be required thereunder until new contracts or agreements shall be made, and such sums, not less, however, than those paid at the expiration of such existing contracts or agreements, as may thereafter be agreed upon from time to time."

Section 3. City and town councils may order the revocation of location and the right to use any portion of a street provided the company interested shall be given a right in another street as nearly similar in public convenience as possible; orders of revocation must be passed upon by the railroad commissioner and from his decision an appeal lies to the appellate division of the supreme court which finally determines all matters of law and fact involved.

Section 4. Companies may increase their capital stock to meet the cost of extensions and new equipment upon the approval of the railroad commissioner.

Section 5. This section deals with the methods of computing the tax.

Section 6. Companies leasing their roads to companies who pay the tax are exempt.

Section 7. This act applies to companies which accept its provisions in writing, and when so accepted it shall constitute a contract which shall not be altered or amended without the consent of both parties. Existing companies accepting this act shall do so on or before October 1, 1898.

Five companies which do the bulk of the street railway business in the state have accepted the act. By a careful reading of the words quoted in section 2 it is seen that so long as the ruling in the Dartmouth College case is law, the five companies cannot have their burdens increased save by their own consent.

The first meeting of the board of directors of the Charleston (S. C.) Consolidated Railway, Gas & Electric Company was held February 21. This company has acquired the property of the Charleston City Railway, the Charleston & Seashore Railroad, and the gas and electric light companies of the city. The consolidation was arranged through the Guaranty Trust Company, of Baltimore.

STEAM SWITCH-BACK MERRY-GO-ROUND.

It is the constant dropping of the nickels which keeps 50,000 street cars going in this country. The 5-cent pieces become dollars with remarkable rapidity, and in no wise is this more clearly shown than in the operation of a merry-go-round in a well appointed street railway park. The steam switch-back merry-go-round herewith illustrated was patented and is made by Norman & Evans, of Lockport, N. Y. These machines are enormously profitable when properly managed. As much as $562 has been taken in during one day's

NORMAN & EVANS MERRY-GO-ROUND.

operation, and at a summer resort one earned $2,850 above all expenses in two weeks.

This merry-go-round has an undulatory rotary motion and carries eight cars, designed to represent Venetian gondolas. Each car will carry 12 passengers, making a total seating capacity for 96. The decorations are highly artistic, and in the center is a military band organ which can be made to play continuously whether the machine is in motion or not. The entire merry-go-round can be packed for transportation on a single flat car and can be erected at its destination in a few hours.

IMPROVEMENTS AT LYNCHBURG, VA.

The Lynchburg & Rivermont Street Railway Company is making an important extension of one and one-half miles to its line and is building terminal station and pavilion. This combination pavilion and station building will be in the public park and the new extension will connect it with the main line.

The company owns also a 30-acre park at Rivermont, which is beautifully located on the highest point of land within 10 miles of the city, and well wooded with oak. This park has proved a favorite spot for the inhabitants of Lynchburg in the summer season, and will grow in favor as the company is able to improve the place. The greatest attractions, however, and always will be, are those features furnished by nature. Beside being covered with oak trees it is on a bluff at the foot of which runs the James river. To the north and west can be seen ranges of the Blue mountains.

The Lynchburg Electric Railway Company has contracted for material to rebuild its road and also about a mile of new track. The new company expects to make the property of the old Lynchburg Electric Company the best in the state. The Virginia Paving Company has the contract for rebuilding the track and overhead work under the supervision of the New England Engineering Company. The Pennsylvania Steel Company will furnish the rails and Jackson & Sharp will furnish 12 new cars, mounted on Peckham trucks.

The company has secured the West Lynchburg Hotel and 65 acres of wooded land adjoining to be used for an amusement ground or park. When the grounds are improved the place will be one of the prettiest places in central Virginia.

The company has two power stations, a small water plant which furnishes power for the incandescent and arc lights and a steam plant to furnish power for street railway and commercial power for electric fans, printing presses, carriage factories, machine shops, etc. The demand for electric power is growing rapidly.

REQUIREMENTS FOR BROOKLYN HEIGHTS EMPLOYES.

The Brooklyn Heights Railroad Company, of Brooklyn, N. Y., has found men of more than average height and weight are required for motormen on its large and heavy cars, and has accordingly fixed its minimum requirements as to height of motormen at 5 ft. 8 in., and the weight at from 160 lbs. to 200 lbs.

The physical examination insisted upon is for the test of eyesight, hearing, lung and heart troubles, etc.—in short, what would be required of every man, wherever employed in a position of responsibility.

The requirements and regulations enforced when selecting employes are merely a recapitulation of the foregoing. The endeavor is, so far as is possible, to pick applicants for the position of conductor from among men who have had some experience in handling money and accounts, who are alert, courteous, cool in emergencies, and of unfailing good temper; motormen are selected from among drivers, laborers of the better class, ex-steam railroad men, and men, generally, who are quick, possessed of keen judgment, and responsive to the wants of the company.

ILLUMINATING TORCHES.

The accompanying illustration shows the No. 6 illuminating torch for gasoline which is made by Chas. G. Smith, 350-352 Pearl street, New York, who is perhaps better known to the trade as "Smith of New York." This is a particularly reliable piece of apparatus and can always be depended upon to be in working order; the advantages of the gasoline torch over that using kerosene is its greater

cleanliness and ease of operation. Needless to say it is a safe torch. The one shown is of 5,000 candle power. The gasoline is carried in a tank made of heavy galvanized iron of any capacity desired; the tanks are designed to withstand a pressure of 200 lbs. per sq. in. The small pump shown at the side of the tank is used to provide the necessary working pressure, which is only 40 lbs.

The torches are particularly adapted for extraordinary park illuminations, and for use when construction work is in progress at night or in tunnel.

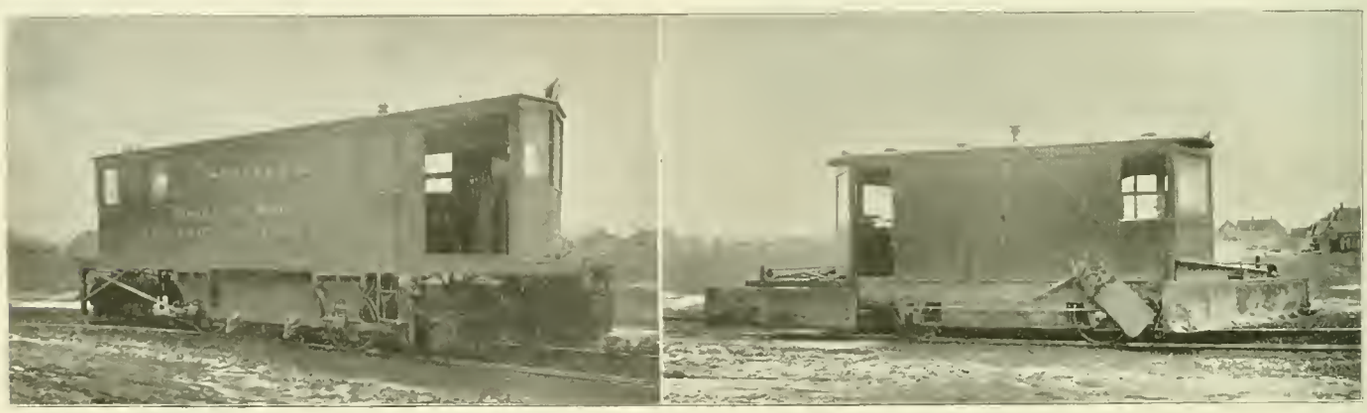
The newly reorganized Saginaw (Mich.) Valley Traction Company has recently moved its offices into a new suite of rooms, on East Genesee street, Saginaw.

A bill is pending in New Jersey to permit city councils to impose license fees of from $25 to $50 per car on the street railways operating in their respective jurisdictions.

REMOVING SNOW ON CHICAGO SUBURBAN LINES.

Fighting snow on some of the Chicago suburban roads is serious matter at times, for many of the lines pass through strips of prairie country where the snow drifts on to the track, often forming great banks through which the plows have to cut, and furthermore, it is hard to keep the tracks clear on account of the long headway of the cars. Almost all of the 35 miles of track of the Chicago Electric Traction Company is laid through the sparsely settled suburban districts. General Manager Gilbert finds that a heavy sweeper is the most satisfactory means of contending with light snows or to keep the tracks clear during a storm. For this purpose the McGuire Manufacturing Company built a specially designed sweeper.

The sweeper, shown to the left in the illustration, is the largest the company ever made, and is perhaps the largest in operation. It is 32 ft. in length and weighs complete, with equipment, 46,000 lbs. There are three 50-h. p. Walker motors, two of which are mounted on the car axles and furnish the motive power; the third is mounted on a shaft which runs lengthwise of the car body and drives the brushes through bevel gears and vertical shafting. There are two clutches on this shaft so that the brushes at either end may be driven. The brushes are mounted on adjustable bearings which can be moved vertically by a chain and hand wheel. A crew of three men work the sweeper satisfactorily. Snow-falls up to 7 in. deep



SWEEPER AND PLOW—CHICAGO ELECTRIC TRACTION COMPANY.

are taken care of by this machine. The sweeper can be operated from either end, there being a controller and hand wheel front and back, and a third controller near one end connected to the motor actuating the brushes. Three sets of standard car storage batteries are carried by the sweeper.

The other illustration shows a Brill snow plow which has been in operation for the past year and a half. This plow is 32 ft. long from tip to tip and weighs 40,000 lbs. Two 50-h. p. Walker motors furnish the motive power and three sets of car batteries furnish the current. Each plow share is mounted on three standards and can be raised or lowered by a chain and hand wheel. The wing used for pushing the snow out from the side of the tracks is shown plainly in the half-tone. This plow has successfully cleared the tracks of the heaviest drifts. Last year there was one 7 ft. deep and 500 ft. long which was quickly and easily removed.

The large home made snow plow of the Calumet Electric Railway Company, described and illustrated in the REVIEW for March, 1897, has accomplished some unusually heavy work. On one of the outer lines a snow drift 16 ft. high accumulated over both tracks. The plow succeeded in clearing one track and then by means of the side wings about a foot on top of the drift over the other track was removed. It passed back and forth cutting into the drift each time one or two feet until the second track was uncovered. General Manager Sloan considered this plow a success and ordered two others of similar design built under the direction of W. A. Harding, master mechanic. The body is 8 ft. 6 in. across and 12 ft. long and the frame is of rigid cross construction to prevent tipping. Each share, 9 ft. in length, is set at an angle of 55° and consists of five segments with spring suspension to prevent them from being damaged when striking a rigid obstruction. There is no truck, the axle boxes being attached to the sills of the car body. Two W. P. 50 motors, one on each axle, supply the motive power. Every part of the plow is made very heavy and to add additional weight about a ton of iron ballast is placed in each corner.

PRACTICE VS. LABORATORY TESTS ON LIGHTNING ARRESTERS.

Due consideration should be given laboratory tests and the results derived therefrom, but often practical operation has varied widely from what was expected from experiments previously conducted. It is the practice that makes perfect. In no industry has this proven so true as in the electrical, and the extreme perfection of electrical machinery is due largely to the correction of defects developed in practice. To no piece of apparatus does this apply with more force than to the lightning arrester. For a long time it was looked upon as a luxury and a nonessential, but experience has taught that they are absolutely necessary for the protection of the expensive electrical machinery.

Lightning arresters have to deal with the forces of nature and therefore in principle must be in accord with natural laws. If for the protection of the dynamo or motor, a piece of wood properly treated, or if a piece of iron and carbon work in unison with nature, accept the one which successfully does the work regardless of theoretical considerations. Arguments have been made against lightning arresters with moving parts, but practice has shown many of these fallacious. The Garton arrester comprises moving parts, but it is so simple and the parts so arranged that all the difficulties anticipated in a device of this character are entirely obviated. The most convincing proof that moving parts are not always objectionable is in the success of the Garton arrester under the most trying conditions.

Every operation of this arrester cleans the contacts and discharge points, thereby keeping the conductivity at a maximum and the resistance at a minimum. The arrester is so quick in its action that discharges in rapid succession are taken care of with the greatest ease. After a discharge the Garton arrester increases the resistance in the circuit and chokes and disrupts the current flow. This operation is done so quickly that a sensitive plate is incapable of detecting any motion, as may be seen in the illustrations from photographs in the catalog.

The Garton-Daniels Electric Company, of Keokuk, Ia., has issued a new catalog, No. 22, setting forth the merits of the Garton arrester and presenting some valuable information regarding protection from lightning. This catalog is very complete and handsomely illustrated and may be had for the asking.

The Marion county (Ind.) commissioners have been petitioned by P. H. Fitzgerald, Sterling Holt, J. C. Tarkington and Joseph Elliott for a franchise for an electric line to connect Indianapolis with Martinsville via Maywood, Valley Mills, West Newton, Friendswood and Mooresville.

CAST STEEL IN TRUCK FRAMES.

In the REVIEW for December, 1898, page 916, was illustrated the McGuire No. 35 truck, which, with the exception of the journal boxes, is made of steel—cast or rolled. The McGuire Company has recently issued a circular relating to the use of cast steel in truck manufacture, from which we take the following:

"Since it has become a fact that cast steel can be made to equal rolled steel and that it is susceptible of being worked in a forge in the same manner as the ordinary bar steel, and since the old difficulty with cast steel—that of blow holes and shrinkage cracks—has been entirely overcome, we have adopted this metal in double and single trucks. The advantage is easily comprehended, the minimizing of parts being greater than by any other method. It simplifies, strengthens, adds life, and absolutely avoids any cost of maintenance as far as the frames of the trucks are concerned.

" The steam railroads of the country, after half a century of experience, are getting away from the composite truck with all possible speed.

"A side of our No. 35 truck was placed on two supports—one on each pedestal opening, and a pressure of 55 tons placed in the middle, with a deflection of ⅛ in. with no permanent set; at 63 tons the deflection was ¼ in. and the permanent set ⅛ in. At 70 tons, a permanent set of 1¼ in. without sign of fracture, was noted, and the tensile member parted at 72 tons, making a total of 288,000 lbs. for one truck, or a total of 576,000 lbs. per car, giving a safety factor for the truck side of 14.4, assuming the load to be 40,000 lbs.; the bolster and transom are equally as safe. All the important pieces in the truck are given physical test of three times the actual load before being used. Side frames 1¾ in. by 4 in. are welded every day in the shops of the company, with the same facility and results that could possibly be obtained from the very best rolled steel."

The company has orders from the following companies: Northwestern Elevated Railroad Company, Chicago (entire new equipment), Colorado Springs Rapid Transit Company, Danville Gas, Electric Light & Street Railway Company, Syracuse Rapid Transit Company, St. Joseph & Benton Harbor Electric Railway, South Bend Street Railway Company, Peoria & Prospect Heights Railway Company, Benton Power & Traction Company, and the Monongahela Street Railway Company, which goes to show that cast steel is fast coming into general use and will command the attention of railway people generally.

SPOKANE'S MAYOR FAVORS FREIGHT.

Spokane, Wash., as all who have ever visited that thriving city know, is destined to become a large manufacturing center on account of its location and nature's ready made water power. Already desirable industries have located there and others will not be slow to favorably consider a city where there is such evidence of extending a broad gage policy.

In his annual address to the Chamber of Commerce, Mayor Olmsted defined his policy in the following:

"There are industries which are prepared to come here when the question of cheap transportation from the factories to the railroad depots is settled to their liking.

"Personally I see no reason why freight should not be hauled over the suburban streets, if it will help to build up the town. I do not think any one would be disturbed by having this done between the hours of 1 o'clock at night and 6 o'clock in the morning. Provided, of course, that this traffic was carried by electricity. I should be opposed to steam engines on the city streets on account of the smoke, the noise and the tendency to frighten horses.

"While in Seattle I have noticed the freight cars being loaded at all hours of the day and in a good part of the city, too. In San Francisco they run the mail cars over the street railway, and I don't see that freight cars would be any different. Everything of this kind helps to attract manufacturing men, and the more facilities that are offered will lead to the location of factories here."

The right by which freight is now hauled over Front street from the C. & C. Mill to the railroad was granted by a franchise given the Spokane Street Railway Company March 6, 1894, and it gives them the privilege of hauling cereals and the products of cereals along and over certain streets.

It is expressly provided that the cars used shall not exceed in length 24 feet and shall be of light construction, similar to the electric cars used on suburban travel, and shall be equipped with electric motors similar to those used on cars with a maximum carrying capacity of ten tons; and the speed at which the cars are to run shall not exceed five miles per hour, and all street passenger cars and the fire department apparatus shall have the right of way over the freight cars.

The president of the city council and a number of the aldermen expressed themselves as heartily in favor of the plan.

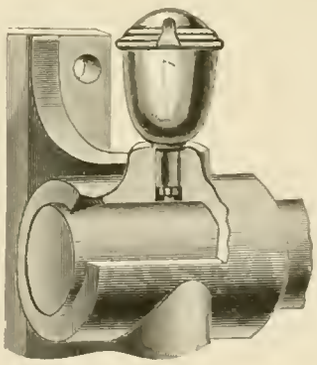
GRINDING FLAT WHEELS.

The flat wheel question is one of the most serious and annoying features which the railway manager has to meet and much time and money has been devoted to it. The Wheel Truing Brake Shoe Company has apparently solved the problem. This company makes a shoe which is interchangeable with the shoe whose place it is to take while doing its work, and is like it in every respect, except that it contains pockets filled with a grinding material. When a wheel becomes flattened the regular brake shoe is removed and the wheel truing brake shoe is put on in its place. The car is then run as usual, and every time the motorman applies his brake the wheel is being ground down. Of course the shoe grinds only when the brake is applied, and as that is but a short time and at intervals it takes some little time to complete the truing process, especially if the flat is a bad one. Usually a days run will true up a wheel.

The shoe being a part of a true circle must of necessity make the wheel perfectly round. The shoe can be put on and taken off as easily and quickly as the ordinary shoe, which means a great saving of time; it can also be used in the barns when the car is out of service.

THE ALBANY LUBRICATORS.

The regular style of spindle compound cup here illustrated is made by the Albany Lubricating Compound Company, Adam Cook's Sons, proprietors, 313 West street, New York. As may be seen from the section, a hole is bored through both the cup and brass of sufficient size to allow the outside tube of the cup passage to the shaft, but only the inside spindle rests on the shaft, the outer tube being about ¼ in. above. The inside spindle is removed and the cup filled with the compound. It is only necessary to replace the spindle with a few churning motions and the cup is ready for use. These cups require a minimum of attention, one charge of lubricating compound lasting from one to four months.

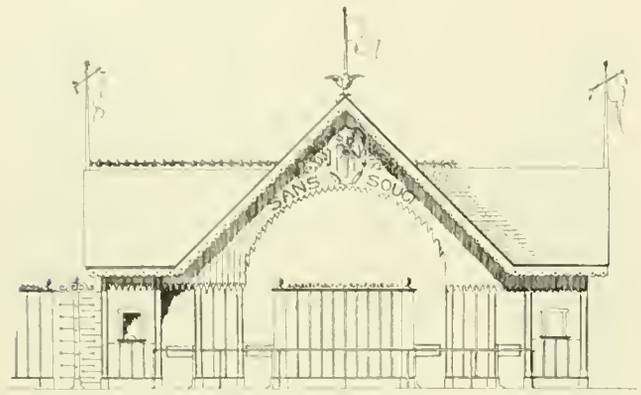


When the Albany compound is used in the cups no drip pan is required, for it is self acting and runs only when the shaft is in motion. This compound is especially desirable for dynamos, motors, heavy cable machinery and other and fully illustrating the cups and compounds, has been published four regular grades, depending upon the temperature and the speed of the machinery. An interesting booklet, giving much information and fully illustrating the cups and compounds has been published by Adam Cook's Sons.

At the annual meeting of the Hamilton & Dundas (Ont.) Street Railway a 5 per cent dividend was declared on the outstanding stock; the surplus, after meeting fixed charges and dividends, was $2,671 for the year 1898.

SANS SOUCI PARK, CHICAGO.

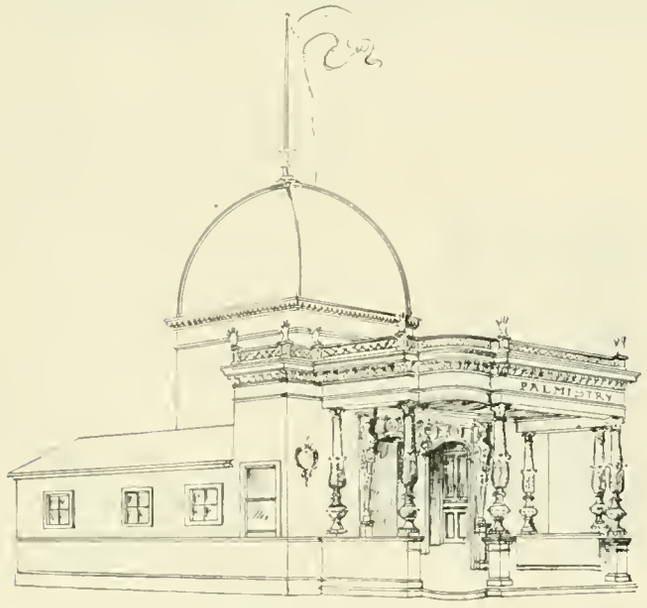
Chicago has a magnificent system of parks and boulevards on the north, west and south sides of the city. In the parks are zoological and botanical gardens, immense pleasure grounds, lakes for boating and fields for all kinds of summer sports. These parks have excellent street railway facilities and the cars are liberally patronized by those seeking fresh air and recreation in the summer. The bounty of the municipality has made it unnecessary for the



ENTRANCE TO THE PARK.

street railway companies to maintain large pleasure resorts. From the standpoint of popular amusements there is but one deficiency in the municipal parks and that is the pleasure seekers like excitement and exhilaration as well as rest; they wish to see summer vaudeville, shoot the chutes, ride on the merry-go-round and have a chance to spend some money on frivolous amusements. To meet such demand the Chicago companies encouraged private enterprise along these lines, such as the Ferris Wheel park on the north side, and spectacular, pantomime and pyrotechnic displays in other parts of the city.

The most elaborate and permanent undertaking of this kind is the new Sans Souci park on the south side. It has an ideal loca-



TEMPLE OF PALMISTRY.

tion, being right at the west entrance of the famous Midway, and on the southern boundary of Washington park. It occupies 10 acres between Langley and Cottage Grove avenues and 60th and 61st streets. The Cottage Grove cable line passes along its east boundary, and on the south is the 61st street electric line of the Chicago City Railway Company. Cable trains and electric cars will pass the park every two or three minutes at busy periods, so that there will be ample facilities for transporting large crowds.

Last summer W. H. Carter, who has been connected with the Chicago City Railway Company since 1892, saw the need of such an amusement resort and began investigations. He secured a 10-year lease on the tract of ground and with the encouragement and assistance of the railway company commenced the improvements. The work of building began late last fall and has proceeded as the weather permitted through the winter. The pavilion, cafe and theater, combined in one large building, 145x180 ft., was designed and erected under the supervision of Robert Hotchkin, architect. It consists of two substantial brick wings, one for the stage and accompanying compartments, and the other for the cafe and refreshment rooms. The two are connected by an iron trussed roof. The theater will have a seating capacity of about 1,000. Extending around the entire building on the first and second floors are 20-ft. verandas, and outside the building will be a finely paved terrace. There will be 350 tables and 2,500 chairs and refreshments of every kind will here be served. For protection on windy or rainy days heavy canvas curtains will be hung on the veranda posts and these can be let down and fastened when desired.

The band stand is a neat structure adjoining the pavilion, as may be seen in the illustration. A band of 30 pieces has been engaged to play afternoons and evenings for the entire summer. Just west of the band stand and within view of the pavilion verandas will be a hippodrome track and arena where outdoor exhibitions will be

JAPANESE THEATER AND TEA GARDEN.

given, such as trained horses and aerial acts, with a change of program each week.

It is the policy of the management to let as many concessions for new and high class attractions as possible. Chief among these is the Japanese tea garden which will be under the auspices of the Japanese Central Tea Association, and will be similar to the garden at the Omaha Exposition, but on a larger scale. This association is supported by the government of Japan, and in reality represents the agricultural department of that country in promoting foreign trade in teas. There will be two handsome buildings with a garden about them laid out and decorated in characteristic Oriental fashion. In the Japanese theater there will be given dancing exhibitions, musical entertainments and Japanese dramas. The two illustrations show features of the entertainments; to the left are the Geishas or dancing girls, and the view on the right is from a photograph of the "gonin-bayashi," or band of five musicians playing on instruments peculiar to the Japanese. Such exhibitions will not only be of interest, but will have an educational value as well. There will be several jinrikishas in the garden, and the pleasant sensation of riding in one of these easy going conveyances may be had for a small fee.

The Temple of Palmistry is a very artistic building, decorated in staff which will attract many who are eager for a vision of the future. The Temple of Illusions will contain a series of popular and mystifying exhibitions. An arcade, 48x120 ft., has been built especially for minor concessions, and will be divided into compartments 12 ft. wide and running the width of the building, for shooting and photograph galleries, phonograph stalls and the like. A large shed, 100x250 ft., has been constructed on the north side of the park to shelter carriages and bicycles, all being cared for free of charge.

The main entrance to the park will be on Cottage Grove avenue, and at this point a fine gateway is building. C. E. Lund, landscape engineer, has spent much time and labor in laying out and beautifying the grounds. A large number of elm, ash, hard maple, linden, white birch, Norway maple and Carolina poplars have been planted. Some of these trees are 12 in. in diameter and 40 ft. high, and were hauled for a distance of 25 miles on wagons. Shrubs,

SANS SOUCI PARK—THEATER AND BAND STAND.

flowers and vines have been selected so that there will be blooming plants from June to late in the fall.

A concession has been granted for a Venetian gondola, which is an improved type of merry-go-round, and this will be located near the Japanese theater. A small zoo will be maintained, including birds, monkeys and other small animals. An artificial lake is on the north side, and here will be black African geese, white ducks and other water fowl. A crew of log rollers has been engaged to give exhibitions on the lake. These men will show how logs are handled in the water, and among other things will have spirited contests, trying to throw each other into the water by rolling the logs.

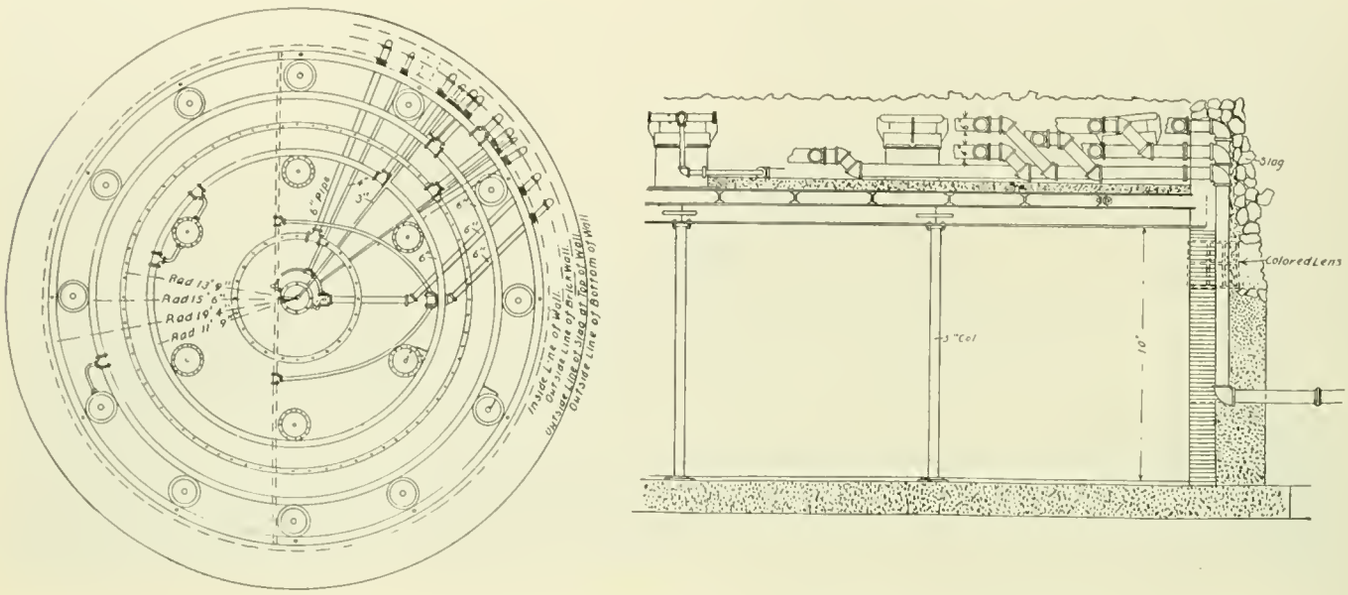
The electric fountain has received more careful consideration in its design and construction than any other feature of the park, and the outcome is one of the largest and finest fountains in the country. The design is the joint effort of C. E. Moore, master mechanic, and C. J. Reilly, superintendent of motive power of the Chicago City Railway Company, and the pipe fitting and machine work was all done in the repair shops of the company. The fountain will be 50 ft. in outside diameter and will have walls 3 ft. thick. The arrangement of the water pipes and the 19 light wells is plainly shown in the plan and enlarged section of the fountain. The water is pumped out of the lake, which is at present supplied from the city mains, but eventually it will come from two 6-in. artesian wells. The power house and operating station is on the north shore of the lake. Two railway motors drive Quimby pumps, supplying 300,000 gals. of water per hour, or running at full capacity the fountain jets will emit 5,000 gals. of water per minute. The current for these motors is to be taken from the trolley circuit.

Each of the light-wells is 2 ft. in diameter and 2 ft. high, and beneath is an equipment of nine colored sashes. These are moved by a motor in the chamber beneath the fountain which drives 19

THE GEISHAS DANCING GIRLS AND JAPANESE MUSICIANS.

shafts connected to the colored sashes by a pinion and rack. Underneath each light-well is an arc light with reflector giving 10,000 c. p. In the power station there will be a keyboard with push buttons to open and close the various circuits, and in this way the combinations can be changed with great rapidity. Already 25 different and distinct displays have been planned. Two men only are required to attend to the fountain mechanism when in operation.

The park being so easily accessible to all the populous districts in the southern part of the city it was deemed necessary to charge an entrance fee to draw the best class of patrons. In the afternoons the admissions will be 10 cents and at night 15, children free. Reserve seats to the theater entertainments will be 10 and 15 cents. The arrangements for an evening's entertainment will be a concert by the band, a short exhibition of the electric fountain, the theatrical performance and another concert and fountain display. The park will be opened May 20. The improvements on the park have cost not less than $85,000; the theater, $25,000; the fountain, $25,000; the other buildings and ground improvements make up the balance.



SANS SOUCI PARK—TOP VIEW AND ENLARGED SECTION OF ELECTRIC FOUNTAIN.

W. H. CARTER.

W. H. Carter is the proprietor and manager of the park, and J. B. Sturtevant is the superintendent. Mr. Carter is a street railway man of long experience. He was born in Union county, Ohio, and moved with his family at an early age to a Kansas farm. In 1885 he became associated in railway work with M. K. Bowen, then superintendent of the Kansas City Cable Railway Company. When Mr. Bowen received a call to Chicago in 1892 Mr. Carter came with him and became one of the division superintendents of the Chicago City Railway Company. Mr. Carter is, therefore, closely in touch with street railway work, and thoroughly understands the requirements of his new undertaking.

ST. LOUIS CABLE MAY GO.

The new owners of the Broadway cable line in St. Louis are considering changing the motive power to electricity, but nothing definite has been decided as yet. It will be an expensive change to make in any event. Capt. Robert McCulloch states that the practicability of using the present cable conduit in connection with an underground trolley system will be considered. The Broadway line is the longest and oldest single line in the city; there are 20 miles of track without a sharp curve.

The city council of Atlanta, Ga., has passed an ordinance providing suitable penalties for the misuse of transfer tickets which are to be issued by the street railway companies of that city.

CONSOLIDATION AT PORTLAND, ME.

The Portland Railroad Company, of Portland, Me., has leased the property of the Portland & Cape Elizabeth Railway Company for a term of 999 years from March 1, 1899. The former company, which was organized in 1863, owned and operated 28.9 miles of track, equipped with 73 motor and 38 trail cars. The latter company was chartered in March, 1895, and in November of that year acquired the property and franchises of the Cape Elizabeth Railway Company, and has at the present time 15.72 miles of track and 34 motor and 6 trail cars; in addition to this the company owns the Cape Cottage park property on which is erected the large casino illustrated in the REVIEW for May, 1898, page 327, which is one of the finest pieces of shore property in New England. The Portland Railroad will make additions to its central power station and operate both systems from the one station.

H. R. McLeod, general manager of the Portland & Cape Elizabeth Railway Company, has been identified with the Cape property since May, 1895, having had the entire supervision of the construction of the system and its operation.

ADDITIONS TO ACCOUNTANTS' ASSOCIATION.

Secretary Brockway reports a steadily growing interest in the Accountants' Association. Members are already beginning to appreciate the value of being able to secure information needed out of the archives which the association is building up. During the month of February new members were added as follows:

Vicksburg Street Railway, Vicksburg, Miss.
North Chicago Street Railroad, Chicago.
Savannah, Thunderbolt & Isle of Hope Railway, Savannah, Ga.
San Diego Street Railway, San Diego, Cal.
Duluth Street Railway, Duluth, Minn.
Glasgow Corporation Trams, Glasgow, Scotland.

FAVORS TROLLEY FUNERALS.

Dr. C. Herbert Richardson, of Baltimore, recently presented a paper before a meeting of Methodist Episcopal clergymen in which he suggested the advantages of trolley funeral trains, and, while not urging the adoption of their use, recommended the plan to the consideration of the public. Trolley funeral cars have proved so popular in many cities that there appears to be no reason for not using them in Baltimore.

The Columbus (O.) Street Railway Company has donated $1,000 to the Board of Trade to be used in entertaining visitors.

THE BALTIMORE CONSOLIDATION.

The incorporation on March 5 of the United Railways & Electric Company, of Baltimore, marks the final step in the consolidation of the street railway systems of Baltimore. The companies absorbed are the Baltimore City Passenger Railway, the Baltimore Central Passenger Railway and the Baltimore Consolidated Railway; the three companies include a number of subsidiary lines and companies which became merged with them by former consolidations, and among these are the Baltimore, Gardensville & Belair; Baltimore, Catonsville & Ellicott's Mills; Maryland Traction, Baltimore & Curtis Bay, Gwynn's Falls, Shore Line, Pimlico & Pikesville; Walbrook, Gwynn Oak & Powhatan, and Baltimore & Northern Companies. The Baltimore, Middle River & Sparrow's Point Railway is controlled through the ownership of the stock and bonds.

The new company is capitalized at $38,000,000, of which $14,000,000 is 4 per cent cumulative preferred stock and $24,000,000 common

W. A. HOUSE.

stock. Bonds to the extent of $38,000,000 have been authorized; $15,550,000 of the bonds will be retained in the treasury to meet outstanding obligations of the old roads, and $4,450,000 to pay for acquisitions and improvements.

The officers of the United Railways & Electric Company are:

President, Nelson Perin, formerly president of the City & Suburban Railway Company and the Baltimore Consolidated Railway Company.

Vice-President, Col. Walter S. Franklin, formerly president of the Baltimore City Passenger Railway Company.

General Manager, William A. House, formerly president and general manager of the Baltimore Traction Company, and vice-president and general manager of the Baltimore Consolidated Railway Company.

Treasurer, Briggs C. Keek, formerly cashier of the City & Suburban Railway Company and of the Baltimore Consolidated Railway Company.

Secretary, H. C. McJilton, formerly secretary of the Consolidated Railway Company.

Directors, E. L. Bartlett, Alexander Brown, Col. W. S. Franklin, W. P. Harvey, George C. Jenkins, Seymour Mandelbaum, Harry A. Parr, Nelson Perin and George R. Webb.

W. A. House, general manager of the consolidated street railway system of Baltimore, has been closely identified with the street railway interests of that city for 20 years, in which time he has risen, solely by reason of his capacity, energy and perseverance, from a subordinate position to that which he now occupies.

In 1879 Mr. House started at the foot of the ladder with the Peoples' Passenger Railway Company, when his chief work was to empty the fare boxes in cars; he worked for five years, Sunday and holidays, without the loss of a day from any cause, and at the end of that period collapsed completely as the result of overwork. This faithfulness brought its reward when the company was reorganized, and Mr. House was appointed secretary and general superintendent. In 1889 the Baltimore Traction Company secured two other lines, and Mr. House was made manager of the new system; other roads were added to the system of the Traction Company, and in 1892 a great impetus was given to the business by the adoption of electricity as a motive power.

Throughout the period of improvement and extension that followed the change from horses Mr. House proved a diligent, alert and indefatigable officer, and in 1895 was chosen vice-president; during 1896 he served as president, President Brown having resigned. In 1897 the Traction Company was consolidated with City & Suburban Railway Company as the Baltimore Consolidated Railway Company, of which Mr. House was chosen vice president and general manager, and now upon the further consolidation of the street railways of Baltimore, he retains the position of manager with vastly increased interests intrusted to his care.

All of his career and successful work have brought out in bold relief the fact that he is possessed of the three primary qualities essential to a progressive executive officer. These qualities are honesty, method or system, and persistent industry. The diligent application of those three qualities is what has placed Mr. House in the list of Baltimore's leading and most reliable railroad men.

THE SITUATION IN ST. LOUIS.

The street railways of St. Louis are now for the most part in the control of three syndicates: The Spencer syndicate has the Southern Electric Railway and the four lines, the Cass Avenue & Fair Grounds, the Citizens, the St. Louis Railroad and the Jefferson Avenue, which were formerly owned by the National Railway Company, of Chicago; these aggregate 88 miles of track. The Turner syndicate controls the lines of which C. H. Turner is president, the St. Louis & Kirkwood, the St. Louis & Meramec River, and the St. Louis & Suburban, which together comprise 57 miles of track. Brown Brothers, of New York, control the Lindell, the Missouri, the Union Depot, and the Midland Street Railway lines, in the aggregate 201 miles. A rumor to the effect that the People's Railroad, 9½ miles, which was sold by the receiver, F. B. Brownell, to August Gehner, on February 19, would be consolidated with the Spencer lines is denied.

Jilson J. Coleman has been appointed general manager of the Brown syndicate lines; three years ago Mr. Coleman was obliged to leave the Allentown, Pa., road because of ill health, but was afterwards with the Nassau lines in Brooklyn, and last was eastern representative of the St. Louis Car Company. We feel sure that all of Mr. Coleman's friends will be glad to learn of his return to street railway work, for which his experience so well fits him.

DAMAGES FOR USE OF TRACKS.

Last November a franchise was granted the Atlanta Railway Company, on Mitchell street, Atlanta, Ga., but from Broad to Madison avenue this street was occupied by the tracks of the Atlanta Consolidated Street Railway Company. Condemnation proceedings were instituted, but were delayed by injunctions of the federal and state courts. The case was referred to three assessors, who recently decided that the Atlanta Railway Company should pay the Consolidated Company $2,951.65 damages, itemized as follows: For right of way and property condemned, $1,556.75; for use of poles and span wires, $50; for consequential damage caused by interference at switches and elsewhere, $1,344.90. It was decided that the only safe way was to suspend the trolley wires of both companies from the same span wire. The Atlanta Railway Company is required to pay one-half the future expense of taxes, assessments for street improvements, repairs and renewals of the property condemned.

SOUTHWESTERN CONVENTION.

The Southwestern Gas, Electric & Street Railway Association will hold its annual convention in the city of Austin, Texas, on April 19, 20 and 21. This association was formed last year at Laredo, out of the three conventions indicated in the present name, and includes a considerable number of members from Mexico. The Austin meeting promises to be a strong one, and to the local attractions of an electrical nature will be added the well known Austin welcome and hospitality.

EAST CAPITOL STREET, WASHINGTON, D. C.

SEVERE SNOW STORM AT WASHINGTON, D. C.

Through the courtesy of George B. Coleman, general manager of the Metropolitan Railroad Company, of Washington, D. C., we have received a number of photographs taken along the lines of that company shortly after the very heavy snow storms that occurred in the first half of February.

On Sunday, February 5, 1899, there was four inches of snow on the ground. It continued to snow up to and including Saturday. There were twenty-four inches of snow on the ground on the morning of the 11th. Metropolitan cars had been operated on the regular schedule during all this time, the management having successfully met and coped with all difficulties. On Saturday, the 11th, it began to snow, and in addition the wind rose until it was blowing at the rate of forty miles an hour. This storm turned into a regular blizzard, blocking all the roads in this section of the country—both steam and street railroad lines. From Monday morning until three o'clock Tuesday eleven inches of snow fell, making thirty-five inches of snow. The storm was such as had never been known in that section of the country before. In many places on the lines the drifts were twelve feet deep, and nowhere less than three feet. It was a physical impossibility to keep the tracks clean, as no set of men could have withstood the cold, snow and wind.

During the storm Mr. Coleman made his plans for opening up the next day. Having secured nearly one thousand men they were started at both ends of the lines, and in the middle, dividing in the middle and working towards each end. In this way eleven miles of double track—24 ft. wide—were cleared by nine o'clock Tuesday night. When the sweepers were run out and the track cleared for operation the next morning, it was found upon starting that the slot was entirely filled from end to end. This was a problem that had never been anticipated, and the officers did not know just what the result would be. However, operations were begun with a dead

SCENES ON THE METROPOLITAN LINES, WASHINGTON, D. C.

plow in front, attached to the sweeper, the leads from the motor which operated the brooms being carried back to the plows of the next car. This train was made up of three motor cars and one sweeper.

In many places along the line the slot was found to have been closed with solid ice. Whenever this was the case gasoline was sprinkled along the slot and then it was burned out, so as not to injure the plow in any way. Apparently the snow in the slot had no appreciable effect as the cars were running the next morning. The company did not lose a single motor during the entire month.

The clearing of such a tremendous quantity of snow from the tracks, and the operation of cars so quickly, was commented upon by the papers of the city in a manner most favorable to the company, and it was, in fact, a great achievement.

Two of the engravings show views in front of the office of the Metropolitan Railroad Company on East Capitol street, between 14th and 15th streets—one before and the other after the tracks were cleared. In the group No. 1 is a view taken at the corner of First and East Capitol streets, looking west; No. 2 shows a sweeper and train of motor cars leaving the car house; No. 3 is a view on East Capitol street, between 1st and 2d streets; No. 4 shows East Capitol street, looking east, on February 14, 1899; No. 5 shows the start from the car house at 14th and East Capitol streets on the morning of February 14 (the plow in front of the sweeper is 4 ft. high); No. 6 is a view of 1st street just north of East Capitol, looking north.

GUSTAVE SUCKOW.

There is doubtless no one who is better known to the street railway managers and purchasing agents of the country than is Gustave Suckow, the genial general manager of the Vose Spring Company, of 25 Murray street, New York. Mr. Suckow grew up with this company, commencing with it when 13 years old, and has been with it for over 22 years. A considerable portion of this time he represented the company on the road, and has been general manager for several years.

The Vose springs have been on the market for many years and are well known among the trade for their quality and durability; the name "Vose" stamps them as being the best. Mr. Suckow has received many testimonial letters from customers which show the high repute which the goods hold. Though the company is an old one, it keeps abreast of the times and does not let its products deteriorate from the high standard set by the late Col. Richard Vose, whose rule of action was: Good quality and good workmanship will hold the trade. Many of the ideas embodied in the Vose springs as made at present are the result of the experience of Mr. Suckow.

GUSTAVE SUCKOW.

Among the company's products are the rubber center yoke springs which claim the distinction of being the only ones that will live in the journal boxes of electric cars, the Vose patent rubber and iron core springs, the Vose elliptic springs, coil and elliptic springs for all the standard electric trucks, trolley springs and bush holder springs, rubber springs, washers and cushions, rubber blocks for elliptic springs, etc.; a complete list would include any and all kind of springs. Mr. Suckow will gladly correspond with anyone who finds his cars not running satisfactorily.

There is a bill in the Missouri legislature providing for vestibules on street cars during the winter months, under a penalty of from $5 to $50 for each violation.

The Buffalo & Niagara Falls Electric Railway has subscribed $7,500 and the Lockport Electric Railway $2,500 to the fund for the Pan-American Exposition.

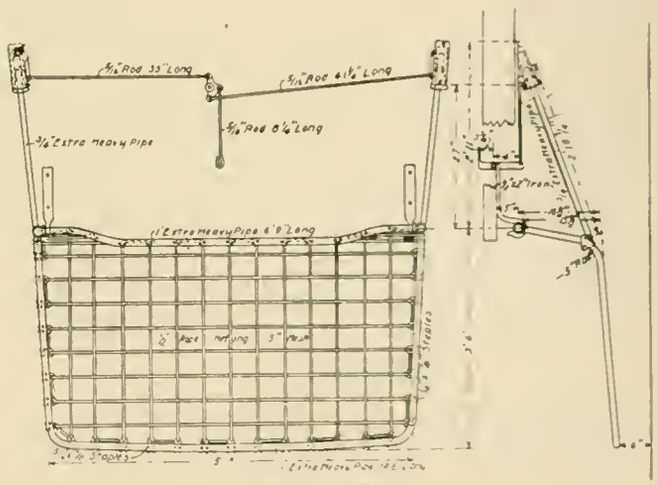
CONSOLIDATION IN DENVER.

The Denver City Tramway Company was incorporated March 3 and effects the consolidation of the Denver City Railroad, which now has 5 miles of horse railway, 11 miles of electric, and 30 miles of cable railway, and the Denver Consolidated Tramway which has 100 miles of electric road. C. K. Durbin, general superintendent of the latter road, advises us that if the permission of the city authorities is obtained the new company will spend half a million dollars in improvements during the next year, putting from 500 to 1,000 men at work at once. The improvements contemplated comprise a central power station located on the Platte river between 15th and 19th streets, the change of the present cable lines to electric, and the rebuilding of the Broadway line.

The capital of the new company is $5,000,000 and its officers are: President, Rodney Curtis; vice-president, William N. Byers; secretary, W. G. Evans; treasurer, G. E. Ross-Lewin. All of these held similar positions with the Denver Consolidated Tramway Company. No changes will be made in the other officers or employes of either of the old companies.

THE TWIN CITY FENDER.

As noted in our February, 1899, issue the Twin City Rapid Transit Company, of Minneapolis and St. Paul, by means of safety gates and fenders has been able to greatly reduce the number of accidents involving personal injuries. The gates were fully shown in that issue, and we herewith illustrate one type of the fenders, with which nearly all the company's cars are equipped. The drawing shows the type first adopted and the slight modifications since made will be mentioned later. The frame is made of extra heavy 1-in. piping and fittings bent as shown in the diagram; staples of ¼-in. round iron are spaced 5 in., center to center, and ½-in. rope run



TWIN CITY FENDER.

through them to make a netting. The frame is hung from hooks and held in its normal position by two struts of ¾-in. extra heavy pipe, one at each side. One end of the strut is fastened to the fender frame and the other rests in a cast iron pocket bolted to the car sill; in each pocket is a dog which when pulled out (by means of the mechanism shown in the cut) when the motorman presses the tripping lever with his foot, permits the strut to go to the bottom of the pocket and the fender to fall to the rail. Normally the front edge of the fender is carried 6 in. from the rail on level track. The newer fenders are made 2 ft. 10 in., instead of 3 ft. 6 in., long, and the front corners are bent to a larger radius so that they do not project so much as that shown. Wire is substituted for rope, and run through holes in the pike frame instead of through staples.

These fenders are made by the company in its own shop, after its own designs and at small expense.

The Monongahela Connecting Railway Company, of Pittsburg, has been authorized by the city council to build an overhead bridge on Second avenue, near Bates street, in order to do away with a grade crossing.

PERSONAL.

Charles S. Butts has accepted a position with the Toledo Traction Company.

It is announced that Tom L. Johnson is going to London and will endeavor to build an electric line in that city.

Samuel Oliver, of Rapid City, S. D., has purchased the plant and franchises of the Sturgis Electric Light & Railway Company.

George B. Hendricks, superintendent of the Fort Worth (Tex.) Street Railway Company, resigned March 1, after eight years of service.

Col. G. W. Parker, has been elected president of the Springfield (Mo.) Traction Company, to succeed his son, C. M. Parker, who recently resigned.

John M. Blatt resigned as superintendent of the Milwaukee, Racine & Kenosha Electric Railway Company on March 1, and will return to Cleveland.

Edwin Warner has been chosen secretary and treasurer of the Birmingham (Ala.) Railway & Electric Company, and has taken charge of his new work.

E. L. Simonton, electrician of the Lincoln (Ill.) Electric Street Railway, who has acted as superintendent since the appointment of a receiver, has resigned .

I. S. Tivoli, who has been general manager of the tramways of Alexandria, Egypt, has resigned and is now engaged in the commission business in that city.

Charles Alderman has resigned as city engineer of Eau Claire, Wis., to undertake construction work for a Boston syndicate now building an electric railway in Ohio.

John Kerwin, superintendent of construction of the Brunswick Traction Company, New Brunswick, N. J., has returned from a two months' visit to England and Ireland.

Mr. Bradley, formerly with the Hull (Que.) Electric Railway, has been appointed superintendent of the Cornwall (Que.) Electric Street Railway, and assumed his duties.

Ira A. McCormack, general superintendent of the Brooklyn Heights Railroad, while working on one of the sweepers during the storm last month had one leg badly frozen.

H. G. Fleming, for six years general manager of the Little Rock (Ark.) Traction & Electric Company, has resigned, and is succeeded by Walter A. Badger, formerly of Boston.

P. J. Callahan has been promoted from chief dispatcher of the United Traction Company, Pittsburg, to the superintendency; he is succeeded by John Lowrie, formerly division dispatcher.

John Murphy, general manager of the United Traction Company, of Pittsburg, was, March 1, appointed general manager of the Allegheny County Light Company; he will fill both positions.

T. G. Janney, chief engineer of the electric line between Chester, Pa., and Wilmington, resigned March 1, to become superintendent of the Bed Rock Dredging Company, Boise Basin, Idaho.

Edwin W. Decker, superintendent of the Portland (Me.) & Yarmouth Electric Railway since June last, resigned on March 1. General Manager L. B. Wheilden will act as superintendent also.

Oscar R. Lewis, assistant superintendent of the Pawtucket (R. I.) Street Railway Company, was married to Miss Alice M. Wood, daughter of George B. Wood, of Leominster, Mass., on February 22, 1899.

H. H. Archer, formerly superintendent of the Wilmington (Del.) City Railway Company, has accepted a position with an English syndicate as manager of an electric railway in the Island of Trinidad in the British West Indies.

George B. M. Harvey, who figured in the purchase of the Havana street railways, and who is interested in various other electric railway investments, has purchased the "North American Review." This is not Mr. Harvey's first venture in journalism, for he was a correspondent, reporter and editor at an early age, and in 1893 became editor-in-chief of the "New York World."

S. W. Jamison, treasurer and general manager of the Roanoke (Va.) Street Railway Company, has resigned. George C. McCahan, secretary, has been appointed superintendent, the office of manager having been abolished.

John Clifford has been promoted to superintendent of the Wilkesbarre (Pa.) & Wyoming Valley Traction Company, succeeding John C. Meixwell, resigned. Edward Irvin, of Kingston, succeeds Mr. Clifford as assistant superintendent.

W. D. Sargent, president and general manager of the American Brake Shoe Company, and vice-president and general manager of the Sargent Company, was married on February 14 to Miss May Partridge, daughter of the well-known capitalist of this city.

The engagement of Henry Nott Ransom, of Albany, to Miss Alice Gillet, daughter of Mr. and Mrs. Elmsie Gillet, of New York City, has been announced. Mr. Ransom has represented the Consolidated Car Heating Company for several years past, and is very favorably known by his large acquaintance.

C. C. Rush, who recently resigned as superintendent of the Joliet (Ill.) Railway Company to accept a similar position in Quincy, Ill., has been reappointed superintendent at Joliet, and will manage the two systems, making his headquarters at Joliet. N. C. Draper, who was temporarily manager of the Joliet road, will remove to Chicago.

W. S. Dimmock, general superintendent of the Omaha & Council Bluffs Railway & Bridge Company, when returning home on February 16 was startled by the whistle of a bullet close to his head; no report of a firearm was heard, and the police believe that a boy with an air gun did the shooting.

W. J. Johnston, founder and for 25 years publisher of the "Electrical World," celebrated the quarter-centennial issue by retiring from active electrical journalism. Mr. Johnston had built up in the "World" the foremost publication in its field, in the world, and should he desire to rest now on well-earned laurels we wish him long life to enjoy the fruits of deserved success.

Albert von Hoffman, inventor of the Falk cast-welded joint, has started on a trip to Mexico, where he will visit all the larger cities and will probably extend the tour to include the large cities of South America. In case he finds the opening favorable he may decide to locate in the City of Mexico, and in that event will represent a line of American street railway supplies. Mr. Hoffman speaks a number of languages and is at home in almost any part of the world.

E. K. Stone, who for several years past has been prominently known as manager of the lines at Quincy, Ill., has been greatly annoyed on account of the blunder of several publications which announced his death, when they should have stated it to be that of his father. The initials of Mr. Stone, Sr., were the same, and the elder

Stone many years ago occupied the position to which the son succeeded. The Mr. Stone who is so well known from his constant attendance at conventions, is we are glad to state just as active as ever.

H. M. Brinckerhoff, electrical engineer of the Metropolitan West Side Elevated Railway Company, of Chicago, has been appointed superintendent of motive power and way. He takes up the work which hitherto has been performed by W. E. Baker, who resigned as general superintendent, and has gone to New York to supervise the electrical equipment of the Manhattan Elevated Railway. Mr. Brinckerhoff had charge of the electrical construction work of the Metropolitan Elevated and has been with the company ever since. He is thoroughly conversant with every detail of the work, and is fully capable of managing the operating department of this fine property.

ELECTIONS.

At the annual meeting of the Beaver Valley Traction Company, Beaver Falls, Pa., held on Feb. 6th, 1899, Hartford P. Brown was chosen secretary and general manager, J. M. Buchanan president, M. C. Simpson vice-president and S. P. Stone treasurer. The newly elected directors are: Jno. M. Buchanan, R. S. Kennedy, A. M. Jolly, J. P. Stone, Hartford P. Brown, W. C. Simpson and T. P. Simpson.

The first meeting of the reorganized Fox River Electric Railway Company was held at Green Bay, Wis., on February 19, and officers elected as follows: President, H. S. Eldred; vice-president, A. M. Marphy; secretary, B. L. Parker; treasurer, Mitchell Joannes; board of directors, H. S. Eldred, A. M. Murphy, C. E. Vroman, J. H. Elmore and Mitchell Joannes. It was decided to retain the services of C. F. Goodrich as superintendent of the road when the company assumes full control.

The annual meetings of the Milwaukee (Wis.) Electric Railway & Light Company and the Milwaukee Heat, Light & Traction Company were held on February 20 and directors for the two companies elected as follows: Of the Railway Company, Henry C. Payne, Milwaukee, and C. W. Wetmore and George R. Sheldon, of New York, the other directors of the company holding over; of the Heat, Light & Traction Company, for one year, William Nelson Cromwell, C. W. Wetmore and C. A. Spofford, New York; for two years, Charles F. Pfister, Milwaukee, and George R. Sheldon and Arnold Marcus, New York; for three years, Henry C. Payne and F. G. Bigelow, Milwaukee, and Silas W. Burt, New York.

The Peoria (Ill.) & Pekin Traction Company has elected the following officers: President, T. J. Miller; vice-president, W. T. Trumbull, Salem, Mass.; secretary, L. E. Meyers, Chicago; treasurer, P. S. Saltonstall, Boston.

The stockholders of the New York & Philadelphia Traction Company met in Trenton last month and chose for directors: Gottfried Krueger, Edward H. Radel, Andrew Radel, J. Blair MacAfee and Henry Schnellbacker. Officers were elected as follows: President, Gottfried Krueger; vice-president, J. B. MacAfee; secretary and treasurer, E. H. Radel. The offices of the company were removed from Trenton to New Brunswick.

The Lexington (Ky.) Railway Company, a consolidation of former Lexington railway companies, at its annual meeting last month chose the following officers: President, C. J. Bronston; vice-president, W. J. Loughridge; secretary, J. C. Rogers; treasurer, R. P. Stoll; directors, the officers and C. H. Stoll, J. T. Shelby and J. R. Allen.

The Union Street Railway Company, recently in charge of Homer Loring and G. B. Morley as receivers, and the Inter-Urban Railway, of Saginaw, Mich., have been reorganized and consolidated, the receivership of the former company having been closed. The new company is the Saginaw Valley Traction Company, and its officers are: President, Homer Loring; treasurer, Frank D. Ewen; secretary, Charles S. Smith; superintendent, Lloyd M. Richardson; chief engineer, Henry E. Warren.

OBITUARY.

Frederic Candee Weir, president and general manager of the Weir Frog Company, Cincinnati, died on Wednesday, March 1.

Joseph Ebbsmith, who has been connected with the Birmingham Tramways Company and other English tramway enterprises, died last month at Monte, Grand Canary, at the age of 50 years.

John H. Callahan, secretary of the United Traction Company, of Pittsburg, died at his home on February 13, of peritonitis. Mr. Callahan was secretary of the Second Avenue Company before its consolidation with the United.

NEW PUBLICATIONS.

The "Electrical World" and "Electrical Engineer" consolidated under the joint title and are now issued weekly as one publication, to be known as "Electrical World and Electrical Engineer," under the editorship of T. Commerford Martin and W. D. Weaver, and the business management of James M. Wakeman, until recently of the "American Machinist," and A. C. Shaw.

The fourth annual report of the Boston Transit Commission dealing with the work on the Boston Subway to August 15, 1898, has been published. Like the former reports of this Commission, the present one contains much valuable information concerning this great undertaking and will be read with interest by the engineering profession. The Commission consists of George G. Crocker, Charles H. Dalton, Thomas J. Gargan, George F. Swain and Horace G. Allen. Howard A. Carson is chief engineer and B. Leighton Beal, secretary.

State Library Bulletin No. 10, of the Legislature Division, giving a summary and index of the legislation in the several states during 1898, and as far as possible complete to January, 1899, has been issued by the University of the State of New York. This bulletin digests and organizes the enormous annual output of state legislation so as to render available with a minimum of labor the most recent experience of other states. Besides a detailed summary, it contains a concise resume of the most important and distinctive laws and indicates the general trend of legislation by reference to laws of previous years. The bulletin is sent postpaid for 25 cents a copy or $1 a volume of five numbers. Checks or money orders should be made payable to University of the State of New York, and orders for the bulletin addressed Treasurer of the University.

UNIFORM CAPS.

Hohenadel Brothers, of 211-213 East Madison street, Chicago, are very extensive makers of regulation uniform caps, which have been found unequaled in style, excellence of workmanship, and durability both of color and material. The firm's long experience in this special line has served to make it thoroughly conversant with the requirements of the trade, and its product has given satisfaction wherever it has been tried. Caps are made of any material that may be desired and in every variety of shape, and the durability is guaranteed.

The illustration shows a conductor's cap made over a wire frame and covered with black or blue gros grain silk and serge or any color of cloth desired; embroidered letters, monograms, wreaths, etc., are added as desired. Hohenadel Brothers will be glad to quote prices and submit samples to those desiring them.

The council of Princeton, Ill., has held a number of informal meetings to consider the draft of a franchise which it is proposed to give the Princeton, Spring Valley & La Salle Railway Company now being promoted.

CONVENTION ANNOUNCEMENTS.

President Sergeant and Secretary Penington issued the following letter under date of March 10:

The American Street Railway Association will hold its eighteenth annual convention at Tattersalls, State and 16th streets, Chicago, Ill., on Tuesday, October 17, 1899, continuing in session four days.

The exhibits and displays of the supplymen are so important a part of our conventions, that the executive committee, in making arrangements for the meeting, has been as mindful of our wide-awake allies and as zealous in providing for their convenience and accommodation as for any other feature of the gathering.

We have held an executive session at Chicago, and give you in this circular the substance of the arrangements we have made in your interests.

The Exposition will be held in Tattersalls, the largest exposition hall in the city. We will have an abundance of floor space with all the light, heat and power required.

Every applicant is assured that he will get all the space desired as our resources in this direction are unlimited.

The convention will be held on the second floor of the exhibit hall, all stairways leading up from the inside, thus insuring the attention of all delegates and visitors to the exhibits.

The income from the sale of space will go to the American Street Railway Association. The executive committee of the Association has fixed the price at 10 cents per square foot, and ruled that no space of less than 100 sq. ft. will be assigned, but applicants may have as many multiples of this quantity as they wish, all in one body. Payment for space should be made to T. C. Penington, secretary and treasurer of the American Street Railway Association, 2020 State street, Chicago, Ill. Application for space should be made to Jas. R. Chapman, 444 North Clark street, Chicago, chairman committee on exhibits. Please state in your application for space the shape desired, number of feet wide and long, and the committee on exhibits will comply with your request if possible. Cars, sweepers and plows will be placed outside of the building on the street.

It is earnestly requested that all exhibits shall be in place and all work finished by Monday evening, October 16th, which is the evening prior to the opening of the convention. The local committee has rented the building from October 10th to 24th, so you can ship your goods early and will have ample time to remove them. Watchmen will be in charge of the building so that exhibits will be safe.

All goods should be marked to yourselves, Tattersalls, Chicago, care of H. W. Smith, successor to Anderson Transfer Company, 1618 State street, sending him bill of lading or advice that you have shipped goods in his care, giving particulars in regard to shipment and it will be delivered to your space in the exhibition hall. Ship all goods early to insure delivery in time and prepay charges. We hope to have you with us with an extensive display.

All articles intended for the exhibition shall be delivered at the building by the agent or owner, and at his expense, but the local committee has made arrangements with H. W. Smith (successor to Anderson Transfer Company) to haul and deliver all shipments to and from the building at low rates if directed in his care.

Articles will be placed on your space in the hall if you mark the number of space on your boxes. The number of your space will be mailed you in ample time for shipment.

All electrical connections for power and extra lights must be made at the expense of the exhibitor.

We expect a large exhibit and perhaps it would be in the interest of the exhibitors to make arrangements to have the building open in the evening, as it is well lighted, and the electrical companies expect to make a large display.

Space must be applied for by September 1. Assignments will be made as promptly as possible after that date and exhibitors notified of their location. Exhibits of like character will be grouped together and space will be assigned in the order of application.

The committee on exhibits will make contracts with carpenters, electrical workers and laborers at regular prices, so the exhibitors will not be overcharged for lumber, labor, etc.

Friday, the 20th, has been set apart by the executive committee for the examination of exhibits. No session of the Association will be held on that day and no entertainments of any kind will be given by the local committee, so all delegates will have ample time to call upon you and see what you have to show them.

The headquarters of the Association will be at the Auditorium Annex. All our hotels are within a radius of one-half mile and within ten minutes ride of the hall. They include Auditorium, Victoria, Leland, Great Northern, Wellington, Grand Pacific, Tremont and Sherman.

The executive committee advises all who desire rooms to apply at once, as they will be assigned in the order in which applications are received.

The executive committee found our Chicago friends so enthusiastic as to the coming meeting, and so hospitable in their greeting, that success is assured, the location being central and accessible; and the inquiries and information already received being so encouraging an unusually large attendance seems guaranteed.

The annual dinner will be held at the Auditorium, Friday, October 20th, at seven o'clock p. m. Tickets will be sold at the actual cost to the Association.

The railroads will sell tickets on the certificate plan. Be sure and leave your certificate with the clerk the first day of the convention, when you register; it will be signed, vised and ready for you on Thursday, October 19, 1899.

Please make your arrangements and applications as above noted as promptly as possible.

THE SALT QUESTION.

William Cummings, superintendent of the South Bend (Ind.) Street Railway Company, was last month fined for salting the tracks of the company in violation of a city ordinance. The case is to be appealed, and we shall perhaps get the views of the higher court as to whether such ordinances as these are reasonable.

The Memphis (Tenn.) Street Railway Company contemplates building a large car barn at an early date.

The city council of Louisville, Ky., has passed an ordinance ordering the street cars of that city to be equipped with vestibules.

Allentown, Pa., has passed a vestibule ordinance; the penalty for failing to equip cars as directed is a fine of $10 per day per car.

A company is reported to be securing consents to the building of an electric line from Canal Dover to Cadiz, O., to be continued later to Martin's Ferry, thus giving an all-electric route from Cleveland to Wheeling, W. Va.

A peculiar accident occurred at Miner's Mills, Pa., on February 7; an electric car had stopped at a railroad crossing to wait on a passing coal train, but the rails were so slippery that the car slid down and was struck by the train and thrown to one side. No one was seriously injured.

Dixon S. Carter, of Mayfield, Ky., is organizing a syndicate to build an electric road some 90 miles in length and will be pleased to receive catalogs of cars, motors, power house machinery, roadbed and line material, etc. The company contemplates doing a freight as well as a passenger business.

The proposed extension of the Cleveland & Chagrin Falls Electric Railroad from its present terminus in Chagrin Falls east to Warren will be built by the Chagrin Falls & Eastern Railroad. Work will be begun in time to have cars in operation by May 1. The cost of building, including cars, is estimated at $300,000. R. L. Palmer, general manager.

Work has begun on the foundations of the power house of the Northwestern Elevated Railroad Company, Chicago. The site is on Fullerton avenue, just east of Southport avenue and is about 3,000 ft. west of the elevated structure. The building is to be 112 ft. on Fullerton avenue by 255 ft. deep and will be 50 ft. high. The exterior is to be of brick and iron; the roof is to be of concrete. The plans call for a stack 15 ft. in diameter and 205 ft. high. The equipment is to comprise one 1,000-h. p. and three 2,000-h. p. direct connected units and 12 400-h. p. boilers. Coal will be supplied over a switch from the Evanston division of the Chicago, Milwaukee & St. Paul. The cost including equipment is estimated at $400,000.

FOREIGN FACTS.

It is proposed to construct an electric railway line between Parry Sound, Ont., and Depot Harbor.

The tramways committee of Newcastle recommends the adoption of the trolley system for the city tramways.

The British Electric Traction Company is expecting to lay a single track electric railway from Ardrossan to Saltcoats.

The British Electric Traction Company will soon construct an electric tramway between Kewhurst and St. Leonards, Bexhill.

Both the town council and the British Electric Traction Company have prepared plans for an electric tramway between Coatbridge and Airdrie.

The consolidation of all the tramways in Brussels seems likely and if this is accomplished important improvements and extensions will be made.

The Thomson-Houston Company has secured the contract to build 1¼ miles of electric tramway between Kalamata, Greece, and its sea port.

The Light Railways Commissioners have authorized a light railway in the county of Sutherland, England, between Forsinard, Melvich and Port Skerra.

The corporation of Riga, Russia, in conjunction with the Ministry of Interior proposes to build a system of electric tramways which will cost about $800,000.

In a Parliamentary paper the statement is made that there are 163 tramway undertakings in the United Kingdom representing a capital outlay of $61,200,000.

The annual report of the Halifax, Nova Scotia, Electric Tramway Company shows a gross income of $197,000 and a net profit of $54,784, which is a substantial increase over the preceding year.

A survey is in progress between Southport and Morecambe for an interurban electric tramway from Knott End, Fleetwood, to Morecambe. The route will be within view of the sea all the way.

The horse tramways of Ipswich, England, will soon be equipped for electric traction either by the company now owning the tramways or by the municipal authorities. Ipswich is a city of 60,000 inhabitants.

The city council of Aberdeen has sent a deputation to Glasgow and other cities to inspect the electric tramway systems, and it is reported that the committee is very favorably impressed with the trolley system.

The tramways committee of Liverpool has been empowered to ask bids for 20 motor cars to be delivered by June 1. The traffic is increasing so rapidly that even more cars will have to be purchased in the near future.

The electric tramways committee of Manchester, England, has unanimously agreed that in comparison between the relative merits of the trolley and the electric conduit systems the trolley is best suited to the needs of the city, and the question is now settled.

The engineer of Huddersfield has prepared plans for substituting electricity for steam as a motive power on two of the municipal tramway lines. It is expected that the work will begin at once and that it is the beginning of a change for the whole system.

The corporation of Doncaster has ordered the preliminary work done in preparing plans for an electric tramway 7½ miles in length. This will afford rapid transit to the residences of Balby, Hexthrope, Bentley and Wheatley with the city. The estimated cost is $350,000.

The town council of Glasgow has resolved to equip all the tramways in the city with the trolley. John Young, general manager, has submitted plans for this work and bids are asked on the equipment. The work to be immediately undertaken is estimated to cost over $270,000.

The Madras Tramway Company has made a contract with the British Electric Traction Company for the provision of the necessary funds to complete electrical equipment of all the lines. The total number of passengers carried during the past year numbered 3,643,000, a substantial increase over last year.

The capital stock of the Smith's Falls, Rideau & Southern Railway Company, amounting to $75,000 has been subscribed and work of construction will soon begin. An electric railway is to be built in the town of Smith's Falls to carry passengers and transport freight from the various mills and factories to the Canadian Pacific Railway. A line will also run to the Rideau Lakes.

After inspecting several electric tramway systems in Great Britain the tramways committee of Aberdeen unanimously recommends that the trolley system be adopted and that the Woodside line be equipped for electric traction at once. It is intended to call for bids for rails, bonds, wire, power station machinery and eight motor cars immediately. The estimated expenditures are to be $166,000.

The Giovi railroad tunnel near Genoa, Italy, is to be equipped for electric traction. It was only a few months ago that an accident occurred on account of the engineer and fireman being overcome by gases from a preceding train. The new electric power station will be capable of supplying current for 2,500 cars per day.

The Hamilton, Chedoke & Ancaster Electric Street Railway Company has applied for powers to increase its capital stock from $100,000 to $300,000, and to build a line to Brantford. The following are the officers: President, J. M. Clark; vice-president, M. Ryan; other directors, J. R. Lowell, R. J. Brodie, A. Patterson; secretary-treasurer, R. A. Bennett.

A new system of guard wires is to be adopted for the electric tramway lines in Leeds, for the grounded iron wires have been found inadequate for the protection of the telephone and telegraph wires. It is now proposed to place a wood strip between and above the trolley wires at such a height as to prevent any falling wires coming in contact with them.

In Buenos Ayres the same results have been experienced with suburban electric railways as in the United States. The La Capital Tramways line extends 10 miles out of the city and this territory has developed with great rapidity. Suburban residences have been built along the line as far out as the village of Flores, rapid transit being the sole cause of this growth.

The Dunedin City & Suburban Tramway Company, of Dunedin, New Zealand, has decided to equip the tramway lines for electric traction. D. R. Eunson is manager of the company and is also general manager of the Mornington tramway which is a cable road. Additional power is needed for the cable operation and the company contemplates purchasing a vertical engine.

In a paper read before the Birmingham Association of Engineers it was stated that the trolley lines of Leeds cost 7.1 cents per car-mile for operation and this was increased to 17.2 cents per car-mile when repairs, interest and depreciation were added. Manager J. Young, of the Glasgow corporation tramways, says that the operating expenses of the electric cars on the Springburn line is 13 cents per car-mile which is increased to 17.24 cents per car-mile by interest and sinking-fund.

Among the tramway projects in the British Isles may be mentioned the following: It is proposed to construct an electric line from Cruden Bay hotel to Cruden Bay station in Aberdeen. A provisional order has been granted to build electric tramways in Barking. Plans for electric tramways for Bath are maturing. The

proposed electric lines in Darlington are estimated to cost $750,000. A tramway line is to be built in Newcastle-under-Lyne from George street to London road. Rapid progress is being made in the construction and equipment of the electric tramways of St. Helens. Walsall proposes to purchase and equip the tramway lines for electric traction.

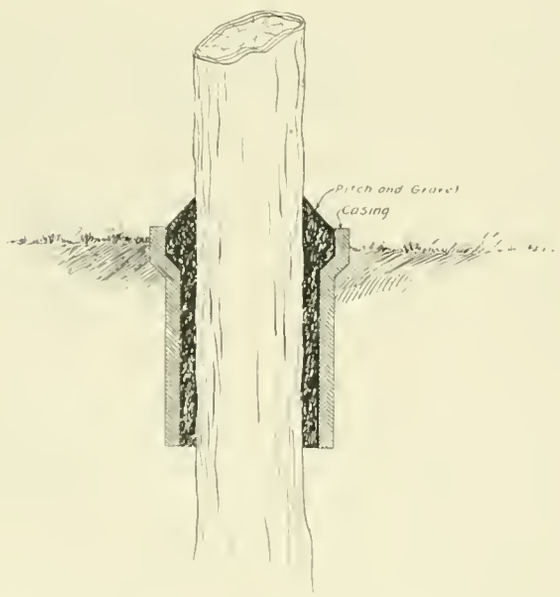
The Paris, Lyons & Mediterranean Railway Company is about to construct an electric railway from Saint Gervais-les-Bains to Chamonix, at the foot of Mount Blanc for carrying both passengers and freight. A third rail will be used for a conductor and a rack will be employed for the steep grades. The current will be supplied from a water power station at Chedde on the River Arve. The line is to be meter gage and 12½ miles long.

U. S. Consul Smith, of Moscow, sends this information:

"All contractors who are desirous of bidding for the construction of electric railroads in this city should make application to the city council not later than April 12. The sum of 750 rubles ($375) must accompany each application. The council will give all parties presenting applications the terms and conditions of the concessions, with all necessary drawings and statistics as to the working of the tramways in Moscow for the past five years, profits of the different localities, list of lines existing, and approximate prices for making out the estimates. For foreign bidders, there will be issued copies of the contracts printed in foreign languages, which will be sent on demand to all electrical companies. Copies will be sold to all applicants desiring particulars of the contract to be issued. The date of presenting the final tenders will be October 1, 1899."

TO PRESERVE WOOD POLES.

The accompanying illustration shows a method of protecting wooden poles at the surface of the ground from decay. A terra cotta casing, 24 in. long and from 2 to 3 in. larger in diameter than the pole, is placed so that it projects above the ground line about 2 in. In setting new poles a solid casing can be used, but for poles already planted a two-part casing is designed with beveled grooves, which



make a good joint. The space between the pole and casing is filled in with asphalt or common roofing pitch and clean gravel, forming a solid water and air tight casing about the pole where it needs protection. Gravel and pitch are the best materials to use, for many poles have season cracks in them and these will be filled with the hot pitch, which will prevent dampness from penetrating the pole. The designer, H. L. Dubois, claims that the life of poles so protected will be doubled.

A bill introduced in the New Jersey legislature provides that 10 hours shall constitute a day's work for street railway employes.

A FAST SUBURBAN CAR.

The Brockton Street Railway Company, of Brockton, Massachusetts, has recently purchased from the J. G. Brill Company a number of cars intended for very fast, heavy suburban service. While they are not of unusual length, having only 25-ft. bodies, they are provided with two 50-h. p. motors, which gives them a power and speed not commonly found on cars of the class. In many respects these cars resemble those recently purchased from the same builders by the Mansfield & Eastern Railway, yet the larger size of the motors make the car much more powerful, enabling it if necessary to haul a trailer and in winter to cope with snow.

These cars are mounted on No. 27 G trucks and weigh complete 20,000 lbs. The wheels are 33 in. in diameter and the wheel base is 4 ft. The long half-elliptics, the spring links and the journal springs combined, make these cars ride very easily. The length of the body over the end panels is 25 ft. 4 in., and over the buffers 36 ft. 5 in. The width is 7 ft. 5 in. at the sills and 8 ft. at the posts. The platforms are 4 ft. 6 in. in length. The vestibules, entirely enclosing the platform, have round ends and folding doors; the lower portion

FAST SUBURBAN CAR.

of each vestibule is sheathed in steel. The buffers are of the Brill angle iron pattern. Two sand boxes are provided.

From the underside of the sills to the rails is 31 in.; the platforms are dropped so that the step with a 13-in. riser is 16½ in. from the rail. The cars seat 36 persons and are fitted with plush covered, spring upholstered, walkover seats. The interior finish is quartered oak.

The cars are fitted with Littell track scrapers whose value has been well demonstrated during the past winter. Cars are frequently stalled by a light snow falling in upon the rails after the passage of a plow or sweeper, and trifling drifts sometimes render them unable to move when they have ample power to remove the snow in front of them if the wheels could only be kept in contact with the rails. This can be accomplished by the use of a scraper and the Littell scraper, owing to its great strength and simplicity of mechanism, overcomes the objections which have ordinarily been urged against scrapers. In the early hours of a snow storm its work is nearly equal to that of a plow and it has peculiar advantages for clearing the track possessed by no other piece of apparatus. It will be seen from the engraving that when not in use it is entirely out of the way of obstructions which might possibly injure it, but it can be dropped instantaneously by the mere touch of the toe against the controlling lever.

Dick, Kerr & Co. have received an order for 70 motor cars from the corporation of Bolton, which is the largest order of the kind so far placed by any municipality in Great Britain. This includes the car bodies, trucks, motors, controllers and air brakes with axle-driven compressor.

In a suit against the Market Street Railway Company, of San Francisco, the court ruled that an owner of the company's bonds and stock was disqualified as a juror.

The Big Consolidated road, of Cleveland, has inaugurated a new schedule giving increased service; 15 new cars have recently been put on by reason of the changes.

HALF FARES.

Frank May, Sr., is the president of the reorganized Fredonia & Dunkirk (N. Y.) Street Railway Company.

The Indiana Electric Railway, of Goshen, Ind., intends to complete its line between South Bend and Elkhart during the coming summer.

It is announced that the Pennsylvania & Ohio Railway Company, of Ashtabula, O., will soon commence work between Painesville and Conneaut.

It is stated that responsible parties have agreed to provide money for an electric railway at Mankato, Minn., provided $15,000 be subscribed by local men.

Michael C. Galvin, conductor, and Thomas Hiney, motorman, who were in charge of one of the cars in the collision at Worcester, Mass., on December 21 last, have been indicted for manslaughter.

Published statements that George N. Stone, of Cincinnati, was to become manager of the Cincinnati Street Railway Company, Mr. Kilgour retaining the presidency, are positively denied by Mr. Stone.

The two street railways and the Hercules Ice Company, of Lexington, Ky., have been consolidated under the name of the Lexington Railway Company; the capital stock of the new company is $800,000.

It is stated that the Whitney-Widener-Elkins syndicate has acquired control of the Electric Storage Battery Company, of Philadelphia, with which the syndicate has recently made some large contracts.

The Los Angeles (Cal.) Railway Company in February made a trust deed to the Union Trust Company, of San Francisco, to secure bonds for $5,000,000. The deed carried revenue stamps aggregating $2,500.

In a suit against the Toledo Traction Company, the plaintiff, who had been given a transfer wrongly punched, was awarded 11 cents damages, 10 cents being for extra fares he was compelled to pay; he had sued for $300.

The Bay Cities Consolidated Railway Company, of Bay City, Mich., has ordered six new double motor equipments which it is expected will be put in service May 1. Numerous improvements will be made during the coming season.

The question of street car service is being agitated in Mankato, Minn., and some local capitalists seem inclined to support the project. It is proposed to combine the railway and electric light undertakings and have one power station for both.

On February 16, Joseph R. Megrue, of New York City, was appointed temporary receiver of the Niagara Falls & Lewiston Railroad Company, commonly known as the Gorge road. The application was made by a majority of the stockholders.

The Sherbrooke, Canada, Street Railway Company has been purchased by F. Thompson & Co., of that city. They have acquired the Brompton falls water power and will increase the number of cars now in operation and build a line to North Hatley.

The street railways of Cleveland report an increase of gross earnings for January as compared with January, 1898. The increase was 3.4 per cent for the Big Consolidated, 45.3 per cent for the Lorain & Cleveland, and 12.5 for the Cleveland, Painesville & Eastern.

The operation of the Frederick City & Middletown (Md.) electric line has resulted in a marked increase in the population of Middletown. Many new houses have been built, but notwithstanding this many families desiring to locate there cannot secure houses.

During the cold weather last month the Toledo Traction Company made arrangements for giving its conductors and motormen warm lunches, with hot coffee served at more frequent intervals, a piece of "paternalism" which was greatly appreciated by the men.

The Winnipeg Electric Street Railway Company has been notified by the city council to build a line on Sherbrooke street from Portage avenue to Notre Dame avenue to be commenced by May 15, and also the cars of the company must be equipped with fenders.

February 11, a car on the McKeesport, Wilmerding & Duquesne Railway jumped the track just as it left the viaduct over the Baltimore & Ohio Railroad, and was wrecked by striking a neighboring building. Of over 60 passengers in the car only one was seriously injured.

The postmasters of Moline, Davenport and Rock Island have been discussing a plan for a trolley mail car service with General Manager Lardner, of the Tri-City Railway Company. If the approval of the department can be secured two mail cars will be put in service.

March 13 the Cook County (Ill.) Commissioners granted the Northern Electric Railway Company a 20-year franchise that will carry the projected line to Elgin as far as River Grove. Franchises will be asked for other towns between River Grove and Elgin, but the company has not given out what the route will be.

The Wheeling Railway Company took advantage of the very cold weather in February to lay a power cable on the bed of the Ohio river from the power station in Wheeling, W. Va., to West Wheeling, O. A channel was cut in the ice across the river and the cable lowered through it. The small station furnishing current to the Ohio division can now be abandoned.

On the evening of March 9, a south-bound electric car with 40 passengers on board, narrowly escaped running into the Chicago river, near Division street. The draw in the bridge was open, and before the car stopped the forward wheels were over the edge of the abutment. Four passengers were slightly injured in the panic that followed the accident; the motorman jumped into the river.

An interesting and unusual shut-down is reported from Kokomo, Ind. On March 11, an engineer formerly in the employ of the street railway entered the power house armed with a shotgun and opened fire on the employes, one of whom was wounded. When alone he shut down the engines and held possession for over an hour, until the sheriff and posse captured him; he is insane.

The Massena Electric Street Railway Company of Massena, St. Lawrence county, N. Y., has been incorporated; capital $100,000. Directors, Thomas H. Gillespie, H. A. Johnson, E. M. Stathers, Howard Hasbrouck, Edward M. Nolan, Thomas D. Harris, Willard A. Esselstyne, James R. Jones of New York and Robert Swan of Massena.

The Manistee (Mich.), Filer City & Eastlake Railway Company, of which G. A. Hart is president, is building three miles of road and constructing a park on the shore of Lake Michigan, where a theater and a number of cottages will be built. Eight new cars will be purchased, making 30 in all. A new engine room, 70 ft. by 70 ft., has been built, and a 750-h. p. cross-compound Corliss engine installed. When completed this road will comprise 14 miles of track, connecting all the villages around Manistee.

It is reported that the Great Northern Railroad is seriously considering electric traction for hauling its trains from Leavenworth, Wash., to Skykomish, Wash., a distance of 65 miles. The company is now building a tunnel 13,228 ft. long, located between these points, in which the problem of ventilation would be difficult of solution were steam locomotives used. If electricity is decided upon a 65-mile section will be so equipped, power being generated at a waterfall in the Tumwater canon.

March 1, the safe in the office of the Jacksonville (Fla.) Street Railway Company was opened and $400 stolen.

The Seattle & Tacoma (Wash.) Electric Railroad Company has applied for franchises for a line to connect these cities.

The Brooklyn Avenue Railway Company, of Kansas City, Mo., has been granted franchise in streets connecting its 10th avenue and Northwest branches.

New schedules on the Everett lines of Cleveland have increased the speed of night cars to 17 miles per hour, a change regarded with great approval by patrons.

The Metropolitan Street Railway, of Kansas City, Mo., has been authorized to build a steel viaduct and to run its union depot cars through the elevated road tunnel.

A suit has been begun to prevent the officers and stockholders of the City Railway Company, Fort Worth, Tex., from selling or otherwise disposing of that property.

The preliminary survey for an electric road from Cincinnati through Madisonville, Loveland, Foster and Kings Mills to Lebanon, O., was completed on February 21.

The Brunswick Traction Company, of New Brunswick, N. J., has ordered six large open cars for April delivery and 10 closed cars, for use on the branch lines to Somerville and Plainfield.

February 23, the first train was run over the extension of the Bergen County (N. J.) Traction Company's line from Fort Lee to the Hackensack river. The line was opened for traffic on March 1.

The Brooklyn (N. Y.) & Brighton Beach Railroad, now operated under a lease by the Kings County Elevated, will be sold March 21, and it is stated that the Brooklyn Rapid Transit Company will endeavor to secure the property.

At a recent meeting held in Chicago the directors of the Rock River Electric Railway Company, of Rockford, Ill., decided upon beginning the work of construction as soon as the weather permits. E. M. Hopkins is president of the company.

Press reports state that Senor Castanada, who purchased the Havana Tramways, and four of the directors of the company have been indicted for fraud connected with the transfer of the property; it is claimed that Castanada was the lowest bidder.

The Chicago city council has granted a 15-year franchise to the Northern Electric Railway Company, for a line between the 27th ward and the town of Cicero. This company is controlled by Ohio parties and contemplates extensions to Aurora and Elgin.

At the annual meeting of the Louisville (Ky.) Railway Company, held on February 15, President T. J. Minary submitted his report showing gross receipts of $1,297,394, and expenses including operation, taxes, interest and dividend on preferred stock, of $1,273,181.

A Chicago attorney recently sued the Chicago City Railway to recover the 5-cent fare paid, because he was carried one block past his destination; the court held that the evidence did not show a breach of contract on the part of the company and he failed to recover.

Joseph L. Lovett, of Emilie, Pa., writes us that he has secured the franchise and right of way to build a trolley line between Trenton, N. J., to Philadelphia, Pa., a distance of 12 miles. It is intended to have this road built in the spring.

The property of the People's Railway Company, St. Louis, which has been in the hands of F. B. Brownell, receiver, was sold on February 19, to August Gehner for $500,000. The company has 9½ miles of cable track and was capitalized at $1,000,000 and bonded for $1,000,000.

A disagreement has arisen among the directors of the Syracuse (N. Y.) Rapid Transit Company as to the desirability of purchasing the stock of the Syracuse & East Side Street Railway Company, and the minority of the board secured a temporary injunction restraining the purchase.

The Chicago Electric Traction Company has let contracts for the line from Blue Island to Harvey, a distance of about eight miles. Work will be pushed in the spring. The company recently acquired the two miles of horse car road in Harvey and will change this to conform with its other lines.

On February 17, about 7 o'clock in the evening, 800 ft. of live trolley wire was cut from the overhead line of the Belleville (Ill.) Electric Railway Company. The theft occurred in the town of Winstanley Park and this is not the first time that the company has suffered from such depredations here.

The Peoria (Ill.) & Pekin Traction Company has ordered 1,200 tons of rails and promises to have a portion of its line in operation by July 1, and the whole completed by October. The contract for the bridge over the Illinois river has been let to the Schultz Bridge & Iron Works, of Pittsburg; this bridge is 1,004 ft. long and will cost $125,000.

We are advised by W. H. Davis, general manager of the Quakertown (Pa.) Traction Company, that an extension of the line will be made to Doylestown via Perkasie, Benjamin, Silverdale, Blooming Glen, Dublin and Fountainsville, a distance of 20 miles. All the rights of way have been secured and it is hoped to have the line running to Perkasie by May 1.

The passenger earnings of the Brooklyn Rapid Transit Company's system for February, 1899, were $370,544 as against $369,420 in February, 1898, and $343,853 in February, 1897. For the eight months ending February 28, 1899, the increase was 12.8 per cent of the same period of the previous year, and 17 per cent over the eight months ending February, 1897.

The project of extending the Evansville (Ind.), Suburban & Newburgh Railroad to Rockport, Ind., is now being agitated. The plan has been considered several times in the last few years, but the proposal of an Ohio company to build an electric line through this territory has again aroused the Evansville, Suburban & Newburgh Company to action; this is a dummy road.

The Southwest Missouri Electric Railway Company has put in service two cars which maintain a fast schedule between Carthage and Joplin, a distance of over 18 miles. The time to make the trip has been shortened by these two cars from one hour and a half to 55 minutes. There are four stops, at Carthage, Carterville, Webb City and Joplin, besides four railroad crossings where the cars have to stop and be flagged before proceeding. The first through car leaves Carthage at 8 a. m. and each hour and a half thereafter until 11 p. m. These cars are equipped with two 50-h. p. motors and are capable of running 40 miles an hour. It is stated that this fast service is drawing heavily upon the patronage of the competing steam road.

W. F. Sadler, Jr., informs us that the Trenton, Lawrenceville & Princeton Railroad Company has been incorporated at Trenton, N. J., capitalized at $200,000, with the following directors: James L. Branson, president, and Henry C. Parry, vice-president, of Langhorne, Pa.; W. F. Sadler, Jr., A. Crozer Reeves and Wallace Buckman, of Trenton, N. J., and Ed. C. Williamson, of Morrisville, Pa. The company purposes to build an electric line, 10 miles in length, work to commence as soon as the weather permits. Bids are wanted for all construction work as well as for equipment. The profile for grading can be seen at the company's offices, 25 and 26 Forst-Richey building, Trenton, and specifications for work will be mailed upon application. Address all communications to Wm. C. Parry, general manager, Langhorne, Pa.

BLIZZARD IN EASTERN PENNSYLVANIA.

The two views here shown were taken on the Easton, Palmer & Bethlehem Street Railway, at Butztown, Pa. This section of country has little or no snow during an average winter, but this winter has been an exceptionally long and hard one, and on two occasions has been visited by blizzards. The electric railways have not been suitably equipped for fighting such snow storms and have had much to contend with during the past three months, but by constant diligence and hard work the lines have been kept open for traffic with few and brief interruptions. These conditions have been particularly hard on interurban lines passing through open country. The pictures prove that Superintendent Chas. H. Cox, of the Easton, Palmer & Bethlehem Street Railway Company, succeeded in operating his cars even with the snow drifts piled as high as the car roofs.

SCENES AT BUTZTOWN, PA.

STREET RAILWAYS OF WASHINGTON CITY.

From the annual reports of the street railways operating in the District of Columbia we extract the following data as to their operation during 1898:

The gross passenger earnings of the Capital Traction Company were $932,170, and the total gross earnings $933,177. Operating expenses were $537,991 and dividends, interest and taxes, $411,107; the surplus for the year was $44,079. During the early part of the year, that is, until a few weeks after the opening of the underground system, the receipts of this company were small, and the fact that so good a showing has been made is cause for congratulation. The expense of installing the electrical underground system was larger than was estimated by the company, owing to the final decision to put the system on the Seventh street line. The total cost of the improvement was $1,296,291.78. Bonds for $1,000,000 were authorized. The insurance on the burned out power-house was $250,000. It was, therefore, necessary to apply $37,000 of the receipts of the road to the construction account. The bonds have not been actually issued; they bear 5 per cent on their face and have been given as collateral on which loans have been placed at about 4 per cent.

The Metropolitan Railroad Company's receipts from passengers were $822,430, and the total gross earnings $836,819. The operating expenses, including improvements, were $471,358; taxes were, $38,565; interest on bonded debt, $143,691; dividends, $74,920. Deducting the amount spent in improvements, $46,776; the operating expenses were 51 per cent of the gross receipts. The number of passengers carried was 18,995,264.

The Columbia Railway Company is controlled by the same stockholders who control the Metropolitan. Its passenger receipts were $170,021; and the gross earnings, $171,397. Operating expenses were $76,180, which is 44.4 per cent of the gross receipts. Taxes were $7,386; interest, $30,000; dividends, $24,000. The amount expended for real estate and improvements was $24,921. This road has 5.6 miles of track.

The gross receipts of the Washington & Great Falls Electric Railway Company for the year were $47,764. Operating expenses were $22,713; expended for construction and equipment, $8,072; for right of way and real estate, $576. The excess of earnings over expenditures is $8,695, which is a better showing than made by any of the other suburban roads of Washington. This road is 7 miles long and carried 998,854 passengers.

The City & Suburban Railway Company (a consolidation of the Eckington & Soldiers' Home Railway Company and the Maryland & Washington Railway Company) has 31 miles of track, and the earnings of the property for the year were $82,551, and the total deficit, $58,621. The Anacostia & Potomac River Railway Company earned $32,743; it barely paid operating expenses. The Georgetown & Tenalleytown Railway Company earned $24,225; the total deficit was $3,966. The Brightwood Railway Company earned $55,935; its operating expenses were $47,565. The Capital Railway earned $18,609; the total deficit was $23,895. These roads are now controlled by a syndicate, whose principal members are O. T. Crosby, F. C. Stevens and C. A. Lieb. The Senate committee on the District of Columbia has favorably reported a bill permitting the consolidation of these syndicate roads and also the Washington, Woodside & Forest Glen Railway & Power Company, under the name of the Washington City Railway Company.

February 4 the directors of the Anacostia & Potomac River Railway Company voted to increase its capital stock from $100,000 to $2,000,000. This sum is to be devoted to installing the electric conduit system and acquiring the other syndicate properties.

The Capital Traction Company has made application for permission to reconstruct its U street line (the Chevy Chase line) and install the conduit system as used on the company's main line.

The District commissioners and the committees of congress are considering the advisability of requiring all street railway companies in the District to equip their cars with air brakes.

BUFFALO, HAMBURG & AURORA RAILWAY.

Work on the new interurban connecting the above named cities has already commenced and will be pushed to completion as rapidly as possible. The line will serve a large population and has fine prospects. U. L. Upson is secretary and general manager. Construction will be done by the Continental Construction Company, of Boston.

ECHOES FROM THE TRADE

The Star Brass Works, Kalamazoo, Mich., report the best of prospects for the coming season.

It is stated that the new Indianapolis street railway will order 100 new cars as soon as the contract with the city is closed.

The Central Traction Company, of Sioux City, Ia., has arranged for a $30,000 bond issue, the proceeds of which will go for buying new equipment and improvements.

The contract for constructing the elevated structure of the Boston Elevated Railway Company along Washington street and Main street, in Charlestown, has been awarded the Pencoyd Iron Works. The requirements state that the work must be completed by October 1 of this year.

The Chase Construction Company has removed its offices from 1113 to suite 1321 and 1322 Majestic building, Detroit. This change was due to the expanding business of the company in contracting for the building and equipping of electric railways and power stations of all kinds.

Harold P. Brown is about to introduce a new tie plate plastic rail bond especially for rebonding rails already in service and for steam roads adopting electric traction. The conductivity of this bond will equal that of the rail; it will last as long as the rail, and lengthens the life of the rail.

The Van Dorn & Dutton Company, of Cleveland, has just received an order for 22 trucks of the latest "99 B" type from the Cleveland Electric Railway Company. Business has never been so good with the company as it is at present and every department of the works is running up to its capacity.

The Miller-Knoblock Company, of South Bend, Ind., reports that it is receiving so many orders from all parts of the country that it must soon enlarge its plant or begin to decline orders. A. W. Morrell, general manager of the company, states that he had a large stock of copper bought when lower prices prevailed, and feels quite pleased because of this fact.

The Monarch Stove & Manufacturing Company, of Mansfield, O., suffered from a disastrous fire at its works on the night of February 9. The company immediately set about repairing the damage and we are gratified to be able to announce that its capacity will soon be larger than ever. The Monarch track cleaner, one of the company's specialties, is in great demand.

A new catalog has been published by the C. W. Hunt Company, of New York, illustrating types of hoisting engines and coal handling machinery made by the company. An account is given of the "noiseless conveyor," which is especially applicable for moving coal and ashes in large stations located in the cities. The motive power may be either steam or electricity.

After a careful investigation of the relative merits of the different sand boxes on the market, the Third Avenue Railroad Company, of New York, awarded the contract of equipping 160 new cars to E. F. DeWitt & Co., of Lansingburg, N. Y. Of this number 100 will be fitted with four boxes and 60 cars, each of which are built up from two of the cars now in operation, will be equipped with two boxes.

The abnormal increase in the market price of all metals, including all iron products, has compelled the Cahall Sales Department, of Pittsburg, to announce that there would be a 20 per cent increase in the price of boilers made by the company, this change taking place on March 1. Most of the iron works have orders booked so far ahead that it is difficult for the boiler makers to secure raw material even at the greatly augmented cost.

The branch factory of the Standard Paint Company in Hamburg, Germany, has been kept busy with foreign orders since it was opened last year. This factory makes insulating tape, armature and field coil varnish, rubberoid, roof paints, building sheathing and insulating papers. The P. & B. insulating tape and compounds has been in equal demand in this country, so that the company's business in 1898 was far in excess of that of any preceding year.

The Western Electric Company, of Chicago and New York, has just issued its illustrated catalog and price list of fan motors for 1899. Illustrations and complete descriptions of desk, bracket, ceiling and column mountings are given. The company makes both direct and alternating current motors; the greatest care has been exercised in their design, and they represent the highest stage of the art, both mechanically and electrically. The company has agencies in London, Antwerp and Paris.

The E. P. Allis Company, Milwaukee, has several notable railway contracts in hand: the South Side Elevated, Chicago, two 2,400-h. p. engines; the Metropolitan West Side Elevated, Chicago, two 2,400-h. p.; the Northwestern Elevated, Chicago, entire engine contract; the Toledo Traction Company, one vertical 1,500-h. p.; Consolidated, Grand Rapids, one 1,200-h. p., and the Cleveland Electric Railway, one 3,500-h. p. vertical. All the horizontal engines are cross compound condensing types. The five orders aggregate 15,800 horse power.

The Ajax Metal Company, of Philadelphia, advises us that it has placed on the market a metal that may be used in place of "Imported Tin" and sold at a much lower price. The new metal is known to the trade as "U. S. Tin," and its use, instead of imported tin in composition metals, results in sounder castings, more homogeneous in structure, richer in color, of greater tensile strength, and a better wearing metal in every way. U. S. tin can be used in the same proportions as the imported tin. The Ajax Metal Company will send to responsible parties small lots of U. S. tin on approval, and if satisfactory will make contracts covering a given time for their wants. This company over 18 years ago began marketing its "Ajax Tin," the sales of which metal have since reached millions of pounds per annum; its success with this metal led to its placing the new U. S. tin on the market. Correspondence is solicited.

The Western Electrical Supply Company, of St. Louis, Mo., has recently sent out to all parties having a copy of its Street Railway Catalog, No. 16, several insert pages calling attention to the many new lines which have been added to this department, or rather for which it has taken the general southwestern agency. This company represents many of the most prominent manufacturers in the country on a general line of street railway specialties, and is prepared to furnish factory prices on any article that is used in the construction and maintenance of a street railway, and it reports many large sales in this line since the season has opened, and anticipates a general increase not only in the railway, but throughout all the several departments the coming season. Parties anticipating the installation of an electric railway or making any improvements on their present system, will find it to their interest to communicate with the Western Electrical Supply Company on this subject.

We give herewith two out of a number of very flattering letters recently sent to the J. G. Brill Company, by whose courtesy we have received copies, and they will doubtless interest our readers. J. W. McFarland, superintendent of the Chattanooga (Tenn.) Electric Railway Company, writes: "Relative to your famous 21 E truck for four wheels, beg to say that we have been operating 10 of them all summer, and they have given the best of satisfaction. We

have ordered 10 more. I consider them the smoothest riding trucks and best truck on the market."

A letter from J. H. Wilson, manager of the Mobile (Ala.) Light & Railway Company, emphasizes most strongly the advantages of the metal seat end panels. The cars which he mentions as having gone to pieces after three years' use were built by a company which boasts of the best workmanship and prides itself on turning out the best wood work that can be done. It was unfortunately handicapped by the necessity of using wood instead of metal panels at the posts, with the result as told below: "What would be the cost of the 32 malleable seat end panels? We have only the two cars that need them, having two of the —— Company's cars that have absolutely got in worse condition after using three seasons than some second-hand horse cars, of your make, which we bought four years ago from West End Company, are in, although the West End Company had used them for 10 or 12 years. We use them as motor cars."

The Garton-Daniels Electric Company, of Keokuk, Ia., has just appointed Mayer & Englund, No. 10 South 10th street, Philadelphia, its representatives in the middle states territory for its line of railway lightning arresters.

The Allen & Morrison Brake Shoe & Manufacturing Company have just moved into much larger and convenient offices in the Fisher building, Chicago; the change became necessary by reason of rapidly increasing business. The new suite is number 604. The officers of the company are: F. R. Spear, president; A. J. Allen, vice-president, and F. D. Freeman, secretary and treasurer.

The "99 Famous" waste oil refiner and purifier, which is the latest improved type of this apparatus built by the Famous Filter Company, of St. Louis, is in use in the U. S. navy. Among other users are the Imperial Electric Light, Heat & Power Company, the Hamilton-Brown Shoe Company, the Regina Mills, the Wellman Dwyer Tobacco Company, the P. B. Mathiason Manufacturing Company, all of St. Louis, and the Bells Asbestos Company, of Johannesburg, South Africa.

The Central Electric Company, of Chicago, finds its present office rooms inadequate, and is about to make extensive changes in order to accommodate its increased office force. It states that, regardless of whether March comes in as a lion and goes out as a lamb, or the reverse, if its spring trade is any indication of later conditions, the season of 1899 will be a record breaker.

A. O. Schoonmaker ,of 158 William street, New York, the importer of mica and the maker of stamped mica segments and washers, has appointed the Electric Railway & Manufacturing Supply Company, of 548 Mission street, San Francisco, to represent him in the Pacific states. Mr. Schoonmaker furnishes mica in any form desired and segments and washers built up and gaged to any thickness.

The American Electrical Works always takes advantage of a holiday to send to the trade some attractive souvenir. February 22 of this year a steel engraving of the mansion house at Mount Vernon, the home of Washington, was chosen as most appropriate. It was accompanied by a circular giving the principal data concerning this historic building. Mr. Phillips is to be congratulated on the excellent choice he makes of souvenirs.

Babcock & Wilcox, Limited, of London, have organized the Deutsche Babcock & Wilcox Dampskesselwerke Gesellschaft, in Berlin, with a capital of $500,000, to establish works in Germany for the manufacture of Babcock & Wilcox boilers. A large portion of the capital will be employed in the expenditure for modern tools and machinery for the undertaking. Babcock & Wilcox, London, are large shareholders in the German company.

The Crouse-Hinds Electric Company, of Syracuse, has sent to the trade a handsome folder entitled "Official Endorsements." It contains over two dozen fac-simile letters from superintendents and general managers of street railway companies in all parts of the country testifying to the excellence of the Syracuse headlight. These letters are exact duplicates of the originals even to the color of the paper, and they form a most impressive testimonial.

L. C. Weir has been elected president and general manager of the Weir Frog Company to succeed Frederick Candee Weir, deceased. The company intends to increase its facilities for manufacturing and to continue its improvements as heretofore.

Eugene Munsell & Co., of New York and Chicago, report a very gratifying demand for their India and amber "Mica," of which they make a specialty for electrical insulation. Some very large orders have been received at both their Chicago and New York addresses.

The American Impulse Wheel Company, of New York, reports some very large electrical transmission work in hand and most valuable results from all its installations. The company is getting a large home and export trade, and the prospects for the coming season are most excellent.

The property of the Detroit Motor Works was sold under foreclosure proceedings on February 27, to the Union Trust Company for $49,500. The Detroit Motor Works were organized in 1892 by William C. Maybury, Ellwood T. Hance, F. A. Blades, W. H. Ellis, T. B. Rayl, Chas. W. Casgrain and executors of the will of J. Huff Jones.

The Ajax Metal Company, of Philadelphia, announces that it will send on approval any number of trolley wheels, up to 100, and meet competitors' figures on the first lot. This drastic measure is taken in order to prove to managers that the company means business and can afford to place sample wheels at a loss, because a trial show that they are better than others; when a trial is made the business of that road is secured.

Meysenburg & Badt, Monadnock block, Chicago, have just published a very complete catalog illustrating and describing the standard Weston electrical instruments. Meysenburg & Badt are western agents for the Weston Electrical Instrument Company, and in addition represent Harold P. Brown, A. L. Ide & Sons, the Helios Electric Company, Hugo Reisinger, the K. & W. Company, the Western Electric Company and the Ward-Leonard Electric Company.

The W. R. Garton Company, of Chicago, has been appointed central western agents for the Electric Equipment Company and also western agents of C. S. Knowles, of Boston. The company is the selling agent in this territory of the Partridge Carbon Company, Billings & Spencer Company, the Garton-Daniels Electric Company, the Miller-Knoblock Company and many others. A complete stock of railway supplies, including tape, insulated wire, trolley wheels, bushings, incandescent lamps and insulating material, is carried subject to hurry orders. "Armalac" and "enamelac," insulating compounds made by the Massachusetts Chemical Company, are held in stock.

Electrical engineers who are not already familiar with the value of "Micanite" as an insulator for commutator segments and rings, will do well to write the Mica Insulator Company, of New York and Chicago, regarding the same. It makes a specialty of furnishing segments for any style or type of machine, and has manufactured some segments recently as large as 30½ in. by 4 in. The company's sheet insulation manual and data book, giving break-down tests of its insulations and samples of goods, will prove very useful to builders of electrical machinery. A large stock of "Micanite" plates, cloth, tubes, paper, and "Empire" and "M. I. C. Compound" insulations is carried at New York and Chicago, also at the sales agencies in Cincinnati, St. Louis, San Francisco and Cleveland. The company reports a heavy business here and in Europe.

A. N. Tally, Jr., M. D., writing in the "United States Health Reports," says, in part:

"Millions of bacilli are found on one coin or piece of money or paper bill, though it may be in almost constant use and circulation. How much more have the bacilli which breed in the out-of-the-way nooks and corners and crevices of our household furniture a chance to multiply and attach themselves by myriads to the clothing or body of those coming in contact with them!

"To prevent this in as great a degree as possible 'Pantasote,' the famous furniture covering, has been devised and put on the market, a water-proof, grease-proof and stain-proof product, durable, inexpensive, and elegant. 'Pantasote' is a thoroughly meritorious article.

"From numerous inquiries received regarding 'Pantasote,' manufactured and for sale by the Pantasote Company, of No. 29 Broadway, New York City, we have had the matter referred to our experts for their investigation, and their complete reports are now filed, unanimously approved by our medical staff. Upon mature consideration of these reports as approved, we cordially extend to 'Pantasote,' the unqualified editorial and official indorsement of 'The United States Health Reports.'"

The Taylor Electric Truck Company, Troy, N. Y., is mailing a very attractive and handsomely illustrated catalog of the various single and double trucks manufactured by that concern. Details are given in a way that not only interests the reader but fully explains the points of merit in the Taylor truck.

McGill & Pomeroy, 317 Dearborn street, Chicago, the only exclusively street railway supply house in the west, have added to the lines of goods heretofore carried by taking the western agency for the Forest City Electric Company and also the agency for J. M. Atkinson & Co. McGill & Pomeroy report a continually increasing business, and we extend our congratulations upon their success.

The Western Electric Company carries the only stock of interior conduits in Chicago. As is well known the standard rubber-covered wires can be placed in these conduits without violating the Underwriters' rules.

The United States circuit court has authorized John C. McNulta, receiver of the National Bank of Illinois and of the Calumet Electric Street Railway Company, of Chicago, to dispose of the Calumet property, which is the principal asset of the bank, at his discretion.

George E. Pratt, Philadelphia representative of the Forsyth Brothers Company, of Chicago, and Elmer P. Morris, of New York, reports that last month was a good one and that during the first half of March he received orders for over 1,000 journal bearings and 13 miles of trolley and feed wire, besides car trimmings, trolley wheels, brake shoes, and smaller supplies. He has recently taken an order for 300 open car curtains with the new Forsyth adjustable fixture. The prospects are all for a large business.

GRAPHITE FOR CONTROLLERS.

C. D. Shepard, superintendent of the Palmer & Monson Street Railway Company, of Palmer, Mass., discusses the subject of controller lubrication as follows:

A lubricant of some sort must be used on the cylinders of controllers on all electric cars. Every electrician having charge of electric cars knows or has experienced the trouble pertaining to the use of any kind of grease or oil, by reason of dust sticking to the cylinder contacts, thereby cutting the cylinder and making poor contact, which causes the controllers to arc, thus destroying the life of the cylinder and fingers, also making it necessary to look over the controllers at least once a week and sometimes oftener. By the use of Dixon's No. 635 graphite this trouble can be remedied. Pure graphite being of high conductivity, and at the same time the best solid lubricant known, it has been demonstrated by practical experience that it is the only lubricant which dust will not stick to, and which will not interfere as a lubricant with making a sure contact between cylinder and fingers, giving a smooth surface on cylinder, allowing controller to be turned easily and smoothly, requiring attention only once a month.

To use this lubricant, clean the contact surface of the cylinder thoroughly with waste which has been dampened with a little kerosene oil, to remove all dust and dirt; then apply the graphite by rubbing smoothly and evenly over the surface of cylinder contacts, it not being necessary to apply any graphite on the fingers. All rough spots on fingers caused by arcing should be removed by file or sandpaper; all cuts or scratches which have been made by grit will become filled by the graphite, thus giving a smooth and even contact between cylinder and fingers.

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The superintendent of a Massachusetts road which was obliged to vestibule its cars, requires motormen to keep the front window down, in order that there may be no danger of accidents resulting from snow or moisture dimming the glass. The motormen have concluded they preferred to run without any vestibules.

Now that Marconi has demonstrated his ability to telegraph some 32 miles without wires, it remains for some still more ambitious discoverer to find a way of transmitting a railway current in the same manner. This, with the cars which substitutes ball bearing for wheels, and a millenium conscience for the passenger who beats his way, would make the operation of street railways one continual round of pleasure.

The daily papers have been printing sensational accounts of the sudden death of a conductor on a Connecticut road just as he was in the act of ringing up a fare, and attempt to draw the conclusion that the man rang up the fare by accident and the shock was too much for him. There was a time years ago when the manager might have suffered a stroke of something at the sight of one of his men registering a fare, but in the present case we are prepared to accept the report of the doctor that the man died from natural causes.

The press dispatches chronicle the attempt in Zurich, on April 2d, to operate a street car with liquid air, and add that if successful the new power will be adopted in general service on the city lines. Liquid air is certainly capable of the most wonderful accomplishments in the laboratory, and to what extent it may be utilized for the practical every day purposes of power has not yet been demonstrated. It may not be an evidence of wisdom in these days to pronounce in advance upon almost any theory however seemingly impossible; at the same time we are old fashioned enough to believe that liquid air will have considerable history to its account before it freezes out the trolley.

The municipal campaign in Chicago which resulted in the re election of Mr. Harrison as mayor was conducted largely on street railway lines. The worst charge that the mayor could bring against his Republican opponent, Mr. Carter, was that Mr. Yerkes advocated his candidacy rather than Mr. Harrison's. Mr. Carter in return paraded his "street railway record," showing how many times he had voted against franchises in the council. Mr. Altgeld accused both the Democratic and Republican candidates of favoring 20-year extensions of existing franchises and therefore robbing the present generation of Chicago of its natural rights, first among which he apparently placed the municipal ownership of street railways. In any event, the street railway interests of Chicago were to be made to suffer as much as possible, and the election went that way.

Rails are getting scarcer every day and the mills will not now take orders for delivery short of three or four months, at any price. With standard sections of T-rail at $25 to $27 per ton, and the other advances in construction materials of all kinds, the situation is not an encouraging one for proposed new lines. In fact we are already beginning to hear of several companies which had fully expected to build this spring, but which have decided to go over until next year. These were established roads, with plenty of money, but did not feel the extensions were sufficiently important to warrant building now.

Last month 714 men employed by the Citizens' Street Railroad Co., of Indianapolis, presented a petition to the city authorities asking that petitions advocating 3-cent fares be ignored, pointing out that they, the company's employes, would be the greatest sufferers from any unreasonable action which reduces the receipts of the company. The fact thus stated by the Indianapolis men is destined, we believe, to result in the organization of employes' associations, which by concerted action will be able to impress upon municipal legislators that the 3-cent fare propaganda is unpopular among a considerable class of men who have votes. And certainly each of these men has one or two friends who also have votes.

During the month past the last cable car was withdrawn from service in Baltimore, and now all the lines in the city are worked by the trolley system. While the cable system was the most economical of operation at the time it was constructed, the trolley has steadily forced its way until the day came when the company was obliged to abandon its expensive plants, and build others. It does not seem possible that as radical changes as the trolley wrought can ever occur again: yet, who can guarantee they will not?

Fitts is the appropriate name of a Chicago woman who is heading a self appointed delegation of other strong-minded females who are to do great things. Three years ago she started out to have the city of Milwaukee buy the street railway lines of that city, but her efforts being unappreciated she enlarged her scope by moving to Chicago. She is now industriously engaged in circulating cards bearing an appeal to the men to "Stand up in street cars and give the women seats;" because "You can vote for municipal ownership and stop this thing—they cannot." We believe Mrs. Fitts would find a great work among the Filipinos.

The recent high price of copper has made that metal particularly desirable, and the depredations of the copper thieves in all parts of the country have been unusually annoying during the past two months. While the country lines have generally suffered the most, city lines have not entirely escaped. From all parts of the country come reports of losses from trolley wires and rail bonds being taken. On one interurban line we inspected recently there was scarcely a bond left in an entire mile of track over which we walked. The line was far removed from any dwellings, and it was an easy matter for the two thieves to pass along the track after the last car

was off the line, and while one ripped the bonds off with tools, the other propelled the wheelbarrow. With copper at upwards of 16 cents a pound, a night's haul of five or six hundred pounds is worth something. With the difficulty of protecting the miles of interurban lines by night watchmen, it may be necessary for the various state associations to secure suitable legislation which shall impose unusually severe penalties for depredations of this kind, which cost a great deal more than is represented by the market value of raw copper. Then it would pay to make a determined effort to catch and convict a few offenders in each state, which ought to have a discouraging effect upon the others.

When a number of bills providing for the vestibuling of street cars were introduced in the New York Assembly and referred to the Committee on Railroads, the Albany Railway submitted an elaborate argument against their passage, which will be found given in full on another page. The line of reasoning is briefly as follows:

The law requires the company to exercise great care in choosing competent car operators, and that the employes shall exercise the utmost vigilance in the performance of their duties. To be vigilant they must use their eyes and ears, and often by a warning cry may apprise pedestrians of danger. A vestibule restricts the range of vision and prevents the car operator from hearing and from giving vocal warnings, and is therefore dangerous.

The experience of electric railways has been that in cold weather the glass portion of a vestibule cannot be kept free from fog, and that at night the motorman cannot see unless the front windows of the car proper are covered by a curtain. The conductor who occupies the rear platform is similarly handicapped by a vestibule. Also, by partially concealing the movements of both motorman and conductor the vestibules render more difficult the task of the companies' inspectors to detect careless and reckless employes.

The reason given by the advocates of the bills in question is sympathy for the car operators, and this sympathy for a small class overlooks the whole general public which may be endangered by the effort to protect car operators from wind and storm. Further, the sympathy in question is misplaced, as during the thirty-six years that the Albany Railway has operated street cars there is no record that any employe contracted any disease while operating either horse or electric cars that caused or hastened his death.

Some extracts from a report by the Committee on Railroads to the Board of Aldermen of New York City unfavorable to a fender ordinance are also given in connection with the protest of the Albany Railway.

The announcement of the death of Mr. Menard K. Bowen, president of the Chicago City Railway, was as great a surprise to his friends throughout the country as it was to the people of Chicago. An exceedingly severe and unyielding attack of appendicitis baffled the skill of the best surgeons in the city, the illness lasting only 48 hours. His success had been phenomenally rapid, having risen by steady promotions until he was the youngest president in the country in charge of interests as extensive, and in his sudden death a future of unusual promise has been cut short. Chicago and the entire street railway fraternity have suffered a great loss.

Detroit is nearer to municipal ownership than any city in this country has ever been, and if the plans of Governor Pingree continue to meet with success and with the same rapidity of action, Detroit will be in possession of the local lines of transportation before the next issue of this publication. As may be surmised, a study of the situation reveals a clearly defined political move, which more than bears out our prediction that municipal ownership in this country cannot be divorced from politics. That important matters have been pushed to final action with less deliberation than is generally given some little cross roads project, need occasion no surprise. At present Mr. Pingree controls the commission, of which he is the chief member. Some of the solid business men and institutions of the city deplore this railroading of the plan through without consulting the citizens, but that does not appear to count for much, and it is doubtful if their attempt to gain time in court will be of much avail.

Our special correspondent in Detroit reports the status of affairs elsewhere in this issue, and the full text of the McLeod bill will also be found.

The various plans which have been suggested during the past 10 years for a solution of the rapid transit problem in New York City, have covered the entire range and included a large number of impracticable schemes. Those which were based upon the construction, or the construction and operation by the municipality have failed to command the confidence of the people, who hesitated to commit so large an undertaking to the chances which attend political manipulation. For the first time a thoroughly responsible and business proposition is offered. It is that of the Metropolitan Street Railway Co., which proposes to construct a tunnel at its own expense and operate it in connection with its surface system. As every street railway man knows, if undertaken by Mr. Vreeland the enterprise will be carried out to prompt and satisfactory completion, and in a manner creditable to both parties. The work is expected to require three years, and it seems probable that the proposition will be accepted.

The announcement made April 3d that the Manhattan Elevated and the Third Avenue (surface) systems had effected a traffic agreement will scarcely have any distracting effect on the underground plans. The arrangement which is intended to force the long haul riders on to the elevated and make the locals use the surface line amounts to little more than a shifting of the present passengers, and as both lines are carrying to practically full capacity, will not increase facilities to any great extent. Nor will it be easy to drive the short distance passengers off the route they have taken for years.

It is now the fashion to talk of the enormously valuable privilege which is granted when a street railway is given a license to operate in the streets of a city, and to demand that the company be made to pay for this benefit. Whenever application is made for a street railway franchise in a city of such size that a passenger traffic of some magnitude is assured, the demands as to what the company shall pay the city in the way of special taxes, or a division of profits become exorbitant beyond all reason.

It is urged that the company ought to pay the city a large percentage of its gross receipts and to pave, clean, and light the streets or considerable portions of them in return for the privilege of using the streets.

These demands are based first on the assumption that as the city owns the streets it should receive a rental for the use of them. This proposition appears quite reasonable to many who would stand aghast at a plan on the part of the city to erect a toll gate at every street crossing. In principle the two schemes are identical and result in taxing the traveling public for the benefit of the whole public. The effect of a toll gate is apparent to every one, and consequently there are no projects for thus increasing the city's revenue; but when the same tax on traveling is filtered through a street railway it emerges in a disguise that succeeds in blinding many to the fact that it is a tax levied on the men who ride for the benefit of those who do not.

When the compensation demanded is formulated as an arrangement by which a street railway company shall pave, clean, or light the streets it is again a tax on the traveling public for the general good, but the advocacy of this proposition involves an admission that the city is not fulfilling its duties in his regard, in a satisfactory manner. We do not doubt but that were the care of the streets confided to a private corporation the work would be better done, but municipal government must be indeed a monumental failure if rank injustice must be done and men who are too poor to ride except on street cars, be taxed to maintain the streets in fit condition for the carriages of their better-to-do neighbors, because the street railway company can do the work in a more satisfactory manner than does the city.

When the streets are paved it is not the city nor the general public which foots the bill, but the owners of property fronting upon the street. If any one is to be paid why not these property owners, instead of the city?

Some new interurban cars have been put in service on the interurban line between Anderson and Elwood, Ind.

The Big Consolidated, of Cleveland, has recently ordered 50 new open cars so that it will not need to operate any closed cars during the summer season.

THE STREET RAILWAY AND THE DAILY PRESS.

One of the most exasperating things with which the manager has to contend is the attitude of the daily press. We are anxious to make particular exception in what follows, for such fair minded editors of daily papers as endeavor to be impartial, and while censuring the company or its manager, if cause is really given, on the other hand are equally ready to extend a word of commendation when the manager or company is entitled to it. We are satisfied, however, from a careful watch of events for many years, that of late where the glad hand is extended once, there are twenty times where censure is passed unjustly.

* * *

When the banks make unusually large clearings, or break all previous records in the amount of deposits, the papers immediately go into a state of expansion and hold it up in big type as an evidence of the growing prosperity and importance of their city. When an opposite state of affairs exist they say nothing. When the list of building permits for the week fills a quarter of a column it is deemed necessary to shout the glad tidings in three or four columns of details giving minute particulars of each structure and rejoicing in the solid growth of the best town in the state. When building is at low ebb you would never find it out if you read the paper, ads and all; and when some little manufacturing industry is looking for the location with the largest bonus, the same paper pounds away day after day trying to whip into line public spirited citizens to secure the "prize." But when the street railway is trying to enlarge and benefit a thousand where the little factory helps ten, that is all at once a different proposition and must be fought tooth and nail.

* * *

This would seem to indicate that the railway and its management, instead of being the good fellows which the bankers, and the architects and the man with the bench and the handful of tools are, do not know how to win the good graces of his highness the editor, nor how to command a position among the other business men of the city which entitles them to equal consideration. And yet nothing could be really farther from the truth. With very rare exceptions a stranger might go to every editor in the city, and his personal expression regarding the social position and business ability of the railway manager would be highly complimentary. Then why is it he thinks and says one thing, and prints another?

* * *

Success and popularity multiply themselves rapidly, and in the same manner and probably for the same reason there has grown up throughout the country an attitude of the press which is either hostile or unfair, or both, toward street railways. A few of the leading journals in different parts of the land with personal axes to grind and whose editorial policies are on the market at a price, piqued at their inability to hold companies up, turn about to teach them a lesson. So they flash a broadside on every possible occasion. In the smaller cities the newspaper satellites of the great dailies take their cue and so it becomes the popular thing to look upon a street railway as a natural target at which to aim all kinds of shot at every possible opportunity. And thus the thing spreads and seems to have become a custom and sort of unwritten law.

* * *

What we object to is the eminent unfairness of it all. The columns of the daily press are supposed to be open to the great reading public. Any man with a grievance of a public nature may here raise his voice in protest. The department "Vox Populi" is always in good working order. It does not seem to occur to the editor ever to investigate the standing or responsibility of the writer, who has a "kick to put up." He must sign his name to be sure, as an evidence of good faith and all that, but if his name appears in the city directory that is sufficient, and even this precaution is not always taken. He may be the most worthless loafer in the ward, one who could never make a success at anything honest or honorable, but this does not act as any barrier to his sending in by mail and securing the free publication in a prominent manner of criticisms, which are the essence of unfairness and statements regarding the business methods of a company into whose office he has never even entered. An analysis of the "protests" and "demands" and "kicks" which go to make up the contributions in question would rarely ever disclose the name of a business man in good standing, or one whose opinion in personal conversation would ever be listened to for one minute. Yet they readily secure valuable space in which to air their views, the publication of which tickles the vanity of the writer and in the mind of the publisher conveys the idea to the public that his paper is the people's bible.

* * *

It is much easier to pull down than to build up, to tear than to mend; to harm the reputation of an individual or concern than to repair it. The work of even the most skillful surgeon leaves some scar. If irresponsible persons who carried an account in even a dime savings bank were allowed in print constantly to question the doings of our oldest and best banks, it would inevitably do them harm even though it did not cause a run on the institution. Just so with the leading dry goods merchant, or grocer, or butcher. Because one chances to fall on a slippery sidewalk or is accidently served with an over corned piece of meat, is no good reason for rushing into print and venting one's spite and damaging another's business. A fly in the coffee might occur even in Delmonico's.

* * *

What we regard as unfair is the thoughtless printing of communications without first verifying them or at least seeking the other side, for there are two sides even to "Constant Reader's" plaintive wail that he dropped his nickel on the floor and the conductor made him pay just the same. A denial can never reach all who read the indictment, and why, moreover, should one be put continually to the necessity of proving his innocence. In this connection by no means the least unfair feature is that while "our columns are always open to the public," when the street railway wants to reply, being a corporation and not a public, it must pay handsomely for the "privilege," and then like as not have its statement garbled out of all shape.

* * *

But much more inexcusable than this is the editorial policy which "has it in" for a road, because in such instance the attack is premeditated and intentionally falsified. It is not by any means difficult to make the most sacred things ludicrous, or to convict a perfectly innocent person out of his own mouth; though no high minded person would do either. Hence it requires neither special aptitude or ability to prove a very plausible case against a street railway on almost any question, especially when the attorney for the defense is not allowed to be heard.

* * *

At the present time in a city of 100,000 the papers are indulging in a combined attack upon the street railway of that place. The road and equipment are in excellent condition, and operation of the system certainly a credit to the city and the management. If we were invited to criticise it we could say nothing worse than that in our judgment the manager is running more and better cars than the business of the road warrants. One paper has been particularly severe, having interests of its own to further at the expense of the railway. The editor urged the manager to contribute an article over his own name setting forth his side. He somewhat reluctantly consented to do so, and the article was printed. But in its editorial columns the same editor after apologizing for printing the contribution which was done as a great favor to the company, etc., in permitting the presentation to the public of the manager's views, etc., he proceeded to tear the article into ribbons and place such a false construction upon it, and to misinterpret what was said in such a manner that the latter end of the manager was worse than the first, and it will be many, many moons before he will allow himself to be flayed alive again in that manner.

* * *

As a general proposition, therefore, we are warranted in assuming that we cannot expect from the daily papers the same fair, unbiased consideration which is accorded to the average business man whom the paper must treat considerately if it expects to continue his advertising. The street railway has no occasion to spend thousands each year in advertising, and however politic it may be to subsidize the papers it is neither right nor is it business. If there is educational and missionary work to do through the press as there is frequently and legitimately, the company should pay for it, and does so generously. But this paying of money to chain the dogs, when one is not a tresspasser, but in the full possession of moral and legal rights supposed to be guaranteed by that document respectfully termed "our glorious constitution," is a transaction

which galls an honest man. The public do not dream of this, and the company has no means of telling them—and even if it could and did, the story would have to be repeated many times—so long has been their education otherwise.

* * *

Is there anything then which can be done to ameliorate our unfortunate condition? We would not fight Filipinos with poisoned arrows for that is savagery, but we would use the same medium to defend and protect our rights that are now employed to attack them. In other words as the printing press is used against us, let us turn to it for assistance. It is not necessary to put in an expensive printing plant, or any plant at all. A small monthly sheet can be issued at a very reasonable figure; when occasion demands, it can appear as a weekly. Let it be devoted to local interests; to the announcement of all the notices the company desires to address to its patrons. Let its spirit be dignified but earnest and very much alive. Pursue a patient course of education in which the good work the company is doing is set forth, not in any boastful manner, but in the same tenor the daily paper treats other local institutions it desires to commend.

Recount the improvements made for bettering the plant and service; arouse a feeling of pride in a worthy local undertaking. The public as a whole is neither unreasonable nor unmerciful, and we should not be surprised, considering its one-sided education, that it thinks exactly as it does. The passenger who grumbles at what seems a poor service during a snow storm, for instance, would be indulgent and even sympathetic if he had a detailed account of the efforts made to keep the lines open, and astonished at the amount of money spent in doing it.

When the local papers "roast" the road, make a dignified reply, but avoid any direct mention whatever of that attack which occasioned it, take all the replies and answers you please, but not as in response to any individual or article.

* * *

The expense as suggested will be much smaller than most of our readers imagine. The circulation must of course be free, and the distribution made on the cars. A suitable rack near the door with a "take one" or a bundle suspended by one corner will find more ready readers than would be supposed. If the little sheet is bright and spicy and contains some general reading matter of good quality in addition to local news outside company matters, it will soon find its way into the hearts and homes of the people. Sixteen pages or more, 6 x 9 in., stitched in pamphlet form would be handy to put in the pocket, or a more pretentious size, say 12 x 18 in., printed in four pages, is good. But above all come out good and strong for your own town. Talk its good qualities all the time. Make the most of its every advantage, and convince the people that you have its best interests at heart—as you ought to have, and undoubtedly do.

* * *

"But I don't know the first thing about making a newspaper," you remark doubtfully. Very likely, and perhaps you could not wind an armature yourself and do it well, but there are others who can. There are good newspaper men in every city whom you can get to do the work on the side, and who will simply need to be advised as to questions of policy and such facts and figures as you wish emphasized. This expense will not be great, nor will the printing bill, and with "a guaranteed circulation" as large as the daily papers combined, if you wish, the time will not be long before local merchants will want to advertise in your columns, and the sheet will at least be self sustaining. The other papers may frown on this new client for advertising patronage, but they are entitled to no consideration; they alone are responsible for it.

* * *

To such publishers as may read the above and feel we have unjustly arraigned the daily press we would repeat the assertion made at the outset. We have only grateful thanks and appreciation for such journals as are fair minded and are willing to give both sides equal consideration. We do not include such in our recommendation to the company to do some printing on its own account. But there are cities where there seems absolutely no other alternative, and as the poisoning process has been of long duration, the evil cannot be corrected in one month or two. It takes longer to unlearn a prejudice than to create it, but conscientious, patient, dignified, manly statements of facts will eventually make their impress on the public mind.

THE ACCOUNTANTS' ASSOCIATION.

President Calderwood and Secretary Brockway, of the Street Railway Accountants' Association of America, under date of Mar. 20, 1899, issued the following announcement:

"It is our privilege to announce that arrangements have been made as follows for the Third Annual Convention of this association.

"Agreeable to our by-laws the meeting will be held simultaneously with that of the American Street Railway Association at Tattersall's corner State and 16th Sts., Chicago, October 17th, 18th, 19th and 20th.

"An exceptionally strong program has been provided, as papers upon these important subjects will be read:

" 'Car Mileage.'

" 'Blanks and Forms.'

" 'Materials and Supplies Accounts.'

" 'What Does the General Manager Want to Know from the Accounting Department?'

"These papers will be the results of studies rather than the experience of the author.

" 'The headquarters will be at the Auditorium Hotel (across the street from the Auditorium Annex), where rates have been provided; European plan $2 to $4 per day, American plan $5 per day. Rooms should be secured at once.

"The railroad rates will probably be the same as heretofore—one and one-third fare for the round trip.

"Those interested are urged to at once make their arrangements for attending the convention and tasting the pleasures of Chicago hospitality.

"Further announcements will be made about Aug. 15, 1899."

These preliminary arrangements were made at a special meeting of the executive committee of the association held in Chicago, at which Mr. Calderwood, Mr. Brockway and Mr. Mackay, of the Milwaukee Electric Railway & Light Co., were present. While here they were entertained at dinner at the Union League Club by Mr. F. R. Greene, secretary of the Chicago City Railway Co.

That the Department of Blanks and Forms, the exhibit of which will be an important feature of the coming convention, has already become of value to members is evidenced by the following letter recently received by Mr. Brockway:

"I am sending you today by express the blanks loaned to this company by the department of blanks, and I desire to say I am most gratified, as I found among the blanks sent me precisely the ideas for which I had need."

STREET CAR BUILDERS COMBINING.

Considerable progress has been made in the effort to consolidate the street car building interests into one organization, though the matter has been worked very quietly. It is intended also to take in the principal truck builders. The plan is to capitalize at $18,000,000. Under this arrangement there would be a saving in freights where western builders are now shipping to the eastern market and vice versa, but unless prices should be raised materially it would seem unlikely that this and such other economies in selling and administration as can be effected would offset the extra amount of interest required under the new stock issue. It is no secret that cars have been selling on very close margins, and in some instances the competition has even been so severe that contracts were taken with the expectation of a loss. Of course such a course could not be continued indefinitely, and it is a question in some instances as to which party suffered the most, the builder who tried to bid too low, or the company which has to use and keep the cheap cars in repair.

It would not seem likely, however, that prices could be abnormally advanced, for in such case the larger roads, which are the heavy buyers, would return to the practice of building their own cars, as they did so generally 15 years ago. The small roads could not do so advantageously and would have to pay the price. The builders are certainly entitled to a fair profit, which few of them have enjoyed during the past three years.

Last month the Saginaw Valley Traction Co., Saginaw, Mich., opened a reading room for the use of its employes.

THE NEW BUFFALO CONSOLIDATION.

The International Traction Co. is the name adopted by the $15,000,000 syndicate that has purchased the electric roads of Buffalo, Niagara Falls and Lockport and other roads in that vicinity. This company is organized under the laws of New Jersey. Benjamin Franklin has been elected president, and Charles McVeagh secretary and treasurer. It is the belief that these officers are only temporary and that in the course of time Hon. W. Caryl Ely will become president of the company, in fact, all signs point to this.

The merging of the various companies now controlled by the syndicate under the new organization is gradually going on. In all, 16 companies are concerned, with a total of about 318 miles of track. It is the belief of the men who have invested in the new deal that the various lines can be operated by the new organization with much greater economy than has been the experience of the several companies that formerly operated them, and that in this way a great saving will be effected.

One of the first steps taken by the new syndicate was to reorganize the Buffalo Railway Co., which was done at a meeting in the office of J. P. Morgan & Co., in New York, when an election of officers took place with this result: President, W. Caryl Ely; vice-president, Daniel S. Lamont; general manager, Burt Van Horn;

W. CARYL ELY.

BURT VAN HORN.

secretary and treasurer, Richard F. Rankine; directors, Charles H. Coster, T. De Witt Cuyler Daniel S. Lamont, Francis Lynde Stetson, William B. Rankine, W. Caryl Ely, Burt Van Horn, Henry M. Watson, Cornelius C. Cuyler, Robert L. Fryer, John N. Scatcherd, George Urban, jr., Daniel O'Day; executive committee, W. Caryl Ely, Daniel S. Lamont, Francis Lynde Stetson, Charles H. Coster, William B. Rankine, Burt Van Horn.

The financial strength of the new syndicate is apparent from a review of the names of some of the men. Charles H. Coster is of J. P. Morgan & Co., of New York. T. De Witt Cuyler comes from Philadelphia. Daniel S. Lamont was secretary of war under President Cleveland. Francis Lynde Stetson is vice-president of the Niagara Falls Power Co., and William B. Rankine is secretary of the same company. Cornelius C. Cuyler is of the firm of Cuyler, Morgan & Co., of New York. W. Caryl Ely is making a reputation as a great electric road financier, and is a man of wealth and ability; to him is given all credit for putting the big deal through successfully. Richard F. Rankine, who is secretary and treasurer of the company, is a brother of William B. Rankine. His assistant will be J. S. Beacher, who held a position under the old company.

The Niagara Falls & Suspension Bridge Railway Co. and the Whirlpool & Northern Railroad Co., of Niagara Falls, were reorganized under the new syndicate on March 27th. The directors elected were W. Caryl Ely, Charles H. Coster, T. De Witt Cuyler, Francis Lynde Stetson, William B. Rankine, Daniel S. Lamont, Burt Van Horn, Charles A. Sweet, Charles B. Hill, and Alexander J. Porter. The officers are: President, W. Caryl Ely; vice-president, William B. Rankine; general manager, Burt Van Horn; secretary and treasurer, Richard F. Rankine. An executive committee consisting of Messrs. Ely, W. B. Rankine, Van Horn, Coster and Lamont was appointed.

The company proposes to spend half a million in improvements during the coming summer and will make changes in the schedule and service wherever they will be for the advantage or convenience of passengers.

Mr. Ely was born at Middlefield, Otsego County, N. Y., on Feb. 25, 1856. He received his preliminary education at the Cooperstown Union School and other institutions, was graduated from Cornell University and then read law at East Worcester, where he was admitted to the bar in 1882. He served in the Board of Supervisors of Otsego County, and in 1883, 1884 and 1885 was elected to the Assembly.

In 1885 Mr. Ely removed to Niagara Falls, where he commenced a career in business and law which has been exceptionally brilliant. The firm of Ely, Dudley & Cohn has probably the most extensive practice of any law firm in Niagara County, but it is as a business man that he is best known in Buffalo.

Mr. Ely was one of the five original promoters of the original Niagara Falls Power Co., and it was largely due to his indomitable energy and business capacity that that concern was placed on the road to success. He was also the principal promoter of the Buffalo & Niagara Falls Railway Co., and carried that enterprise to a successful accomplishment. It was through his efforts that the sixteenth annual meeting of the A. S. R. A. was held at Niagara Falls, and all of those attending can bear witness to the successful manner in which the plan was carried out.

SOUTHWESTERN MEETING POSTPONED.

Because of the smallpox epidemic at Laredo, Tex., which would detain many members of the Southwestern Gas, Electric & Street Railway Association in quarantine and prevent them from attending the annual convention at Austin on April 19th to 21st, the meeting has been postponed for one month, and will be held May 17th, 18th, and 19th.

The members of this association are those who formerly constituted three separate associations interested in gas, electric lighting, and street railway enterprises, and have always taken the greatest interest in their work, so that a successful meeting is assured.

The following papers have been prepared for presentation at the convention. The list is a good one, both of subjects and of authors:

"The Item of Depreciation."—W. E. Hamilton, Shreveport, La.
"Meters."—W. E. Holmes, Austin, Tex.
"Transformers."—Harry L. Monroe, Dallas, Tex.
"The Amount and Extent of Legitimate Investment in Electric Lighting Plants of Certain Capacities."—F. Fries, San Antonio, Tex.
"Summer Amusements for Street Railway Companies."—T. H. Stewart, Waco, Tex.
"Art and Science of Selling Gas."—Thos. D. Miller, Dallas, Tex.
"A Model Plant Under Model Management; What Both Would Be Like."—J. F. Strickland, Waxahachie, Tex.
"Alternators."—E. Dysterud, Monterey, Mex.
"The Attitude of a Corporation to the Public."—W. R. Weiss, San Antonio, Tex.
"Means for Encouraging the Diversified Use of Electric Current."—C. L. Wakefield, Dallas, Tex.
"Electric Lighting and Application of Electricity to Various Purposes in Mexico."—By a Mexican Delegate.
"Arc Lamps."—May Levy, Galveston, Tex.
"Fare Boxes v. Conductors."—F. E. Scovill, Austin, Tex.
"Transfers."—(To be assigned.)
"Gas for Fuel."—(To be assigned.)

The Bellaire, Bridgeport & Martin's Ferry Street Ry., of Bridgeport, O., is now a part of the Wheeling (W. Va.) Railway Co.'s system.

The lower court has decided that the Rapid Railway Co., of Detroit, is possessed of a franchise to build across Hamtramck Township and dissolved the temporary injunction issued on the application of the township authorities.

The Mahoning Valley Ry. and the Trumbull Electric R. R., which connect Youngstown and Warren, O., have arranged so that the time between the two cities is to be 57 instead of 70 minutes.

Detroit and Municipal Ownership.

From Our Special Correspondent.

At last the great 10-year street railway controversy in this city is nearing its end. Only one more step is necessary to be taken and the municipality of Detroit will have acquired control of all the street car properties in this city on a basis perfectly satisfactory to the owners.

It only remains for the courts to say that Detroit has a right to give "municipal ownership" a trial and the final step will be taken.

Detroit has been a central figure in the street railway world for the past decade, but during the past two years little has been done or attemptted by the city officials, but Governor Pingree and his political supporters did not entirely abandon the idea of still making a great political issue out of the one topic that had carried them to offices and victory so many times.

So, almost a year ago Governor Pingree opened negotiations with Messrs. T. L. Johnson and R. T. Wilson, who controlled the various street railway properties of Detroit, relative to the same being transferred to a city commission and so operated. These negotiations were strictly private, and the citizens of Detroit, and its officials, are as yet in darkness as to what has been done.

Governor Pingree has stated, however, that he has an option from Mr. Johnson on the three street railway systems of this city.

When the Michigan Legislature met at Lansing in January Representative McLeod, from this city, who has been a conductor on the local street car lines for many years, introduced by title a bill designated as H. B. 1011, called "An act to authorize the city of Detroit to construct, acquire, maintain and operate street railways and to construct extensions thereof."

"Some labor crank movement," was about all the consideration this bill received at the start, and the friends of the governor never even intimated that they were in the least interested in what is now known as the McLeod bill.

A few days later came the McLeod bill in full and so little was thought of its importance or probable support that the local papers failed to even give mention of its introduction.

This McLeod bill, now destined to become noted in street railway circles over the entire world, is composed of a dozen short sections and in all contains about fifteen hundred words.

First, it provides that the city council of Detroit shall at any time during the next 20 years be empowered to appoint three persons to be known as the Detroit Street Railway Commission, the regular term of office of the commissioners being six years.

As the present mayor of Detroit is very much anti-Pingree, special provision was made that the first commission should be appointed by the council without the consent of the mayor; but all future commissions should be appointed by the mayor and only receive the approval of the council.

Under section five of the McLeod bill the commission is given immense authority to expend unlimited sums of money and incur unlimited liabilities without the approval of the city council or any direct representatives of the people. This section reads as follows:

"The said commission may in their discretion and upon such terms and conditions as they may deem advisable for the interests of said city acquire, by deed, lease or other satisfactory conveyance from the company or companies owning the same in said city, any street railway or railways existing at the time of the passage of this act and lying wholly within or partly within and partly without said city, operated by the same company or companies, together with the property, rights, privileges, etc., owned and used in connection with or pertaining to said railways, including right to routes belonging to such company or companies upon which a railway shall not be in operation, and may operate and maintain said street railways so acquired, for the carriage of passengers and freight for hire."

That section is really the McLeod bill, the incidental features providing that the liability of the obligations incurred by said commission shall only cover the street railway property so acquired and under no circumstances shall its bonds be considered a part of the indebtedness of the city. While the city treasurer shall be the custodian of the funds of the commission, under no circumstances shall the monies received become a part of the general funds of the city. The commission has full power to fix the rates of fare to be charged, the extreme limit to be six tickets for a quarter, with such transfers as they may designate. The only privileges given the mayor and the city council is that of examining the books of the commission once in three months.

GOV. HAZEN S. PINGREE.

ELLIOTT G. STEVENSON.

CARL E. SCHMIDT.

DETROIT STREET RAILWAY COMMISSION.

Any cause of action for personal injury shall be against the commission and not the city, and shall be started within one year of the alleged injury; written notice of the alleged injury must be given within 30 days thereafter.

The commission is positively prohibited from extending the life of any franchise of any of the existing street railway companies.

These are the salient features of the McLeod bill under which it is more than probable that Detroit will buy the property of four street railway companies and operate them for a few years at least.

Detroit citizens did not realize that the bill had any real support until about the middle of March, when the Pingree party in the Legislature began to have a good word to say about the bill. Governor Pingree even hinted one day that the bill would do no harm. Next it received commendatory notice from members who were with the street railway in most of their requests.

One morning the citizens of Detroit awoke to the fact that they were about to be plunged untold millions of dollars into debt without having a word to say on the subject; that if the plans of Governor Pingree were successful he would have control of the entire street railway system of Detroit and millions of dollars annually to expend in the building up of his political machine.

A special meeting of the city council was held and a request made that the bill be so amended that the commission, before making a final purchase, would have to submit the matter to a vote of the people. A mass meeting was called by the mayor and thousands attended to protest, asking that at least the council should have the final approval of any purchase contract and long protests were sent to the members of the Legislature.

Nevertheless, on March 23d the bill went through both branches of the Legislature and received the signature of the governor in the face of all protests.

With the passage of the McLeod bill leading members of the city council predicted that it would be years before sufficient votes could be secured to make the necessary appointments. A majority of the members of that body stated positively that under no circumstances would they vote to name the commissioners unless the act was so amended as to allow the council to give final approval to any purchase contemplated.

But the friends of Governor Pingree did not waste many days in getting down to business. The argument was made that the properties were now under option, so that it was important that immediate action should be taken. In the face of the opposition of the mayor and the president of the council, the Chamber of Commerce and the Merchants' and Manufacturers' Association, as well as of the leading property owners of Detroit, the council, by a vote of 21 to 11 on April 1st, named Hazen S. Pingree, Elliott G. Stevenson and Carl E. Schmidt as the members of the Detroit Street Railway Commission.

On April 3d the commissioners held their first meeting, elected Governor Pingree as president and notified Mr. T. L. Johnson, president of the various street railway companies, that they were ready to open negotiations as provided by the McLeod bill.

When the commission was four days old it selected experts to assist in arriving at the values of the profits it hoped to acquire. Prof. M. A. Bemis, of Kansas City, a student of political economy, will be consulted regarding the value of the various franchises held by the street railway companies. Prof. M. E. Cooley, of the University of Michigan, will appraise the value of the machinery and mechanical equipment, and Gilbert Wilkes, electrical engineer, of the overhead system. Mr. W. J. Spicer, ex-manager of the Grand Trunk Ry., will appraise the tracks of the companies. Local business men were chosen to fix the values of the real estate and buildings included in the street railway properties. All of these appraisers are under instructions to be prepared to make their final reports before May 1st.

In the meantime the street railway people are paving the way to simplify matters in making the proposed transfer. In the first place the Metropolitan Railway Co. has been organized for the purpose of consolidating all of the street car property in one company. Mr. S. B. Clarke, a New York attorney, representing the interests of Mr. R. T. Wilson, is here looking after this consolidation. Under date of April 5th the Metropolitan Railway Co. notified the Detroit Railway Commission that they were ready to negotiate, as follows:

"The Metropolitan Railway Co. have the honor to say that we are in a position to enter into negotiations with you and are willing to do so on the following basis:

"Provision to be made for the acquisition of the Metropolitan Co. of the properties of the Detroit Citizens' Street Railway Co., of Detroit, the Detroit Suburban Railway Co., the Detroit, Fort Wayne & Belle Isle Ry. and the Detroit Electric Ry.

"The Metropolitan Railway Co. is to issue a series of new bonds, the aggregate amount, character and security of which is to be agreed on.

"The city to acquire the properties from the Metropolitan Railway Co., subject to the new mortgage, on terms to be agreed on."

Experts are to have access to all of the books of the various companies, that the earning powers of the properties may be ascertained. This information is not to be made public unless the final purchase is consummated.

But this rapid progress in negotiating does not mean by any means that Detroit is "municipal ownership" mad. On the contrary, nine business out of ten are opposed to the proposed undertaking and every possible legal effort will be made to prevent the commission from carrying into effect any of the provisions of the McLeod bill.

The Good Government League, composed of the leading public-spirited men of Detroit, has raised by subscription $1,000 to employ legal talent and carry on the fight in the courts. The papers are already prepared for the starting of quo warranto proceedings within the next few days, and by this process it is calculated that the general constitutionality of the McLeod bill can be tested in the lower courts and also a foundation made by which the Supreme Court of the state will have to pass on the right of the Legislature to create a commission to form part of the municipal government without the local officials having the right to pass upon its acts.

Mr. J. G. Gates, a leading attorney and large property holder in Detroit, is one of the most active in endeavoring to prevent the proposed transfer of the street car properties to the city commission. "No municipal government can operate an institution of this kind as profitably as private individuals," he argues. "The power vested in the commission is too great to be placed in the hands of three men. Officers and employes would be selected, not for their efficiency, but for their political influence. I do not believe civil service would protect the efficient employes when it came near election time and aldermanic candidates had to look after the faithful in their wards."

"It would be the greatest mistake the city of Detroit ever made," was the concise statement of George H. Barbour, president of the Michigan Stove Co. "Today we have a street railway system equal to any city of the size in the world. What will it be after the politicians have made the appointments for a few years?"

Mr. Seligman Schloss, retired banker and for many years one of the managing directors in the Detroit, Fort Wayne & Belle Isle Street Ry., sees all kinds of trouble ahead in case municipal ownership is thrust upon the city. "Motormen who are political pets will not be noted for their sobriety and accidents will be frequent," was his prophesy before a party of bankers in discussing the matter. "The superintendents and bosses would have to hold a political pull and to exercise that they would have to give places to ward heelers. In 10 years the property would be a wreck."

Mr. George H. Russell, president of the American Bankers' Association and president of the States Savings Bank, of Detroit, one of the leading financial institutions of Michigan, is very positive in his opposition to the commisson buying or acquiring the street railway properties of this city. "It is against all public as well as business policy, and in the end will be an injury to the city," said the banker. "A commission cannot look after the welfare of its patrons like the manager for owners looking all the time after increasing the value of the property, and I trust it will not come about for the sake of Detroit."

The leading merchants of Detroit, like Mr. J. L. Hudson and Mr. W. H. Elliott, are aiding in the legal fight against the commission; the Chamber of Commerce, Merchants' and Manufacturers' Club and the leading newspapers are also on the anti-ownership side, so that if it is among the legal or argumentive possibilities, the final step in municipal ownership will not be taken in Detroit.

The street railway world will be interested in knowing what the street railway properties in Detroit consist of.

In the first place, there are 191 miles of track, nearly all of which has been relaid with girder grooved rails during the past five years. On some of the leading lines 90-lb. rails were used, steel ties underlaid with 14 in. of concrete and afterwards welded by electricity. The overhead equipment, with all the feed wires, at present price of copper, are said to be worth almost a million dollars.

Three power houses are owned by the street car companies of Detroit, one of 1,200 h. p., one 4,00 h. p. and one of 6,000 h. p., the machinery in which is estimated to have cost $800,000.

According to the tax rolls of Detroit, some twenty pieces of real estate are owned by the three companies, occupied by car barns, repair shops, abandoned horse car barns, power houses and a five-story office building. The valuation of this realty, with the building improvements thereon, will not fall much short of a million and a half.

According to the local street railway officials they have in service more than 700 motor cars and there are the thousand and one things necessary for the operation of a street railway system.

In the way of franchises, the first will expire in about six years and the franchise rights on two-thirds of the trackage has a life of 17 years, while the 60 odd miles of the Detroit Ry.—the 3-cent line—has 26 years yet to run.

Of course, the leading question here with all classes of people is, what will be the price of this property?

While Mr. Johnson and the street car people have not a word to

say on that subject, yet it is an undoubted fact that Governor Pingree knows, approximately, what the properties can be secured for, and from a source thoroughly reliable it can be stated that the figure is near $12,000,000. the same to be provided for by 30-year 4 per cent bonds.

A very important feature of the negotiations is the outstanding indebtedness—bonds—of the various companies, which is as follows:

Detroit Citizens' Street Ry. to New York Security & Trust Co., $7,000,000, due July 1st, 1905, interest rate 5 per cent.

Detroit, Fort Wayne & Belle Isle Ry. to New York Security & Trust Co., $1,200,000, due April 1, 1927, interest rate 6 per cent.

Detroit Electric Ry. to Cleveland Trust Co., $2,800,000, due July 1, 1916, interest rate 5 per cent.

An investigation in local financial circles indicates that at this time the market value of Detroit Eelectric Ry. bonds is 110; of the Detroit, Fort Wayne & Belle Isle 112, and of the Detroit Citizens' Street Railway 80 to 85. A large amount of the later bonds were never placed in the market and there are really none of them in commercial circles.

The stock of the three companies, aggregating something like $5,000,000, is all controlled by the Johnson-Wilson syndicate.

The handling of this vast amount of securities and stocks and turning the property they cover over to the commission, which has not one cent, is the part that the Metropolitan Railway Co. will play in the deal. This new company, organized for only $25,000, is able to command all of the enumerated stocks and bonds. Should the commission and the street railway owners come to terms, and provided the courts do not interfere, the Metropolitan Company will secure all of these outstanding obligations, issue a new series of bonds to the amount and at the rate of interest agreed upon, and then dispose of the Metropolitan stock to the commission. In case the commission failed to meet the interest charges on the liabilities of the Metropolitan Company, the ordinary foreclosure proceedings would naturally result.

This really tells of the progress made towards street car municipal ownership in Detroit. If the terms of sale can be agreed upon, which seems very possible, and should the courts not interefere by declaring the McLeod bill unconstitutional, it seems very possible that Detroit will try the experiment.

Members of the commission, in discussing some of their future plans, state positively that Mr. J. C. Hutchins will be retained in his present place of manager of all the properties, and also that Mr. A. B. du Pont, general superintendent, and other officials will be retained.

Something about the 10-year street car fight in Detroit may today be of general interest.

A decade ago Ifazen S. Pingree had never indulged in a political dream; had never aspired to an office nor did he care an iota about the operation of street railway systems. He had spent a quarter of a century in building up a shoe factory from the point where he was the only workman to a business now giving employment to 2,000 persons. Having always been a Republican, it was his yearly practice to give so much to the campaign fund at each election, but he took no interest in the naming of candidates. At that time the city of Detroit had been Democratic so long that it was almost impossible to secure a Republican candidate for mayor, and it was owing to the fact that Mr. Pingree had in the past been so liberal —also that he was out of the city at the time and unable to object to the scheme—that the Republican leaders nominated the shoe manufacturer.

It did not take Candidate Pingree long to get the political fever and he started in to putting up a campaign that continued night and day and resulted in his election.

At this time in politics street car matters were not considered and the then leading street railway owners of Detroit were among Pingree's warmest supporters. Before Mayor Pingree had occupied his official chair one year he became interested in street railway matters, but it was rapid transit that he started out to secure. Detroit had only one electric line, and during the few years to the present electrical system was constructed, probably not so much from the fighting carried on by the citizens as from the fact that the use of electricity was advancing so rapidly. Yet this has always played a prominent part in Pingree campaign literature. In the summer of '91 Mayor Pingree was looking after re-election, and it so happened that there was a big street car strike. The mayor lent his official assistance to the men, helped them secure their demands, and was rewarded with a re-election.

Starting on his second term Mayor Pingree began his bitter fight against all street car interests. The validity of certain franchises was attacked in the courts and in the legal battle that followed the city spent nearly $100,000 for attorneys and expenses. During this term 3-cent fares were first talked, and as the third campaign approached the question of lower fares first became a political issue. It was made a part of the platform and every aldermanic candidate in both parties talked in favor thereof.

This new council and the mayor endeavored to secure a compromise of seven tickets for a quarter from the new owners of the street railway system, the Johnson-Wilson syndicate. Unsuccessful in this, an opposition line was organized and a 3-cent franchise granted to Henry A. Everett, of Cleveland, Ohio, and Albert Pack, of Alfena, Mich.

When work on the new line started, Mayor Pingree got the governorship bee, but failed to secure the nomination. The 3-cent line was just completed in time to be a great benefit to the mayor in his fourth city campaign. The Detroit railway, to which he had pointed with so much pride as evidence of 3-cent prosperity, was amalgamated with the general electrical system, and before the fourth Pingree term was one year old the mayor had been promoted to the governorship.

Since that day the street car question has been but a pleasant dream of the past to the people of Detroit. The street car companies improved their property, and it was not until a month ago when the McLeod bill bobbed up in the Legislature, that the people knew that the old subject was to be resurrected.

What does Pingree want now? was the first question asked by the politicians.

"The second term for governor over and the political career of Pingree is ended," was the way they calculated. "He cannot be mayor again, but as president of the Street Railway Commission his power and patronage would be larger than that of mayor or governor, therefore he would continue to be a political power."

As to the other members of the commission. Elliott G. Stevenson is a young attorney with political ambitions; would like to represent in Congress the district in which the Street Railway Commission will employ 3,000 of the voters.

Carl E. Schmidt is a retired millionaire tanner, and has always been a warm supporter of Mayor Pingree. He will devote his entire time without recompense to the Detroit Street Railway Commission. Incidentally, it might be mentioned that Mr. Schmidt has had the mayoralty bee for a number of years, and is now being pushed for the Republican nomination of next fall.

Now the entire question is up to the courts, and there the business men of Detroit generally will exert their every influence and use every effort to have the McLeod bill declared null and void.

Mr. T. L. Johnson will not talk about municipal ownership, simply stating that he has street car properties to sell, and any opinions he might give would be misunderstood. Other officials of the Detroit street railway companies are equally non-committal.

Detroit, April 10, 1899.

THE M'LEOD BILL.

An act to authorize the city of Detroit to construct, acquire, maintain and operate street railways, and to construct extensions thereof.

The People of the State of Michigan enact:

Section 1. That the common council of the city of Detroit be and is hereby authorized and empowered to appoint by resolution at any time within the next 20 years, three persons, electors and freeholders of said city, who shall constitute a board of commissioners, to be known as the Detroit Street Railway Commission. One of said commissioners shall be appointed for the term of two years, one for a term of four years, and one for a term of six years. Their successors shall be persons of like qualifications, and shall be appointed by the common council on the nomination of the mayor of said city at the expiration of said term for the term of six years. Vacancies shall be filled by appointment by the mayor, and persons so appointed shall hold office for the unexpired term. All members of said commission shall hold their offices, respectively, until their successors are appointed and qualified. Any person otherwise eligi-

ble may be appointed as aforesaid, notwithstanding he may hold other office, excepting that of alderman.

Sec. 2. Said commissioners shall organize by the appointment of one of their number as president and one of their number as vice-president. They shall appoint a secretary, who shall keep a record of their proceedings. They shall fix his compensation and prescribe his duties.

Sec. 3. Before entering upon the duties of their office the said commissioners shall severally execute a bond to the city of Detroit, with one or more sureties, which shall be some responsible surety company or companies, in the penal sum of $250,000, and conditioned for the faithful performance of the duties of their office, which said bond shall be approved by the city comptroller and the corporation counsel of said city.

Sec. 4. The city treasurer shall be the treasurer of the moneys of said commission, and the same shall be credited to the said commission, and shall be disbursed by warrant drawn upon the controller of said city, signed by the president and countersigned by the secretary of said commission. Upon the presentation of such warrant it shall be the duty of the controller to draw his warrant upon the city treasurer for the amount and in favor of the person named in the warrant of the commission.

Sec. 5. The said commission may in their discretion and upon such terms and conditions as they may deem advisable for the interests of said city acquire, by deed, lease or other satisfactory conveyance from the company or companies owning the same to said city, any street railyway or railways existing at the time of the passage of this act and lying wholly within or partly within and partly without said city, operated by the same company or companies, together with the property, assets, rights, privileges, etc., owned and used in connection with or pertaining to said railways, including rights to routes belonging to such company or companies upon which a railway shall not be in operation, and may operate and maintain said street railways so acquired, for the carriage of passengers and freight for hire.

Sec. 6. Said commission may provide for the payment of rentals or other obligations and may provide for a sinking fund for the discharge of any liens upon any of the property acquired by them and may pledge the earnings and receipts of said railways for these purposes and may use the earnings in operating and maintaining the same, and may use any surplus of earnings in acquiring any bonds secured by lien upon the property so acquired, or may use such surplus in making needed extensions or betterments to said railways. Said commission shall have no power to incur any obligation on behalf of said city except such as shall be chargeable only upon the railways and property so acquired and the earnings and increments and extensions thereof.

Sec. 7. The said commission shall manage, maintain and operate any street railway so acquired or extended, and may purchase from the revenues thereof all lands, tracks, cars, motors, dynamos, machinery, equipment, tools and furniture necessary and useful therefor to be used in connection therewith, and may establish rates of fare for the carriage of passengers and freight, provided the rates of fare shall not exceed those now charged by the Detroit Citizens' Street Railway Co. In operating any railway so acquired, the commission may exercise such other general powers as are possessed or exercised by boards of directors of corporations organized under the laws of this state providing for incorporation of street railway companies.

Sec. 8. After acquiring any railway or railways pursuant to section five thereof, said commission shall have the power to enter into agreements with any street railway company having a line of street railway, for or in relation to the exchange of tickets and transfers, and for the carriage of passengers, use of tracks, or operation of cars, provided that such agreements shall not be inconsistent with or in violation of the terms of the conveyance or contract mentioned in section five thereof.

Sec. 9. The common council may examine the books, papers and accounts of said commission at any time, or cause the same to be done, and it shall be the duty of the city controller to make an examination of the books and vouchers of said commission every three months, and report the results of such examination to the common council. It shall be the duty of the commission to annually report to the common council, which report shall contain a complete and detailed statement of its receipts, and from what sources derived, and expenditures, and for what purposes made, and a detailed statement of the condition of the business and property under the management of said commission.

Sec. 10. Said commission may employ a director, and a manager, and such superintendents, attorneys, cashiers and other assistants and employes, and for such time and upon such terms and conditions and for such compensation as they may deem advisable. They may require security for the performance of the duties of any person so employed. They may make such rules and regulations relative to their meetings and proceedings, and for the government and conduct of their officers and employes, and for the regulation of the business as they may think best

Sec. 11. All causes of action relating to or arising out of the owning, operating or control of any street railway constructed or acquired by said commission shall be prosecuted by or against said commission by the name herein designated and said commission shall carry into effect, pay or discharge any order, decree or judgment, in any suit or proceeding to which it shall be a party, in like manner as if the same were prosecuted or defended by said city; provided, that no action for negligent injury arising out of the operation of said railways shall be maintained unless it be commenced within one year from the time when the injury was received, nor unless notice shall be given of such injury to the said commission, its secretary or attorney, of the time, place and circumstances of such injury and of the nature thereof.

Sec. 12. Nothing in this act shall be construed as granting any franchise to any of the existing street railway companies, or as extending the life of any existing franchise, or as implying any franchise rights in case of reversion of the property to the grantors or their successors; and said commission is hereby expressly prohibited from granting or extending the life of any franchise under any of the powers conferred upon it by this act.

This act is ordered to take immediate effect.

FENDERS IN CHICAGO.

Chicago, Apr. 1, 1899.

Editor "Review": Replying to your letter of March 21st, requesting information relative to the comparative number of accidents reported during the months of January and February, 1898 and 1899, will say that our records show a decrease of 60 per cent in collisions with pedestrians and 25 per cent in collisions with vehicles for January and February, 1899, against the same two months in last year. The statistics recently published in one of the daily papers were misleading inasmuch as this decrease was wholly attributed to the fact that certain companies in the city had in the interim equipped their cars with what is commonly known as "basket shaped fenders." The Chicago City Railway operated no cars during these two months in either year so equipped. The decrease in the number of accidents, therefore, must be attributed either to climatic conditions, more care on the part of pedestrians and drivers of vehicles or railway employes rather than to the use of mechanical safety devices. In January and February, 1898, a considerable snow fall was prevalent, while during the same months of 1899 the snow fall amounted to practically nothing. Experience has taught that accidents more than double in number when the ground is covered with snow and ice, and I would therefore attribute the decrease in accidents above stated to this condition more than to any other. From the fact that the "basket shaped fender" projects over three feet in front of the car, is it not reasonable to suppose that if our cars had been equipped with this style of fender a great many people might have been struck who were fortunate enough to avoid injury by being able to get out of the way of an approaching car simply by reason of the cars not being provided with extension fenders?

The nature of accidents varies so widely and operating conditions change so frequently it hardly seems reasonable that an intelligent comparison can be made and the results attributed to any particular cause. Yours truly,

G. O. NAGLE,
Superintendent Chicago City Ry.

Beginning with June 1st the Twin City Rapid Transit Co., Minneapolis, Minn., will increase the wages of conductors and motormen to the highest rate ever paid by the company. This will be 18 cents per hour. Good times and a prosperous year have induced this action.

Pleasure Resorts in 1899.

PARKS AND FREE ENTERTAINMENTS AS A MEANS OF STIMULATING STREET RAILWAY TRAFFIC.

By J. P. E. Clark, Manager, Binghamton Street Railroad Co., Binghamton, N.Y.

The question of whether pleasure resorts and special entertainments as a means of stimulating street railway traffic are profitable, is no longer asked, it having been decided in the affirmative by the street railroads of the many provincial cities who are studying to increase traffic as much as possible, and are not bothered by the problem that confronts a very few of the larger cities, whose great difficulty is to provide suitable and comfortable arrangements for the great number who desire to ride. The most difficult questions at the present time are:—How should the pleasure resorts be conducted? What style of entertainment should be furnished? and whether or not it is necessary to employ a practical man to take charge of the amusement department. My observations are the result of nine years' experience in catering to street railway patrons by means of public parks and special entertainments. In fact the company by whom I am employed—The Binghamton Railroad Co., Binghamton, N. Y.—is the pioneer in employing the means above mentioned for stimulating street railroad traffic.

It has been demonstrated beyond peradventure that the most essential and important feature in laying out and maintaining a pleasure resort as an adjunct of a street railway system is respectability. To attract large crowds and increase the popularity of the park, the presence in large numbers, of ladies and children is indispensable, therefore in establishing an out-door resort all features of an objectionable character should be eliminated, and only harmless and unobjectionable amusement and recreation provided. In selecting entertainments great care should be exercised to avoid engaging any act which approaches vulgarity, or is the least objectionable, as it is an easy matter to overthrow an entire season's hard work in establishing the reputation of a pleasure resort by a single week's performance.

PAVILIONS.

ROSS PARK, BINGHAMTON, N. Y.

It goes without saying that the character and style of entertainment to be furnished is governed entirely by the surroundings and environments of the resort at which the entertainment is to be presented. For instance, where the entertainment is presented out of doors upon a large platform erected for the purpose and the people, are not provided with regular seating facilities, what are known as "dumb acts" in the vaudeville profession can be presented in the most satisfactory manner. By "dumb acts" is meant those which appeal entirely to the eye, such as aerial, acrobatic, sensational novelties, Japanese, Arabs, and other acts of this description. In employing acts of this kind the performance can be witnessed by those scattered throughout the woods or upon the hill sides, as it is not necessary to be in close proximity to the stage.

Where the pleasure resort is provided with a pavilion or hall a performance of a more diversified character can be successfully arranged as singing and talking acts can be introduced, which interspersed with other features present a more varied and oft times more satisfying bill. But as heretofore stated, the program must be arranged with the greatest care, and the various acts selected with an idea of pleasing, and not affronting, either by dress, action, or word, the most fastidious.

The price to be paid by the railroad company or park management for the special entertainments provided, is governed entirely by the size of the city, the number of cars operated, facilities for reaching the pleasure resort, and whether or not an admission fee is charged, and upon circumstances in general. Our experience has taught us that a very pleasing and diversified program, running (including a ten-minute intermission) about two hours, can be provided for from $250 to $300 per week, but in order to arrange a satisfactory program, embracing seven or eight distinct acts and occupying the length of time above specified, and keep within the price mentioned, the person selecting or organizing the entertainment must necessarily be conversant with the business and know something about amusement matters. The amount to be expended for an entertainment is simply a question of good business judgment on the part of the person in charge.

Numerous combinations for park entertainments have been formed by the various vaudeville agents and amusement managers throughout the country. In many instances, where street railway managers are inexperienced in the amusement business and do not possess a general knowledge of the many hundred available vaudeville acts, the combination managers are perhaps their most reliable means of procuring a satisfactory park entertainment; but where the street railway manager is thoroughly posted and experienced, a cheaper and much more satisfactory program can be arranged by engaging the individual performers and making up his own program, thereby securing a much better and more diversified entertainment, and particularly adapted to the resort where it is presented. This, however, is an unsafe plan to attempt unless the party arranging the entertainment is competent to discern the good from the bad.

To make pleasure resorts profitable it is absolutely necessary to

make them attractive. A park or resort, even those possessing the greatest natural beauty and advantages, will soon drop into disfavor, and eventually out of sight, unless a carefully studied plan is devised for making them attractive, animated and respectable. There are innumerable features that can be added such as "carrousals," "scenic railways," "mazes," "bowling alleys," "shooting galleries," and many other smaller and less expensive features. The number and character of these special features should be governed entirely by the size of the city, location of the resort and general requirements. The fundamental principle in the operation and maintenance of any pleasure resort is to keep within bounds in the matter of expense, and to make the resort in itself self-sustaining (as far as possible) or even profitable.

The many pavilions and stands that must necessarily be provided for the sale of refreshments, popcorn, soft drinks, etc., can in themselves be made an attractive and special feature of any resort. This can best be accomplished by providing buildings of pretty and fancy designs, even though inexpensive, and employing attendants that are courteous, neat in appearance, and uniformed in keeping with the resort and its environments.

In a great many instances a portion of all the amusement and refreshment privileges can be sub-let to advantage, but this is always an unsafe policy unless an iron-clad contract is entered into whereby the virtual control, manner of conducting and operating of the several stands and places of amusement is in the hands of the railroad company, who, morally, has to stand sponsor for the resort, and its several features.

A tendency toward general improvement is always anticipated by the general public which is subserved by the respective resorts, therefore managers must be on the alert for new features, and where they are added it is always well to secure as much publicity of the improvement (even though it is slight) as possible. Keep your resort well before the people. Commence advertising early in the spring. Have your local newspapers mention the contemplated improvements; the number of people that visited the resort the season previous, and the immense popularity it attained. The saying that "Nothing succeeds like success" applies very closely to parks and pleasure resorts.

The question of whether admission should be charged or not is governed entirely by circumstances. Where the haul is short and a great many people can be quickly and easily transported and the park or resort is not provided with seating arrangements, it is in my opinion generally advantageous to make admission to the resort and the entertainment absolutely free, and particularly if you control and have charge of the various privileges, as oft times the extra revenue secured at the various stands from the largely increased crowd (due to the fact that no admission is charged) more than offsets the money that might be received from admission fees, to say nothing of the largely increased street railway receipts derived from a free entertainment.

THE CASINO, FROM THE RIVER.

Whether or not other than passengers should be admitted free is a proposition that is also largely governed by local conditions and circumstances. If you have numerous attractions and stands that you desire patronized it is not always well to drive people away therefrom because they did not pay 5 cents car fare. "A half a loaf is better than no bread" applies as well to street railway business as any other, and there is one fact that should never be lost sight of in conducting a park or pleasure resort, that is a crowd always follows a crowd. An immense concourse of people is the best single attraction you can have.

BALLOON RACE, CASINO.

The underlying and most important benefits to be considered in the establishing of a pleasure resort is how you can best and most effectively increase the street railway traffic, and if you control the various privileges, how you can secure the largest throng of people.

In a great many cases where arrangements will admit, a free admission to the park and a small charge for a seat proves a source of sufficient revenue to pay for the special attraction provided and this plan does not serve to drive patrons away from the resort itself. This, in my opinion, has proved the most satisfactory and advtantageous plan.

If possible, make special and careful arrangements for the care of excursions, picnic parties, conventions, etc. Provide free of expense, tables, dishes, cooking facilities and other necessary accommodations; these can be provided at a nominal expense, and while it requires care and attention to look after this department, it will, if properly conducted, yield the most satisfactory and gratifying returns.

Daily concerts—by either a band or orchestra—are the most potent, permanent attraction that can be secured. The most advantageous and economical way to arrange this feature is to hire the men outright for the season. Twelve musicians that can double in brass and orchestra make a convenient and adequate number for all ordinary purposes. They should be engaged with the understanding that they are to respond whenever and to whatever they are called upon to perform. In addition to the daily concerts they can be used for advertising, street parades, dancing, furnishing music for the entertainments, and in many other ways.

Fireworks make a cheap and standard attraction. The most economical and satisfactory way to arrange the display is to buy the material in bulk and educate someone in your employ to manufacture the set pieces and arrange and fire off the display. In this manner fully 50 per cent can be saved from the price charged for regularly prepared exhibitions.

A zoo is always an important attraction and almost indispensable feature of any park or resort. The more pretentious and complete it is the better it serves its purpose; but if unable to provide a very extensive affair of this kind, there is no excuse why the more com-

mon animals, such as bears, monkeys, birds, etc., should not be provided. They always prove a source of interest and enjoyment to all visitors, and particularly children. A proper place should be provided for caring for these animals, and their cages and surroundings should always be kept neat and clean.

Street railroads have unsurpassed facilities for advertising their summer resorts and special entertainments, and this is a branch of

ADVERTISING IN BINGHAMTON, N. Y.

the business that requires careful attention. A free entertainment properly advertised cannot fail to attract a crowd. The most effective of the many means offered is a car covered with immense banners with the band inside. This perambulator can be put out for two or three hours in the mornings so as not to interfere with the regular duties of the musicians. This advertising medium never fails to attract universal attention.

Pleasure resorts should always be located near a body of water if possible. Nothing adds more to the beauty and pleasure of an out-door resort than a pretty lake or river, offering many additional attractions, such as boating, bathing, and innumerable entertainments that cannot be arranged or provided without water facilities.

Under no circumstances should liquor be sold at parks or pleasure resorts operated in conjunction with street railways. The liquor traffic should be kept entirely aloof and apart from resorts of this kind, primarily for the reason that no park or pleasure resort can succeed without the unrestricted patronage of ladies and children, or without the good moral endorsement of the community, wherein it is located, neither of which can be attained when liquor is sold. A resort where liquor is dispensed must be established and arranged upon an entirely different basis, and cater to an entirely different element.

Keep your resort clean, wholesome, attractive and respectable! Select your entertainments with care and good judgment! Keep within bounds as to expense, or in other words "Cut your garment according to the cloth;" by so doing, and keeping a close watch upon the turn of affairs, I state emphatically and unreservedly that a pleasure resort operated in conjunction with a street railway will prove a profitable investment and a benefit to its projector, and the public at large of the community in which it is located.

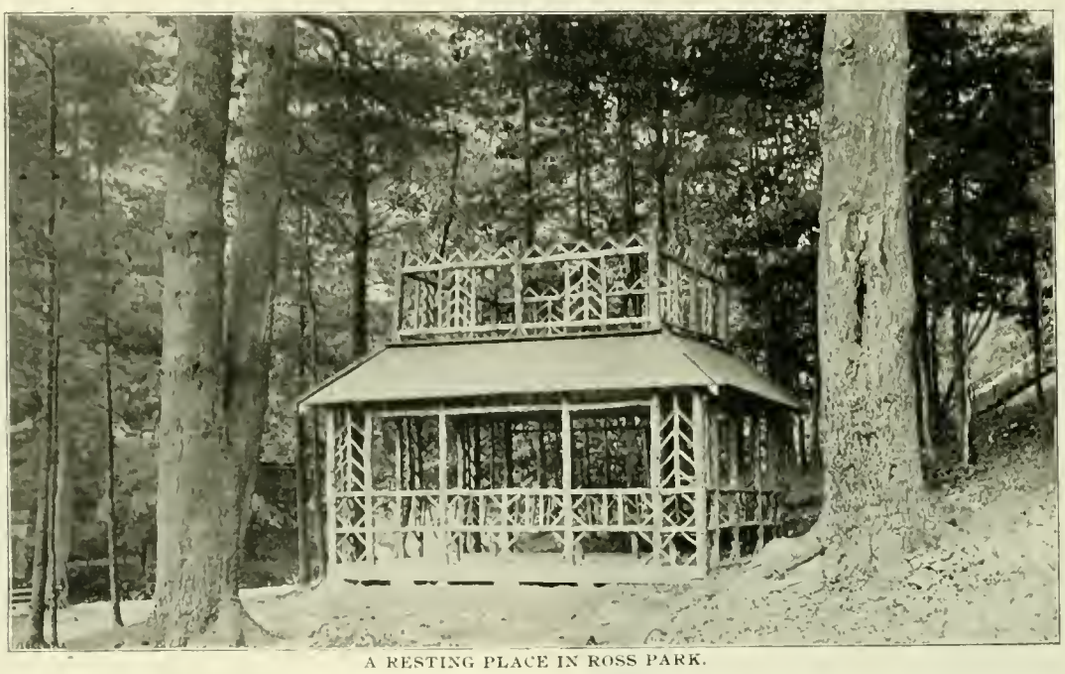
BINGHAMTON, N. Y.

The Binghamton Street Railroad Co. will open Ross Park and the Casino grounds on Decoration Day. At the Casino more electric lights will be placed about the grounds giving brilliant illumination. The band concerts beginning June 1 will be a regular feature, as it was last year. Athletic sports will receive more encouragement; the track, base ball field, tennis courts and golf links will be kept in fine condition. The cafe in the Casino will be enlarged and first-class meals served at all times.

Ross Park last year was a Mecca for excursion parties from many cities in New York and Pennsylvania. From Decoration Day until the season closed, October 1st, hardly a day passed without an excursion of some kind coming to the city to enjoy the beauties of the park. The seating facilities in front of the platform, where the entertainments are given are not sufficient, and it is intended to make a natural grand stand on the hill facing the dancing hall. Rustic seats will be arranged on the shaded hill side for the comfort of the spectators.

ALLENTOWN, PA.

The Allentown & Lehigh Valley Traction Co. operates its own park and does not rent any part of it. No admission is charged to passengers or others, but bicyclists must leave their wheels outside the park at the check rooms. The theater has six dressing rooms and a stage, the entire front of which is simply an open shell with a roof covering almost to the front of the stage. The dressing rooms are in the rear, and of course entirely closed. The performances are given in the open air entirely, no building or enclosure being necessary. The ground lies naturally in an upward slope, upon which are built benches giving capacity for about three thousand persons. A charge of 10 cents is made for 450 reserved seats directly in front of the stage. The theatrical attractions this year will be on the variety order, such as vaudeville, specialties and minstrel shows, these being very much the same as they have been during the past five years.



A RESTING PLACE IN ROSS PARK.

Mr. A. F. Walter, secretary and treasurer of the company, says:

"Our experience with these attractions has been satisfactory, considering the fact that they seem to have become incident and necessary to street railway operations. We believe that picnics and conventions are more profitable, however, than theatrical attractions, if they can be got, the experience we have had in this line leading us to believe this. We expect to make an extraordinary effort during the coming season to get more picnics and conventions than during the past two or three years. Our company owns an elephant which has not been at the park for the past few years, but which we expect to place there again this year. This is a great attraction for young children. We also have quite a number of animal cages and in some of these we expect to have a few animals. One or two cages at least will contain 12 or 15 monkeys. The monkey cage at our park has always proved to be a center of attraction."

AT A BAND CONCERT—WILLOW GROVE PARK.

PHILADELPHIA.

In Willow Grove Park, Philadelphia has the most highly improved street railway resort in the country, upon which $500,000 has been spent by the Union Traction Company. It lies in the beautiful Chelden Hills about 13 miles from the center of the city and includes three large groves which easily shelter 25,000 pleasure seekers. Thousands of trees, flowers, tropical plants and shrubbery of every variety have been planted in the park. The company has built a scenic railway which is said to be the longest in the country, a carrousel, a Moorish maze, a bicycle swing, shoot the-chutes, a theatre, a fine casino and the artistic music pavilion shown in the illustration. Each season one of the finest bands in the country is engaged together with choruses and special artists to furnish high class music. This season Damrosch and his New York Symphony orchestra and Band Rosa of 55 pieces will render musical programs.

The electric fountain was constructed at a cost of $100,000 and surpasses even the famous electric fountain at the World's Fair. It measures 44 ft. across the base, has two basins, one 5 ft. and the other 8 ft. above the lake. It contains 38 nozzles, varying from ⅝ to 1½ in. in diameter, and 867 ⅛ and ¼-in. jets emitting in all 1,500 gallons of water per minute, and arranged to throw vertical and inclined columns and sprays in large and small circles, by which a large number of beautiful combinations can be made and these are especially impressive when illuminated by powerful electric lights. The operation of the fountain is conducted from a room on shore which is connected with another directly beneath the fountain by a tunnel, two men only being required for the work. The lake in which the fountain is situated covers an area of 10 acres and affords fine boating facilities.

WATCHING A BICYCLE RACE—WILLOW GROVE PARK.

The Willow Grove park bicycle track and athletic field have a national reputation and large athletic meets and contests are often held here. An electric theater with phonographs and kinetoscope entertainments is a great attraction. There was one huge weeping willow tree in the park which was decorated in a most unique manner by hanging 250 incandescent lamps in its branches. The crowds at the park are often very large, numbering at times as high as 50,000, and it is natural that there would be some petty accidents and sudden sickness. To provide for such emergencies there is a doctor at the superintendent's lodge who can be reached by telephone from any part of the grounds.

ELECTRIC FOUNTAIN, WILLOW GROVE PARK.

No intoxicating liquor is sold and its use is absolutely prohibited on the grounds. A detachment of 25 policemen keep perfect order, as it is the object of the company to cater to the best class of people. Special effort is made to secure the annual picnics and gatherings of churches, Sunday schools and societies, and last season over 500 church organizations held their picnics in the park.

LYNCHBURG, VA.

The Lynchburg & Rivermost Street Railway Co. is developing and improving Rivermost Park, which is an undulating tract of 30 acres of primeval forest growth upon an elevated plateau with a magnificent view of the Blue Ridge Mountains 20 miles distant. The natural beauty of the park has been enhanced by laying out walks and lawns and planting trees and shrubbery in suitable places. The company owns the park and rents the amusement and refreshment concessions. Admission to the park is free to all, including bicyclists, but it is divided into two sections, one for white and the other for colored people, and no passage is allowed between them. There are two pavilions, one for each section, and the automoatic swings owned by the company can be used by all visitors. A switchback railway is owned and operated by a private party, who charges 5 cents a ride, and sells eight tickets for 25 cents. The privilege of giving theatrical performances is leased for the season. Picnic parties are encouraged, and there is a large patronage from the same.

H. P. Woodson, president of the company, states: "An extension is being built which will put our cars into City Park, owned by the municipality. It is undergoing improvement under the hand of an experienced florist and park superintendent and it is now one of the prettiest in this section of the state. The city has given permission to the company to erect a neat and attractive pavilion in the heart of the park, and we expect by May 1st to have our cars running into the park. As soon as the extension is completed we will have a park at each end of the road, and the route between them lies through the heart of the city and over an elevated route beyond to the terminus at Rivermost Park. This route is perhaps the most picturesque in the state, with a magnificent view of the Blue Ridge Mountains, and the short spurs reaching within 10 miles of the city. In warm weather a delightful breeze sets in about 7 oclock in the evening and lasts until midnight, making trolley rides most delightful. Concerts, musicales and other entertainments will be provided at Rivermost Park during the season from 8 to 10:30 p. m. The distance from park to park is about four miles and the fare is 5 cents."

TOLEDO, O.

The Toledo Traction Co. manages its own park but rents such concessions as selling popcorn, peanuts, confectionary and operating the merry-go-round and scenic railway. There are two theatrical performances daily, usually high class vaudeville, and band concerts afternoon and evening. The electric fountain and the zoological garden are great attractions, as is also the boating. Picnics and conventions are sought after and prove profitable. The round trip to the park costs 15 cents, including the admission, for which others than passengers are charged 10 cents. Bicycles are checked free on payment of admission.

DAVENPORT, ROCK ISLAND AND MOLINE.

The park about Black Hawk's Watch Tower, maintained by the Tri-City Railway Co. is one of the most attractive in the Central States. The famous Black Hawk Inn, overlooking the Rock River valley and the beautiful scenery thereabouts, have been described and illustrated in previous issues of the "Review." Besides the natural attractions many facilities for entertainment have been provided by the railway company such as bowling alleys, dancing pavilion, rifle range, museum, carrousal, merry-go-rounds, swings and electric fountain. The theater is a neat little outdoor play house, the stage, wings and property rooms absorbing the whole structure, and the audience occupies seats arranged up the hill. Vaudeville, comic opera and dramatic entertainments are given. Nearby, balloon ascensions are made and trapeze and slack-wire acts amuse the crowds.

THE CHUTES FROM THEIR HEAD WATCH TOWER.

The chutes are a never-failing attraction, being the most popular feature of the park. The toboggans are built like boats and slide

down a greased track several hundred feet long and at the foot rush splashing into the river. At the bottom of the chute the speed approaches a mile a minute and yet there is perfect safety, for no accident has occurred to the thousands who have enjoyed the sport. All the concessions are rented to one party. Admission is free to all, but bicycle riders must leave their wheels in the check room and pay 10 cents for their keeping. All buildings and improvements were carried out by the railway company.

BALTIMORE, MD.

The Baltimore Consolidated Railway Co. owns and operates Gwynn Oak Park, which is located seven miles northwest of the city at Gwynn Falls. It covers 76 acres, wooded with ancient and stately oaks. Sunday schools, church parties and all kinds of pic-

BAND STAND, GWYNN OAK PARK, BALTIMORE.

nics are especially solicited and tables and benches are placed through the woods for their convenience. No intoxicating liquors are allowed on the grounds, and the best police regulations are observed. The restaurant, dining pavilion, and the other buildings clustered about them are entirely new and of ample size for the shelter of the largest multitude in case of storms. The dancing pavilion, the interior of which is shown, is the largest and finest in the state. A string orchestra will furnish music from 10 a. m. to 11 p. m., and sacred concerts will be given on Sunday. There are tennis courts and base ball grounds for athletic games, also the lake with bath houses give opportunity for boating and bathing. The merry-go-round, photograph and shooting galleries furnish much amusement. Ballon ascensions, rope walking, high diving, music, specialties, circuses, etc., are free to the patrons of the park.

GRAND RAPIDS, MICH.

The Consolidated Street Railway Co., of Grand Rapids, rents the park privileges such as the restaurant, ice cream, soda water, cigars, peanuts, popcorn, fruit, candy, etc., but retains supervision over all. It is the purpose of the management to fill the grounds, 16 acres, with merry-go-rounds, switchbacks, gypsy camps and like attractions which are respectable. Near the park is a fine bathing beach. Two large steamers make the round of Reed's Lake all day and are liberally patronized. Picnics and conventions are desired, and if they cannot be located at the resort the company assists in getting them to the city. Admission is free to all, including bicyclists. A check room is provided, which may be used at a charge of 5 cents.

In reference to the management of the park Pres. G. S. Johnson says: "We devote a good deal of time and much attention to our summer resort, because we find the better it is conducted the larger the traffic is, and the better the class of entertainments given, the more popular it becomes. Each year we have been enlarging the scope of the entertainments. This year there will be a variety of entertainments and attractions, and they will all be high grade. We confine ourselves to no special features, and embody in our programs everything which promises to draw. For instance, we have Barlow Brothers' Minstrels and comic opera troupes of from 18 to 25 singers. We have various troupes of trained animals, wild and domestic, also some of the very best grade of vaudeville attractions, gymnastic and athletic performances. In fact, the range of the attractions extends over nearly the whole field of amusements. Of course we endeavor to limit the expenditures so that they will not exceed the receipts to any great extent.

"The admission to the pavilion, which will easily accommodate from six to seven thousand people, is free, and the arrangement of the building is such that the stage performances can be seen from and part of it. We have about six hundred reserve seats, for which we charge 10 cents each for every performance. This affords those who desire to be absolutely comfortable during the whole performance the opportunity to be so, and yet it does not prevent those who do not care for the seats from seeing what is going on. We find this arrangement very satisfactory, and the seats sell readily for the better class of performances. For the poorest or medium grades, they do not sell so rapidly. We find this reserve seat arrangement a considerable help financially, as the money so gathered goes some way toward paying the salaries of the performers.

"We have a band, which is a fixed feature of the place, a contract being made with them for an engagement from the begining to the close of the season. This band is made up from 15 to 20 pieces, and is so arranged that it can be converted from an orchestra to a brass band or vice versa, as occasion requires. If we find we have a stage performance which is not up to the standard, we strengthen it and fill up what is lacking with the band, it, at such times, giving concerts, which are attractive to people in this vicinity."

ELGIN, ILL.

The Elgin City, Carpentersville & Aurora Railway Co. is favorably situated with reference to parks, for there are a number along its lines which it does not have to maintain. The city of Elgin owns a fine park of 80 acres, with two lakes for boating, and a zoological garden, including bear pits, deer, foxes and other wild animals. This is at the terminus of one of the company's lines. An electric fountain is operated by the company and weekly concerts are given by the Elgin band. Besides this one, Front Park is on the Dundee

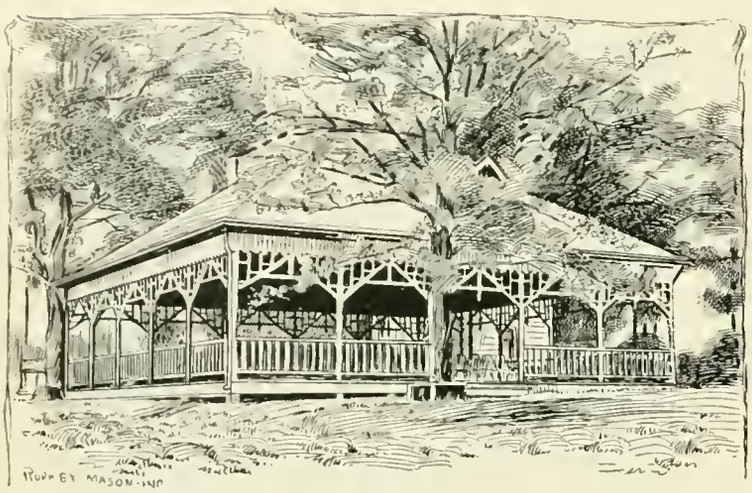
DANCING PAVILION, GWYNN OAK PARK, BALTIMORE.

line, Five Islands Park on the Geneva line and connection is made with St. Charles Park.

INDIANAPOLIS, IND.

Fairview Park, owned by the Citizens' Street Railroad Co., of Indianapolis, is a tract of 260 acres beautifully situated on an elevation overlooking the White River valley. The refreshment building shown in the illustration was built by the company. The concessions for the refreshments, pony track, bowling alleys, merry-

go-round, boating, photograph and shooting galleries are all let. Band concerts are given through the summer. Admission to the park is free to all. The "Open Air Mission" is a charitable work encouraged by the company. The poor and sick children in the city are conveyed to the park each morning through the summer



FAIRVIEW PARK, INDIANAPOLIS.

on a special car, leaving the city at 8 a. m. and returning in the evening.

CLEVELAND, O.

The last four views are of the Avon Beach Park of the Lorain & Cleveland Railway Co. The station at the park is a large brick building sufficient to accommodate big crowds. The pavilion is a commodious and well lighted frame building. The bathing beach and pulpit in the woods constitute the other views.

ATCHINSON, KAN.

The Atchinson Railway, Light & Power Co. manages its own park and rents only the refreshment privileges. A charge of 10 cents is made to those who are not passengers and bicyclists are not encouraged. A base ball diamond is enclosed within the park and the usual admission is charged to the ball games. There are also boating facilities. A summer theater has been built with stage and scenery and a seating capacity of 600. The floor is used for dancing purposes a portion of the time. One or two good opera companies have been engaged for one week each, but these have proved unprofitable, heretofore. A first-class orchestra will furnish music for this summer. It has been found that picnic parties draw the greatest numbers to the park at least expense to the company. As economically as the park can be managed, it has been found that it cost 42 per cent of all fares collected for expenses, including attractions.

HOT SPRINGS, ARK.

The Hot Springs Street Railroad Co. owns and manages its own park, renting only the refreshment stands. It is equipped for all kinds of athletic and aquatic sports, there being facilities for boating, fishing, bathing, baptizing; there are base ball and foot ball grounds, bicycle track, bowling alleys and a ring for boxing contests. There are dancing floors and a merry-go-round, and in fact opportunity for all kinds of amusements in season. Minstrel and vaudeville entertainments are given in the theater and pyrotechnic displays always draw large crowds. The company solicits and gets many school picnics and conventions. Gen. Mgr. C. G. Convers states that the results last year were good, for the park is operated to stimulate travel, but care is exercised to keep expenses down to a reasonable figure.

HARRISBURG, PA.

There was recently a conference at Harrisburg, Pa., attended by managers of electric railway companies of Altoona, Allentown, Reading, Williamsport, Lancaster, York and Carlisle for the purpose of forming a circuit to arrange with theatrical managers for the park entertainments. By this means lower rates can be secured, each attraction will stay one week at each park and a better class of entertainments can be secured.

The Bay City (Mich.) council has requested the street railway companies to employ only residents.

AVON BEACH PARK—LORAIN & CLEVELAND RAILWAY CO.

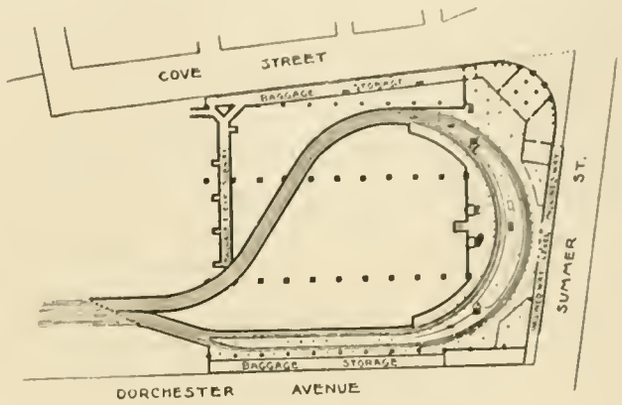
SOUTHERN TERMINAL STATION, BOSTON.

The Southern Terminal Station in Boston, which was opened to traffic January 1, 1899, is the largest terminal passenger station ever built and it is of interest to electric railway men because of the arrangements made by the steam railroads for competing with electric street railways by adopting electricity as the motive power on suburban lines. A union station for handling the traffic of the Boston & Albany, the New England, the Boston & Providence, and the New York, New Haven & Hartford Railroads, was strongly advocated by Mayor Josiah Quincy at the commencement of his first term in 1896. When he broached the plan to the officials of the railroads interested they readily acquiesced and on June 9, 1896, a bill chartering the Boston Terminal Company, and providing for the erection of a union station, was approved by the governor. The four railroad companies mentioned constitute the Boston Terminal Company, and they handle approximately 25,000,000 passengers per annum, this number being about one half the total for Boston. The population within 50 miles of Boston is 2,302,000, which is greater than that within the same distance of any other American city save New York.

The main building extends 792 ft. along Atlantic avenue, and 672 ft. along Summer street; the central curved portion is 228 ft. long. As seen from Federal street the central station is a five-story building; the first story is used for station purposes and the others for offices, conductors' and trainmen's rooms and the offices of the Boston Terminal Company occupy the second floor, the Boston & Albany the third, and the New York, New Haven & Hartford the fourth and fifth floors.

The five-story building has a total frontage of 875 ft., and on Summer street, Atlantic avenue and Dorchester avenue are two-story buildings 234 ft., 356 ft. and 725 ft. long, respectively, making the total frontage on the three sides 2,190 ft.

the station at one side of the steam tracks and at a grade about 17 ft. beneath them, and, as they enter, they spread, so that there is a large platform between the tracks. This central platform lies immediately below the midway on the main floor, and is connected with it and the main waiting room by stairs. It is designed to be the loading



PLAN OF SUBURBAN TERMINAL.

platform, and is the right platform for all trains. The unloading is designed to be done on the outside platforms. The total platform area on this floor is large enough to allow the assembling of about 25,000 people at one time. It is to be raised about 4 ft. above the tracks, so that the height of the stairway is to be 13 ft., while there is an 8-ft. rise in passing to Summer street by the inclined way, which will have a gradient of not more than 6 ft. in 100. So long as only one of the two loop tracks is needed, therefore, all climbing

NEW SOUTHERN TERMINAL STATION, BOSTON.

The new and important features of this station are the separation of the local and through traffic, the arrangement of these two classes on different floors, the use of loops instead of stubs for the local traffic, and the use of some other motive power than steam for the local traffic.

The trainshed is 570 ft. wide by 602 ft. long, with 28 tracks; including the headhouse the area covered is 13 acres. The tracks are 5 ft. above the street level and are reached without steps, the approaches being inclined grades of 3 and 5 per cent. The suburban traffic is to be handled on a lower level. Two loops were deemed equivalent to the 28 stub tracks in the main shed. The loops enter of stairs will be avoided. The radius of the outer track is 262 ft., and the inner, 242 ft.

This station was built with the idea of eventually substituting some other motive power for steam in handling the local traffic. While the Terminal Company does not state that electricity has been decided upon, it admits that it is at present the most probable.

The Atlanta Consolidated Railway Co. has just put in service a very handsome car which was built in the company's shops. Six other cars similar to this one are near completion and 20 more are under headway.

OPERATING EXPENSES OF CONNECTICUT ROADS IN 1898.

The Railroad Commissioners of Connecticut, in their annual report for 1898, give street railway statistics for nine months only, that is, from October 1, 1897, to June 30, 1898. This change in the fiscal year was made in order to make the fiscal year for the street railways the same as for the steam roads. The fact that the returns given do not include the months of July, August and September, when traffic is heaviest, renders the figures less valuable for the purpose of making comparisons with previous years.

There are now 31 street railways reporting to the Commissioners, two new ones having been added during the period covered by the report. One of these is the Manufacturers' Railroad Company, of New Haven, which has 1.36 miles of track and handles freight cars only.

The increase in mileage was 25.71 miles; of this 25.00 miles was increase of main track. The total trackage June 30, 1898, was 411.41 miles, including 24.40 miles of sidings.

The total capital stock issued was $10,451,000, an increase of $680,600; the stock per mile, excluding sidings, is $27,004.50. The bonds aggregate $10,022,800, an increase of $930,000; the bonded indebtedness per mile is $25,897.97. The floating indebtedness is $758,828.04, a decrease of $312,593; per mile it is $1,960.74.

The total cost of construction was reported as $17,519,534, or $42,584.53 per mile, excluding sidings; and the total cost of equipment as $2,286,706.56, or $5,908.63 per mile. These figures are stated to be only approximate, and to include the cost of electric lighting plants in a number of instances.

For the nine months the gross earnings were $2,018,985.98, being $5,253.55 per mile operated, $.1945 per car-mile run, and $.0514 per passenger carried. Operating expenses were $1,312,561.37, being 65 per cent of the gross earnings, $3,391.53 per mile operated, $.1271 per car-mile run, and $.0334 per passenger carried.

Dividends were declared by 10 operating companies of $180,276.40 on $3,777,500 of capital stock.

Taxes to the amount of $161,164.36, which is about 8 per cent of the gross earnings and 22.7 per cent of the net earnings, were paid. Of this, $133.053 went to the state.

The car-miles run in the state (three small roads not reporting) were $10,323,464. The passengers carried were 39,272,306, being 3.8 per car-mile.

The number of employes is 1,978, or about five persons per mile of road.

In the nine months 138 persons were injured, of whom 10 were killed

Data as to equipment and itemized statements of expenses in cents per car-mile are given below for the roads which gave the necessary data in their reports. Track is measured as single track, exclusive of switches and sidings.

The Manufacturers' Railroad Company, of New Haven, owns one 30-ton electric locomotive and 1.364 miles of track, hauling freight cars only; its gross receipts were $4,106.56; operating expenses, $2,780.38.

BRIDGEPORT TRACTION COMPANY.

Track, 52.60 miles; closed cars, 53; open cars, 51; equipped with motors, 66; cars equipped with fenders, 65; snow plows, 7; car-miles run, 1,454,638; passengers, 4,108,260; passengers per car-mile, 2.824; round trips, 220,680; employes, 200; fare, 5, 10 and 15 cents; operating expenses, 51.6 per cent of earnings.

Repairs of roadbed and track	.2620
Repairs of fences	.0352
Repairs of buildings and fixtures	.1777
Repairs of electric line construction	.0893
Removal of snow and ice	.1578
Repairs of cars	.1927
Repairs of equipment of cars	.6906
Care of horses	.0542
Electric motive power	.9730
Wages, conducting transportation	4.1110
Wages and salaries, other	.7790
Accident fund, 2½ per cent of gross earnings	.4720
Fire insurance	.1448
Other expenses, legal, printing, etc	.4171
Total expenses per car-mile	8.5564
Receipts from passengers per car-mile	16.4330
Earnings per car-mile	16.5680

BRISTOL & PLAINVILLE TRAMWAY COMPANY.

Track operated, 7.33 miles; closed cars, 5; open cars, 10; equipped with motors, 14; snow plow, 1; car-miles run, 145,629; passengers carried, 543,032; passengers per car-mile, 3.728; round trips, 15,725; employes, 30; fare, 5 and 10 cents, 4-cent commutation, 3-cent school; operating expenses, 69.7 per cent of passenger receipts.

Repairs of road bed and track	.7801
Repairs of buildings and fixtures	.0389
Repairs of electric line construction	.1889
Removal of snow and ice	.1490
Repairs of cars	.6500
Repairs of equipment of cars	.0508
Park attractions	.0457
Legal expenses	.1011
Transportation supplies	.1407
Electric motive power	2.5025
Wages, conducting transportation	6.1500
Wages and salaries, other	.9280
Damages, persons and property	.1065
Insurance	.4669
Sundries	.4280
Total expenses per car-mile	12.7271
Receipts from passengers per car-mile	18.2650

CENTRAL RAILWAY & ELECTRIC COMPANY, NEW BRITAIN.

Track operated, 16.55 miles; closed cars, 16; open cars, 22; equipped with motors, 32; cars equipped with fenders, 32; snow plows, 4; car-miles run, 338,403; passengers carried, 1,434,105; passengers per car-mile, 4.238; round trips, 60,294; employes, 83; fare, 5, 8 and 15 cents; operating expenses, 7.57 per cent of earnings.

Repairs of roadbed and track	.8115
Repairs of buildings and fixtures	.0755
Repairs of electric line construction	.3785
Removal of snow and ice	.2246
Repairs of cars	.8146
Repairs of equipment of cars	.2042
Care of horses	.0628
Electric motive power	2.9387
Wages, conducting transportation	5.6402
Wages and salaries, other	.6121
Damages	.0668
Insurance	1.0832
Legal expenses	.1012
Park expenses	.5198
Sundries	.7410
Total expenses per car-mile	14.2747
Receipts from passengers per car-mile	18.3800
Earnings per car-mile	18.8600

DANBURY & BETHEL STREET RAILWAY COMPANY.

Road operated, 11.15 miles; closed cars, 13; open cars, 18; equipped with motors, 22; trailers, 3 closed, 6 open; equipped with fenders, 22; snow plow, 1; car-miles run, 244,533; passengers carried, 823,669; passengers per car-mile, 3.368; round trips, 27,170; employes, 45; fare, 5 cents plus 5 cents on one long line; operating expenses, 61.4 per cent of earnings.

Repairs of roadbed and track	.4594
Repairs of electric line construction	.1391
Removal of snow and ice	.0168
Repairs of cars	.5038
Repairs of car equipment	.4317
Blacksmithing	.2025
Horses, headlights and fires	.3062

Electric motive power	2.4927
Wages, conducting transportation	4.2630
Wages and salaries, other	.6670
Insurance	.9130
General expenses	.2613
Total expenses per car-mile	10.6565
Receipts from passengers per car-mile	17.2460
Earnings per car-mile	17.3580

DERBY STREET RAILWAY COMPANY.

Road operated, 5.89 miles; closed cars, 10; open cars, 15; equipped with motors, 17; cars equipped with fenders, 25; freight cars, 3; snow plows, 1; car-miles run, 154,275; passengers carried, 712,344; passengers per car-mile, 4.595; round trips, 32,353; employes, 22; fare, 5 cents; operating expenses, 57.0 per cent of earnings.

Repairs of roadbed and track	.2933
Repairs of buildings and fixtures	.3782
Repairs of electric line construction	.2208
Removal of ice and snow	.0293
Repairs of cars	.7100
Repairs of car equipment	.7362
Electric motive power	2.3860
Wages, conducting transportation	5.0200
Wages and salaries, other	1.4750
Damages, etc.	.0738
Insurance	.0656
Transportation expenses, other than wages	.8036
Park expenses	.8326
Total expenses per car-mile	13.0244
Receipts from passengers per car-mile	22.3000
Earnings per car-mile	22.8570

ENFIELD & LONGMEADOW ELECTRIC RAILWAY COMPANY.

Road operated, 8.36 miles; closed cars, 5; open cars, 5; equipped with motors, 10; snow plows, 1; car-miles run, 128,881; passengers carried, 284,482; passengers per car-mile, 2.207; round trips, 4,356; employes, 17; fare, 5 and 10 cents; operating expenses, 95.6 per cent of earnings.

Repairs of roadbed and track	.3385
Repairs of buildings and fixtures	.0074
Repairs of electric line construction	.0139
Removal of snow and ice	.1448
Repairs of cars	.1206
Repairs of car equipment	.0073
Electric motive power	2.3973
Wages, conducting transportation	4.8105
Wages and salaries, other	2.7815
Insurance	.1654
General	.4842
Total expenses per car-mile	11.2714
Receipts from passengers per car-mile	11.2800
Earnings per car-mile	11.7850

FAIR HAVEN & WESTVILLE RAILROAD COMPANY.

Road operated, 29.853; closed cars, 52; open cars, 46; equipped with motors, 88; cars equipped with fenders, 88; snow plows, 1; car-miles run, 1,283,642; passengers carried, 4,898,363; passengers per car-mile, 3.816; round trips, 170,046; employes, 225; fare, 5 cents plus 5 cents on one line; operating expenses, 56.3 per cent of earnings.

Repairs of roadbed and track	.5711
Repairs of buildings and fixtures	.0746
Repairs of electric line construction	.1592
Removal of snow and ice	.1226
Repairs of cars	.4029
Repairs of car equipment	.2610
Electric motive power	1.0413
Wages, conducting transportation	5.6470
Wages and salaries, other	1.4385
Damages	.2502
Insurance	.0525
Sundries	.8516
Total expenses per car-mile	10.8725
Receipts from passengers per car mile	19.0050
Earnings per car-mile	19.3060

HARTFORD, MANCHESTER & ROCKVILLE TRAMWAY COMPANY.

Road operated, 18.675 miles; closed cars, 12; open cars, 19; equipped with motors, 31; cars equipped with fenders, 31; snow plows, 2; car-miles run, 243,542; passengers carried, 599,429; passengers per car-mile, 2.471; round trips, 19,532; employes, 65; fare, 5, 10 and 15 cents; operating expenses, 68.0 per cent of passenger earnings.

Repairs of roadbed and track	1.2635
Repairs of buildings and fixtures	.1466
Repairs of line construction	.1520
Removal of snow and ice	.1803
Repairs of cars	1.2793
Repairs of car equipment	1.0463
Electric motive power	3.8942
Wages, conducting transportation	5.3850
Wages and salaries, other	1.3070
Damages, etc.	.0567
Insurance	.2875
Rent and miscellaneous expenses	.9250
Total expenses per car-mile	15.9234
Receipts from passengers per car-mile	23.4160

HARTFORD STREET RAILWAY COMPANY.

Road operated, 70.261 miles; closed cars, 95; open cars, 85; equipped with motors, 180; cars equipped with fenders, 180; snow plows, 8; car-miles run, 2,228,932; passengers carried, 8,886,229; passengers per car-mile, 3.996; round trips, 284,203; employes, 530; fare, 5, 10, 15 and 20 cents; operating expenses, 69.2 per cent of earnings.

Repairs of roadbed and track	1.0328
Repairs of plant, tools, etc.,	.3467
Repairs of buildings and fixtures	.2741
Repairs of line construction	.3608
Removal of snow and ice	.2264
Repairs of cars	.8264
Repairs of car equipment	.5662
Care of horses	.1412
Electric motive power	1.9926
Wages, conducting transportation	5.8554
Wages and salaries, other	.7810
Damages, etc.	.3878
Insurance	.2127
Printing	.0535
Legal expenses	.1033
Car supplies	.2288
Total expenses per car-mile	13.5975
Receipts from passengers per car-mile	19.6180
Earnings per car-mile	19.6520

HARTFORD & WEST HARTFORD HORSE RAILROAD COMPANY.

Road operated, 17.8 miles; closed cars, 8; open cars, 13; equipped with motors, 21; cars equipped with fenders, 16; snow plows, 2; car-miles run, 188,892; passengers carried, 375,375; passengers per car-mile, 1.987; round trips, 7,220; employes, 32; fare, 5, 10, 15 and 20 cents (7½ and 8 cents for commutation books); operating expenses, 92.7 per cent of earnings.

Repairs of roadbed and track	1.0759
Repairs of line construction	.0217
Removal of snow and ice	.0623
Repairs of cars	1.4422
Repairs of car equipment	.2620

Electric motive power	3.7960
Wages, conducting transportation	3.6697
Wages and salaries, other	.8618
Damages	.1800
Insurance	.2358
Rent of other roads	3.3515
Other operating expenses	.2640
General expense	.2767
Total expenses per car-mile	14.4996
Receipts from passengers per car-mile	14.4460
Earnings per car-mile	15.6470

MERIDEN ELECTRIC RAILROAD COMPANY.

Road operated, 17 miles; closed cars, 22; equipped with motors, 22; open cars, 24; cars equipped with fenders, 21; car-miles run, 445,864; passengers carried, 1,439,285; passengers per car-mile, 3.228; employes, 73; fare, 5 cents local, 10 and 15 cents interurban; operating expenses, 77.8 per cent of earnings.

Repairs of roadbed and track	.5619
Repairs of buildings and fixtures	.0982
Repairs of line construction	.1657
Removal of snow and ice	.0684
Repairs of cars	.1793
Repairs of car equipment	.6621
Electric motive power	2.2730
Wages, conducting transportation	5.3830
Wages and salaries, other	.3933
Care of horses	.0662
Repair of trucks	.2223
Repair of power plant	.2368
Office expense	.1318
Legal expense	.0658
Park expense	.7187
Insurance, fire and accident	.9114
Miscellaneous operating expenses	.4690
Total expenses per car-mile	12.6069
Receipts from passengers per car-mile	15.9600
Earnings per car-mile	16.1870

MIDDLETOWN STREET RAILWAY COMPANY.

Road operated, 7.92 miles; closed cars, 6; open cars, 12; equipped with motors, 13; snow plows, 2; car-miles run, 102,801; passengers carried, 461,948; passengers per car-mile, 4.494; round trips, 27,649; employes, 17; fare, 5 cents; operating expenses, 73.4 per cent of earnings. This includes five months' operation of Portland Street Railway.

Repairs of roadbed and track	.4254
Repairs of electric line construction	.0684
Removal of snow and ice	.1195
Repairs of cars	.7145
Repairs of car equipment	.1877
Cars of horses	.0687
Electric motive power	4.2410
Wages, conducting transportation	4.6110
Wages and salaries, other	1.0943
Damages, etc.	.0122
Insurance	.2399
Car house account	.8114
General expenses	.5418
Total expense per car-mile	13.1358
Receipts from passengers per car-mile	17.6450
Earnings per car-mile	17.9020

NEW HAVEN STREET RAILWAY COMPANY.

Road operated, 30.75 miles; closed cars, 35; open cars, 39; equipped with motors, 68; cars equipped with fenders, 68; snow plows, 4; car-miles run, 883,731; passengers carried, 3,093,458; passengers per car-mile, 3.503; employes, 160; fare, 5 and 10 cents; operating expenses, 60.6 per cent of earnings.

Repairs of roadbed and track	.4461
Repairs of buildings and fixtures	.0150
Repairs of machinery	0953
Repairs of line construction	.1534
Removal of snow and ice	.1052
Repairs of cars	1.1540
Repairs of car equipment	.3595
Wages, conducting transportation	4.8690
Wages and salaries, other	.4372
Boiler and engine room service	1.7320
Damages, etc.	.0242
Insurance	.1315
Electric motive power	.0178
Attractions	.0802
Rent of track	.0611
Sundries	.2438
Total expenses per car-mile	9.9253
Receipts from passengers per car-mile	16.2160
Earnings per car-mile	16.3700

NEW LONDON STREET RAILWAY COMPANY.

Road operated, 7.18 miles; closed cars, 7; open cars, 16; equipped with motors, 22; snow plows, 2; car-miles run, 137,841; passengers carried, 666,844; passengers per car-mile, 4.839; round trips, 25,636; employes, 25; fare, 5 cents; operating expenses, 74.8 per cent of earnings.

Repairs of roadbed and track	.9958
Repairs of buildings and fixtures	.1543
Repairs of line construction	.1502
Repairs in power plant	.0293
Care of horses	.0678
Removal of snow and ice	.4121
Repairs of cars	1.1220
Repairs of car equipment	.7321
Fuel for electric motive power	1.7820
Wages, conducting transportation	5.2150
Wages and salaries, other	3.4380
Insurance	1.5770
Miscellaneous	1.1583
Total expenses per car-mile	16.8339
Receipts from passengers per car-mile	22.1950
Earnings per car-mile	22.4925

NORWALK STREET RAILWAY COMPANY.

Road operated, 7.91; closed cars, 11; open cars, 9; equipped with motors, 19; cars equipped with fenders, 20; snow sweeper, 1; car-miles run, 167,592; passengers carried, 748,842; passengers per car-mile, 4.468; round trips, 27,556; employes, 25; fare, 5 cents; operating expenses, 69.4 per cent of earnings.

Repairs of roadbed and track	.0874
Repairs of buildings and fixtures	.0163
Repairs of line construction	.0188
Rent of right of way	.0746
Removal of snow and ice	.0256
Repairs of cars and equipments	.7241
Electric motive power	3.0482
Wages, conducting transportation	5.5461
Wages and salaries, other	2.4632
Damages, etc.	1.2585
Legal expense	.2888
Miscellaneous	1.5438
Total expense per car-mile	15.0952
Receipts from passengers per car-mile	21.7380
Earnings per car-mile	21.7380

NORWALK TRAMWAY COMPANY.

Road operated, 18.33 miles; closed cars, 9; open cars, 16; cars equipped with fenders, 25; snow plow, 1; car-miles run, 302,608; passengers carried, 816,113; passengers per car-mile, 2.697; round trips, 43,318; employes, about 50; fare, 5 cents; operating expenses, 78.9 per cent of earnings.

Repairs of roadbed and track	.2414
Repairs of buildings and fixtures	.0610
Repairs of line construction	.2800
Removal of snow and ice	.0797
Repairs of cars and trucks	.2659
Repairs of car equipment	.1817
Electric motive power	2.2795
Rentals	.2230
Office expenses	.1362
Wages, conducting transportation	3.6355
Wages and salaries, other	1.0752
Damages, etc.	.0083
Insurance	.5225
Miscellaneous	.5895
Total expenses per car-mile	9.5894
Receipts from passengers per car-mile	12.1050
Earnings per car-mile	12.1580

NORWICH STREET RAILWAY COMPANY.

Road operated, 11.915 miles; closed cars, 13; open cars, 14; motor equipments, 21; cars equipped with fenders, 27; snow plows, 2; car-miles run, 223,347; passengers carried, 1,256,626; passengers per car-mile, 5.628; employes, 45; fare, 5 and 10 cents; operating expenses, 70.7 per cent of earnings.

Repairs of buildings and fixtures	.0779
Repairs of roadbed and tracks	.9864
Care of horses	.1154
Park expense	.1294
Damages	.0093
Repairs of line construction	.2214
Removal of snow and ice	.2900
Repairs of cars	.5308
Repairs of car equipment	1.0200
Electric motive power	3.7490
Wages, conducting transportation	6.0260
Wages and salaries, other	1.8745
Insurance	1.1083
Operating expenses, miscellaneous	.9404
Total expenses per car-mile	17.0788
Receipts from passengers per car-mile	23.7700
Earnings per car-mile	24.1650

PORTLAND STREET RAILWAY COMPANY.

Road operated, 2.8 miles; closed cars, 2; motor equipments, 2; snow plow, 1; car-miles run, 16,834 in four months; passengers carried, 49,333 in nine months; employes, 5; fare, 5 cents; operating expenses, 77.8 per cent of earnings. These figures are for four months only; the road was consolidated with the Middletown Street Railway, January 31, 1898.

Repairs of car equipment	.1148
Repairs of buildings and fixtures	.1684
Repairs of roadbed and track	.2498
Removal of snow and ice	.0128
Repairs of cars	.0567
Electric motive power	4.7120
Wages, conducting transportation	4.0988
Insurance	.3410
Other expense	.6038
Total operating expenses per car-mile	10.3531
Receipts from passengers per car-mile	12.9420
Earnings per car-mile	13.3150

STAMFORD STREET RAILROAD COMPANY.

Road operated, 11.05; closed cars, 9; open cars, 11; motor equipments, 15; cars equipped with fenders, 7; snow plow, 1; car-miles run, 226,264; passengers carried, 618,845; passengers per car-mile, 2.735; employes, 40; fare, 5 cents; operating expenses, 97.3 per cent of earnings.

Repairs of roadbed and track	.2255
Repairs of buildings	.0106
Repairs of electric line construction	.1424
Removal of snow and ice	.0307
Repairs of cars and trucks	.5540
Repairs of car equipment	.5460
Care of horses	.1092
Electric motive power	4.9450
Wages, conducting transportation	4.5420
Wages and salaries, other	.8830
Insurance, fire and accident	.6445
Other expenses	.3226
Total expenses per car-mile	12.9555
Receipts from passengers per car-mile	13.2300
Earnings per car-mile	13.3140

TORRINGTON & WINCHESTER STREET RAILWAY COMPANY.

Road operated, 12.559 miles; closed cars, 5; open cars, 9; equipped with motors, 12; equipped with fenders, 8; snow plow, 1; car-miles run, 162,684; passengers carried, 496,726; passengers per car mile, 3.056; round trips, 7,073; employes, 27; fare, 15 cents (5 cents in town limits); operating expenses, 64.3 per cent of earnings.

Repairs of roadbed and track	.3176
Repairs of buildings and fixtures	.0884
Repairs of electric line construction	.0644
Removal of snow and ice	.1366
Repairs of cars	.2385
Repairs of car equipment	.0547
Wages, conducting transportation	3.4340
Wages and salaries, other	.9084
Insurance	.7538
Power station operation	3.0118
General expense	.5155
Amusement	.0449
Total expenses per car-mile	9.5686
Receipts from passengers per car-mile	14.6000
Earnings per car-mile	14.8770

WATERBURY TRACTION COMPANY.

Road operated, 12.18 miles; closed cars, 26; open cars, 30; equipped with motors, 52; equipped with fenders, 52; snow plows, 3; car-miles run, 435,431; passengers carried, 2,515,116; passengers per car-mile, 5.778; round trips, 77,760; employes, 85; fare, 5 and 10 cents; 4 and 8 cents for tickets, 3 cents for school tickets; operating expenses, 57.8 per cent of earnings.

Repairs of roadbed and track	.8672
Repairs of line construction	.1351
Removal of snow and ice	.1297
Repairs of cars	1.0127
Repair of buildings and fixtures	.0527
Repairs of car equipment	.3866
Teams	.0645
Electric motive power	3.0002
Wages, conducting transportation	6.9350
Wages and salaries, other	.7386
Damages	.1541
Insurance	1.1414
Legal expenses	.0714
General expenses	.9065
Total expenses per car-mile	15.5957
Receipts from passengers per car-mile	26.8680
Earnings per car-mile	26.9800

WESTPORT & SAUGATUCK STREET RAILWAY COMPANY.

Road operated, 5.12 miles; closed cars, 3; open cars, 2; equipped with motors, 4; car-miles run, 42,300; passengers carried, 77,702; passengers per car-mile, 1.837; round trips, 5,713; employes, 8; fare, 5 and 3 cents; operating expenses, 17.60 per cent of earnings.

Repairs of roadbed and track	.0974
Removal of snow and ice	.0778

Care of horses	.1596
Electric motive power	6.8810
Repairs of cars	.0899
Damages	.6147
Wages, conducting transportation	6.4050
Wages and salaries, other	.2062
Insurance	.4979
Other expenses	1.7865
Total expenses per car-mile	16.8160
Receipts from passengers per car-mile	8.6780
Earnings per car-mile	9.5550

WINCHESTER AVENUE RAILROAD COMPANY, WEST HAVEN.

Road operated, 21.44 miles (includes West Shore Railway, 3.90 miles); closed cars, 39; open cars, 52; equipped with motors, 59; equipped with fenders, 60; snow plows, 4; car-miles run, 746,801; passengers carried, 4,381,462; passengers per car-mile, 5.729; employes, 155; fare, 5 and 10 cents; operating expenses, 67.8 per cent of earnings.

Repairs of roadbed and track	1.1458
Repairs of buildings	.0985
Repairs of line construction	.0743
Removal of snow and ice	.0803
Repairs of cars	.5992
Repairs of car equipment	.4942
Care of horses	.1624
Electric motive power	1.5804
Wages	6.6140
Insurance	.2089
Wages and salaries, other	.8532
General expense	1.3885
Total expenses per car-mile	13.2997
Receipts from passengers per car-mile	20.1240
Earnings per car-mile	21,5300

ST. LOUIS WORLD'S FAIR.

It is proposed to hold a World's Fair in St. Louis in 1903 to celebrate the Louisiana Purchase Centennial, and arrangements are progressing for the organization of a stock company with a capital of $5,000,000; the city of St. Louis proposes to raise $5,000,000 on an issue of bonds and the National Government will be asked for a loan of $5,000,000 and the state of Missouri for a loan of $2,500,000 more.

The electrical industries are taking an active part in the enterprise, and at a recent meeting of their representatives in St. Louis E. J. Spencer, 24 Laclede Building, of the Safety Insulated Wire & Cable Co., was appointed chairman of the committee to solicit subscriptions to the stock of the exposition company. This stock of a par value of $10 per share is offered for popular subscriptions; the first payment of subscriptions to stock is to be 5 per cent; no subsequent call for payment on stock is to exceed 20 per cent of the amount subscribed; and no two calls are to be made in any single period of six months. All subscriptions are conditioned on the aggregate of at least $5,000,000; and except for the first payment of 5 per cent, or such portion thereof as may be necessary for preliminary expenses, no further calls on subscribers will be made until the aggregate subscriptions are at least $5,000,000.

NO COMPETING LINES AT QUINCY, ILL.

Last fall the city council of Quincy, Ill., granted a franchise to the J. C. Hubinger Co., of Keokuk, Ia., to construct a street railway system in that city. The Quincy Horse Railway & Carrying Co. secured a temporary injunction, and recently the United States Circuit Court has made the injunction perpetual. The judge held that the present company has an exslusive right to the streets of Quincy, and no one can interfere with these rights until after the expiration of the 50-year franchise granted by the Legislature, and that has still 15 years to run.

STEEL IN CAR REPAIRING.

BY W. H. GLENN.

The majority of the street railways of this country which have been electrically equipped, bought their original rolling stock for this equipment some six or seven years ago; consequently, most of them find just now that their cars and motors must either be repaired or renewed. And just which one of these to do is a question that is today puzzling many a manager. If he buys new cars, they must, of course, be charged to expense accounts, because they take the place of worn-out ones. This would run his operating expenses up in an alarming manner.

On the other hand, while it would not cost so much to repair the old cars, yet he would not get the service from them that he would get from the new ones. Naturally, then, he is loath to repair. But if he could hit on some scheme by which he could repair his old cars, and get from them one-half the service that he could from new ones, and at a cost of only one-fifth, or, at most, one-fourth, of the cost of the new ones, then the problem would to some extent be solved.

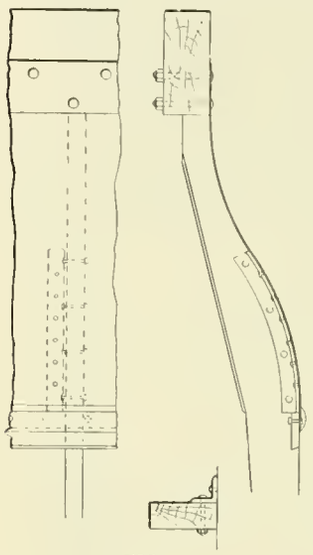


FIG. 1.

The introduction of steel into building construction, and its universal approval and adoption by the most expert architects and builders, has for some time past had the manufacturers of street cars experimenting along this same line, with a view to lightening and at the same time strengthening their cars; but so far as the writer's knowledge goes, it has not been adopted to any extent. The managers, in many instances, discouraged the use of steel, stating in proof of their position that it would be too likely to short circuit the current and cause no end of trouble. There was a time when there might have been some virtue in this idea; but the almost absolute control under which the current has lately been brought, due to more perfect methods of insulation, has rendered the use of steel available for street car purposes, especially in repair work. No one will deny that the tensile strength of a given weight of steel is much greater than that of the same weight of wood; and its durability is, of course, beyond question. Then, too, smaller cross sections can be used, retaining the same strength. This is a very important item, as will be explained later. There are many places, however, where it is impossible to use steel.

Let us take an ordinary box car which has been running for seven or eight years, and has the side sills and framing all decayed and the panels all stove in; it presents a very dilapidated appearance and it hardly seems worth while to attempt to repair it. By close examination we find that most of the timbers above the lower rail of the windows are in fair shape, with the exception of the roof. We must confine our repairs, then, to the lower portion of the car, for if the corner posts and window posts are held securely, the upper portion of the car will give little trouble.

The first thing, then, is to take the old framing from the bottom of the car and make a new one. If all the corners of the framing are lined with ⅛ or 3-16 steel for about 18 in. on each side of the corner, it will very materially strengthen the framing. This done, any corner or window posts that have decayed or been broken must be replaced, and the car is ready to be let down on the framing. When this has been completed the panels are ready to be put on. This is where the most important substitution of steel for wood comes in. Instead of using two pieces of poplar and bending them, one for the convex panel and one for the concave, we will take a solid sheet of steel as long as the car, about .135 in. thick and wide enough to make both panels, which is ordinarily 36 in. This sheet is bent to conform to the curve of the window posts; that is, the upper portion is convex and the lower concave. This process of bending will be found to be somewhat difficult at first, but if forms are made over

which the sheet can be bent it will soon be an easy matter. By all means bend the sheet before it is bolted to the car. Some may advise drilling it and letting each bolt, as it is put in, draw the sheet to conform to the proper curve, but sheets thus applied are always under stress and will very soon buckle.

We now take a piece of 1½-in. angle iron about 16 in. long and bend it also to conform to the upper curve of the window post (see Fig. 1). Placing the upper end of this angle iron about on a line with the lower edge of the window rail, we bolt one leg to the window post, using a ⅜-in. carriage bolt; the other leg is bored for ⅜-in. rivets. The sheet is bored so as to be riveted to this leg. It is countersunk on the outside, so that when the rivets are put through, with the heads on the inside (see Fig. 1), and the riveting done, with a little filing this sheet will be left perfectly smooth and ready for the painter. Of course these sheets could be bolted directly to the window posts, but these posts varying in thickness up and down would require a different length bolt for each hole. Then, too, the panel, all covered with bolt heads, would not present so neat an appearance. When the side panels are up, the end panels (that is, the ones on either side of the door) must be cut and put on. This is an easy matter, as there is no bending to be done. Where this end panel meets the side panel on the corner post, it would, of course, look rough; but we take a piece of 1½-in. angle iron, bend it to conform to the curve of the corner post and put it on over the joint. This makes a strong and at the same time a neat job.

The ideal car on which to put this steel panel would be one with straight sides; that is, no concave or convex panels. Then we could have one solid sheet starting at the side of door on one end of the car, curving round the corner post, extending the entire length of the car and around to the door. We would thus avoid the necessity of bending (except at the corners), and have all the panels, including the ends, in only two pieces.

The panels up, the next point to claim our consideration is the platform. Just here it is well to note that the street railways are enlarging their platforms. This is as it should be, for there are always a number of passengers who like to ride outside either to smoke or for any other reason, and a company will lose nothing by enlarging its platforms and taking care of this class of passengers. Let them ride where they please, so long as nothing is thereby endangered; for in so doing the passengers are humored, and the more they are humored the more they will ride, and the more they will ride the better able the company will be to drive away that awful "wolf"—fixed charges.

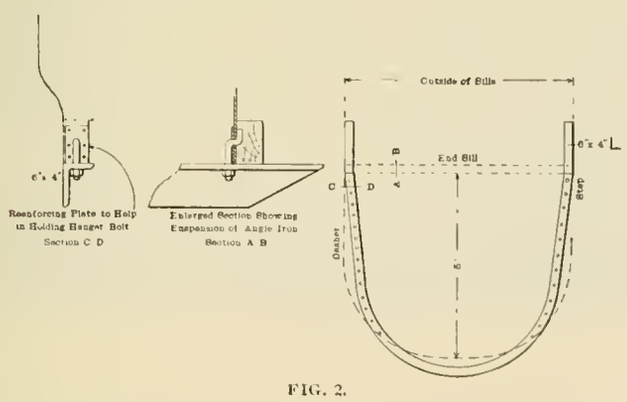


FIG. 2.

To make the platform, we take a piece of 4 in. x 6 in. angle iron, with the 6 in. leg vertical, and bend it as shown in Fig. 2. Of course the length of this platform may be regulated to suit the occasion; but a 5-ft. platform will prove very commodious and convenient. The ends of the angle iron should extend back under the sills for at least 24 in. The method of holding this angle is shown in the section of Fig. 2. The angle iron is drilled so as to allow the flooring (which should be at least 1¼ in. thick) to be bolted directly to it. This avoids the numerous timbers usually underneath a platform, and which are so much in the way of the wires and cables.

The dashers should be made of steel .065 in. thick and 36 in. wide, and bent, as shown by the dotted line in Fig. 2. It will be noticed that this dasher commences at the end of the side panel on the right of the car and extends around to the step on the opposite side. The dasher on the other end is arranged so as to throw the step on the diagonally opposite corner. In this way the step on the rear platform is always away from the paralleling track, and should anyone desire to get off from the front platform (the step of which is toward the paralleling track), the motorman is so close by that he can easily watch him and regulate the movements of the car accordingly. This obviates the necessity of gates, unless it is desired to close the front step, in which case it would require only two gates to the car.

These dashers are fastened to the floor by means of pieces of 1½-in. angle iron about 2 in. long and spaced about 12 in. apart. One leg

FIG. 3.

of this angle is bolted to the floor and the other either bolted or riveted to the dasher. For a dasher rail, take a piece of 1½-in. angle iron the length of the dasher, bend it to the same curve and rivet it to the top of the dasher.

The hoods are made so as to conform to the curves of the platforms.

When the necessary repairs are made on the roofs, the cars are ready for the painter.

Fig. 3 shows a car that has been repaired in the manner outlined above, and although it has not been in service long enough to tell just exactly what it will do, still it is safe to say that it is good for at least three years longer. This identical car was examined three years ago and reported worthless. It stood in the barn for two years and was then ordered to be burned; but when the work of repairing cars with steel sheets, etc., was begun, the car was saved, and at the present day it is one of the best on the line. The steel sheet not only serves the purpose of a panel, but braces almost the entire car.

This is merely a general statement of the method, the details of which can be easily worked out, and may be the means of converting some almost worthless cars into serviceable ones.

TENNESSEE STREET RAILWAY ASSOCIATION.

Since the organization of the Tennessee Street Railway Association in January last several meetings have been held in Nashville for the discussion of matters of general interest to the members, and the next meeting will probably be at Memphis. The object of this association is to render more intimate the business and social relations of the members and at present the questions under consideration are the practicability of organizing an inspection service so that some reputable and responsible agency may keep one or two men in the state, and satisfactory arrangements for a circuit of park and amusement attractions.

The membership includes the street railways of Knoxville, Nashville, Chattanooga and Memphis. The officers are: President, C. C. Howell, vice-president and general manager Knoxville Traction Co.; vice-president, E. J. Jones, vice-president and general manager Memphis Street Railway Co.; secretary and treasurer, E. G. Connette, general manager Nashville Street Railway.

NEW TAX BILL IN ONTARIO.

The government party in the Ontario Provincial Legislature has proposed a bill taxing railroads, telegraph, telephone, express and similar companies, banks, insurance companies, etc., which it is stated will probably be passed. So far as it affects street railways its provisions are as follows:

Every street railway company in any city and every company operating or owning a railway in a city any portion of which is operated by electricity, shall pay $20 for each mile of track when there are not more than 20 miles of such track in the city; $35 per mile when there are more than 20 and less than 30 miles of track· $45 per mile when there are between 30 and 50 miles; $60 per mile when the total exceeds 50 miles. The mileage is to be measured as single track.

The companies shall continue to be assessable and taxable for municipal purposes as heretofore.

CIVIL ENGINEERS' CLUB, CLEVELAND.

The annual meeting of the Civil Engineers' Club of Cleveland was held March 14th and the following officers chosen: President, Col. Jared A. Smith, U. S. A.; vice-president, Prof. John W. Langley; secretary, Arthur A. Skeels; treasurer, John N. Coffin; librarian, William E. Reed.

The membership of the club has slightly decreased, but its financial condition is excellent. W. H. Searles was the secretary of the club last year.

SILVER BOW RAILROAD.

In the "Review" for March, page 176, was published an abstract of a paper by Francis W. Blackford, engineer of the Butte Consolidated Railway Company, in which he described the Silver Bow Railroad, a double-track electric line between Butte and Centerville, Mont. The distance between the termini of the road is about 4,750 ft., but because of the difference of 390 ft. in elevation to be overcome, and the necessity of not crossing valuable mining property, the line is over twice as long and abounds in curves.

By the courtesy of J. R. Wharton, receiver of the Butte Consolidated, we have received photographs taken at different points along the line, and these are reproduced herewith. No. 1 shows a 5 per cent grade near station 80 (see St. Ry. Rev., Mar. 1899, page 177, for profile). No. 2 is the crossing over steam railroad tracks. No. 3 is a view of a 7½ per cent grade near station 35. No. 4 shows the 5 per cent grade near station 85.

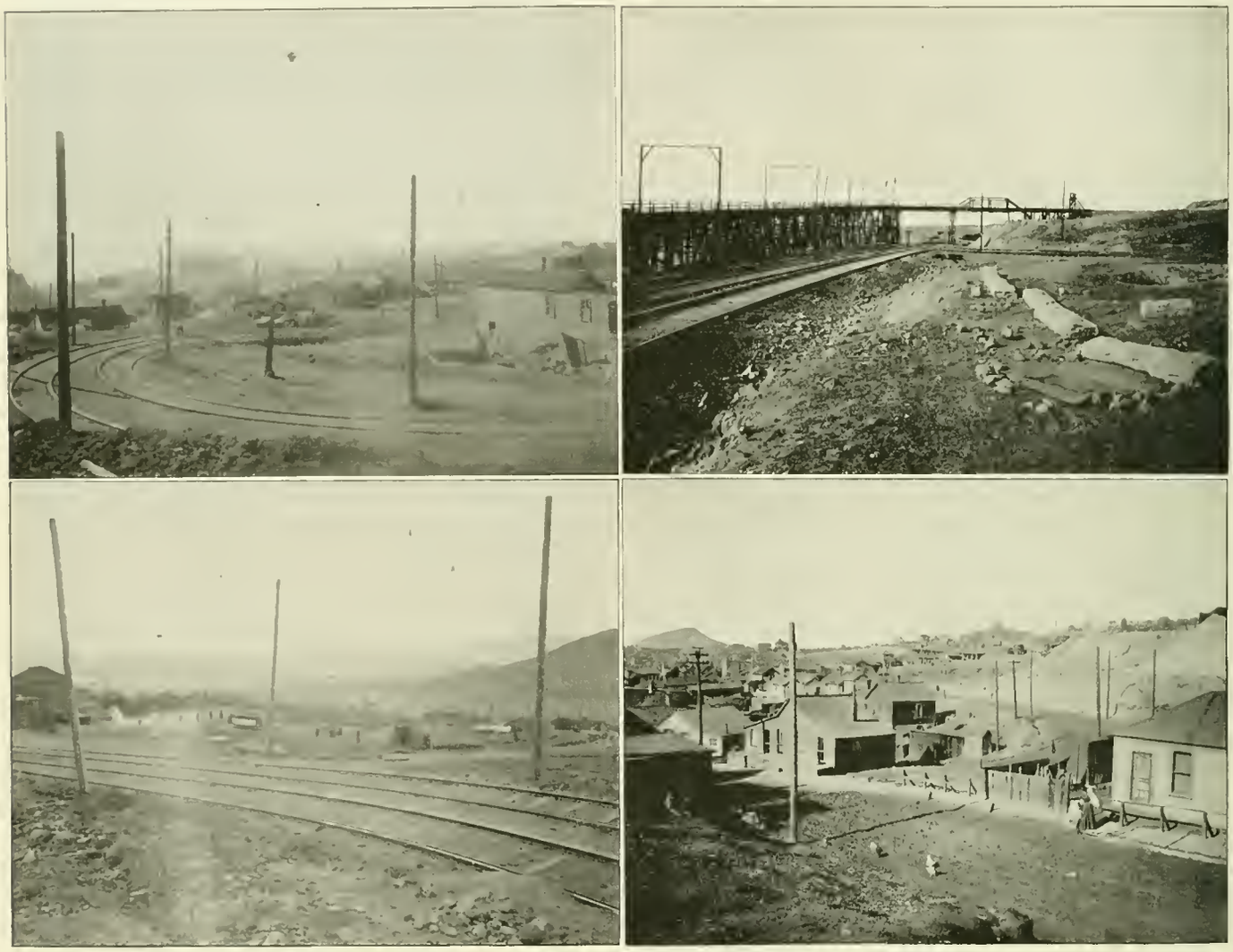


FIG. 1. FIG. 3. SCENES ON THE SILVER BOW RAILROAD. FIG. 2. FIG. 4.

Fig. 5 shows a section and elevation of the trestle conctruction for the approaches to the railroad crossings. Fig. 7 shows in detail the mannar of elevating the outer rail on curves; the elevations were calculated for a speed of 12 miles per hour.

The Silver Bow road was built by the Silver Bow Railroad Company, of which W. A. Clark is president; W. L. Hoge, vice-president, and J. R. Wharton, manager. The road is leased to the Butte Consolidated Railway Company.

The city council of Superior, Wis., has passed an ordinance prohibiting the street railway company granting to any alderman or city official free transportatilon under a penalty of from $5 to $25.

SHOP FLOORS.

Abstract of a report to the Association of Railway Superintendents of Bridges and Buildings.

Assuming the soil to be firm and well drained, excavate the ground to an even surface 8 in. below the grade of the desired floor. Tamp well with heavy rammers to secure a firm foundation, then fill in with good, clean sand or gravel to within 3½ in. of the grade, making a crown of about 2 in. between pits for drainage; wet this down well, tamp with rammers, and trim off with a straight edge, taking care to get good even surface brick on edge, close to each other and breaking joints so the tops come one-half above grade. After laying, roll the bricks with a 2,000 or 3,000-lb. roller, cover the surface with 1 in. of fine sand and broom it well into cracks, or fill the cracks with cement grout. A concrete foundation is recommended by some, but except in cases where the natural ground is not firm, or where the floor is to be subject to extremely heavy loads, it is not considered necessary.

For blacksmith shops or foundaries the natural earth frequently forms a very suitable as well as substantial floor. In localities where the soil is too soft in its natural state, the addition of cinders or clay will solve the problem cheaply and satisfactorily.

In machine shops the conditions are different, and here we find the recommendations almost as varied as are those for round house floors. A brick floor in a machine shop answers many of the requirements, but there is good evidence in support of the objection that men cannot stand all day on such a floor or upon a surface of concrete or asphalt without feeling the bad effects of cold upon the feet. This difficulty is overcome to a large extent by the use of slatted floor racks or platforms at the machines where operatives stand. When machines are set upon a brick floor there should be special provisions made for foundation. But this can hardly be urged as an objection, as it is necessarily the case with heavy machines under almost any circumstances.

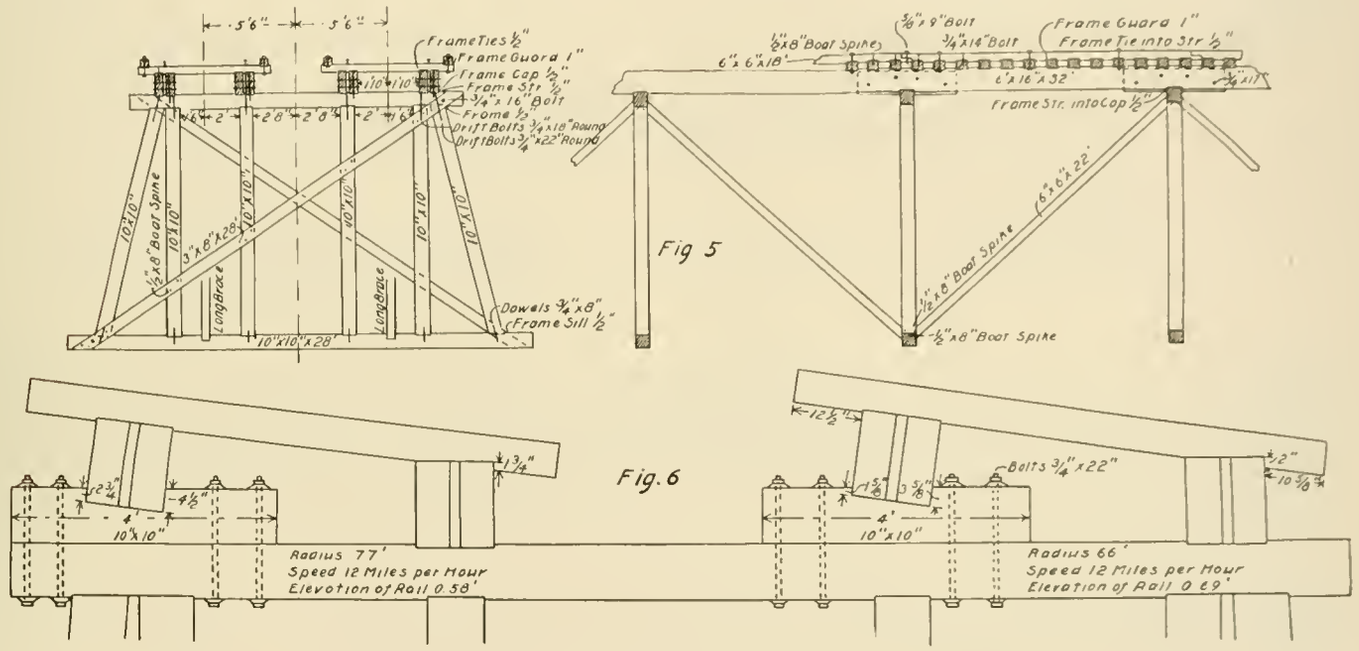
A bedded plank floor has recently been laid in an extensive shop plant of the Boston & Maine road. The earth is well compacted and brought to the proper surface and a bed of coal tar concrete put down in three courses. This bed is 4 in. thick when finished. The specifications are that the stones of the lower course shall not be less than 1 in. in diameter, and those of the second course not more than 1 in. in diameter. Stones of each course to be well covered with tar before laying and thoroughly rolled afterward. The finishing course to be composed of good, clean, sharp sand, well dried, then heated hot and mixed with pitch and tar and brought to a true level to fit a straight edge. Roller to weight not less than 700 lb. on a length not exceeding 22 in. On this finished surface of the foundation there is spread a coating ¼ in. thick of the best roofing pitch, put on hot, into which the lower course of plank is laid before it cools. Care must be taken to have the plank thoroughly bedded in the pitch, and, after laying, the joints must be filled with pitch. If vacant places occur under plank they should be bored and filled. The finishing flooring is laid across the lower and thoroughly nailed.

For the lower course 2½ in. spruce plank is used, and for the upper 1½-in. spruce plank. It is also noted that the lumber for lower course should be fairly seasoned, and that of the upper course well seasoned before using. The cost of such a floor is given at 18 cents per sq. ft., using spruce lumber.

For paint shops and car shops brick floor has been found very satisfactory. The committee believes that a brick floor, generally speaking, is the most economical, durable and satisfactory floor for shops as well as for round houses.

FORMS FOR STANDARD SYSTEM OF ACCOUNTS.

In the Review for April, 1898, page 232, were reproduced a number of forms used by the Twin City Rapid Transit Company, of Minneapolis and St. Paul, which were designed by J. F. Calderwood, auditor of the company, in conformity with the recommendations of the American Street Railway Accountants' Association. By the courtesy of Mr. Calderwood we have received some new blanks designed by him to conform to the later recommendations of the Association, and in the arrangement of several statements on the same sheet to give greater convenience.



SILVER BOW RAILROAD—TRESTLE AND ELEVATION OF RAIL ON CURVES.

The comparative statement of pay rolls is on a separate sheet 10 in. by 14 in. In the reproduction this form is superposed on a portion of the rear side of Form 455.

Three of these forms are shown, reduced on the succeeding pages, 244 and 245. Form 454 is on a sheet 21 in. by 15⅜ in. On one side is the comparative statement of operating expenses, and the statement of mileage, passengers, cars, transfers, etc., which constituted a portion of the Form 447 published last year. On the opposite side of the sheet are the comparative statement of earnings and expenses (both operating and fixed), the general balance sheet, and a statement of earnings and mileage by divisions; these were formerly on different sheets.

Form 455 is on a sheet 25 in. by 17 in. On one side are the comparative statement of the mechanical department and a summary of storehouse statement. In the former are provided spaces for each of the 54 accounts, as on the general expense blank, though many of the items may not be used in the mechanical department. On the opposite side are a statement of vouchers and a comparative statement of mechanical department pay rolls.

MINNEAPOLIS STREET RAILWAY COMPANY — TWIN CITY RAPID TRANSIT COMPANY. — THE ST PAUL CITY RAILWAY COMPANY

Form 454 Front. Comparative Statement of Operating Expenses, by Divisions and Consolidated, for the Month of ______ 189 Compared with 189

Classification	No.	Current Month 189 Amount	Per C.M.	189 Amount	Per C.M.	Increase or decrease	January 1st to date — months 189 Amount	Per C.M.	189 Amount	Per C.M.	Increase or decrease	Divisions, Current Month: Twin City Rapid Transit Co.	Minneapolis	St. Paul	Interurban	Como Interurban	Distribution Current Month: Labor	Material	Miscellaneous	Total
Maintenance of track and roadway																				
Electric line overhead																				
Conduits																				
Buildings and fixtures																				
Total maintenance of way and structure																				
Maintenance of power plant — Steam																				
Water																				
Electric equipment — Steam																				
Water																				
Cars																				
Electric equipment of cars																				
Miscellaneous equipment																				
Miscellaneous shop expense																				
Total maintenance of equipment																				
TOTAL MAINTENANCE																				
Power plant wages — Steam																				
Water																				
Fuel for power — Steam																				
Water for power																				
Lubricants and waste for power plant																				
Water																				
Miscellaneous supplies and expenses — Steam																				
Water																				
St. Anthony Falls Water Power Co.																				
Less power sold																				
Total operation of power plant																				
Superintendence of transportation																				
Wages of conductors																				
Motormen																				
Other car service employees																				
Car house employees																				
Car service supplies — General																				
Fuel for cars																				
Miscellaneous car service expense — General																				
Station fuel																				
Cleaning and sanding track																				
Removal of snow and ice																				
Total car service																				
TOTAL TRANSPORTATION																				
Salaries of general officers																				
Clerks																				
Printing and stationery																				
Miscellaneous office expense																				
Store room expense																				
Stable expense																				
Advertising and attractions																				
Miscellaneous general expense																				
Damages																				
Legal expenses incident to damages																				
Other legal expenses																				
Rent of land and buildings																				
Rent of track and terminals																				
Insurance																				
Taxes																				
Total general expense																				
TOTAL OPERATING EXPENSE																				

STATEMENT OF MILEAGE, PASSENGERS, CARS, TRANSFERS, etc.,

MONTH OF ______ AND YEAR TO DATE, 189 , COMPARED WITH 189

Classification	Current Month 189 Total per mo.	189 Av. per day	189 Total per mo.	189 Av. per day	Increase or decrease	January 1st to date — months 189	189	Increase or decrease	Divisions, Current Month: Minneapolis	St. Paul	Interurban	Como Int.
Motor mileage												
Trailer												
Total												
Total cars run												
Passengers carried for revenue												
Free												
Total passengers												
Transfers received												
Per cent of operating expenses to earnings												
Average earnings per day												
Operating expense per day												

Form 455 Front.

TWIN CITY RAPID TRANSIT COMPANY.

Comparative Statement of Mechanical Department for month of ______ 189

Classification	No.	Current Month 189 Labor	Material	Total	189 Labor	Material	Total	Increase or decrease	January 1st to date — months 189 Labor	Material	Total	189 Labor	Material	Total	Increase or decrease	Divisions: General	Minneapolis	St. Paul	Interurban	Como Int.
Maintenance of track and roadway																				
[illegible]																				
Maintenance of electric line																				
[illegible] of conduits																				
Maintenance of buildings and fixtures																				
Total way and structure																				
Maintenance of power plant — Steam																				
Water																				
Electric — Steam																				
Water																				
Car equipment																				
Electric																				
Cars																				
[illegible]																				
Maintenance of miscellaneous [illegible]																				
Miscellaneous shop expense																				
Total equipment																				
TOTAL MAINTENANCE																				
Power plant wages — Steam																				
Water																				
Fuel for power																				
Water for power																				
Lubricants & waste, power plant — Steam																				
Water																				
Misc. supplies & exp. — Steam																				
Water																				
[illegible]																				
Total power plant																				
Superintendence of transportation																				
Wages of conductors																				
Motormen																				
Other car service employees																				
Car house employees																				
Car service supplies																				
Car fuel																				
Miscellaneous car service expense																				
Station fuel																				
Cleaning and sanding track																				
Removal of snow and ice																				
Total car service																				
TOTAL TRANSPORTATION																				
Salaries of general officers																				
Clerks																				
Printing and stationery																				
Miscellaneous office expense																				
[illegible]																				
Store room expense																				
Stable expense																				
Advertising and attractions																				
Miscellaneous general expense																				
Damages																				
Legal expenses incident to damages																				
Other legal expenses																				
Rent of land and buildings																				
Rent of track and terminals																				
Insurance																				
Taxes																				
Total general expense																				
TOTAL OPERATING EXPENSE																				
[illegible]																				
Engineering and superintendence																				
Right of way																				
Track and roadway construction																				
[illegible] construction																				
Electric line construction																				
Conduits																				
[illegible]																				
[illegible]																				
[illegible] real estate																				
Power plant [illegible]																				
[illegible]																				
Cars																				
[illegible]																				
Miscellaneous equipment																				
[illegible]																				
Miscellaneous																				
TOTAL CONSTRUCTION																				
TOTAL EXPENDITURES																				

SUMMARY OF STOREHOUSE STATEMENT

Debits	Labor	Material	Total	Credits	Labor	Material	Total	Recapitulation	Labor	Material	Total
Pay rolls				Charged to operation				Balance from statement			
Storehouse labor and materials				" " construction				Debits as above			
Invoices of purchases, operation				Bills to [illegible]				Total debits			
Construction				Labor charged material							
Freight and express								Less credits			
Total debits				Total credits				Balance to statement			

Form 454 Book.

MINNEAPOLIS. ST. PAUL.

Twin City Rapid Transit Co.

COMPARATIVE STATEMENT

OF

Earnings and Operating Expenses.

Month ending ________ 189__

Compared with ________ 189__

Approved

Auditor

TWIN CITY RAPID TRANSIT COMPANY

Comparative Statement of Earnings and Expenses (both Fixed and Operating) for Month of ________ 189

CLASSIFICATION	CURRENT MONTH			JAN. 1st TO DATE			DIVISIONS CURRENT MONTH				
TOTAL DEDUCTIONS											
SURPLUS											

GENERAL BALANCE SHEET

________ 189

ASSETS		LIABILITIES	

EARNINGS AND MILEAGE, BY LINES AND DIVISIONS

Month of ________ 189

LINE	EARNINGS			MILEAGE		
	TOTAL	PER DAY	PER MILE	MOTOR	TRAILER	TOTAL
TOTAL MINNEAPOLIS DIVISION						
TOTAL ST. PAUL DIVISION						
TOTAL INTERURBAN DIVISION						
TOTAL COMO INTERURBAN DIVISION						
TOTAL FOR MONTH 189						
TOTAL 189						
INCREASE or DECREASE						

VOUCHERED INVOICES			VOUCHERED INVOICES			BALANCE SHEET			
NO	NAME	AMOUNT	NO	NAME	AMOUNT	DESCRIPTION	LABOR	MATERIAL	TOTAL

TWIN CITY RAPID TRANSIT COMPANY

COMPARATIVE STATEMENT OF PAY ROLLS ________ DAYS TO ________ 189__

OCCUPATION	Days to					Months		Days to Days
	Men	189	Men	189	Inc. or Dec.	189	189	Inc. or Dec.
Roadmasters								
" Assistants								
Laborers								
Total Track and Roadway								
Linemen								
Laborers								
Total Electric Line								
Master Mechanic								
Carpenter Shop								
Paint "								
Blacksmith "								
Machine "								
Brass Foundry "								
Armature "								
Gen'l Repair "								
Total Thirty-First Street Shops								
East Side Station Shop								
31st Street "								
Bloomington " "								
Washington " "								
Midway " "								
Selby " "								
Seventh St. " "								
Rice Street "								
Smith Av. " "								
Total Station Shops								
Total Maintenance								
Superintendent								
Electricians								
Engineers								
Oilers								
Firemen and Helpers								
Laborers and others								
Total Power Plant								
Superintendents								
Clerks								
Aids								
Secret Service								
Conductors, Regular Time								
" Extra "								
Motormen, Regular Time								
" Extra "								
Carhouse Foremen								
" Employees								
Other Car Service Employees								
Cleaning, Watering and Sanding Track								
Removal of Snow and Ice								
Total Car Service								
Total Transportation								
Salaries of General Officers								
" General Manager's Clerks								
Auditor's Clerks								
Storekeeper and Purchasing Agent								
" " " " Bldg.								
Parks and Park Properties								
Stable Expense								
Janitors								
Contingent								
Total General Expenses								
Total Construction								
TOTAL PAY-ROLL								

Form 455 Back.

COMPARATIVE STATEMENT

OF

MECHANICAL DEPARTMENT PAY ROLLS.

FOR THE

Month of ________ 189

OCCUPATION	CURRENT MONTH					JANUARY 1st TO DATE		MONTHS
	MEN	189	MEN	189	INCREASE or DECREASE	189	189	INCREASE or DECREASE
[illegible]								
TOTAL TRAIN ROLL								
[illegible]								
TOTAL ELECTRIC ROLL								
[illegible]								
TOTAL 31ST STREET ROOMS								
[illegible]								
TOTAL ROBERT ROLL								
[illegible]								
TOTAL GENERAL ROLL								
TOTAL MECHANICAL ROLL								

CORRECT ________ Auditor

APPROVED ________

THE GORGE ROAD IN WINTER.

During the winter season the Niagara Falls & Lewiston R. R., better known as the Gorge road, has but little traffic, and when the cars are operated at all in winter only the outer of the two tracks is used. Considerable debris from the cliff falls onto these tracks

THE GORGE ROAD IN WINTER.

at all seasons of the year, but there is much more of it in winter; naturally the greater portion falls upon the inner track, and with a heavy fall of snow its removal presents added difficulties.

In the spring a great deal of repair work is always necessary to put the roadbed in proper shape for the tourist season when the

THE GORGE ROAD IN WINTER.

traffic is very heavy. During the past winter the road has not been operated and is now in the hands of a receiver. The accompanying illustrations lent us by the Railway Age show how the summer road appears in winter.

FROM THE WAGE-EARNER'S STANDPOINT.

On March 15th a committee of the street railway employes of Indianapolis waited upon the municipal authorities and presented a petition signed by 714 men employed by the street railway company, which was as follows:

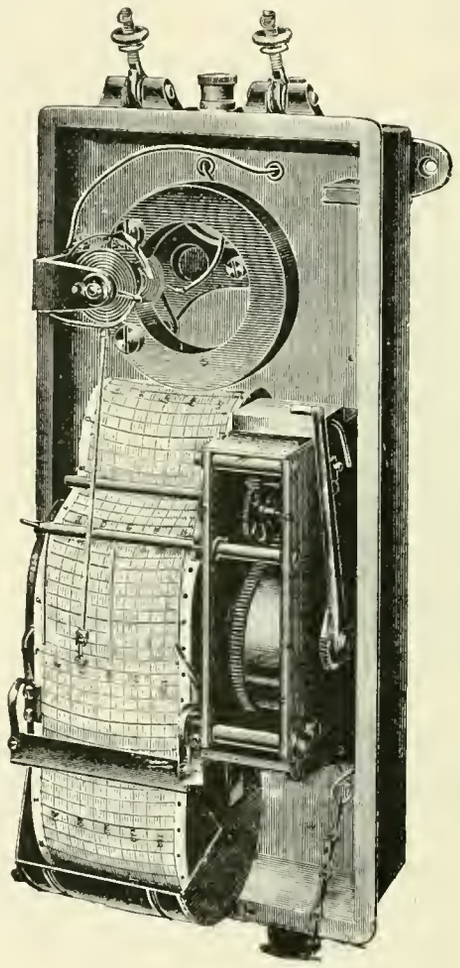
"As employes of the Citizens' Street Railroad Co. whose interests are vital in the scale of fares to be determined upon, we humbly ask your honorable body to ignore any and all petitions advocating the adoption of 3-cent fares, as we feel that we would be the sufferers thereby in having to submit to a cut in wages in order to enable the company to properly conduct its business.

"We therefore trust you will view this matter from our standpoint and have our interests at heart when considering this important question."

A truer statement of the case could not be made.

A RECORDING VOLTMETER.

The illustration represents a recording voltmeter which is made by Elliott Brothers, of London. The electrical mechanism consists of a small sphere of soft iron between the poles of a permanent magnet and a ring of insulated copper wire. At the end of the long aluminum arm or pointer is a pen formed for holding aniline ink. The recording mechanism comprises an eight-day clock and friction rollers for holding the plotted paper. The clock is wound by the lever shown to the right in the cut and drives by friction a drum



RECORDING VOLTMETER.

against which the paper is pressed by a spring. Teeth on the rim of the drum pass into holes perforated in the margin of the paper and prevent it from slipping. The clock gears can be proportioned to feed the paper 1 in., 3 in., 6 in. or even more per hour. The paper after passing under the pen is coiled in a drum at the bottom, from which it can easily be removed. The coils of fresh paper can be put in position with equal facility. Both voltmeters and ammeters can be fitted with this recording mechanism where a continuous record is desired.

The Toledo Traction Company Centennial Band has placed an order for new uniforms.

The Winnipeg (Manitoba) Electric Street Railway Co. has offered to install new 500-volt electric motors in place of the motors already in the factories and stores in that city. The proposition was accepted.

The Newport News (Va.) & Old Point Railway & Electric Co., which now comprises the Hampton & Old Point Railway Co. and the Chesapeake Light & Power Co., is making extensive improvements. A new power house is being designed and five miles of new track are under construction. Alexander Brown, of Baltimore, has control of the new company, and his superintendent, H. H. Carr, is getting the road in readiness for the heavy summer traffic.

RECENT STREET RAILWAY DECISIONS.

EDITED BY J. L. ROSENBERGER, ATTORNEY AT LAW, CHICAGO.

COMPETENT EVIDENCE OF INCOMPETENCY OF EMPLOYE.

Morrow v. St. Paul City Railway Company (Minn.), 77 N. W. Rep. 303. December 7, 1898.

Among other things, it was contended in this case, on the third appeal therein, that a certain gripman was incompetent because he did not have sufficient presence of mind in an emergency, and that he was not of sufficient judgment, and did not have sufficient strength and acuteness of intellect to be competent for the work of a gripman. On these questions, the supreme court of Minnesota holds that evidence of certain acts done in another part of the man's work was admissible. For example, the man was employed a part of the time as motorman on an electric line, being changed back and forth from the occupation of such motorman to that of gripman on a cable line. On one occasion, while acting as motorman, his car was stalled by reason of there being ice on the rails, which insulated the car wheels, and prevented the electric current from passing off from the wheels to the rails. He did not know that he could start his car by breaking the scale of ice on the rails, so as to make a connection for the current, and was not able to move his car. The trial judge charged the jury that they might consider these facts, with many others, in determining whether or not the man was competent as a gripman. In this the supreme court holds there was no error. It says that it may be conceded that, if the question of competency was merely as to the man's skill in the science of running a grip car, this part of the charge would be erroneous, but that as tending to show that he did not have sufficient judgment and presence of mind to be competent as a gripman the evidence was admissible. In more general terms, the court holds that evidence of certain acts done in one part of his work by an employe is competent as tending to show that he did not have sufficient judgment and presence of mind to be competent for the other part of the work in which he was employed.

MEN AT WORK ON TRACK ARE ENTITLED TO WARNING OF APPROACH OF CAR.

Lewis v. Binghamton Railroad Company (N. Y.), 54 N. Y. Supp. 452. November 16, 1898.

Men at work for a city contractor paving a street, who have to go upon a track laid in the street to do some of their work, the third appellate division of the supreme court of New York holds, have a right to expect a warning of an approaching car; something more than the mere noise which the running of the car itself will make.

Here a workman was stooping down and pouring hot tar into the cracks between the paving stones along the sides of the rails, when he was struck by a car, the approach of which the jury found had not been announced by the ringing of the bell, and for this reason, the court holds, negligence was established against the defendant. It says that inasmuch as the man was rightfully at work on the track, he could not be charged with negligence for being there. The only precautions he could take while there were to listen and look, and, of course, withdraw in ample time when he knew the car was approaching.

Negligence not being charged against the motorman for not stopping the car soon enough, but for not giving a reasonable warning of its approach, the court does not consider that the fact that the plaintiff had been in the habit of waiting, after he knew that the car was approaching, until it was very close upon him, and then quickly getting out of the way, had any controlling effect upon the question presented. Former delays on the plaintiff's part in getting out of the way of the car, it holds, did not warrant or invite any omission on the motorman's part to give, upon this occasion, the usual and ample warnings of its approach.

Whether the plaintiff was negligent in not keeping a better lookout for the car, after he began emptying his bucket, the court holds was properly left to the jury, which decided that he was not, under the circumstances. And the court adds that the measure of his duty in this respect was quite different from that of a pedestrian.

VALIDITY OF ORDINANCE REQUIRING WATERING OF TRACKS.

State v. Canal & Claiborne Railroad Company (La.), 24 So. Rep. 265. June 21, 1898. Rehearing denied December 5, 1898.

The supreme court of Louisiana holds that an ordinance of the city council of the city of New Orleans which requires corporations operating street electric cars within the limits of the city, upon tracks laid down in the public streets thereof, to water their tracks so as to effectually lay the dust within their tracks, is a legal exercise of the police power of the city, because such an ordinance tends to promote the comfort and convenience of passengers, and the health and comfort of the inhabitants of the city.

Neither does the court consider the ordinance indefinite nor unreasonable.

This decision becomes more significant when it is recalled that this court held a previous ordinance too indefinite and unreasonable, which made it unlawful for a corporation "to operate any electric, trolley or other cars or trains on the streets of the city without first providing, in some reasonable manner, for sprinkling of the streets through which their cars run," that is to say, from curb to curb.

Two defects in the last-mentioned ordinance are particularly recalled: First, that it singled out the street car companies, simply because they exercised a franchise upon certain streets of the city, and imposed upon them, solely and alone, the bearing of a public burden which should have been discharged by the city, or shared by the general public, namely, the sprinkling of the streets from curb to curb; and, secondly, that the provision that the companies should provide "in some reasonable manner for the sprinkling of the streets" was too indefinite and indefinable as to time, manner, amount and extent.

Speaking of the new ordinance, which it holds valid, the court says that it is obvious that the duty imposed is specific; that is, "to water their tracks." It does not require the street car companies to "sprinkle the streets," nor to sprinkle their tracks; but to "water" them. Water them where, and to what extent? "So as to effectually keep the dust laid on same." To water that part of the streets which is occupied and used by their tracks, and immediately covered by their franchises, it insists, is an altogether different thing from sprinkling the streets from curb to curb, and to a very great extent, at least, relieves the ordinance of the onerous and oppressive feature that was properly attributed to the former ordinance,—the imposition upon private individuals and corporations of a public burden.

MOTORMAN'S FIRST DUTY IS TO SEE THAT TRACK IS CLEAR.

White v. Albany Railway (N. Y.), 54 N. Y. Supp. 445. November 16, 1898.

A judgment recovered in this case for the death of a boy alleged to have been killed by the negligence of the defendant, is reversed by the third appellate division of the supreme court of New York, and a new trial granted. According to the statements of both the motorman and the conductor, the boy darted suddenly onto the track, just ahead of the car. The motorman testified that when he first saw him he was running along diagonally by the car, and as quick "as a shot," "like the snapping of a finger," he ran over the rail; that he instantly let down the fender and applied the brakes, but the boy was too near the car to be saved. Under such circumstances, the court holds, negligence could not justly be charged against the motorman.

Nor does the court consider that the motorman was negligent in not seeing the boy before he got upon the track. Undoubtedly, it says, it was the duty of the motorman to use all the means in his power to prevent the car from striking the boy, and to begin the use of such means as soon as the danger of hitting him became apparent. But he could not justly be charged with negligence in not stopping or beginning to stop the car until it became reasonably apparent to him that the boy was in peril unless he did so. Such is the measure of responsibility it applied to the motorman in considering this case. The motorman's attention, it maintains, is required first

to the track, to see that it is clear, and to the cross walks where people are expected to pass over the track or get aboard the car.

In this case they were just about entering a switch where a down car might be passed, and a cross walk was about 124 feet ahead of them; also, a railroad crossing at grade, where the car must come to a full stop. All these demanded the attention of the motorman, and the court holds that they were points on the track which it was his first duty to watch, so that if, until he was close upon him, he omitted to notice the boy on the street, and to apprehend that he was about to cross the track and so incur a peril, it surely ought not, under the rule above stated, to be charged as a negligent omission against him.

Moreover, the court says that two seconds is a short time to comprehend a situation of danger and avoid it, and that an inference that the motorman was negligent in not stopping the car and saving the boy in that space of time should not prevail.

POWER OF MUNICIPALITIES TO MAKE CONTRACTS WITH NEW COMPANIES.

City Railway Company v. Citizens' Street Railroad Company (Ind.), 52 N. E. Rep. 157. December 16, 1898.

The supreme court of Indiana holds, in this case, with which readers of the Street Railway Review are already more or less acquainted, and concerning which a statement of facts was made in the January number, on page 9: That the right of the Citizens' Company to exercise its franchise upon the streets of the city of Indianapolis will expire on January 18, 1901, by limitation of its contract; and also that the agreement entered into by the city and the City Railway Company April 24, 1893, was and is a valid contract "in praesenti" between the parties thereto; and that said City Railway Company, under said contract, had a right to enter at once upon the construction of what is known as the "North and South Line," and, on consent given by the city, upon any other unoccupied streets and parts of streets not in use by the Citizens' Company or necessary for the reasonable and safe operation of its lines; and that, on like consent given by the city, said City Railway Company may, upon the expiration of the term of the Citizens' Company, and the vacation of the streets by said company, enter upon and occupy such vacated streets for the construction and operation of its lines.

First of all, granting that the Citizens' Company has the right to use the streets occupied by it, and which it may hereafter lawfully occupy, until January 18, 1901, the supreme court maintains that, without additional legislation or consent given by the city of Indianapolis, the company cannot continue to exercise its franchise after that date.

It is true, says the court, that, by the statute of 1861, a street railroad company, when duly organized, is declared to be "a body politic and corporate in perpetuity;" but it also calls attention to the fact that the statute likewise declares that "nohing" in this act contained shall be so construed as to take away from the common councils of incorporated cities the exclusive powers now exercised over the streets, highways, alleys and bridges within the corporate limits of such cities," and that it further declares that, before constructing its railroad, any such company shall first obtain the consent of the common council. It may well be, therefore, that, subject to the right of the legislature to amend or repeal, retained in the act, the franchise of the company is perpetual. But the exercise of that franchise, the court holds, requires the consent of the common council as a condition precedent. And it would never do, it thinks, to admit that, by first agreeing to allow the company to enter upon its streets, and continue there for a definite term, the city thereby gave up forever that exclusive control over its streets which the same section of the act says shall never be impaired by any construction that may be given to the statute. As well contend that the landowner, by allowing a tenant to enter upon and cultivate his farm for a limited period, has thereby lost forever the right to reoccupy it himself, even after the time prescribed in the lease has expired. The very circumstance, too, that the statute provides for the consent of the city to the exercise of the franchise, the court holds, implies that the city may give or refuse such consent, according to its own discretion; and, if it gives consent, such consent may be with such limitations and conditions as the city may deem consistent with its own welfare and the welfare of its citizens.

It was not contended that in giving consent the city might not make all reasonable requirements as to location of rails, running of cars, kind of motive power, repair and improvement of streets occupied by tracks, amount of fare charged, and numerous other details, and the court thinks it inconceivable that the much more important consideration as to the length of time during which the company might occupy the streets should not also be in the control of the city. Moreover, it insists that it would hardly be consonant with common honesty, as practiced between man and man, for the company to seek for and enter into a contract, first for 30, and afterwards for 37, years, and then, when the right had been enjoyed for the time stipulated and agreed to, to turn around and claim that the contract was without a time limit; that the tenant for a term of years, being once in, had thereby become the owner of the fee simple. Besides, by its course, the court holds that the company, in conjunction with the city, put a practical construction upon the statute under which it claims corporate existence, which would be conclusive against it.

Taking up the question of the validity and scope of the contract made by the city, in 1893, with the City Railway Company, the court holds that, notwithstanding the Citizens' Company already had the city's permission to lay and operate its tracks in and along all the streets of the city, nevertheless the city had the right, at any time, to enter into a contract with another company to lay a street railroad upon any street or parts of streets not actually occupied by the tracks of the Citizens' Company or needed for the operation of its road, and that, consequently, the contract between the city and the City Railway Company was valid, in so far as it concerned streets and parts of streets not occupied by the Citizens' Company. Thenceforth, so long as both companies have the respective rights thus acquired, it seems that, in the court's view of it, as to unoccupied streets their rights will be equal. As to streets actually and legally occupied by either company, including, however, only so much of such streets as may be necessary for the proper operation of the cars, the rights of such occupying company are exclusive.

Moreover, whether the contract made by the city with the second company under such circumstances may be an advantageous one for the city and people or not, the court affirms that it is very plain, in any event, that the city had the right to enter into such contract, and that the same is legal and binding as between the city and such second company.

And the court insists that if the contract made by the city with the City Railway Company, in 1893, was in fact valid and binding, it could not be abrogated or annulled by any act of the legislature or of the city.

The court further holds that a city ordinance of 1865 giving a street railway company permission to lay and operate its tracks in and along all the streets of the city would not warrant it commencing the construction of a particular line nearly thirty years thereafter, without first having obtained the consent of the council to the location, survey, and construction proposed, where the statute under which the company was incorporated provided that such consent must be obtained before the construction of any line was commenced.

Finally, where one company forcibly takes possession of a street, without the required consent of the city, and against the protest of another company authorized to construct its line upon said street, the court maintains that the company thus seizing the street cannot be heard to object that the other company did not construct its line within the time limit fixed by its contract with the city.

ADHERES TO DOCTRINE TOUCHING CONTRIBUTORY NEGLIGENCE OF PARENTS.

Ploof v. Burlington Traction Company (Vt.), 41 Atl. Rep. 1017. July 21, 1898.

Much has been written for and against the doctrine of imputed negligence. Referring to Robinson v. Cone, 22 Vt. 213; 54 Am. Dec., 67, and note in which case it itself rendered the decision, the supreme court of Vermont says that the case has become a leading one against the doctrine of imputed negligence, and that its doctrine is quite generally followed by courts of last resort, and indorsed by eminent legal writers. Consequently, it is not surprising to find the court adding that it is content to abide by the decision in that case on the doctrine of imputed negligence.

In a suit in which a minor or his administrator seeks to recover damages in the right of the minor, or in the right of his estate, for

injuries inflicted upon such minor by the negligence of a party, the supreme court insists that it is difficult to find any satisfactory legal ground upon which such party can, in a court of justice, be heard to say: "True, I negligently inflicted a serious injury upon the child, but no legal obligation rests upon me to compensate the child for injuries inflicted by my negligence, because the parents of the child were negligent in the same transaction, and their negligence contributed to the happening of the accident occasioning such damages." It declares that it would be much easier to find good reasons for holding that such an injured child might recover jointly against his parent and the third person (or street railway company).

On the other hand, under a statute providing that when the death of a person is caused by a wrongful act such as would have warranted an action for damages in behalf of the person injured, if his death had not ensued, an action shall be brought in the name of his personal representative and damages shall be awarded "with reference to the pecuniary injuries resulting from such death, to the wife and next of kin," the supreme court holds that the negligence of such wife and next of kin, entering into and contributing to the accident causing such death will defeat their right to recover, it being manifest that the recovery under the statute, though in the name of the personal representative of the deceased, is not, in general acceptation, for the benefit of the estate of the deceased, but is for the benefit of those who may take by the terms of the statute. The court established a precedent for this in its late decision of Lindsay v. Railroad Co., 68 Vt. 556; 35 Atl. 513.

Thirdly, the court holds that where the most that the evidence tended to show was that the parents negligently permitted a boy 10 years of age, healthy, and of ordinary ability, to go unattended upon the street where the car ran, or that their negligence was a factor in bringing him to the place of the accident, but not a factor in the boy's attempting to cross the street in front of the moving car, and therefore not a factor entering into and contributing to the happening of the accident which caused his death, their negligence was at most a remote, and not a proximate, factor of the accident, and that such remote negligence would not defeat a right of recovery otherwise proven.

RIGHT TO LAY DOUBLE TRACKS ALONG NARROW STREETS.

Poole v. Falls Road Electric Railway Company (Md.), 41 Atl. Rep. 1069. December 20, 1898.

The question presented by this case was as to whether, if a double track street railway be built upon a street so narrow that the space left would not be sufficient to allow vehicles to pass or stand between the tracks and the curb lines, there would be such an invasion of the rights of an owner of abutting property as would warrant the court in interfering by the writ of injuction . The contention of the property owner seeking an injunction in this case, was that, even if it be conceded that the street had been dedicated and accepted, yet the laying of two tracks in such a narrow street would amount to a use of the street not embraced within the rights that passed by the dedication, because such a use would necessarily deprive the street of one of its most important attributes, and that, this being so, the complainant was entitled to an injunction, "as owner of the reversionary interest in the street bed, as well as of the fee in the adjoining lots," in order "to prevent the infringement of his constitutional right not to be deprived of his property without due process of law;" and also because the contemplated use would be an abuse of the street, and a "public nuisance, not sanctioned by the legislature."

The decision is in favor of the street railway company. To begin with, the court of appeals of Maryland says that it may be accepted as the established law in that state that, where the construction of a railroad is authorized by competent authority, and there is no invasion of, or physical interference with, the property of an abutting owner, there is no "taking" within the meaning of the constitution, and the remedy by injunction to prevent consequential injuries resulting therefrom cannot be invoked.

Upon the theory contended for, that the structure contemplated would subject the street to a new use, not included in any of the rights conferred by the dedication, the court says that the question would be, not whether there were or would be incidental or consequential damages growing out of the construction of the road, but whether there would be such a subjection or appropriation of the reversionary interest of the owner of the abutting property in the bed of the street as would amount to a constitutional "taking." By the dedication of property to the uses of a street the public acquires an easement of passing and repassing, with all such incidents as properly belong thereto; but all other rights in the soil remain in the owner. Any use not incident to such right of passage is a new one, an additional servitude, to which the street cannot be subjected, without first making proper compensation to the owner of the bed of the street. The laying of rails on a street and the running of cars thereon for the accommodation of persons desiring to use the street is not a new one, because it is only a new mode of using the street for the purposes for which it was originally taken.

The test, therefore, of what is a new use, continues the court, would seem to be found, not necessarily in the nature of the structure, nor in the number of the tracks, but in the use itself,—whether it is promotive of the objects and purposes for which the easement in the public was acquired.

The municipal authorities of the city of Baltimore have had committed to them the power to regulate the use of the streets, and that power is a trust of which they cannot divest themselves. The "primary use of the streets is not by any means that of furnishing tracks for street railways," and, therefore, further says the court, the municipal authorities cannot grant to railway companies such privileges as will obstruct the general public in the proper use of its highways, but must exercise the power vested in them; so that the beneficial enjoyment of the streets by the public in the ordinary and usual modes of passage thereon shall not be defeated or seriously impaired.

Here the street railway company, having obtained full legislative authority, proposed to lay two tracks in the bed of the street in question, with poles and wires to supply the electricity. The street was 40 feet wide, and in places there would not be room enough for vehicles to pass or stand in the space between the tracks and the line of the street. But, the court maintains, the street would not thereby be destroyed or seriously impaired for the ordinary uses of the public. Carriages, wagons, and other vehicles could always pass, unless the railway company blocked the street by permitting two of its cars, on different tracks, to remain stationary, and side by side; and this it would have no right to do for an unreasonable length of time.

Furthermore, the proof in this case showed that the weight of opinion among the property holders along the street was that advantages of better and quicker transit would outweigh any inconvenience that might result from the construction and operation of the road, and that the presence of the road with its two tracks would cause an increase in the value of the abutting property.

Under these circumstances, the court insists that it is difficult to understand how the construction of the two tracks, with necessary poles and wires, and the running upon them cars propelled by electricity, could be regarded as burdening the street with a new servitude. The rights of persons passing along it on foot, or with horses, or with vehicles would be the same as before. Cars could not be permitted to stand on the tracks in such manner as to prevent carriages and carts from passing. It would not be impossible for vehicles to be kept standing at the curb as long as might be reasonable for the purpose of unloading or loading their burdens or for discharging passengers. There might be some inconvenience at times, but not greater than often occurs in crowded thoroughfares.

And it must also be borne in mind, adds the court, that the relief asked for in this case could not be granted, whatever might be the incidental or consequential damages, unless the use proposed by the street railway company was a "new use," the imposition of which upon the street would amount to a "taking" of the complainant's reversionary interest in the bed of the street.

As to the other point raised by the complainant, the court deems it sufficient to say that it has more than held that the construction of the railroad, being authorized by competent authority, cannot be treated as a public nuisance.

CARE REQUIRED OF PERSONS USING TRACKS.

Johnson v. Brooklyn Heights Railroad Company (N. Y.), 54 N. Y. Supp. 547; Devine v. Brooklyn Heights Railroad Company, 54 N. Y. Supp. 626. November 22, 1898.

Johnson, the plaintiff in the first case, was a driver on a market wagon. He was driving upon the tracks of a street surface railway, operated by electricity. He was in a suburban community, where the cars were operated at a high rate of speed, and he was fa-

miliar with this fact. He was on the line of track where all of the cars must approach him from the rear, and he was passing down a grade where it was more difficult to stop a car than would have been the case on level ground, or where the grade was running the other way. Clearly, there could be nothing in this state of affairs, says the second appellant division of the supreme court of New York, from which a jury might reasonably infer that the plaintiff was free from contributory negligence, and, in the absence of direct evidence upon this point, it holds, there was nothing before the jury on which to find a verdict in favor of the plaintiff, and the motion of the defendant's counsel for a nonsuit should have been granted. Consequently, it reverses the judgment given the plaintiff for damages alleged to have been caused by a collision due to the defendant's negligence.

There are no presumptions in favor of the plaintiff, declares the court. The law imposes upon him the burden of proving, by a fair preponderance of evidence, not alone that the defendant has been guilty of negligence resulting in the injury, but that he (the plaintiff) has been free from negligence contributing to the accident; and, the court continues, where there is no evidence of the exercise of any degree of care on the part of the plaintiff, and when there are no circumstances from which such inference may be fairly drawn, there is clearly no question for the jury.

The fact that there was no room for the plaintiff to drive outside of the double tracks of the defendant, the court further insists, imposed upon the plaintiff, in common with the defendant, the duty of exercising a higher degree of care than would have been necessary under less dangerous circumstances. The danger was both known and obvious, and, while the defendant owed the plaintiff the duty of using reasonable care in the operation of its cars to prevent the collision, the plaintiff could not enter upon the tracks of the defendant, and rely wholly upon the defendant's servants seeing him in time to give warning. He was in a situation of danger. He was occupying the tracks of the defendant subject to the paramount right of the latter, to whom he owed the duty of using reasonable care, not only to avoid collisions, but to keep out of the way, and allow the cars to pass without unnecessarily impeding their progress; and, an accident happening to the plaintiff under these circumstances, the court holds, as before stated, he is bound to show affirmatively that he was exercising that reasonable care which the known and obvious dangers of his situation demanded.

Of something of the same character as this Johnson case, was the Devine case, which is cited with it at the heading of this article. Both cases were decided the same day, and by the same court, and to much the same effect.

But in the second, or Devine, case, wherein it was contended that the plaintiff had the right to assume that he would be given timely warning of the approach of the car by the motorman, it should be observed that the court says that, while it was the duty of the motorman to give timely warning, if he saw the wagon, or if he might, in the exercise of reasonable care, have seen the wagon, in time to have given such warning, he was not bound to do so under all circumstances; and it was for the jury to determine, under all the circumstances of the case, whether the motorman had discharged his duty, and whether the plaintiff had been free from contributory negligence.

Continuing, the court says that the defendant did not have the absolute right to the use of the tracks; the plaintiff might lawfully drive upon them; but the defendant did have the paramount right, and the plaintiff could not drive upon the tracks of the defendant, and impose upon it the absolute duty of giving timely warning of the approach of the car. The plaintiff was charged with the duty of exercising reasonable care, in using the tracks of the defendant, to guard against collision. He could not depend upon the motorman to give timely warning. He was bound to exercise that degree of care which reasonably prudent persons should or would have exercised under the same conditions; and, if he failed in this regard, he was not entitled to recover damages under the law. He could not enter upon the tracks of the defendant, and, closing his eyes to his surroundings, await the timely warning of the defendant's motorman.

If the night was dark, and the highway poorly lighted, so that the defendant's motorman, in the exercise of reasonable care, could not have seen the wagon of the plaintiff in time to prevent the accident, he was not bound, as a matter of law, the court holds, to give such warning.

On the other hand, if the plaintiff lawfully using the tracks of the defendant, subject to its paramount right, could, by the exercise of reasonable care, have discovered the approaching car in time to have left the track before the car reached him, the court insists that it was his duty to do so; and, in the absence of evidence tending to show such reasonable care, the jury would have been justified in finding that the plaintiff had not been free from contributory negligence, which is necessary to maintain an action for damages.

At the same time, the court does not wish to decide that, as a matter of law, it is negligence for a driver to fail to turn and look backward to discover the approach of a car from the rear. It holds that it is a question of fact for the jury whether, under the circumstances of the case, such precaution was necessary.

In other words, the court holds that the jury are to determine, as a question of fact, whether, under all the circumstances, the defendant was guilty of negligence in not giving timely warning; and that it is equally a question for the jury whether the plaintiff has been guilty of contributory negligence.

ALLEN ON THE REPEAL OF THE ALLEN LAW.

There is more truth than poetry, and, perhaps, elegance, in the following interview of Hon. C. A. Allen, author of the famous bill which bears his name. Mr. Allen remarked:

"I can only say what was long ago said, 'Let the heathen rage and the people imagine vain things.' The re-enactment of the old horse and dummy act is simply going back to the days of the single shovel plow and the reaping hook. Every man who has sense enough to draw his pay, if he is honest, will admit it. We have lots of brave men in the House who might smile at Satan's rage, but who could not face a frowning world—men who could look into a cannon's mouth on the field of battle, but who would cringe like miserable hound pups if commanded to do so by some newspaper without a revaluation clause or one run by a biscuit at a high rate of interest. The Allen law has adopted all over the state, and is giving splendid satisfaction. It is as legitimate as bread, and gives unlimited self-government to Sodom, otherwise known as Chicago, which has a mayor doing more business on less mental capital than any man in the world, who will drop out of sight so suddenly some day that it will require a search warrant to determine from what particular point he sloughed off. If old Ananias were living today he would belong to the newspaper trust and be running a newspaper on a school site or a dam site, as occasion might require, without a revaluation clause.

"The law as it now stands is wholly inadequate and will undoubtedly be revised and revampered after the municipal election in Chicago. It does not permit the operation of street railways under the Chicago River; the act says 'over,' and their operation could be enjoined at any time. The Hon. John P. McGoorty, Democratic minority leader, told the truth when he said: 'The Alling bill, if passed, will not provide permanent legislation on the street car franchise matter. It has no provision for the extension of the franchise of the existing street railway companies, and if passed the situation would be worse than it is now. The bill is simply a temporary makeshift to carry the question over until after the spring campaign, and although it is popularly stated now that, if passed, no further legislation would follow this session, the statement is clearly untrue.'

"When I stated on the floor of the House that the repeal of the Allen law and the re-enactment of the old horse and dummy act was the most infamous and cowardly act that ever disgraced a legislative body, and was done solely to influence the Chicago city election by both parties, I told a truth which will be admitted when the saintly members crawl out from under the ban of the devils now engaged in purifying the city of Chicago."

A working agreement between the Meriden Electric Railroad Co. and the Meriden, Southington & Compounce Tramway Co., of Meriden, Conn., has been effected whereby the latter will run its cars over the tracks of the former company.

The citizens of Zionsville, Ind., are very anxious that a franchise be granted to what is known as the Marott Co., to build an electric line over the Michigan road, and are using every endeavor to have the county commissioners reconsider their action in rejecting the company's petition.

A PROTEST AGAINST VESTIBULES.

Under date of Mar. 2, 1899, the Albany Railway, of Albany, N. Y., addressed to the Committee on Railroads of the Assembly, the following protest in the matter of the several bills then pending before the committee in relation to vestibuling or enclosing platforms of street railway cars:

The Albany Railway respectfully opposes the passage of any of the proposed measures providing for the vestibuling or inclosing platforms of its cars, for the following reasons:

I.

The Appellate Courts of the several states of the United States and the Supreme Court of the United States have laid down the law in relation to the care to be exercised by persons or corporations operating street railways. According to the several decisions, the operator of a street car, especially if it is impelled by cable or electric power, is bound to keep a constant watch for persons and vehicles on the street, and although he is not bound to anticipate that foot passengers will attempt to cross otherwise than at regular crossings, and he, therefore, need not maintain quite the same degree of vigilance, he is always held responsible for failing to see even persons crossing at other places if he would have seen them had he been in the exercise of ordinary care. (Sherman & Redfield on Negligence, Sec. 485c.)

1. This being the law, street railway managers are obliged to select able-bodied, competent operators of its cars.

The operator must be able-bodied, and physically able to promptly control all the appliances usually on cars for the purpose of starting and stopping them. His eyesight must be good, so that he may be able to see obstructions on the track, or at points along the line see those who are about to cross the track. His hearing must be good, so that he may be able to hear all signals given to him by the conductor and promptly obey them; and the warnings and signals of pedestrians or persons desiring to board cars. He must be able to speak, and preferably to speak the English language. His habits must be good.

No one known to habitually use intoxicating liquors can legally be employed as the operator of a car. (Railroad Law, Sec, 42, and Liquor Tax Law, Sec. 41. Penal Code, Sec. 420.)

II.

The law requiring the utmost vigilance on the part of those operating street railways is being constantly enforced by the courts in actions brought by persons suffering damages either to person or property. It would seem, therefore, unjust to require street railways, first, to take the greatest care in the selection of the operators of its cars and the greatest vigilance on their part, and then, second, to compel them to place such operator in such position that having ears he cannot hear, having eyes he cannot see, and having a tongue and voice he cannot use them. That is just what each one of the bills we are considering requires street railways to do. It requires the operator to be inclosed in a vestibule, so that his ability to see and hear and make himself heard is abridged.

1. As cars are now operated in Albany, the operator is in a position where he can be seen by all persons traveling on the street; where he himself can see all persons who are crossing, or attempting to cross, the track upon which he is driving his car; and he is in a position to hear warnings given to him by others; and is also in a position to give warning himself to those who may inadvertently place themselves in danger.

2. It is not saying too much to say that hundreds of persons have been saved from serious injury by reason of the ability of the operators of the cars of the Albany Railway to make themselves heard.

III.

The experience of electric railways and other railways using vestibules is that the vision of the operator is very much obscured, and the percentage of accidents happening by reason of this interference with vision is consequently larger.

1. It is impossible to keep the glass portion of the vestibule clear in cold, foggy or stormy weather. It is found at night that in order to enable the operator of the car to see at all, it is necessary to cover the front part or front windows of the car proper with a curtain. The effect of this, of course, is to prevent the passengers riding in the car from seeing the operator. For aught they know, he may have been taken with a fit and be lying senseless on the platform.

2. The hearing of the operator of a car while inclosed in a vestibule is very much impaired by reason of the resonating effect of the vestibule. All the noise made by motors and wheels on the track seem to be concentrated and intensified in the vestibule.

3. The conductor of the car, who occupies the rear part, is handicapped by the vestibule. If the trolley goes off, which is quite a common occurrence on all overhead trolley roads, it is necessary for him to get off the car to put the trolley on.

4. The present platforms enable persons to see the conductor or the driver, both from the inside of the car and from the outside of the car, during an impending accident. Many an operator of a car has been able to prove his great vigilance by aid of the testimony of persons standing on the sidewalks or sitting in the car which he was operating, when, if he had been inclosed in a vestibule, as these bills propose to inclose him, it would be impossible for him to do so.

5. The motion of his hands in throwing off power and putting on brakes is plainly visible. If he were inclosed in a vestibule, no one would be able to see whether he made any effort to stop the car or not.

6. The open platform enables inspectors of operation to readily see the position and condition of the operator.

IV.

Unless, therefore, the Legislature is prepared to relax the rule of law established by the courts, and give the operators of street railways the same right to operate their cars as is now enjoyed by steam railroads, they, the railways, should be permitted to manage the operation of their cars in such way as to secure the least possible damage to the persons and property of others.

V.

The reason given by the proponents of the several bills for their passage, namely, their sympathy for those engaged in operating cars, does not take into account the much larger number of persons interested in preserving their lives. For instance, the number of operators of cars employed by the Albany Railway does not exceed 150, while the population of the cities through which the cars of the Albany Railway are operated exceeds two hundred thousand. It is, therefore, a question whether it is better to conserve the health and comfort of 150 persons who may be exposed to wind and storm for a few days in each year, or to jeopardize the limbs and lives of thousands of people who have occasion to use the streets through which the cars run.

1. The Albany Railway and The Watervliet Turnpike & R. R. Co. have operated street railway cars in the city of Albany and vicinity since 1863. During that time there is no record that any operator of either a horse or an electric car contracted any disease while operating such cars which caused his death or hastened his death. The fact is that the drivers of cars are among the healthiest of the employes of a street railway.

2. The lives of persons run down by street railway cars are as precious to their fathers and mothers, or in the case of parents to their children, as the lives of the operators of street cars are to those who are related to them. With all the care which it is possible now to exercise, many annually lose their lives by reason of being struck or run over by street cars. It would seem, therefore, that any legislation which tends to increase the number who thus annually lose their lives should be restrained and withheld.

3. It is well known that pedestrians and drivers of vehicles on streets through which street railways are operated rely upon the vigilance of the operators of street cars to warn them of the approach of the car, and to stop the car if necessary to prevent a collision or accident.

4. A car with a human being in plain sight on an open platform seems less like an engine of destruction than a car with an inclosed platform, the operator of which is concealed from those using the streets as pedestrians or drivers of vehicles.

VI.

The fact that the operators of street cars—motormen and gripmen—want vestibules; or the fact that corporations owning railways do not want them, should not influence the decision of the question.

1. Many who advocate the vestibuling of cars do so simply from the standpoint of sympathy for the operator of the car. All other considerations are ignored or forgotten.

2. It is barely possible that some operators of cars may desire vestibules, forgetting for the moment how a vestibule would handicap them in the operation of their cars.

VII.

The question, therefore, whether any of the bills providing for the vestibuling of cars, or the modification of any of them, should be reported by your committee is respectfully submitted to you for consideration on all the facts which have been laid before you.

Respectfully submitted,

The Albany Railway,
By John W. McNamara,
General Manager.

In the same connection it is interesting to note the action of the Committee on Railroads of the Board of Aldermen of New York City. Oct. 4, 1898, an ordinance providing for vestibules on street cars was introduced and referred to the Committee on Railroads, which held public hearings, and on Jan. 24, 1899, reported unfavorably, no one having appeared at its hearings to advocate the measure.

While appreciating the humane purpose of the ordinance the committee felt that the proposed remedy was impracticable in New York City. Portions of the arguments of counsel representing the railway companies were approved and incorporated in the report. Some extracts from these are given below:

"Take a snow storm like we had last week and you would find it would be absolutely impossible for a motorman to run a car even a single block with glass up in front of him. He could not run his car even at a snail's pace without striking something. You must remember that a motorman has an awful lot to do. He has to attend to his brake. He has to start the car and stop it. He has to listen to the bell signals. He has to look out for parties on both sides of the street. He has to watch the track on the surface of the street in front of him. He has to look out for small objects on the track as well as large objects, such as trucks and carriages. He has to be alert every minute. He has to look out for the people standing on the sidewalks wanting to get on, and he has to listen for the conductor's bell for people wanting to get off. He has to look out at the corner of every street for people wishing to cross the streets. He could not possibly attend to all these things if he was inclosed in a glass case."

A letter from Mr. H. H. Littell, general manager of the Buffalo Railway Co., was quoted as follows: "We find the percentage of accidents very much greater where vestibules are used than we do where they are not. They obstruct the view of the motorman when he most needs the protection afforded by the vestibule, and he is compelled to throw open the front glass in order to see. We find that during rain, sleet and soft snow it adheres to the glass and prevents him from seeing. In such cases he is forced to open the vestibule and stand in a draft which results in severe colds and sickness."

The Municipal Record and Advertiser was quoted: "This one objection, on account of the greatly increased possibilities for serious accidents to the public in general, is sufficient to condemn the use of vestibules in climates that are subject to very cold and stormy weather. The benefit is only for the few employes of the road, but the danger is for the whole public at large. This danger has been considered by railroad men to be so great that many roads have refused to equip their cars with vestibules, even though the law demands it, and they are going to let the law take what steps it may, and then fight the question out in the courts."

In conclusion, the Committee said: "The importance of this subject and the desire to afford relief to the men at the front end of our cars prompted one of our members, Alderman John T. McCall, while recently at Springfield, Mass., and at Hartford, Conn., where vestibule cars are being operated, to inquire from railroad men whether they are beneficial and practicable. The responses were in the negative and the views expressed conformed absolutely to those hereinbefore quoted."

The Board discharged the Committee and placed the proposed ordinance on file.

MAINTENANCE AND REPAIRS OF ROLLING STOCK.

BY J. W. GREER, GENERAL MANAGER YOAKUM (TEX.) IMPROVEMENT COMPANY.

PART I.

The fact that this subject relates practically to the only department of street railroading which the manager is allowed to run without the advice and assistance of the law, should, if for no better reason, commend it to the careful consideration of every street railway man.

We pay a celebrated corporation counseller a fat fee for drawing up and putting through a franchise, which he modestly assures us gives us practically possession of the streets, and, acting upon this, we begin to build our road. We do not proceed far, however, before a big policeman arrests the whole gang and arbitrarily informs us that "it's against the law and you must have a permit before you can dig up the streets." We get the permit after considerable argument on both sides and find that it reads "tracks and switches to be located by the public improvement committee; grades and centers to be furnished by the city engineers; poles to be located and holes dug under the supervision of the committee on telegraphs, telephones and electric lights; all other work to be done under the supervision of the street and bridge commissioners."

We again consult the eminent counseller and find "that these simple matters in nowise interfere with the value of our franchise," but owing to a clause in the constitution vesting legislative bodies with the right to make "police regulations" for the sake of peace, we had better submit to these simple requirements. "Of course it is understood that if they try to interfere with our rights, why we'll fight 'em, sir; fight 'em to the last ditch, and through the Supreme Court, if need be, sir!"

About the time we get to working in the harness just mentioned along comes the artist who poses as city electrician and proceeds to sit down on the over-head scheme we have planned, gives us points on the best brands of insulated wire, poles, lightning arresters, etc.; brings the fire committee around to hear him talk, and intimates that "things must go his way or they don't go at all."

I remarked at the outset that the department to which his subject relates was free from the advice and assistance of the law. The needs qualifying to a certain extent; as we have all been forced to listen to the censure of the court on the subject of defective brakes after his honor and gentlemen of the jury have had the subject glibly explained to them by the ex-motorman who "could stop a car going 20 miles an hour in less than half its length provided the car had proper brakes," or, if he used the reverse lever, he could stop inside of three to five feet. Of course the funny story the superintendent tells about discharging the same ex because he was too lazy to stop the car at all, and allowed it to run off the end of the track, fails to go down with such early risers as the judge, the jury and the learned counsel for the plaintiff, so your company suffer accordingly. Its a sad world, Mr. Jones, a sad world, sir! However, its the best world the average street railway man has seen, or is likely to see, and the business with all its trials, troubles and tribulations has a peculiar fascination which impels those who enter it to continue in it (as the story papers say) "ever afterward."

Enough of ruminating, and now to the subject in hand, which we will begin by advising you to adopt as your motto (have it framed and conspicuously displayed in all your shops),

A STITCH IN TIME SAVES NINE.

In no business does this maxim apply with more force than in the maintenance and repairs of the rolling stock of a modern street railway. The expense of the mechanical department is usually about equally divided between labor and material supplied.

In order to keep the labor account at the minimum, it is better to pay a few men the highest possible wages, provided they understand their business, and do the work promptly and right, than to have a yard full of cheap labor to botch things and soldier when in their ignorance they have gone as far as they know how. It is well to mention just here that if the manager of a street railway is not himself a practical mechanic, the hardest labor problem he has to solve is in connection with the mechanical department, as all first-class mechanics are more or less cranky, and in the language of the

natives of this sunny clime, " the more better they air the wus crankier they gits." I speak knowingly, because I have trotted all the gaits of the mechanical department personally, from roustabout to master mechanic, and have many times seen the head of the mechanical department holding lordly sway over the impractical manager, who, if he had been able to personally direct that department, would have known what to do.

You may be able to impress the president and the board of directors, by means of a glossary of technical phrases, into the belief that you are thoroughly conversant with every detail of the construction and operation of street railways, but unless you are practically experienced don't try it on the intelligent mechanic; for he will at once measure you correctly, and will ever afterward feel a contempt for your knowledge and authority.

Nearly all the friction existing between heads of departments in street railroading emanates from the mechanical department. Lack of practical knowledge on the part of the president or general manager, causes him many times to listen to the tale of woe from the head of the mechanical department, because (as he reasons in his ignorance), a man who can keep the complex machinery in proper repair and the cars always looking spick and span must be right.

No man is fit to be master mechanic or head of any other department who does not thoroughly believe that except for his individual efforts, the whole road would stop and everything go to smash; but because you have men who take this interest in the road, don't lose your own head and conclude that his plan is necessarily best. Listen patiently to all he has to say in his zeal to help you, but after he is gone give the problem an equally careful study before unjustly reprimanding perhaps an equally good or better man. Nothing so takes the zeal and energy out of a faithful man as to be unjustly censured by his superior at the instigation of his inferior.

I am aware that there are managers (and apprently successful ones) who advocate and practice criticism all the time and with everybody on general principles, claiming that one should never be satisfied with anything, but keep everybody stirred up with the idea that they must do better or that better results must be obtained. Why do I say such managers are apparently successful? Because men ruled with a rod of iron or by fear, will do the outward things necessary to hold their place, while inwardly dissatisfied with the manager, the road and everything pertaining to it, and do not take that interest in their work they should.

The motorman and conductor may wear neat and clean uniforms, polish their shoes, and be at the sheds promptly on time, for the man who "always raises Cain," but the motorman will reverse his motors at an opportune time, burn out the armature with the brakes, or tear up the gears "to get even." The conductor will let the old lady drop off the steps and bring a damage suit, or run by passengers with his face earnestly looking out for them the other way, "to get even." The track man will spike out the rails, the wheels will cause an unavoidable spread, and he "gets even" by delaying the cars half an hour. The shop man loosens the brush-holder so it will jab into the commutator and tear it up, or puts a loose key into the gear wheel; it fails to mesh, and it goes to smash, and he "gets even," and so on ad infinitum.

If the board of directors at the annual meeting gives you a vote of thanks for your wise and successful management during the past year, you feel so good over it that if, on the quiet, they gently intimate that it might be as well to discontinue this, or make a change in that, you cheerfully and willingly make a trial of the suggestion. If, however, you never heard anything from the said board but a growl of discontent, what heart would you have to try to do the things they advised, knowing full well you could not please them in any event.

Some of us, after we have risen a few notches in the social scale or climbed a few rounds of the ladder of fame toward the goal of success, seem to imbibe the idea that there must have been some special mixture in the batch of clay we were made of, or that the material was ground finer, or something took place to make us a shade superior to our fellow man struggling at the point we began. Put ice to your head, or take something for your liver when you get in this fix, for 99 times out of 100 you will find it a case of swelled head or billiousness you are suffering with, instead of superiority.

In dealing with shop men, and all other employes, let your motto be, "exact justice to all and special favors to none." Be as profuse in your praise of faithful and efficient service as you are prompt to condemn the things that are wrong. Be sure you are right before you condemn anything. This will save visits from grievance committees, and the humiliation of correcting mistakes, which always cause a loss of prestige. If a manager exacts what is right of his men, investigates carefully and fully all complaints before passing judgment, promises nothing to them except what he invariably carries out, he gets the respect and willing obedience which makes true success. Without the personal interest and good will of the employes, all the scrupulous neatness, and military precision and outward appearances in the world will not give full measure to success.

Having now settled the labor question to the entire satisfaction of—the writer—we will next month take up the subject where we digressed.

To be continued.

NEW INDIANA LEGISLATION.

The Indiana Legislature at its last session, which ended March 6th, enacted a number of laws affecting street railways:

A law providing that between the 1st of November and the last of March of each winter, every street car shall be comfortably heated by electricity or otherwise. The penalty to which a failure to comply subjects the company and its agents, is a fine of from $25 to $100 per day.

A law providing for the consolidation of street railway companies whose roads form continuous lines. Special provision is made for interstate lines, and the act has an emergency clause.

An amendment to the general street railway law so that the city line in Fort Wayne must permit the use of its tracks by suburban companies.

An amendment to the act of 1891 providing that the Board of Public Works and the Common Council of Indianapolis, instead of the Aldermen and Council shall determine whether suburban railways entering the city may use the city company's tracks. A suburban company is given the right to use the city company's tracks from the time it files a petition for condemnation; the city company is required to furnish a loop for turning suburban cars at the city terminus; the suburban company may use the other's poles to string wires if the latter cannot furnish power over its own wires; the 10-mile limit formerly on suburban roads is removed. (This act is regarded as of doubtful validity.)

A new law authorizing the city of Indianapolis to contract with any street railway company organized since the census showing Indianapolis to have more than 100,000 inhabitants, for a surrender of existing franchises and the grant of a new one for a time not exceeding 34 years. The company's rights in the streets are to terminate at the end of 34 years and a franchise for not more than 30 years more shall then be sold to the highest bidder. The fare under this act shall not exceed 5 cents a single ride, and tickets shall be sold 6 for 25 cents and 25 for $1. Persistent violations of the provisions of the act will work a forfeiture.

ACCIDENT AT WATERTOWN, N. Y.

On March 20th a car of the Black River Traction Co., Watertown, N. Y., left the track and plunged down a 30-ft. embankment into the Black River. The conductor and motorman jumped, and were uninjured. There were three passengers in the car; one was not injured and two are reported more or less seriously hurt.

ELECTROLYSIS DAMAGE SUIT.

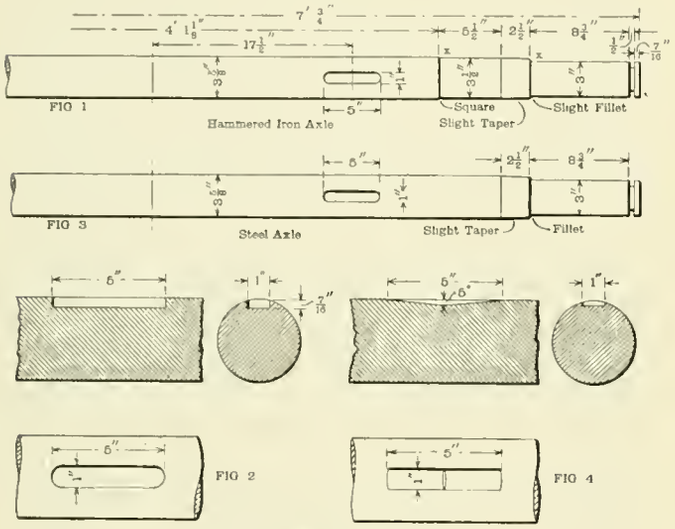
The city of Dayton, O., has sued the City Railway Co., of that city, to recover $45,000. that being the damages which it is alleged the city has suffered through having its watermains injured by electrolytic action, for which the City Railway Co. is responsible. The city's side of the case was probably well set forth in the article on "Electrolysis of Cast Iron Water Pipes at Dayton," which appeared in the "Review" for November, 1898, page 817; that article was written by Harold P. Brown, who made an electrical survey in behalf of the city. The railway company doubtless has matter to offer in defense, which will come out on the trial.

Mechanical Department.

SOME DATA ON AXLES.

A few weeks since we received a letter from a street railway company requesting information upon the subject of axles and the causes of their failure in service. The road in question found that the steel axles used by it broke either near the gear or near the collar very soon after they were put under the cars. Since that time we have made inquiries of a number of other roads as to their experience with axles, the substance of the replies received being given below.

The experience of road A in the matter of axles has been as follows: Hammered iron axles of the dimensions shown in Fig. 1 were put in service under single truck cars. The weights were as follows: Body 9,150 lbs.; truck, 4,000 lbs.; 2 motors, 4,910 lbs.; 2 axles, 500 lbs.; 4 wheels, 1,440 lbs.; total, 20,000 lbs. The first axle broke after six months and they continued to break, sometimes as many as nine axles (30 cars were in service) broke in one month, until all were gone. The axles broke at the square shoulder (x in Fig. 1) just inside the hub or at the fillet on the journal (x' in Fig. 1).



AXLES AND KEYWAYS.

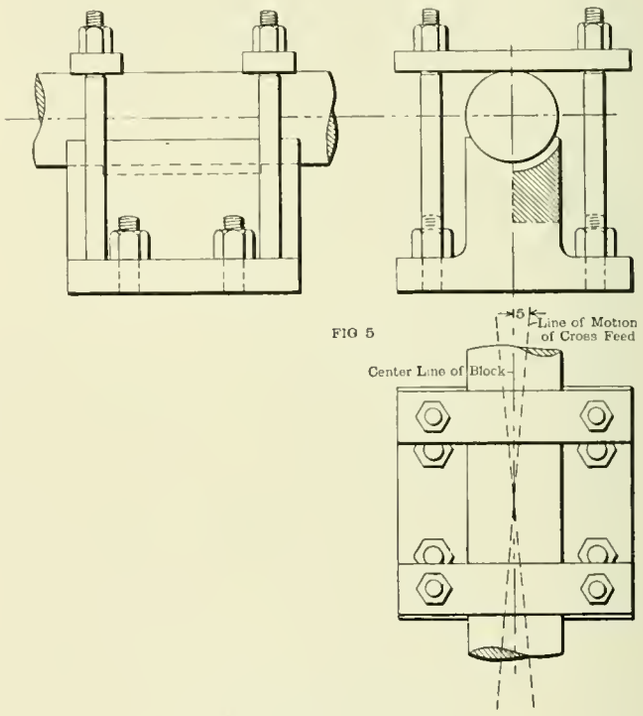
The iron axles breaking were replaced with cold drawn steel axles which were bought on the sole guarantee that they would prove better than the iron axles previously used. These steel axles when turned all over weighed 250 lbs. and had the dimensions shown in Fig. 3, differing from Fig. 1 only in having the wheel seat of the same diameter as the rest of the axle between the hubs. The key seat was of the same dimensions as in the old iron axles; and this is shown in Fig. 2. After about a year in service these steel axles began to break with the same rapidity as had the iron axles; in every instance the break started at one end of the keyseat. To remedy this it was decided to cut the keyseat only ¼ in. deep instead of 7-16 in.; before many of the axles had been so fitted, the master mechanic decided to adopt the key seat shown in Fig. 4, which is about .22 in. deep at the center of its length and tapers to nothing at the ends. Since adopting this keyway but three axles have broken and those failed by reason of the track spreading and letting the wheels drop between the rails; when the car reached a point where the track was in gage the binding of the wheels broke the axles. These three breaks occurred with successive cars at the same point and thus the cause of failure established beyond question. The break was not at the keyway. Many of the axles now used have been in service over three years.

The method of cutting the peculiar form of keyway shown in Fig. 4 is as follows: The tool rest on one of the lathes in the shop is removed and a cast iron block of the form shown in Fig. 5 placed on the cross feed, and the cross feed set at an angle of 5° with the line at right angles to the center line of the lathe bed. The head center is replaced by an end-cutting tool 1 in. in cutting diameter. An axle is placed in this block, held down by straps, and fed against the tool at the middle of the cut, the inclination of the block with the line of cross feed is changed from + 5° to — 5° and the cut continued.

The advantage claimed for the keyway of this form is that it places the weakest section of the axle in the center of the gear hub, which latter being set up tight serves to reinforce the weak place; if the top and bottom of the key are made parallel the weakened section of the axle extends beyond the gear hub.

This road, A, is now buying short piled, forged steel axles though no particular reason for the change is given. Of the axles now under cars 46 are cold drawn and 76 forged. The only specification is that the carbon shall not be above.15 per cent; no tests are made.

The wheels are bored to fit the axles, and not the wheelseats turned to fit the wheels as is the usual practice; in replacing wheels,



CLAMP FOR HOLDING AXLE.

the wheelseats are not turned off unless the surface is bad. Eight-bolt gears are used, and are bored .01 in. smaller than the axle.

The old equipment of the road in motors and trucks prevents the use of a larger axle, that shown in Fig. 3, without expensive changes. New cars recently ordered, however, have axles 4 in. in diameter between journals, with 3½-in. journals.

Road B uses the axle shown in Fig. 6 under all its cars, which are 20-ft. body closed cars seating 28 persons and 30-ft. open cars seating 50 persons. The weight of the car body empty is given at 8,000 lb., the truck at 3,700 lb., two motors at from 1,450 to 2,200 lb. each. The axles used are Jones & Laughlin's cold rolled steel and no specifications other than those as to dimensions are given. All axles are driven and the breakage during five years that steel axles have been in use is less than 3.5 per cent per year.

When the axles break the fracture is usually just outside the gear, but occasionally one breaks outside the wheel. The average mileage of axles (all driven) on this road is 80,000 miles; the axles are thrown out if the journals wear to 2¼ in. in diameter, which they sometimes do, and in such cases the axles are turned down to make armature shafts. With the present truck and motor equipment a 4-in. axle could be used without making expensive changes, but the 3¾-in. cold-rolled steel axles are considered satisfactory.

Road C uses the axle shown in Fig. 7 under single truck cars; its closed cars are 16 ft. cars seating 22 persons, the open cars are 27-ft. cars seating 45 persons. These axles are of crucible machinery steel, turned to size; there are no specifications as to chemical composition or tests. It is stated that this road has been using crucible machinery steel for axles for two years, and that prior to that cold rolled steel was used for five years; the reasons for using the machinery steel are that it has a high resistance to wear, is tough and not easily sprung. From this we infer that there was trouble experienced from the cold rolled axles springing when the keyways were cut. The keyways are ¾-in. wide and ½-in. deep, the length varying with the type of motor used. These are cut on a planer after drilling at the ends.

About 20 per cent of the axles break in service each year; two-thirds of the failures occur just inside the wheel hub, a few at the gear keyway and the others just outside the wheel.

The average mileage made is 70,000 miles; the permissible journal wear is 3-16 in. and a very few axles are thrown out because of wear. The road found that axles 3⅜ in. in diameter had a life of from 18 to 24 months, and increased the size to 3¾ in. which give over double the service. The diameter might be further increased ¼ in. with making changes in the equipment.

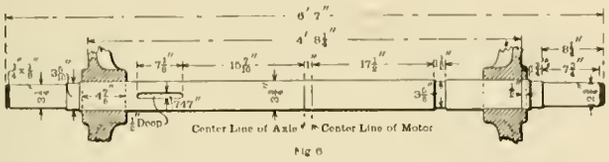


Fig 6

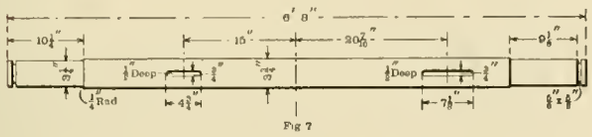


Fig 7

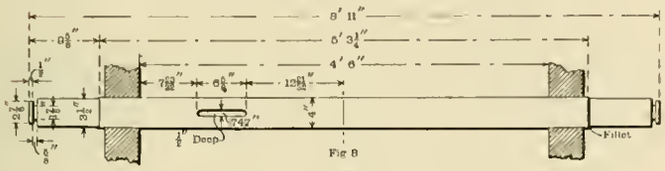


Fig 8

STREET RAILWAY AXLES.

Road D uses hammered steel axles, turned all over to the dimensions given in Fig. 8, not specifying for chemical compositon or tests. Three axles are used under box cars (18 ft. inside) seating 24 passengers, and open cars (29 ft. 6 in. over dashes) seating 45 persons. The location and dimensions of the keyseat vary with the type of motor, but for G. E. 58 motors are as shown in the drawing; special end mills are used in cutting the keyway.

This company formerly used 3⅜-in. and 3⅝-in. axles of cold rolled steel but found them too light, all breaking within three years; three years ago the 4-in. hammered steel axles were adopted, since which time only three have broken. When axles broke the fracture in nearly every case was at the end of the keyway just outside of the gear.

Road E, a 23-mile road with 10 motor cars reports that in 4 years and 5 months it had no broken axles.

Road F, which operates 180 miles of track and over 300 motor cars (18-ft., 20-ft. and 23-ft. bodies) uses 3¾-in. cold rolled steel axles with 3⅜-in. journals. The keyseat is 6⅝-in. long, ¾-in. wide and ½-in. deep and is cut by the maker of the axle. Steel axles have been under horse cars for 16 years and under electric cars for 6 years, and the percentage of broken axles is very low, ⅛ of 1 per cent. When an axle breaks the point of fracture is between the gear and the wheel. This company has recently increased the diameter of its axles from 3⅜ in. to 3¾ in. at small cost.

Road G, operating 31-ft. double truck cars which weigh 30,000 lb. each and carry maximum loads of 32,500 lb. each, uses 3¾-in rolled steel axles for motor-driven wheels and 3-in. or 3⅜-in. axles for non-driven wheels. The keyseats in motor driven axles are ¾ in. wide and ½ in. deep, being cut by drilling and planing in the usual manner. In nine years, with at least 100 axles always in service three driven axles have broken; two of these broke in the journal, and one at the axle collar inside the hub. No non driven axles have broken in service. The permissible journal wear is 9-16 in. with 2¾-in. journals and ⅝ in. with 3⅛ in. journals; most of the renewals are made because of journal wear.

The first equipment had 3⅜ in. axles, but the size was increased to 3¾ in. when making renewals because it was believed that the smaller axles had given poor results on other roads, a larger axle cannot be used because motor casings will not take them. This road is laid with light rails and the track is rough.

Road H reports that it uses 3¾-in. axles under 16-ft. body cars and has had but four axles break in seven years; it has 35 motor and 15 trail cars.

Road I has 52 motor and 16 trail cars which are single truck cars varying from 25 ft. to 29 ft. over the buffers, and seat from 35 to 40 passengers. Cold rolled steel axles 3⅜ in. to 3¾ in. in diameter are used, but all renewals are now made with 3¾-in. axles, which is the limit fixed by the motor bearings now in use. From 5 to 10 per cent of the axles break each year.

Road J operates about 150 motor cars and 50 trail cars; the motor cars, with double trucks, motors, etc., weigh 20,000 lb. and seat 32 persons. Hammered steel axles 4 in. in diameter are used and none have broken in the last five years.

Mr. A. B. du Pont, manager of the Detroit Citizens' Street Railway Co., in replying to our inqury says: "We purchased all our axles from the Johnson Co. in connection with the du Pont trucks, and although we use car bodies 22 ft. long and we have 10 and 12-bench open cars, we have not broken a single axle in four years. In regard to the axles that we had in use on other than du Pont trucks, we broke such a large percentage, that we scrapped the whole lot and replaced them with axles purchased from the Johnson Co. The cause of the breaking of these axles was that square shoulders had been turned on them just outside of the wheel line for the purpose of forcing on a dust collar for the journal boxes, and they would have broken whether the material in the axles had been good or bad. In replacing them we were careful to have spiral fillets left in at each place where there was a shoulder designed in the axle; since this was done, more than a year ago, we have not broken a single axle."

One of our corespondents is firmly convinced that the keyseat is the weak point of a street car axle; some forms of keyseat are worse than others, but all are bad. The question suggests itself to him: Is it necessary to use a key in securing the gear to the axle? He once put an axle in service, and severe service at that, without a key to hold the gear; it made 60,000 miles before going to the shop again and the absence of the key was not discovered until that time. We all know that wooden pulleys are not keyed to shafts, and perhaps it may some day be discovered that iron pulleys do not need keys.

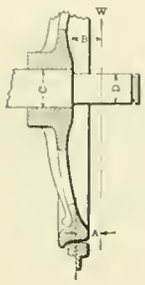
In 1891 a committee reported to the Master Mechanics' Association on iron and steel axles, and the master mechanic of one road stated that steel driving axles with keyways having square ends broke, while if the keyways were cut with a milling tool so as to leave a round corner at the end the axles did not break.

As a rule very little trouble is experienced with hammered steel or cold drawn steel axles; cold rolled axles usually spring out of line when the keyway is cut as cutting into one side relieves the initial tension of the metal. Some master mechanics prefer wrought iron because it is fibrous in structure, but as the fibrous structure is caused by the presence of impurities (slag, etc.) in the metal this does not seem to be a good argument. And it is every year becoming harder to secure a good quality of wrought iron because of the difficulty of keeping steel from becoming mixed with the scrap from which the iron is forged.

As many of the street car axles are reported to have broken just inside the hub, or in the journal, a table has been prepared to show

the relative strengths of the M. C. B. standard axles for freight cars of different capacities and a number of street car axles. In estimating the load per axle for the street cars, the figures for a crowded car have been taken, and perhaps that is as fair as to take the freight cars as loaded up to their full capacity. In general cars of either kind are not run fully loaded at all times. The dimensions indicated in the sketch were taken from drawings of the axles. As the strength of the axle varies as the cube of the diameter, the cube of the diameter divided by the moment to which it is subjected will give a measure of the strength; what is called in the table the "relative strength" is the quotient so found multiplied by 1,000.

It will be noted that the four street car axles, under the conditions assumed, are subjected to relatively heavier stresses than are the M. C. B. axles for freight cars.



Street cars make from from four to eight times the average daily mileage for freight cars on steam roads, though the speed is less, and there would seem to be no reason for making the axles at least relatively as strong as those used under freight cars.

The fact that with street cars a part of the weight of the motor is carried on the axle does not materially affect the moment to which the axle is subjected, but this weight being without spring support makes the effect of shocks more severe when passing a low joint or other irregularity in the track.

COMPARISON OF VARIOUS AXLES.

Axle.	W Lb.	A In.	B In.	C In.	D In.	Rel. str. at C.	Rel. str. of journal	
M. C. B. 40,000-lb.	8,000	10.	3.5	4.875	3.75	1.449	1.882	
M. C. B. 60,000-lb.	10,500	8.5	4.	5.5	4.25	1.866	1.829	
M. C. B. 80,000-lb.	13,750	9.125	4.5	6.375	5.	2.075	2.020	
1	8,000	3.875	4.25	4.	3.5	2.062	1.300	Few broken in in last 3 years.
2	8,000	4.56	4.56	3.75	3.25	1.429	.940	About 20 per cent break each year.
3	8,000	5.875	3.875	3.75	3.25	1.121	1.107	3½ per cent break each year.
4	8,000	4.69	4.375	3.625	3.	1.266	.771	

The general experience so far as we have been able to determine is that the great majority of steel axles that fail in street railway service break at a square corner or the fracture starts in the key. In some instances it has been found that the cracks started at tool marks in a fillet.

In discussing this subject before the American Society of Mechanical Engineers, (Trans. Vol. xvi.; p. 244), Mr. G. C. Henning said: "In a great number of axle fractures you will see that there is a central part of the axle which broke with a granular appearance, while between this part and the outer edge, there are a number of rings in which the metal is crushed more or less. Now, every axle is strained very much more in passing over a frog on a switch than by any of the reversed strains, oscillations, vibrations, or static loads. These are very small compared to the impact of the axle at the instant of crossing over a frog. Suppose the car is loaded to its maximum capacity, and a frog is struck when the roadbed is very hard, it may crack that axle on one or the other surface, according to how it is strained. If the wheel is inside as usual, then, of course, the fracture would be likely to occur on top. Now, that axle will run for a long while with that fracture in it. The next time that axle hits a frog it will break a little bit further. The next time it runs under a heavy load and strikes another bad place in the track it breaks still further. The journal section of the axle has by that time been very materially reduced, and careful inspection reveals these fractures; and when the fracture shows very plainly and opens the axle is taken out. But many of them are not found, because of carelessness during inspection. Then ultimately the axle will break with the central action of the material in perfect condition at the time of rupture; all the rest has been hammered during service, so that it is all polished. But the fracture does not occur uniformly. Some of these rings are wide and others are narrow. I have one axle in my office which has at least sixty such distinct rings, which shows that it broke on sixty different occasions. That is the way axles break. They do not break because they are weak. They do not break because the static loads are too great. They simply break because of the enormous impact in crossing over frogs, and they break very gradually."

Mr. E. D. Estrada in the same discussion submitted a sketch, Fig. 9, showing the end of a street railway axle broken on a Pittsburg road in the manner described by Mr. Henning. Tensile and chemical tests did not show anything which in Mr. Estrada's opinion would warrant adverse criticism of the material.

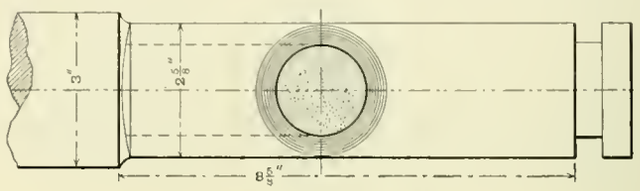


FIG. 9.—A BROKEN JOURNAL.

Most axles break in cold weather. They do not break because, as has some times been stated, the metal becomes weaker as the temperature decreases, but because the roadbed is frozen hard and is more unyielding, thus causing a severer shock. Experiments made by Prof. R. C. Carpenter (Trans. A. S. M. E., vol. xvii., p. 198), show that the tensile strength of iron and steel increases as the temperature falls between the limits of + 70° F. and — 60° F.

Professor Dewar found that at very low temperatures iron and steel became brittle, but the tensil strength was greatly increased. Thus iron which at + 59° F. had a resistance in tension of 34 tons per sq. in., at — 292° F., had a resistance of 62.7 tons; for a specimen of steel the figures were 35.4 tons and 60 tons respectively, for the two temperatures.

Another reason for some of the failures of axles in cold weather is that the track rails are forced together by the expansion of the paving, and the wheels are caught where the gage is tight, breaking the axles.

FOR TURNING TROLLEY WHEELS.

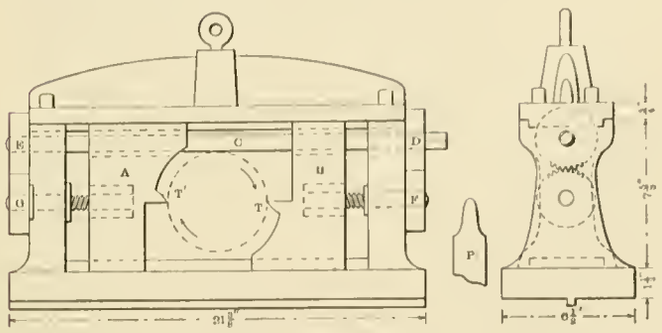
In the Review for May, 1897, was described a plan devised by C. E. Moore, master mechanic of the Chicago City Railway, whereby trolley wheels could be turned in four minutes; the work was done on a milling machine, a special cutter being used and the trolley wheels slowly revolved while under the cutter. This method was a great improvement of that formerly employed as four minutes sufficed for work that previously required 20 minutes.

Mr. Moore has recently designed and built a piece of apparatus which is an equally great improvement over the one previously described, and reduces the time required for turning a trolley wheel to one minute or less. This apparatus is shown in the accompanying sketch. It consists of a special tool holder which may be clamped to the bed of a lathe or milling machine (Mr. Moore uses it in connection with a milling machine). The frame has guides at the top and bottom in which the blocks A and B are free to move longitudinally; near the top of the frame is a ⅞-in. shaft C extending from end to end with a gear of 3 in. diameter at the pitch circle, keyed at each end; one end of this shaft is squared to receive a crank. The gears D and E mesh with similar gears F and G, each of which is keyed to and drives a ⅞-in. screw with six threads to the inch; F drives a right hand screw and G a left hand screw; the screws work in brass nuts which are fixed in the blocks A and B. On each block is fixed a tool, which is shown in plan at P. It is evident that on turning the crank on the end of C the two cutting tools will approach or recede from each other at the same speed.

The trolley wheel to be turned is mounted on the milling machine and rotated at a speed of about 45 r. p. m., and the tool holder fixed to the bed so that the trolley wheel occupies the position T T in the sketch. The two tools are at the extremities of a diameter and hence there is no chattering; they can be fed about as fast as a man

can turn the crank. As stated 60 wheels per hour can be turned by using this device.

When one of the cutting tools needs regrinding it is placed in a



TOOL HOLDER FOR TURNING TROLLEY WHEELS.

metal case or form, the end of which has the exact contour to be given the tool, and the case placed in contact with a stop on the grinding machine. By this means the tools may be quickly ground and always to the proper shape.

A 50-YEAR FRANCHISE IN INDIANA.

Mr. C. L. Henry, president of the Anderson Electric Street Railway Co., and Mr. G. F. McCulloch, secretary of the Citizens' Street Railway Co., of Muncie, have been devoting a great deal of time to an electric road which it is proposed to build between Muncie, Anderson and Middletown, Ind. The old state road through the towns of Yorktown, Daleville and Chesterfield has been selected for the route.

On application to the commissioners of Delaware County everything asked for except a perpetual franchise was granted; the commissioners wanted to make the term as short as they could, and cut the term down to 50 years.

INTERESTING, BUT NOT TRUE.

The highly colored account of an employe of the Metropolitan Street Railway Co., of New York, receiving a shock at 2,000 volts turns out to be a mistake; the highest voltage used on that system is 550. Some of the details of published accounts showa well developed imagination; for instance, the following: "The man's body was burned black from head to foot; every stitch of clothing was torn from him, and he fell senseless through a hole instantaneously burned in the floor by the terrific electrical power. The doctors who attended him say there is no case on record of a man withstanding a similar shock."

OWL CARS IN BALTIMORE.

About the middle of February the City Passenger Railway Co. began to operate all-night cars on one of its lines, and the Baltimore Consolidated Railway Co. put them on three lines. As the owl car was a new thing in Baltimore a careful account was kept of the receipts and expense of operating. The cars from 1 a. m. to 5 a. m. were run on a headway of one hour and it was found that the returns are away below the cost of operation.

There is now an ordinance before the council requiring all-night cars to be run, but President Perin states that the company's experiment will be continued for at least six months, regardless of the action the council may take.

PAVING IN CLEVELAND.

The general street railway law of Ohio requires street railway companies to pave the space between the rails of each track and 12 in. on each side. A special statute was enacted giving the city of Cleveland power to require that companies pave all of the space between double tracks, irrespective of the width, and attacked by the Cleveland Electric Railway Co., and a recent decision of the Supreme Court affirms the ruling of the lower court that the special act is unconstitutional.

THE DEVELOPMENT OF ELECTRIC TRAMWAYS IN THE UNITED KINGDOM.

From Our Own Correspondent.

The next twelve months will witness the completion of 200 miles of electric tramways in this country, which affords some evidence that we are making progress. Most of these lines, however, are experimental, especially those that are being carried out by municipal authorities. The most important among the tramway schemes are those which are being engineered by private enterprise, and in this respect the rise of the British Electric Traction Co. is one of the most remarkable features of the new phase of tramway work. The managers of this company quite early perceived that electric traction would not only improve the speed and decrease the working expenses upon existing tram lines, but would open up quite a new sphere of activity in creating new systems. As one travels about in the country and becomes acquainted with the methods of transportation between quite important towns, one is irresistibly reminded that ancient institutions in this country die slowly. Even in the great centers of industry there is a woeful lack of speedy communication between towns and villages, and in that hive of industry, the potteries district, it is impossible in many cases to travel direct from one town to another by railway, and frequently a journey of seven miles will take an hour. A similar state of things prevails in the manufacturing districts of Lancashire and Yorkshire. It is true that the train service between such places as Manchester, Liverpool, Bolton, and similar towns is very admirable, but connection between slightly less important towns is exceedingly bad.

It is in linking such districts together that the British Electric Traction Co. is about to carry on some useful work. A concrete example of what the company is doing is in the North Staffordshire towns already alluded to under the title of "the Potteries," which have been for some years badly served by a steam tramway—this line has been bought up by the British Electric Traction Co., and is being relaid and equipped for electrical working, and in addition quite new districts are being opened up and the total length of line will be close on forty miles. Then, again, in other parts of England, round the neighborhood of Newcastle, in the Lancashire districts, and between the busy parts of South Wales, this company is rapidly acquiring rights which will enable it to commence large systems of electric tramways. It is stated that the aggregate length of lines now owned by this company is over three hundred miles, and every foot of these will be operated electrically. Although the company is not yet operating more than a few miles, it is a significant fact as showing the faith of the public in this enterprise, that the company has for the past year's working shown a profit of over £2,000, which has been for the most part derived from premiums on shares.

Naturally the success of the British Electric Traction Co. is calling forth imitators, and there is no reason why many of them, with good management, should not prove financially successful. The question of municipal tramways has reached a most interesting and indeed a serious position. It is not unreasonable to suppose that municipalities and other local authorities, arguing from the success of their electric lighting schemes, should have assumed that they were equally well fitted to operate an electric tramway service. Opinion, however, is very much divided as to whether such a body can develop the real utility of an electric tramway, because, in the first place, the success of a tramway service depends upon carrying people from the center of the city to the suburban districts, and in most cases suburban districts are under a different local government from the center of the city. In many large towns, such as Glasgow, the difficulties in this direction are not insuperable, for the small local authorities in the outskirts of the city have neither the inclination nor the financial strength to operate any portion of a tramway system, and there is, under such circumstances, very little difficulty in inducing smaller local authorities to permit a large city authority to carry trams through the various districts.

While, of course, there is much to be urged against the control of tramways by local authorities, there is very little doubt that many of the largest schemes will be carried out by such bodies. A most interesting example of what can be done in this direction is Glasgow, where, many of your readers will remember, a short line has been recently equipped for the purpose of demonstrating the economical working of electricity for tramway propulsion. The suc-

cess of the line was soon demonstrated and the corporation has practically decided to carry out what is considered in this country an exceedingly large scheme of electric traction; it will comprise no less than six hundred cars and a power house probably having plant of seventeen or eighteen thousand horse-power. Mr. Parshall, who may be considered the leading authority on electric tramways in this country, has recently reported for the Glasgow corporation on the subject, and he recommends that the best method to meet the conditions obtaining in Glasgow is to adopt a three-phase high tension generating station with sub-stations, and he recommends this system for the reason that it will require less capital expenditure and that it is possible to obtain a site for a generating station which will give the advantages of good coal delivery, and where extensions may be easily provided for. He further considers that the three-phase system has the advantage of less working costs and repairs, and he states that it has been conclusively shown at Niagara, Dublin, Middlesborough and other places; that rotary converters require less attention than ordinary 500-volt railway generators, and that no skilled labor is required. The three-phase system, in his opinion, has greater flexibility and is better adapted to the requirements of future extensions. He further states: "In considering the transition from horse traction to electric traction the question of time is of great importance. The single generating station which I have recommended can be installed and put in working order more quickly than several stations. The loss through delay can be estimated upon the basis of your present working. The cost for horse traction is 3½d. per mile on a mileage of 9,000,000 per annum; taking the working cost for electric traction on the same basis as to maintenance, etc., the saving, assuming no increase in traffic, amounts to £112,000 per annum."

The Glasgow corporation is fully alive to the advantages that an electrical system will give, and there is very little doubt that it will adopt Mr. Parshall's scheme as it stands. The position of affairs at Glasgow has to some extent raised the question of combined stations. There is considerable leaning among engineers in this country towards power houses in which lighting and tramway plants are arranged together. To some extent this arises from the fact that many towns have already in existence a lighting plant, and it is assumed that it will give a more economical method of working if one staff of engineers is able to look after both sets of machinery.

Obviously, the system has its limitations, and there are not wanting very strong opinions on the disadvantages of combining lighting and tramway business. Mr. Parshall has reported most strongly against a joint supply, for the following reasons:

"1. On many days in the year the maximum load in lighting, and that in traction, occur at the same time, so that the same maximum total capacity in plant has to be provided, whether or not the supply is from a common station.

"2. Owing to the different nature of the loads, the capital cost for a given watt-hour production is three or four times as great for lighting as it is for traction; in other words, in traction apparatus it is worked at its greatest capacity three or four times as many hours in the year as is lighting apparatus, consequently it can be of a more substantial type with advantage.

"3. That machinery of a different type is commonly used for lighting, and the switching appliances are absolutely different. In the Glasgow lighting stations numerous small high-speed engines are in use; such engines are unsuited for the generation of current for your traction purposes. I have yet to find the engineer of extended experience in dealing with traction matters who would propose the use of high-speed engines for such loads as you have to consider in Glasgow for electric traction.

"4. The electrical arrangements for electric lighting are necessarily much more complicated and elaborate than is the case for electric traction. Electric lighting has to be carried on with reference to the delicacy of the human retina; in other words, the voltage at the point of consumption has to be regulated to a nicety. In electric traction the same conditions do not obtain, since uniform acceleration and speed of the car can be obtained to the satisfaction of the passenger within a much greater range of voltage.

"5. From a business point of view, the different conditions in electric supply are sufficiently shown by the difference in cost of energy between electric traction and electric lighting. The cost of energy for electric traction, owing to the better load factor, would not be more than 25 per cent of that for lighting. The present cost of electric lighting in Glasgow is 1.26d. per Board of Trade unit, which does not compare unfavorably with that of lighting for other cities. This figure is 4.8 times as high as would be expected in the traction service outlined. When you consider that in Edinburgh, according to published accounts, current is generated cheaper than in any other city in the United Kingdom, and this cost is 2.95 times that which I predict for your traction system, the difference in the nature of the load is apparent.

"6. It has been suggested that economy in staff will be gained in a joint station. This does not apply provided the tramway business is attended to as a business by itself. In the station which I have outlined this staff will, as I have said, be regularly employed during the sixteen hours of the day at practically full load, and during five more hours at one-third load, so that the staff would be fully occupied during the hours of working. Owing to the difference in the nature of load, a different class of attendants would be required for the two classes of work."

Mr. Parshall's opinion on this matter is shared by other prominent engineers, and some time ago Lord Kelvin and the late Dr. John Hopkinson, when considering the case of the Bristol Tramways & Carriage Co., strongly urged the inadvisability of combining lighting and power plants. The view, at any rate, taken by the Glasgow corporation on the subject is summed up in the phrase, "Whoever controls the power, controls the tramways." The chief objection in Glasgow is that the lighting arrangements are in the hands of one committee and the tramways controlled by another committee, consequently any arrangement of combined plants would confuse accounts to some extent, and having regard to the magnitude of the tramway system in Glasgow, probably the wisest course is to generate the electrical energy on quite a separate system. No doubt the decision of the Glasgow corporation will be followed by others, and it would not be surprising to find that the London County Council (which is now controlling some forty miles of lines) will adopt some such scheme as that suggested by Mr. Parshall for Glasgow. It is interesting to observe that the London County Council, which, before purchasing tramway systems, so persistently opposed electrical methods, has now appointed Professor Kennedy to prepare a report as to the best methods of electrically working the large tramway system of the South of London. The probability is that in many thoroughfares the conduit system will be adopted, while in the less important streets the overhead system will be used.

London, April 2, 1899.

A SCHEME TO DEFRAUD STREET RAILWAYS.

March 3d Henry D. Fowler, 20 years of age, and Ernest W. Wilson, 25 years of age, were arrested in Brooklyn on a charge of larceny, preferred by the Union Traction Co., of Philadelphia. They had been employed by this company, Fowler as a conductor, and Wilson as an inspector, and on February 8th Wilson stole a cash register, with which he and Fowler, who is his cousin, went to New York. Fowler secured a position with the Brooklyn Heights road and Wilson with the Dry Dock road, in New York. The scheme contemplated by these men was to use the stolen register during a part of the day, defrauding the company to the greatest extent that prudence permitted.

Upon discovery of the loss of its register the Union Traction Co. made an investigation, traced the theft to Wilson and secured his indictment. After their arrest in Brooklyn they were brought to Philadelphia and committed to prison March 11th. The register has not been recovered.

Wilson is said to have confessed that he is the man who stole the register and took it to the rooms occupied by him and Fowler. Fowler was charged with receiving stolen property, and pleaded guilty. March 20th Wilson was sentenced to four months' imprisonment; sentence was suspended as to Fowler.

Employes of the Marietta (O.) Electric Co. were given a 12 per cent increase in wages on March 10th, the notice coming as a welcome surprise.

The franchise granted to the Columbus (O.) & Buckeye Lake Street Railway Co. has been declared forfeited by the Franklin County commissioners.

TWIN CITY ROAD IN 1898.

The annual report of President Lowry to the stockholders of the Twin City Rapid Transit Co., of Minneapolis and St. Paul, under date of March 1, 1899, is as follows:

"The gross and net earnings of the property for the year ending Dec. 31, 1898, show a gratifying increase over the previous year; the gross being 8.29 per cent and the net 59 per cent.

"The physical condition of the property has been maintained to the highest possible degree and the expense thereof charged to the cost of operating. This cost of operating for 1898, including taxes, is 49.92 per cent of the gross earnings as compared with 53.18 per cent for 1897.

"During 1898, $825,000 of the 7 per cent preferred stock was issued, $750,000 of which was used to pay the "collateral notes" mentioned in our last report. The company has also issued for construction $90,000 of the consolidated 5 per cent bonds of the St. Paul City Railway Co., and under a provision of the Minneapolis Street Railway Co's. first mortgage, $20,000 of the 7 per cent bonds have been redeemed by the issue of a like amount of 5 per cent consolidated mortgage bonds.

"The Selby Ave. cable line in St. Paul has been changed to an electric line, with all new construction of concrete and 80-lb. 'T' rail with cast-welded joints. This has been made possible by the installation of a modern counter-weight system which overcomes the heavy grade of 15½ per cent, and it has been in successful operation since August, standing the severe tests of our low temperature and heavy snows.

"The company has likewise completed a new Interurban line between Minneapolis and St. Paul, via Como Park, St. Anthony Park, the State Fair grounds and the State Agricultural College.

"The company has constructed and fully equipped, during the past year, a new brick car shop 359 ft. long and 136 ft. wide, and has built and equipped 22 44-ft. electric cars.

"The water power plant, mentioned in our last report, to generate electric power has been in partial operation about a year.

"To avoid any possible delay in service the steam power plants were held in readiness for operation until all the electrical apparatus and transmission cables of the water power plant were in successful operation. This test consumed several months and the plant was only accepted by our company in December. This delay prevented the sale of surplus power and increased the expense of power plant operation."

Appended to this report was the statement of earning by months during 1898, as given in the following table:

EARNINGS IN 1898.

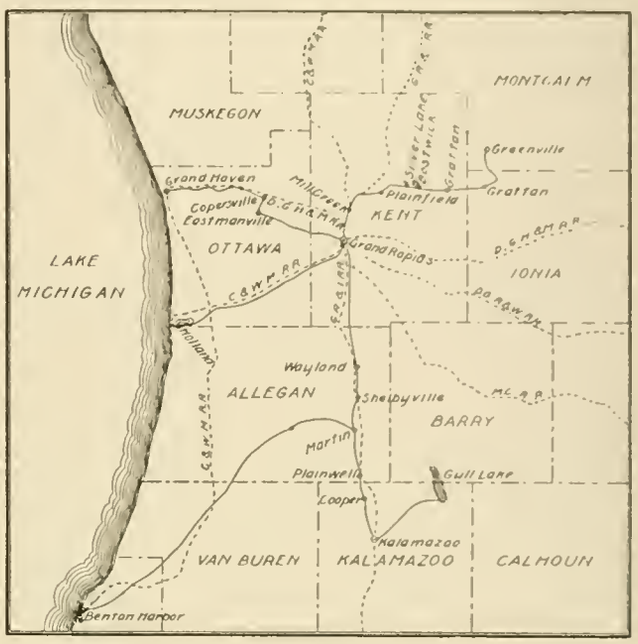
	Passenger Earnings	Miscellaneous Earnings.	Total Earnings.
January,	$163,722.50	$1,526.69	$165,249.19
February,	150,756.00	1,069.90	151,825.90
March,	168,848.15	1,496.44	170,344.59
April,	164,384.00	1,419 59	165,803.59
May,	178,816.05	1,490.49	180,306.54
June,	169,901 70	1,603.05	171,504.75
July,	194,762.35	1,754.02	196,516.37
August,	184,175.80	2,537.17	186,712 97
September,	206,708 35	1,473.68	208,182.03
October,	185,443.45	1,416.00	186,859.45
November,	176,067.00	1,555.05	177,622.05
December,	201,507.60	8,280.98	209,788 58
Total,	$2,145,092.95	$25,623.06	$2,170,716 01

The expenses are itemized as follows:

Maintenance of way and structure	$ 76,837.27
Maintenance of equipment	131,368.30
Operation of power plants	129,805.69
Car service	497,413.34
General expense	95,884.29
Legal expense	23,442.38
Injuries and damages	58,492.63
Insurance	6,148.24
Total operating expenses	$1,019,392.14
Net earnings from operation	$1,151,323.87
Interest on debt and dividends on 7 per cent preferred stock	$713,454.07
Taxes	64,214.11
Total interest charges, taxes and preferred stock dividend	$777,668.18
Surplus	$373,655.69

INTERURBAN ROADS ABOUT GRAND RAPIDS, MICH.

A glance at this map of southwestern Michigan will convince one that this is quite an active field for electric interurban railways. The different lines are in various stages of promotion, but the prospects are good for considerable construction work during the season. The longest road proposed from Grand Rapids is the one to Kalamazoo, following the Grand Rapids & Indiana R. R. most of the way. From Martin a spur will be built to Allegan, where connection will be made with the proposed line to Benton Harbor. The line southwest to Holland parallels the C. & W. M. R. R. The interurban to Grand Haven will pass through Lamont and Eastmanville and follow the D., G. H. & M. R. R. to Spring Lake and Grand Haven. The line to run in a northeasterly direction will follow the county roads and connect Mill Creek, Plainfield, Silver and Boswick Lakes, Grattan Center, Cook Corners and terminate at Greenville.



NEW ST. LOUIS COMPANY.

The Brown syndicate, of St. Louis, has organized the Central Traction Co., and Patrick Calhoun, Murray Carleton, H. S. Priest, George W. Hunter and J. J. Coleman have been chosen directors. The directors on March 13th elected officers as follows: President, Murray Carleton; secretary, John H. Blessing; general manager, J. J. Coleman.

CARS WITHOUT WHEELS.

Street cars without wheels are the latest novelty in vehicles. The cars run on ball bearings, and, being near the line instead of raised above it, are not subject to the same amount of resistance in the form of centrifugal force. Much greater speed is thus obtained, and the wear of the balls in carrying the car is much less than the wear of the wheel rims. The movement of the tramcar is easy and agreeable.—Chicago Journal.

The Chicago cars still continue to run on wheels, however.

In the Power House

This department is devoted to the construction and operation of electric railway power houses. Correspondence from practical men is specially invited. Both the users and makers of power house appliances are expected to give their views and experiences on subjects within the range of the department.

What is said to be a very delicate, accurate, reliable and simple test for the presence of acids in lubricating oils is proposed by Dr. Wiederhold. Sub-oxide of copper, the red oxide, is placed in a white glass vessel and covered with the oil to be tested. If the oil contains a trace of acid, or any resinous acid from rosin, which may have been used to adulterate it, it will turn green. In the cold the reaction requires from 15 to 30 minutes, but a gentle heat hastens it. The chemical reaction is as follows: The free vegetable and animal acids separate the sub-oxide into oxide of copper and metallic copper; the former then combines with the acid to form greenish-blue salts that dissolve in the oil and give color to it. If but little acid is present the green color is faint, more acid makes the color deeper, and if rosin has been used the color is bluish. Oil which is not turned green by this treatment may be pronounced free from acid.

* * *

A LARGE CONCRETE CHIMNEY.

What is believed to be the only large concrete chimney in this country, or perhaps elsewhere, is the one built last year at the plant of the Pacific Coast Borax Co., Bayonne, N. J. The factory building of this company, which covers a ground space in excess of 50,000 sq. ft. and incloses a volume of nearly 2,000,000 sq. ft., is entirely of concrete and steel construction. The chimney is 150 ft. high and 10 ft. 4 in. external and 7 ft. internal diameter. It is erected inside the building and therefore the lower 70 ft. is fully protected from wind pressure. There are two concrete shells; the outer one is 5 in. thick, the inner one 7½ in.; for the first 20 ft. the inner shaft is lined with firebrick. Each shell of the stack is reinforced by ¾-in. steel rings placed 2 ft. apart vertically and by eight ¾-in. vertical bars of square steel twisted. After the concrete had set it was dressed by a pneumatic hammer to give it the appearance of rough pointed masonry; wooden strips were inserted in the molds so that the exterior face is pointed to represent coursed ashlar work.

* * *

AN AUTOMATIC LUBRICATING SYSTEM.

In building power stations, both large and small, those responsible for the design and those who have the bills to pay often put off until the very last thing consideration of the system of lubrication to be adopted, regarding it as an unimportant detail, whereas efficient lubrication is an absolute necessity in operating machinery, and economy is as desirable in a lubricating system as elsewhere about a plant.

Automatic lubrication is recognized as economical because it is saving of both oil and labor, and a number of automatic systems have been developed, one of the most successful of which is that controlled by the Siegrist Lubricator Co., of St. Louis. This system is in use in the power house of the Southern Electric Railway Co., of St. Louis, and also in that of the Missouri-Edison Co., which has the lighting for the city of St. Louis. Mr. Herbert A. Wagner, general superintendent of the Missouri-Edison Co., states that in the six months that this oiling system has been in use the company has effected a saving because of the oiling apparatus of over $150 per month in the cost of oil and $150 per month in wages paid. Four oilers formerly required; the work is now done by one.

At this station the lubricating system comprises automatically governed oil pumps, oil piping, automatic sight-feed cylinder lubricators and bearing oil cups, and the necessary tanks and filters. Four small duplex pumps are mounted on a polished iron table 2 x 4½ ft. in size; two pumps are for cylinder oil and two for engine oil, though only one of each is used at a time, the others constituting a reserve. There are three pressure gages, one for steam and one each for the two systems oiling piping.

Pressure in the engine oil piping is kept at from 60 to 80 lb., independent of the quantity of oil used, by means of a regulating valve in the oil discharge pipe, acting to control the steam admission to the pump.

At each bearing or part to be oiled is a Siegrist automatic sight feed pressure oil cup. The rate of speed of each oil cup can be regulated at will by a thumb screw provided for that purpose, but a diaphragm pressure valve (see Fig. 1) in each cup instantly closes

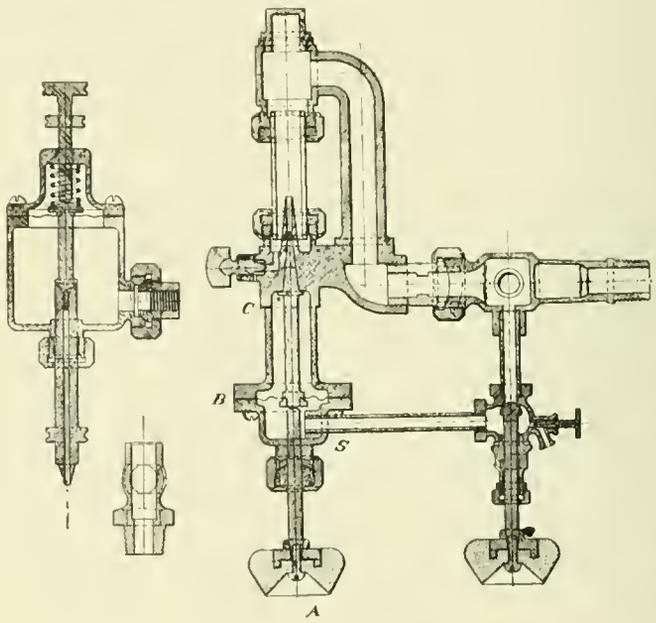


FIG. 1. FIG. 2.

the oil drip if the pressure in the system is lowered more than two or three pounds. One globe valve placed in the supply pipe for the oil system of each engine is therefore sufficient to start or stop all the oil cups on that engine. On closing this valve the flow of oil is stopped within a few seconds at every oil cup whether located at the highest or lowest points of the engines. This prevents any waste of oil after the engine is stopped.

For the cylinders Siegrist automatic lubricators are used. They have a sight feed, and the glass tube is 1 in. in diameter, giving but slight chance for oil to come in contact with the glass. A section of this is shown in Fig. 2; the diaphragm B has oil on one side and steam on the lower side, and if the oil pressure falls below that of the steam, the valve C is seated and the oil kept from backing down. The rate of feed is regulated by the screw A.

* * *

PURIFICATION OF WATER FOR STEAM BOILERS.

From a paper read before the Engineers' Society of Pennsylvania, by James Otis Handy.

The troubles which render boiler water purification necessary or desirable, are corrosion, scale formation, and foaming.

Corrosion is caused chiefly by acid waters from coal mines or coal washers, and is made evident by the appearance of red hydrate of iron in the boiler water. When the leaking of the boiler becomes so troublesome that repairs must be made, the tubes and sheets of the boiler are found to be covered with rust and pitted in

COST OF POWER FOR ELECTRIC RAILWAYS.
Output Measured by Wattmeter in Each Case.

Station.	Month. 1898.	Monthly Output, Kilowatt-Hours.	Cost of Electrical Output per Kilowatt-Hour—Cents. Fuel.	Labor	Supplies, Oil, Waste, etc.	Water.	Repairs.	Total.	Gals. Cylinder Oil per 10,000 k. w. h.	Gals. Lubric't-ing Oil per 10,000 k. w. h.	Lbs. Water per Lb. Coal.	Lbs. Fuel per k.w.h.	Price of Fuel per Ton of 2,000 Lbs.	Kind of Fuel
1	Dec.	1,890,603	.264	.127	.030	.027	.028	.476	3.34	1.58	9.77	2.52	2.10	Bituminous
3	"	244,720	.496	.234	.049	.011	.025	.814	3.73	4.04	.....	4.66	2.13	"
4	"	413,360	.413	.154	.024	.001	.008	600	2.4	4.06	.....	3.83	2.16	"
5. Metropolitan Elevated, Chicago.	Nov.	1,852,026	.330	.135	.019	.018	.027	.529	5.1	2.2	4 62	3.83	1.75	"
5	Dec.	2,127,921	.336	.124	.017	.018	.048	.543	6.08	2.1	4.95	3.87	1.75	.....
6	June	493,000	.758	.252	.117	.....	.209	1.336	.....	.....	.....	2 82	.845**	Oil.
6	July	510,320	.715	.252	.095	.....	.177	1.239	.....	.....	.....	2.60	.865	"
6	Aug.	517,532	.769	.251	.100	.....	.225	1.345	.....	.....	.....	2.83	.856	"
6	Sept.	503,741	.765	.227	.090	.....	.278	1.360	.....	.....	.....	2.57	.938	"
6	Oct.	555,372	.724	.297	.098	.....	.159	1.278	.....	.....	.....	2.62	.857	"
6	Nov.	556,121	.789	.244	.085	.....	.078	1.196	.....	.....	.....	2.61	1.015	"
6	Dec.	540,041	.779	.275	.081	.....	.166	1.301	.....	.....	.....	2.55	.951	"
10 Central Av., Metropolitan, Kansas City, Mo.	"	463,581	.316	.106	.005	.008	.002	.439*	1.13	2.35	5.25	.....	1.24	Bituminous

*Miscellaneous .002. **Price of Oil per Barrel.

a manner resembling worm-eaten wood. Many boilers in western Pennsylvania have been ruined by acid waters. The remedy lies in selecting a new supply, or in treating the water with lime or soda ash, or caustic soda as described later.

Corrosion may also be caused by organic acids contained in waters derived from peaty soils, or it may be due to the decomposition of magnesium chloride under the influence of heat in the boiler. In the latter case there is corrosion of the steam spaces and pipes as described later in this paper. The remedy for all tendency to corrosion is found in the maintenance of a slight excess of alkali in the waters at all times. Corrosion caused by the liberation of dissolved gases and by the air is not an important factor except in boilers which are cooled down every night.

The scale or incrustation forming in the tubes and sheets of the boilers may be hard or soft according as the water which is used contains only carbonate of lime, or both carbonate and sulphate of lime. The former deposits as a spongy coating which would not be adherent were it not for the crystallization of sulphate of lime between the particles of carbonate, thus forming a bond which is afterward made still stronger by the change of the $CaSO_4$, $2H_2O$ into anhydrite under the influence of the heated plates upon which the deposit has formed.

The rational remedy for scale formation is the removal of the lime compounds by treatment outside the boiler, or the addition of soda ash to decompose the sulphate of lime in the boiler. Scale allowed to accumulate means loss of fuel, injury to the heating surfaces, expense of cleaning, and danger of explosion.

The frothing or foaming of water in boilers may be due to one of several causes. Water free from suspended matter will foam if the alkali salts accumulate to 200 grains per gallon. Waters containing .75 grains of alkali and considerable sludge (precipitated carbonate of lime or magnesia) will also foam. Oily substances introduced into the boiler tend to produce foaming.

In any case the complete remedy is washing out, and the temporary relief is the blowing off of a part of the contents of the boiler and replacing it by fresh water.

The purification of water for use in steam boilers if intelligently carried out, pre-supposes, in the first place, a very intimate acquaintance with the properties and reactions of those substances which render natural water impure; and in the second place, a clear understanding of the conditions to which the boilers in which treated water is to be used are to be subjected.

The first requisite in any case is a correct analysis of the water, and this is by no means a simple matter. It is not sufficient to determine the total lime and total magnesia and base the proportion of purifying agents on these data alone. The amount of soluble lime, i. e., the lime as sulphate, chloride, and nitrate must be distinguished from the lime existing as carbonate. In the same way, the magnesia as sulphate, chloride, and nitrate must be distinguished from the magnesia in magnesium carbonate. It is not enough to evaporate a measured amount of water to dryness and to treat with hot water Some $CaSO_4$ may be left undissolved, and a small amount of $CaCO_3$, and a larger amount of $MgCO_3$ are sure to be dissolved along with the salts known to be freely soluble. In acid waters the free sulphuric acid and the sulphuric acid existing as sulphate of iron, and in peaty waters the organic acids, must be accurately determined, and this cannot be done unless the influence of acidity due to dissolved carbon di-oxide is eliminated, by thorough boiling.

In short the analyst must ascertain everything of import concerning a water which is to be purified, and having calculated the required charge of purifying agents, he should then make a laboratory trial of the efficiency of his formula.

The compounds existing in natural waters and influencing their value for steam making are:

Mud, organic matter, silica, oxides of iron and aluminum, carbonate of lime, carbonate of magnesium, sulphate of lime, sulphate of magnesium, chloride of lime, chloride of magnesium, nitrate of lime, nitrate of magnesium, carbonate of sodium, sulphate of sodium, chloride of sodium, nitrate of sodium, free sulphuric acid, sulphate of iron.

These may be classified imperfectly as follows:

Constituents forming sludge or soft scale: Mud, silica, oxides of iron and aluminum, $CaSO_3$ and $MgCO_3$.

Constituents forming hard scale: Sulphate of lime, hydrate of magnesia from decomposition of magnesium salts.

Constituents producing corrosion: Organic acids, and acids liberated by the decomposition of magnesium salts, notably the chloride, sulphuric acid and ferric sulphate.

Constituents causing foaming: Sulphates of magnesium and sodium, chlorides of lime and sodium, nitrates of lime, magnesium and sodium, certain organic matters and mud.

Upon entering the boiler, the water at a stationary plant has usually been heated by waste steam, so that a part of the dissolved gases have been expelled. In locomotive boilers, the water is not usually pre-heated. As the cold water enters the hot boiler, its dissolved gases are expelled by virtue of the temperature, although the condition of pressure existing in the boiler has some retarding effect on the liberation of the gas. Some corrosion of the metal by the escaping O and CO_2 is generally noticed near the point of entry. Following the expulsion of CO_2 precipitation of $CaCO_3$ and $MgCO_3$ occurs down to the point where they are held in solution by the water alone. After the first day's use of a newly filled boiler the deposition of CaCO, and MgO, will be at a constant rate dependent upon the rate of evaporation.

The $CaCO_3$ and $MgCO_3$ thus precipitated form at first a loose deposit or sludge, or a loosely adherent crust on the tubes and plates. Frequent blowing off removes most of this sludge, and washings out keep the boiler fairly clean and free from scale if no $CaSO_4$ is present. $MgCO_3$ is further decomposed into $Mg(OH)_2$ and CO_2. The hydrate, with $CaSO_4$, forms a hard porcelain-like incrustation. $CaSO_4$, lying as sludge in a boiler, may be acted on by $MgCl_2$, forming $Mg(OH)_2$ and $CaCl_2$ and CO_2, or by $MgSO_4$ forming $Mg(OH)_2$ and $CaSO_4$. The latter change should be guarded against very carefully. $Mg(OH)_2$ is usually found in boiler scales to the exclusion of $MgCO_3$.

$CaSO_4$ in boiler water is not completely deposited. Tilden and Shenstone's experiments have shown that the popular belief that $CaSO_4$, is practically insoluble at temperature above 212° F,, is not correct. At 473° F., higher than any ordinary steam boiler temperature, pure water can retain in solution 12.6 grains $CaSO_4$ per imperial gallon=18. parts per 100,000. Hence it is probable that $CaSO_4$ deposits even more regularly than the carbonates, with increasing density of the water. The solubility of $CaSO_4$ is increased by NaCl up to a certain point. Na_2SO_4 is said to have a similar effect and $CaCl_2$ the opposite influence. $MgCl_2$, at ordinary temperature, increases solubility, but at higher temperatures it diminishes it. A small amount of $CaSO_4$ seems to have the power of transforming a loosely adherent coating of $CaCO_3$ and $Mg(OH)_2$ into a more adherent scale, but an excess of $CaSO_4$ is necessary to make a really hard scale.

The reagents that have been proposed for the purification of water are: Hydrochloric acid, barium salts, magnesia, alkali oxalates, lime, carbonate of soda, caustic soda, phosphate of soda, fluorides.

Hydrochloric acid has been used for waters containing bicarbonates of lime and magnesia. If used to excess it causes much trouble and is not used in boilers.

Barium chloride has been suggested for waters containing calcium sulphate, but the reaction does not take place in the cold; and if magnesium sulphate is present magnesium chloride is formed which is objectionable because of its corrosive action.

Hydrate of barium precipitates both the bicarbonates and sulphates of lime and magnesia, but it is too costly.

Magnesium hydrate has been tried as a water purifier, but is very costly and the purification is incomplete.

The lime salts are all precipitated by oxalate of sodium. As a by-product of the reaction of sodium oxalate on the bicarbonate of lime, there results carbonate of soda, and this, if formed in sufficient amount, will theoretically precipitate the magnesia which the water contains. As a matter of fact, when used in the cold, sodium oxalate produces a precipitate which settles very slowly, and although the deposition is more rapid when the solution is heated, it is still necessary to filter in order to obtain a clear water. Sodium oxalate being expensive, the process is costly, and although it is possible to regenerate by heating the precipitated oxalate of lime with sodium carbonate, this method has not found general favor.

In 1840, Dr. Clark, of Aberdeen, patented his process for purifying water by the addition of lime. This process is especially useful for waters containing only carbonate of lime, sulphate of lime is not acted on by CaH_2O_2. Bicarbonate of magnesium is precipitated by CaH_2O_2, but the deposition of the $MgCO_3$ is very slow.

The reaction with magnesium sulphate has a very objectionable by-product, $CaSO_4$.

It is not possible to lower the $CaCO_3$ below 3.6 parts per 100,000, the solubility of $CaCO_3$ in pure water, and as a matter of fact, the result of the Clark process is usually not so good as this. At Bushey, in Herts, near London, the Clark process is used for purifying the town supply and the purified water has a hardness of 5 to 6 degrees, corresponding to 7 to 8.5 parts per 100,000.

Lime and soda ash are often used in conjunction and are capable of bringing about a nearly perfect softening of any water intended for boiler use. The amounts of carbonate of soda and lime which are used are to be varied according to the proportions of bicarbonate or temporary hardness and the sulphates and chlorides of lime and magnesia which constitute permanent hardness. The following rules have been formulated and are concisely given in "Water and Its Purification," S. Rideal, London, 1897.

Rule 1. For a water in which the temporary hardness exceeds the permanent, caustic soda must be added equivalent to the permanent hardness, and lime equivalent to the temporary hardness minus the permanent hardness.

Rule 2. For a water in which the permanent hardness, due to sulphate of lime, exceeds the temporary hardness, carbonate of soda must first be added in proportion to the permanent hardness, and then, if necessary, lime equivalent to the temporary hardness.

My own experiments have indicated that the process is not available for waters which contain only moderate amounts of carbonate and sulphate of lime.

Carbonate of soda may be used for purifying water and has proved its usefulness in railroad work. Unless the water is rich in calcium sulphate no precipitation takes place in the cold.

Caustic soda is capable of effecting a complete purification of water provided it contains enough carbonic acid in carbonates to form with the caustic soda sufficient carbonate of soda to precipitate the sulphate of lime. If the water is moderately hard, purification cannot be accomplished in the cold.

Sodium phosphate enters into reaction at once with all lime and magnesia compounds in natural waters.

The water purifiers adaptable for softening outside the boiler are:

Lime.—For bicarbonates; for soluble magnesia, if high; for acid waters of any degree of acidity.

Soda ash.—For waters containing $CaSO_4$ or $CaCl_2$ or $Ca(NO_3)_2$ in large proportion. Ordinary waters unaffected by soda ash in the cold.

Caustic soda.—For bicarbonates directly; for magnesia salts, if present in extraordinary proportion; for soluble lime if sufficient Na_2CO_3 is formed by the decomposition of the bicarbonates.

Tri-sodium phosphate.—For lime compounds. About 75 per cent is precipitated in the cold. Magnesium phosphate deposits with extreme slowness.

Sodium fluoride.—Unsuited for precipitations of lime and magnesia outside the boiler.

Bicarbonate of lime and to a less extent bicarbonate of magnesia, may be precipitated outside the boiler by lime or soda or tri-sodium phosphate; for sulphate of lime, and other soluble salts, if present in large proportion, use soda ash; if in smaller amount, only tri-sodium phosphate is available. From water containing both bicarbonate and sulphate of lime, the use of lime and soda ash removes indirectly nearly all of the soluble lime compounds. For acid waters, lime may be used, but soda ash or caustic soda are the best neutralizing agents.

For magnesia compounds in ordinary waters, no practically successful means of precipitation in the cold is known. In connection with removal of lime by the use of lime and soda ash, a small amount of magnesia is precipitated.

Those adaptable for softening water in the boiler are:

For bicarbonates.—No precipitant is needed. Heat accomplishes the work.

For soluble magnesia compounds.—No precipitant is needed. They are decomposed under boiler conditions, the magnesia being deposited as hydrate. This deposition is hastened by the presence of soda ash or caustic soda, and any acid liberated by decomposition of magnesia salts is at once taken up and rendered harmless.

For soluble lime salts.—Soda ash is cheap and effective. The sludge must, of course, be removed regularly. Sodium phosphate may be used. It forms light, bulky precipitates, whereas those formed by sodium carbonate are more dense. Sodium fluoride may be used, but the expense is two and a half times greater than that for soda ash, even when only one-fourth of the required amount is used, as suggested by its advocates.

Furthermore, there is no means of preventing sodium phosphate and sodium fluoride, when added to a water containing both bicarbonates and sulphates from doing useless work by precipitating the bicarbonates, and leaving the sulphates undecomposed.

The Consolidated Electric Light Co., of Birmingham, Ala., has placed an order for two 600-h. p. engines, and the necessary boiler equipment. They will be built in Birmingham and are to drive railway generators.

The work of building foundations for the elevated structure of the Boston Elevated Railway Co. is progressing rapidly, and the piers will be ready to receive the iron work as it arrives.

The Lake Street Elevated Railroad Co., Chicago, has appealed its case against William Zeigler and others to enjoin the foreclosure of a $6,500,000 mortgage, to the United States Circuit Court of Appeals.

The Leavenworth (Kan.) Electric Railroad Co. has increased 10 per cent the wages of all employes who have been in the company's service for five years or more; other employes receive an advance of 5 per cent.

The power transmission line between Stockton, Cal., and the Blue Lakes has been inspected and pronounced complete. The company is awaiting the arrival of the transformers from the East. The line is of aluminum wire.

Designing Boilers for a Small Street Railway Plant.

BY WILLIAM KENT, M. E.

PART III.

EXTENT OF HEATING SURFACE REQUIRED.

For factory boilers, or for any boilers that are to be driven at a uniform rate throughout the day, the boilers should be so proportioned that the rate of driving should not exceed 3 lbs. of water from and at 212° per sq. ft. of heating surface per hour; the extra cost of coal for driving at a more rapid rate usually being greater than the interest on the extra investment necessary to secure a sufficient extent of heating surface over and above that required for more rapid rates of driving.

With boilers for electric street railway service, however, the case is entirely different. The heavy load upon the boiler plant lasts for only about two hours out of the 24, and unless money is very cheap and coal very dear, it will usually pay to sacrifice 15 per cent of economy during those two hours rather than go to the expense necessary to proportion the boilers so that they will be driven at their most economical rate during those two hours. It is also to be considered that the extra boiler which is to be put in the plant so that any one boiler may at any time be laid off for cleaning or repairs may be used most of the time, since repairs and cleaning are not required often, so that all the boilers may be in service during the time of the peak of the load for a large proportion of the days in the year, and the excessive rate of driving during the time of the peak of the load may thus be diminished.

It will therefore not be bad designing if the extent of heating surface is proportioned so as to allow of the boilers, after one is laid off for cleaning or repairs, to be driven at a rate of 6 lbs. of water evaporated from and at 212° per sq. ft. of heating surface per hour during the time of the peak of the load, provided that no mistake has been made in estimating the quantity of steam needed during that time, due consideration being had to the fact that the engines are wasteful of steam when overloaded, as they are likely to be during that time, and provided also that sufficient coal burning capacity is provided in the furnaces, so that enough coal may be burned, including the 15 per cent wasted by rapid driving, to supply this steam, under the most unfavorable conditions of wet weather and of poor coal.

Assume that the steam engineer's estimates show that 600 indicated h. p. will be required to be furnished by the engines during the time of maximum load, that the engines are non-condensing, requiring 30 lbs. of steam per i. h. p. per hour at their economical load and 20 per cent more when overloaded so as to furnish the 600 i. h. p.; that the feed water is furnished from a heater at 200° F and that the steam pressure is 125 lbs., we then make a calculation as follows:

	600	I. H. P.
	30	Lbs. steam per I. H. P. per hour.
	18,000	Lbs. per hour.
Add	3,600	20 per cent for overloaded engines.
	21,600	Lbs. per hour.
Mult. by	1.057	Factor of evaporation for feed at 200° and steam of 125 lbs.
Product	22,831	Lbs. equivalent evaporation from and at 212° per hour.
Divide by.	6	Lbs. evap. per sq. ft. heating surface per hour.
Quotient	3,805	Sq. ft. heating surface.

This is the very smallest amount of heating surface that should be provided for the given conditions. It may be divided among two boilers of not less than 1,903 sq. ft. each, or three boilers of 1,268 sq. ft. each, and in either case an additional boiler of the same size must be provided so that one boiler may be laid off. The plant will therefore contain either three boilers of 1,903 sq. ft. each = 5,709 sq. ft., or four boilers of 1,268 sq. ft. each = 5,172 sq. ft. It may be found that the three larger boilers including setting, valves, piping, etc., will cost little if any more than the four smaller boilers with their setting, etc., and it may also be considered advisable to have the three larger boilers, with their greater total extent of heating surface, to provide against the contingency of an increased amount of steam being needed by the engines.

A plant of three boilers is a favorite arrangement for a new street railway plant, two of the boilers being set in one battery and the third singly, a space being left alongside of the third boiler for a fourth, completing two batteries, if ever it should be needed.

Now let us assume that the coal to be used is a rather low grade of Illinois coal, of a heating value of 14,300 heat units per lb. combustible, and that it may be expected to contain occasionally as high as 18 per cent ash and 12 per cent moisture. The heating value per lb. of coal will then be 14,300×.70=10,010 heat units. This divided by 965.7 gives 10.36 lbs. of water from and at 212° as the possible evaporation of the coal if it were completely burned and all the heat utilized by the boiler. But only a portion can be utilized, say 55 per cent, if the boiler is provided only with an ordinary setting, or say 65 per cent if it is set with a fire-brick oven, especially designed to burn the volatile gases, or if it is provided with a down-draft furnace or a mechanical stoker suitable for that grade of coal. The difference in economy between an efficiency of 55 per cent and one of 65 per cent is not 10 per cent, as some may suppose, but 10÷.65= 15.4 per cent.

We now make the following calculation:

	Plain furnace.	Special furnace.
Heating value of 1 lb. of coal, equivalent evaporation from and at 212°	10.36	10.36
Efficiency of boiler and furnace	.55	.65
Product, lbs. from and at 212°	5.698	6.734
Deduct 15 per cent for loss due to driving the boiler at 6 lbs. per sq. ft. of heating surface per hour, or double its most economical rate	.855	1.010
Lbs. water evaporated from and at 212°, per lb. coal	4.843	5.724
Divide these figures into the figure already found for total water from and at 212° per hour	22,831	22,831
Quotient, lbs. of coal per hour	4,714	3,989

The difference, 725 lbs., is 15.4 per cent of 4,714 lbs., which agrees with the economy of the more efficient furnace, as above stated, and checks the computation.

EXTENT OF GRATE SURFACE REQUIRED.

To calculate the extent of grate surface required we must know how many pounds of coal may be burned per sq. ft. of grate per hour. This will depend on the draft, on the kind of grate used, and on the nature of the coal as to free-burning quality and as to its clinkering on the grates and choking the air supply. We may assume that a chimney 150 ft. high is provided, which after making allowances for bends in the flues from the boiler to the chimney will under the most unfavorable conditions of weather give a draft of at least 0.5 in. of water column at the end of the boiler. The coal is free-burning, and will burn rapidly if supplied with enough air through the grate bars, but it clinkers badly. With ordinary grates we cannot count on burning it at a faster rate than 25 lbs. per sq. ft. of grate per hour, but with shaking grates well handled so as to keep the fire clear of clinker a rate of 35 lbs. may be expected. We now calculate the grate surface required as follows:

	Plain furnace.	Special furnace.
Coal to be burned per hour, lbs.	4,714	3,989
Plain grates, 25 lbs. per hour, sq. ft.	189	160
Shaking grates, 35 lbs. per hour, sq. ft.	135	114

With shaking grates and hard, steady firing, we may expect a loss through the grates of unburned coal amounting to about 2 per cent more than the loss through the plain grates, but as in a street railway plant this hard firing will last only about two hours a day we need make no change in our calculation on this account.

We thus have four different figures for the extent of grate surface required, according to whether we use ordinary or special furnaces

and ordinary or shaking grates. Dividing the heating surface already found, 3,805, by these figures we have for the ratio of heating to grate surface the following:

	Plain furnace		Special furnace	
	Plain grate	Shaking grate	Plain grate	Shaking grate
Sq. ft. of grate	189	135	160	114
Ratio heating to grate surface	20.1	28.2	23.8	33.3

These figures for the ratio of heating to grate surface are very much smaller than those provided in the common designs of modern boilers, especially those of the water-tube type. The ratio they give usually ranges from 35 to 50. The reason for this difference is that the data upon which the above calculations are based are very different from those upon which these boilers are designed. We have assumed a maximum rate of driving of 6 lbs. of water evaporated from and at 212° per sq. ft. of heating surface per hour, with an intentional sacrifice of economy in order to save first cost of installation. We have also assumed a low grade of coal that clinkers on the grate, and in the case of the plain furnace a low efficiency. In the design of the ordinary water tube boiler, especially for factory purposes, economy of coal is the first consideration. The heating surface is therefore made of such an extent that it does not require to be driven at a rate greater than 3 lbs. per sq. ft. per hour on an average, with a maximum of 4 or 4½ lbs. The boilers are by most builders rated in h. p., at the rate of 3 lbs. evaporation per sq. ft. of heating surface per hour, and when evaporation tests are made to prove guarantees a good quality of coal is usually obtained and the boilers are driven at not above 4 lbs. per sq. ft. of heating surface per hour.

Another reason for the high ratios of heating to grate surface in modern water tube boilers is that when designed with a view to economy of first cost and of ground space occupied they are made long, narrow and high, so as to pile a great amount of heating surface on a small ground area. A narrow boiler means a narrow grate surface, and as it is not easy for a fireman to handle with good results a grate over 7 ft. long, it means limited extent of grate surface. This is all right for good semi-bituminous coal or for Pittsburg or Hocking Valley bituminous, which are both free burning and low in ash. With these coals and strong draft, and a ratio of heating to grate surface of 45 or even 50 to 1 it is possible to drive the boiler to double its economical rate. For poor coals, however, whether anthracite or bituminous, such a ratio gives entirely too small a grate for rapid driving.

About three years ago in a series of tests made by the writer on a water tube boiler, with a very poor quality of Illinois coal, with an ordinary furnace and plain grate bars, and with a good draft, he found that only about 85 per cent of the capacity of the boiler could be developed even with the expert firing. The chief troubles were the clinkering of the grates and the excessive amount of moisture in the coal, which retarded the combustion. With the same boiler provided with a fire-brick arch setting, with shaking grates, and with Hocking Valley lump coal the boiler was driven to over 170 per cent of its rating, or over 5.1 lbs. of water evaporated from and at 212° per sq. ft. of heating surface per hour. Had it been possible to double the extent of grate surface when using the poor grade of coal it is quite likely that the capacity obtained could have been doubled.

Having made the calculation, as above shown, for the extent of grate surface required under the four assumed conditions, we must next consider which one of the four results should be adopted in the design. Unless coal is very cheap it will pay to go to any reasonable expense to provide the special furnace, either a fire-brick oven built in front of the boiler with arrangements for burning the smoky gases, or a down-draft furnace, or a mechanical stoker. With any of these devices a saving of 15 per cent in fuel should be expected when the coal is a highly volatile bituminous. Shaking grates are also desirable in a street railway plant using poor fuel, since they enable the grate to be kept free from clinker, and diminish greatly the grate surface and therefore the ground area required.

SPECIFICATIONS FOR BIDS.

Having fixed upon the extent of grate surface that is necessary to burn the coal under the most unfavorable conditions of weather, moisture, etc., for the heaviest load, adding, of course, the grate surface for the extra or reserve boiler, this should be entered in the specifications for bidders for boilers, and no bid should be considered which did not give the full extent called for. Many expensive mistakes have been made by purchasers of boilers who have accepted the guarantees of economy and capacity offered by builders, without reference to the extent of grate surface. After erection the boilers may be proved to have fulfilled the guarantees, on an expert test, with good coal, but afterwards they fail to develop the additional capacity required of them in emergencies, or even their rated capacity, when the coal is poorer than that used in the test. The remedy then usually is the costly one of obtaining additional boilers, and sometimes of building a new boiler house. The purchaser is fortunate if he can by a change in the style of furnace, or of grates, or by building a taller chimney, or by introducing forced draft, so increase the capacity of the boilers as to avoid the necessity of buying additional ones.

The extent of heating surface found by the calculation should also be entered in the specifications as the minimum to be bidden upon. Some bidders may not be able to furnish together with the specified extent of grate surface as small an extent of heating surface as that called for, since their designs are not adapted for such small ratios of heating to grate surface as those given above, but there is no objection to their furnishing as much more as they choose, and among bidders offering the same grate surface those offering the greater extent of heating surface should have the preference, other conditions being equal. Capacity for emergencies being obtained by extent of grate surface, economy of coal will be obtained by extent of heating surface above that needed to give an evaporation at the rate of 6 lbs. per sq. ft. of heating surface per hour.

BIDDERS' GUARANTEES.

Guarantees of economy and capacity may be inserted in specifications, but they should be considered secondary as compared with dimensions of grate and heating surface, and no attention should be paid to guarantees of unusual economy offered by any bidder who does not give any more heating surface than other bidders, unless that guarantee is based upon the offer of a special furnace or stoker, which may reasonably be expected to give better economy than a plain furnace when soft coal is used.

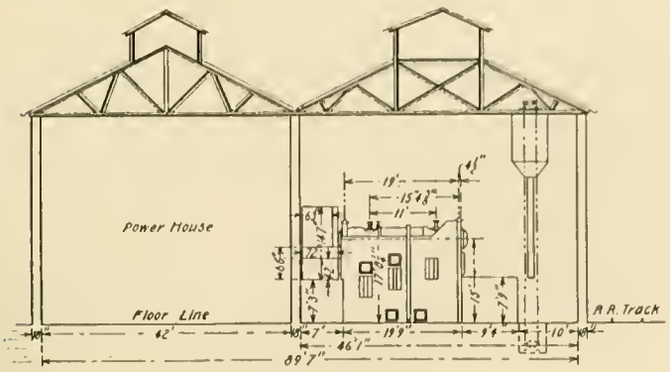
TYPE OF BOILER.

The calculations made as above described are applicable to any type of boiler. The selection of a type depends on other considerations than capacity or economy, for these depend upon proportions and not on type. These considerations are safety, durability, convenience or facility for cleaning and making repairs, ground space occupied, ability to furnish dry steam when overdriven, and last of all, cost. The writer's preference among the great variety of types now in the market, is the common form of water tube boiler, with horizontal steam and water drum and straight inclined tubes. The excellence of this form of boiler has now been proved by 30 years of experience in this and other countries, under all conditions of fuel, water and service. The foundation patents on this type having expired, and competition among builders being brisk, the old objection of high cost no longer holds.

ARRANGEMENT OF BOILERS.

The accompanying cuts show a good arrangement of water tube boilers, recently planned by the Babcock & Wilcox Company. Two boilers are set in a battery, with a division wall between them, so that either boiler can be run independent of the other. The complete plant may contain two or more such batteries, with a space of 3½ or 4 ft. between each battery and an equal space between the end wall of the boiler house and the first battery, to give ample room for blowing off the dust from the tubes, which is done by a steam nozzle inserted in the cleaning doors in the side walls. Each boiler contains 126 4-in. tubes 18 ft. long, set in 14 staggered vertical rows, nine tubes high, each vertical row being expanded into a header or manifold at each end. There are two horizontal steam and water drums in each boiler, 3 ft. diameter and 18 ft. long. The total heating surface of each boiler is about 2,700 feet, equivalent to 235 boiler h. p., at 11½ sq. ft. per h. p. The furnace is built in a fire-brick oven extending in front of the boiler, giving a large space for combustion of the gases of the fuel before they are allowed to touch the heating surface of the boiler. Provision is made for

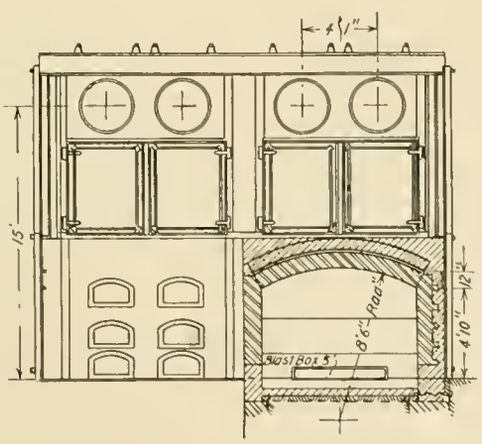
forced draft by a large flue built in the bridge wall with openings leading into the ashpit under each boiler. Part of the air may be admitted at the bridge wall, through the narrow vertical passage shown in the drawing. Coal is stored in bins located in the upper part of the boiler house, and is led down to the space in front of the furnace by vertical pipes. The position of the coal pipes and also



SECTION OF STATION.

of the coal conveyor for lifting the coal into the overhead bins is shown in one of the drawings. A large horizontal flue leading to the chimney is located immediately in the rear of the water and steam drums, into which each boiler discharges its flue gases. The space underneath this flue gives access to the rear end of the boilers and to their mud drums. The whole arrangement is an excellent one for a street railway plant. Ample room for coal storage is available above the oven furnace, so that the floor space usually required for storing coal is saved. The oven insures greater economy of fuel when soft coal is used than the ordinary furnace built under the tubes, and the arrangement for forced draft gives provision for driving the boilers far beyond their rated power in case of emergencies. Sufficient space is left in front of the boiler for the easy removal and replacement of a tube, and for removing the scale from the tubes by means of scrapers or other scaling appliances.

The writer would suggest one modification of this plan for use with very poor qualities of coal, high in ash and sulphur. It is that the space of 3 ft. 6 in. between adjoining pairs of furnaces, which is not needed for access to the cleaning doors, since the space between the boilers may be reached from the rear passage under the flue, be utilized for increasing the width of the furnaces. By this means each furnace may be increased in width from 8 ft. 6 in. to 10 ft. 8 in., leaving a 24-in. wall between each two adjoining furnaces. The grate surface may thus be increased 25 per cent, giving the furnace this much increased coal burning capacity, if the air supply be sufficiently increased to burn this additional quantity of coal. Since the capacity of a boiler using poor coal depends on the extent of grate surface, rather than upon the extent of heating surface, it is possible by this increase of the grate surface to increase the boiler capacity 25 per cent, and to make four boilers do the work of five set with the ordinary area of grate, thereby making a most important saving in the cost of boilers for a given plant. Such an increase of grate surface is, however, not recommended if good free burning coal, low in ash, is to be used, for in that case enough coal may be burned in the regular sizes of grate to develop much more than the rated capacity of the boilers, and too great an area of grate surface is apt to lead to boilers being driven far beyond their economical rate, thus causing a great waste of fuel.



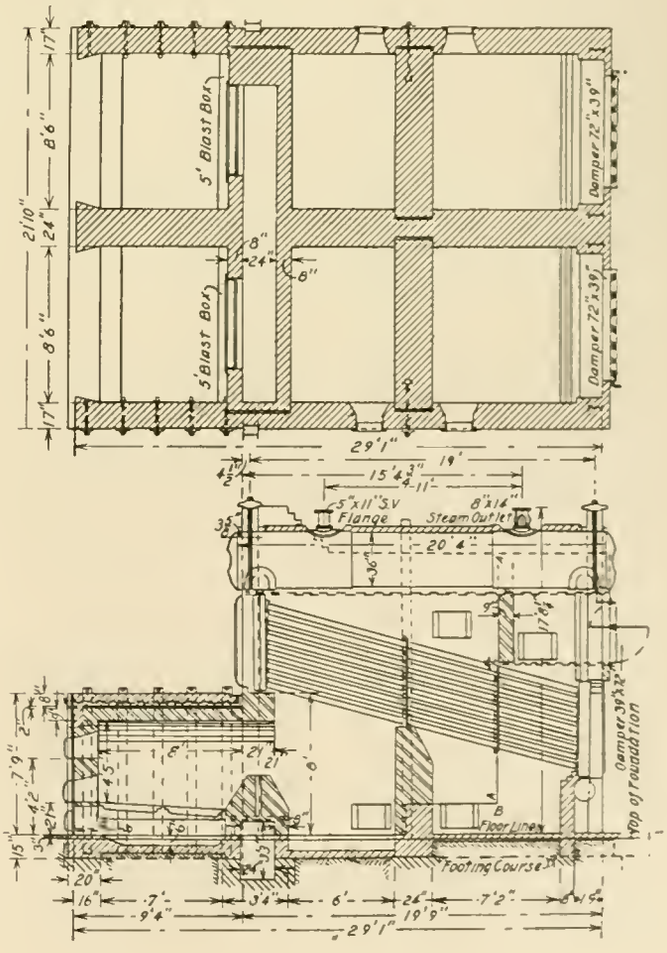
CHANGES IN DALLAS, TEX.

Mr. G. Van Ginkle, of Des Moines, Ia., for himself and Messrs. T. M. Earl and P. H. Bousquet, of the same place, has purchased the Dallas (Tex.) Consolidated Electric Street Ry. property for $900,000. The receipts of this road at this season of the year are reported as $350 per day, which will, it is expected, be increased at least $100 per day by reason of improvements which are soon to be made in the system. One of the lines, six miles long, which has been operated by animal traction, is to be equipped for the overhead electric system.

Dallas is now enjoying a rapid growth, and there is every reason to believe that the street railway company will receive its share of the prosperity. It is stated that there are now 500 residences and numerous business blocks in course of construction, and the predictions are that Dallas, now claiming 65,000, will have a population of 100,000 in five years from now.

The formal opening of the new electric line between Carlisle, Pa., and Wilmington took place on March 20th. Special cars filled with guests left Wilmington at 9.30 and made the round trip.

The Suburban Electric Railway Co. has been temporarily enjoined from laying double tracks on the turnpike near Belleville, Wis. The petition was brought by abutting property owners, who object to a second track, claiming that one is amply sufficient for the traffic.



BOILER SETTING.

The Relations of Municipalities and Their Street Railways.

Benefits of a Street Railway—Why it should not be Persecuted—The Liability for Paving from the Company's Point of View.

BY JOHN W. BOYLE, PRESIDENT OF THE UTICA BELT LINE STREET RAILROAD CO., UTICA, N. Y.

In all controversies there are two sides of the question. A persistent and reiterated presentation of one side, especially when this is in the nature of an arraignment of the other, with silence on the part of the other, is usually construed to mean that the other has nothing it can say in its own justification. This is not true in the present taxpayer-railroad controversy, and this is to present the question from the railroad point. I assume that a street railroad company is entitled to a point of view.

Throughout the press of the state of New York in those localities where a good railroad service is already in existence, the statement is being printed under conspicuous head lines, and the assertion is made, editorially, that the railroads are moving heaven and earth to shift their burdens on the taxpayers. In those localities which do not possess a good railroad service, and which are desirous of obtaining one, local bills are being introduced at Albany to relieve the railway from this same taxation, this being necessary in order to induce a company to invest its capital in a plant.

The fact that a railroad is built, and cannot be picked up and carried out of the city, if unjustly treated and taxed, renders it a peculiarly safe object of attack. The people know that even while they are endeavoring to slaughter the corporation, they will miss none of the conveniences and benefits of its service. A railroad cannot afford to retaliate by lowering the excellence of its accommodations. There is everything to gain and nothing to lose. The position taken by a portion of the public is not the loftiest one in the world, but it is exceedingly human.

The present agitation is over the liability of the street railroads for the cost of paving between its tracks and for 2 ft. outside. If this liability exists it is fixed by law. No law is infallible or immutable. It is entirely possible that two radically different opinions as to the justice of a statute, as well as to its interpretation, can exist and each be a perfectly honest one. The street railroads of this state, more especially those of cities below the first class, deny emphatically the "righteousness and justice" of the present law, as recently interpreted. They claim they should not be asked to pay for a pavement which is no benefit to them, which may be used by every vehicle in the city except the street cars, and which, if the railway plant could be swept from the streets of the city, the taxpayers would be obliged to pay for, and would simply be deprived of a convenience that no city can exist without.

Pavements are built only at the request of abutting property owners. They secure the pavement and pay for it for their individual convenience and benefit, and this proposition is so well recognized that the law compels them to pay two-thirds of the cost of the pavement and the city one-third, on the ground that the abutting property owner is the persons chiefly benefited. Does any one pretend that the pavement benefits the railroad companies? They use not one square foot of pavement. The street car is the only vehicle in the street which furnishes and keeps in repair at its own expense that portion of the street upon which its wheels revolve. It is the only vehicle which neither uses, wears out, nor litters the pavement. It is the only one which will furnish the public any kind of transportation for 5 cents. Every other common carrier furnishes his carriage or wagon and the taxpayers furnish the pavement for him to use, yet not another carrier will furnish transportation to those taxpayers for less than from five to twenty times the street car fare.

When a new pavement is to be laid a track, which is perfectly satisfactory to the company, and which has cost thousands of dollars to build, must be torn up, a new and expensive construction put in, entirely unnecessary except for the pavement, and when it is finally laid, it becomes a constant source of inconvenience and expense, whenever work is necessary upon the tracks. And the railroad company is expected to, and does, bear this increased expense for an improvement which is made for the benefit of every one in the city except itself.

Now it is proposed to compel the railroad companies to pay for about one-third of these pavements, which are a postive detriment to them, but have been laid at the solicitation of the property owners for the benefit of themselves and their property; and the attempt of the railroads to avoid this imposition is called "an astonishing scheme to further deliver the people into the hands of the railroad corporations."

The present law has been upon the statute books for 15 years. This fact is commented on in most of the attacks upon the railroads and the assertion is made that they obtained their franchises and were built under the present law, and having accepted these franchises and been built under this law, they are not justified in now asking its repeal or amendment. They are also accused of having evaded their "just" taxes all these years.

A discriminating selection of facts, is it not? But omits the important point that for more than 14 years of that time the decisions of the courts of this state, under this same law, exempted the railroads from liability for the cost of new pavements. It was under these decisions that more than two-thirds of the street railroads of the state were built, including the entire Belt Line system, and they can hardly be considered reprehensible in declining to pay taxes for which the courts had decided they were not liable. But these decisions, favorable to the railroads, were not acceptable to the taxpayers, and every effort was made to reverse this interpretation of the law. These efforts were considered entirely justifiable and nothing was heard of the "righteous and legal liability" of the taxpayers as fixed by those decisions. But when, after 14 years a decision against the railroads was finally obtained, and they in their turn sought relief from this decision, the press of the state comes down with an avalanche of vituperation upon the street railroad companies and declares their action an outrage on the taxpayers.

That this last interpretation of the law was by the court of appeals does not by any means establish the justice of the law itself. It simply establishes its meaning. It does, however, force the railroad companies to seek relief through legislation, instead of litigation. There is a prescribed routine for this, and it involves the presentation of the desired bill to the Legislature by some member of that body. But the members of the Legislature are being frantically warned that they are sent to Albany by the people, they are paid by the people, and are there to protect the people's rights. But the only people who have rights to be protected, who are entitled to frame the laws affecting street railroads are those who have not one dollar of interest in street railroad properties, and to whom their financial success or ruin is a matter of no concern. These are the people, and the protection of their rights means war upon the street railway corporations.

But what of the component parts of a corporation? Since when have men become outcasts from the people of their state, because they have united their capital and efforts for the prosecution of a business that one or two could not possibly conduct? And yet that is all there is to a corporation. Does a man who invests his money in a street railway property rather than a manufacturing business, therefore forfeit his right as a citizen to legislative representation and protection, and become a proscribed enemy of mankind, denied all right of relief or protest? It would seem so.

The representatives at Albany are paid by taxes, and of those taxes the street railroads pay their full and legal share in their respective districts. They are entitled to the same representation, protection in their business interests, and against oppressive legislation and courtesies from their representatives as any other taxpayer in the community. This is their right. How is it granted? It is almost worth the political life and reputation of any member of the Legislature if he dares to introduce a bill which remotely or directly is intended for the benefit of a surface railroad. He is at once branded as a scoundrel and corruptionist, and the tool of the railroad companies. It is strange that the promoter of any scheme to fasten a burden upon a railroad for the benefit of some one else

is never a tool. He may be a striker, but not a tool. If the recent decision of the court had been like those preceding it, in favor of railroads, how many bills would have been introduced at Albany this winter nullifying this law, and placing the burden on the railway corporations? But these would have been bills for the "relief of the people," not a "taxpayer's grab." Verily, it makes much difference whose ox is gored.

In fixing the duties and liabilities of street railroads very little argument is used. It is largely a matter of assertion. It is allowed to exist, therefore it should be compelled to pay for the privilege of existence. If one asks why, he is given invariably the following reasons: The railroads occupy the streets; they have possession of the streets; they injure the pavements; they have been donated a valuable franchise. Let us see. The company occupies the streets. Yes, as regards its cars, precisely as all other vehicles occupy them, except that in proportion to the number of persons carried, it occupies a much smaller portion of the street than do other vehicles. If the passengers carried by street cars were transported in any other known conveyance the streets would be considerably more occupied than at present, and very much more to the detriment of the pavement. Its tracks certainly occupy a portion of the street surface, and are something of an inconvenience, but they are an absolute necessity, if cars are to be run or anything like rapid transit given. Does any one pretend that the inconvenience of the track overbalances the convenience of the cars? That a city would be better off to remove from within its limits both tracks and cars? I think not. But if people are not to be compelled to walk or pay carriage hire, but are entitled to cheap transportation, some portion of the surface of the earth must be occupied to accomplish it. This is made necessary by the laws of gravitation, for which the railroad companies are not yet held responsible.

"They take possession of the streets," but when a person riding or walking disputes that question and collides with the car, he brings suit for damages. Nothing is now heard of the railroad having possession or exclusive use of that portion of the street. Judge and jury inform the company that if it was a possible thing for their motorman to stop his car, and give that person safe passage across the tracks in front of it, he was bound to do so. If he failed the company is liable for damages. If the company is exonerated it must not be because of any paramount right of the car in the street, but on precisely the same grounds that would relieve a truck driver from liability under the same conditions. Where, then, is the possession of the street?

"They injure the pavements." Not when the pavement is properly constructed. But when, under poor construction, defects appear in a pavement, it is a question of repairs, and no railroad company ever fought the law that placed upon them the liability for repairs on the portion of the street in question.

"The city has donated a valuable franchise." Has it donated it? When you part with one commodity and receive another in return, does either party to the transaction talk of donation? I maintain that the relations of municipalities and their street railways are entirely reciprocal; that when a city grants a franchise to a railroad company, that company, in the building its road, confers as great a benefit upon the city as the municipality has conferred upon the company in granting the railroad the privilege of existence and allowing its owners to invest their money and take the risks of the enterprise. The value of a franchise to a company is measured by its value to the public. These values correspond exactly. A street railway franchise is not worth a dollar unless the public patronizes the cars. The cars are patronized only by those to whom the accommodation is worth a nickel. No one ever rides under compulsion or for the benefit of the railroad, but solely for their own convenience, and when they decide that convenience is not worth their nickel they keep the nickel and walk. Every dollar in the company's coffers means a dollar's worth of accommodation to the people, and the value of that accommodation was passed upon by them before they entered a car. It is no answer to this to say that many ride from necessity, because the exigencies of their business demand it and pay the fare under protest. There are people who pay under protest for the food they eat and the clothes they wear; but when the food has been furnished them at the lowest market price, and the clothing for less than any other merchant of the city sells it, the protest carries little weight. If people ride from necessity, then the railroad becomes a necessity to the city, which is precisely what the railroad companies claim.

But those who are broad minded enough to admit the benefits of street railroads and their necessity to the existence of a city sometimes add that it is nevertheless an opportunity given the railroads to conduct a business and eventually reap profits, and that therefore they are indebted to the municipality for the chance and should be willing to pay for the favor.

If any other business enterprise proposes to establish itself in a new location subscriptions are circulated, money is donated, gifts of sites are made, and chambers of commerce fall over themselves in order to secure the plant in their city. Is there any one manufacturing business that contributes more to the prosperity of a city of fifty thousand population than does its railway plant? It would be a very extensive and well established business if it did. Is there any one manufacturing business that the city of Utica, for instance, could not dispense with for the next fifty years more easily than with its street railroads? If a modern Solomon forced a city to decide on the value of its respective business enterprises, by depriving it entirely of the less valuable, would the street railway be thrown out first? If a street railway were unattainable except by effort on the part of a city, would any municipality in the state leave a stone unturned to secure one? Yet all other business enterprises should be paid to come, but a street railroad should pay for the privilege of coming.

But it is said, in the case of Utica, that the Belt Line has a practical monopoly as a carrier. It is not likely to attract much competition with fares at 4 cents. The different lines of the city are under its control, but when the franchises for those lines were applied for did any other company signify a willingness to build them, or to bid on those valuable franchises? Did no one but the Belt Line company have sufficient foresight to see the need of a good and extended railway service, and should not its great future value have awakened competition? It is not so many years since the Belt Line railroad was in the hands of a receiver and on the market. Did the municipality or any of the taxpayers, who are now the "people," show any anxiety to obtain possession of this most valuable property, this Klondike on wheels? The opportunity was theirs, but they respectfully declined to take any chances. The men who had business interests already at stake were forced to take up their own burden, invest their own money, take their own risks, and accept as their daily portion more contumely, fault finding and annoyance than falls to the lot of any other citizen in the municipality, and when they have finally placed their property on a reasonably secure basis, they are told that for this great and valuable holding, for which they are indebted to the city of Utica, they shall submit to a burden which would be placed upon no other business enterprise within its limits. If this is done on the ground that they are better able to bear it than are some property owners, which proposition is sometimes gravely advanced, then every wealthy citizen owning horses and driving them and large business concerns, whose teams are constantly seen on the streets, should be asked to contribute to the paving assessment of their poorer neighbor, whose pavement they are using, and who does not himself drive over it once a year.

The Belt Line company does not claim to be a charitable institution, notwithstanding the good-natured sarcasm frequently leveled at it on this point. It has, however, just as much of this character as any other business enterprise in the city. They are all conducted on precisely the same basis. Merchants and manufacturers, professional men and wage earners, all prosecute their daily labors with a direct view to their individual benefit, and none of these gentlemen has a right to ask anything more or different of the railroad company.

The attitude of the press toward the street railways is perhaps excusable (if sometimes a little aggravating). It is a question of existence with them. As the railroads object to a law which means bankruptcy to them, so a newspaper should not be expected to adopt a policy which means bankruptcy for it, and the newspaper which boldly and openly championed the cause of the railroads would be doomed from the initial letter of its first editorial. The general trend of public opinion must be catered to. That the trend is not any too friendly to the railroads is shown by the demands made upon them when the enforcing of these demands means serious financial difficulty for most and bankruptcy for many.

It is shown in the fact that it is possible for a man to enter a street car, evade payment of his fare, lie to the conductor and boast of it afterward as a smart accomplishment. If the same man enters a store, slips an article in his pocket from the counter, and walks

off with it, he is a thief and a shoplifter. Yet there is no question but that the railroad is entitled to its nickel as justly as a merchant to his wares. This, fortunately for the railroads, is not a very common thing. The great majority of our patrons would no sooner attempt to beat their ride on a car than they would filch five cents from the pocket of a fellow passenger. But the fact that these things are done shows how confidently the beat and impostor relies upon the state of public sentiment.

It is this sentiment which is entirely responsible for the conditions out of which grows the present controversy. There is no law of right or justice which imposes upon a railway company or any other corporation the burden of paying for a thing which it does not use, does not want, which is no benefit to it, but a positive detriment; for the necessity of which it is in no way responsible, and which is built for the benefit of everybody in the city except the railway company.

NEW CHARLESTON (S. C.) COMPANY.

Mar. 1, 1899, the street railway and lighting interests of Charleston, S. C., were consolidated, and Charleston is now one of the few cities in the country where these public utilities are operated by one company. Four companies, the Charleston City Railway Co., the Charleston & Seashore Railway Co., the Charleston Edison Electric Light Co. and the Charleston Gas Light Co., were united under the title of the Charleston Consolidated Railway, Gas & Electric Light Co. All of the properties are considered good investments, and they were purchased by the Baltimore Trust & Guarantee Co.

The officers of the new company are: President, J. S. Lawrence, Charleston; vice-president, Francis K. Carey, Baltimore; secretary and treasurer, J. Banister Hall, Baltimore; general manager, W. S. Hill, jr.; superintendent of railway, T. W. Passailaique.

The Charleston City Ry. comprised the Charleston Street Ry.

SCENES ON THE CHARLESTON CONSOLIDATED RAILWAY AND AT THE ISLE OF PALMS.

There is only one law which does justify it, and it is the law under which the highwayman says to the traveler: "I am a larger man than you are. I am armed and you are not. You are here and can't get away. You have money and I want it. Give it up."

A proposed ordinance to elevate the railroad tracks crossing the Twin City interurban line at Washington Ave., Minneapolis, is meeting with strong opposition from the railroads.

The Canton & Massillon (O.) Electric Railway Co. has heretofore had a very stringent rule regarding tardiness of its employes; the man who was late was discharged. Recently a modification has man who was late was discharged. Recently a modification has second offense, 10 days; third offense, discharged.

and the Enterprise R. R., which were old horse car lines, one having been chartered in 1861, and the other in 1870. These two properties were purchased in the interest of the Charleston City in February, 1897, and the motive power changed to electricity. The company had 30 miles of track and operated 40 motor and 15 trail cars. The Charleston & Seashore has been in operation since August, 1898; this company had nine miles of single track with turnouts about one mile apart, running from Pleasant Point to the Isle of Palms along the shore of the bay the entire distance. Pleasant Point is across Cooper River from Charleston, and is reached by ferry boats; for this service the new company has secured two good boats each capable of carrying 1,600 people at one trip.

The seashore line and its beautiful resort on the Isle of Palms have been a great success from the first, the people of Charleston

having been very willing to avail themselves of this outing place. In the group of scenes on the Charleston Consolidated, No. 1 is what is known as the Cove Inlet trestle, on the seashore line; No. 2 shows the terminal pavilion, steeple chase carousal and Ferris wheel on the Isle of Palms; No. 3 is a view drawing the seine on the beach; No. 4 shows Fort Moultrie; No. 5 is the Charleston

ON THE ISLE OF PALMS.

ferry slip, the terminal building is not quite completed; No. 6 is a view on the pavilion veranda facing the sea at the Isle of Palms. The separate engraving shows the vegetation on the Isle.

We are indebted to Mr. W. S. Hill, jr., general manager of the company, for the photographs from which these illustrations were made.

NEW FRANCHISE AGREEMENT AT INDIANAPOLIS.

Press dispatches from Indianapolis state that the city council has granted the new street railway company a 34-year franchise. The conditions of the contract are: fare to be 5 cents and 25 tickets sold for $1 and a universal transfer given; the company to pave between the track and 18 in. outside; to expend $1,000,000 in improvements when necessary; to turn over its old Shelby St. barn for a market house; to pay the city $30,000 per year for 27 years, and $50,000 a year for 7 years.

IMPROVEMENTS AT ST. JOSEPH, MO.

The St. Joseph (Mo.) Railway, Light, Heat & Power Co. has purchased the material for extensive improvements and several miles of new track, and also ordered new equipment; some of the material is now delivered and the work will be rapidly pushed until completed. The company will build two extensions to its lines, one comprises three miles of double track and the other one mile of single track with turnouts and switches; three miles of double track will be rebuilt.

The power house equipment ordered includes one 1,200-h. p. engine to be direct connected to an 850-kw. General Electric railway generator and one 700-h.p. engine direct connected to a 700-h.p. Westinghouse alternating machine, and which may also be used to drive other smaller generators. In the boiler room a battery of Babcock & Wilcox boilers, 1,017 nominal h. p., equipped with Babcock & Wilcox stokers, are to be installed and a new steel stack erected.

The company has bought 12 large open motor cars and 12 11-bench trail cars, to be equipped with G. E. 1000 motors; and also ordered 10 20-ft. closed cars to be delivered Oct. 1.

All of the overhead railway lines are being rebuilt, and this work will be completed within 30 days. The copper for trolley and feeder lines was bought last May at the bottom price, the trolley wire costing 12¾ cents. General Manager Van Brunt is now selling the old trolley wire for 13 cents.

NEW JERSEY CONSOLIDATION.

It is stated that the North Jersey Street Railway Co., of Jersey City, which leases and operates the Newark & South Orange and the Consolidated Traction Co.' lines, aggregating 218 miles of track, is to lease the North Hudson County Ry. (52 miles) and if possible all the street railways in Essex, Hudson, Union, Somerset, Passaic and Bergen Counties. The principal men interested are said to be: P. A. B. Widener, William B. Elkins, Randolph Morgan and Thomas F. Dolan, of Philadelphia; William C. Whitney, J. D. Crimmins and Patrick H. Flynn, of New York city; former Senator Smith, B. M. Shanley, Leslie D. Ward, Elisha B. Gaddis, Gottfried Krueger, John F. Dryden, L. D. Howard Gilmour and David Young, of Newark; E. F. C. Young, of Jersey City; Garret A. Hobart and Augustus Barber, of Paterson, and John Kean, of Elizabeth.

AVALANCHE AT NIAGARA FALLS.

Early on the morning of March 31st there was a great avalanche of rock in the Niagara gorge. The mass fell from a point on the river bank close to the Buttery elevator and plunged 200 ft. straight down on the tracks of the Gorge road and the buildings of the elevator at the base of the cliff. It was the greatest fall of rock that has occurred from the Niagara banks in many years and the north end of the city was shaken as though by an earthquake. One immense boulder fell from the extreme top of the cliff full onto the Gorge road tracks, with the result as shown in the accompanying engraving. Between this rock and the base of the cliff is a mammoth pile of broken rock and shale that came down with the avalanche, the entire mass being piled many feet high.

There are numerous points along the cliffs where such falls of rock are expected during the spring and fall, but this was not one of them. An examination showed that another fall of rock was

GORGE ROAD AFTER THE AVALANCHE.

imminent, and proper precautions were taken to warn people away from the danger.

Had this fall occurred a few hours later loss of life might have resulted as the Buttery elevator is a favorite place from which to view the rapids. The building leading from the Gorge road depot to the foot of elevator was demolished; it had just been rebuilt, having been wrecked by the fall of an old elevator shaft during a high wind a few weeks ago. About 30 ft. of the lower end of the new elevator shaft was torn away.

DEATH OF M. K. BOWEN.

Menard Kenner Bowen, president of the Chicago City Railway Co., died suddenly at the Chicago Hospital on Sunday, April 9th. Mr. Bowen had been suffering for more than a year with stomach troubles which were thought to be of a catarrhal nature, but neither he nor others supposed the malady to be dangerous. He had been working unusually hard of late, and had planned to leave the city for a brief rest almost on the hour in which he died. He attended to business as usual on Friday, taking lunch at a down town club that evening. At 1 o'clock Saturday morning he became violently ill, and on the decision of a consultation of eminent physicians was taken at 5 o'clock to the hospital, which is one of the best equipped in the country, and immediately operated on for appendicitis. The operation disclosed an aggravated case of blood poisoning which made recovery extremely doubtful. The patient rallied, however,

M. K. BOWEN.

and some hope was entertained until 9 o'clock a m., at which hour a relapse occurred, under which he sank steadily until 10 p. m. when he died. At the bedside were his wife, his mother who was called from St. Louis, and his sister, Miss Annie Bowen, who arrived from Philadelphia four hours before. He had just purchased a residence into which he expected to move May 1st and was planning an extensive trip to Europe for next year.

Mr. Bowen was recognized as one of the brightest and most promising street railway men in the country, and although a young man, had learned the secret of turning off an immense amount of work in the shortest possible time, and had advanced far on a highly successful career. He was born in Jefferson Barracks, Mo., the army post on the Mississippi river, about 10 miles below St. Louis, in 1858. His father was Gen. John S. Bowen, a graduate of West Point, and his grandfather Pierre Menard,the famous lieutenant-governor of this state Mr. Bowen received his early education in the St. Louis university and later took a course in engineering at Washington university in the Mound city. At the age of 19 years he went into the service of the United States Government, being assistant engineer on a triangulation survey on the Mississippi river. A short time later he was made assistant engineer of the jetty work in the New Orleans harbor. In 1880 he became identified with a topographical survey from Fort Smith, Ark., through to California. In this work he was engaged eight years. His next step was to assume the duties of chief engineer and superintendent of construction of the Kansas City cable railway. Upon the completion of the cable line Mr. Bowen went to New York city as representative of the Short Electric Railway Co. He remained there a year and then came to Chicago as assistant superintendent of the City Ry., from which position he rapidly rose, until in January, 1898, he was made president and general manager. The entire conversion of the company's horse lines to electricity was made under his supervision. He was an excellent organizer, and had worked out a system of comparative records which was the admiration of all who were familiar with them. He was both approachable and friendly, and had won an extremely large circle of friends.

Mr. Bowen left two children, Allan, a boy of 12, and Marion, 4 years of age.

The funeral services were unusually impressive. Fully 1,200 people were present, and many of the best known millionaires in the city touched elbows with the humblest employes of the company. The remains were escorted from the residence to the train by a procession of 800 of the men, including delegations from each division and the shop and track departments. The Cottage Grove Employes band led the way, playing dirges. The floral tributes in number and beauty have rarely been equalled here, the special pieces alone more than filling four carriages. They were taken in the private car to Jackson. The honorary pall bearers were made up from the officers and directors of the road, as follows: S. W. Allerton, Joseph Leiter, George T. Smith, T. C. Pennington, W. B. Walker, D. G. Hamilton, F. R. Greene, G. O. Nagle; and the active pall bearers from heads of departments. As the great throng filed slowly past the casket while the band played the Dead March in Saul there was scarcely a dry eye in the whole assemblage. The voluntary demonstration on the part of the men was extremely touching, and a noble tribute on their part that while unsuccessful a few years ago in their labor matter, they had since come to love and respect the man who at that time defeated them. Each division and department sent a large floral piece. Nearly every street railway official in the city was present.

The interment was at Jackson, Tenn., the former home of Mrs. Bowen.

RAPID TRANSIT IN NEW YORK.

During the last three weeks the question of rapid transit for New York City has attracted a great deal of attention. On March 27th counsel representing the syndicate which controls the Metropolitan Street Railway Co., made a proposition to the Board of Rapid Transit Railroad Commissioners embodying the following points: A new company is to be formed to build an underground railway which is to be leased in perpetuity, or for a very long term, to the Metropolitan for 5 per cent on the cost of construction; fare on local trains to be 5 cents, with transfers to the Metropolitan surface system for 3 cents extra; fare on express trains (20 to 30 miles per hour), 10 cents; the company to pay the city 5 per cent of gross receipts, or so much of 5 per cent as shall remain after operating expenses and fixed charges shall be paid; exemption from taxation until tunnel road pays 5 per cent on the cost; the company to sublet space for wires, pipes, etc., to other companies; downtown sections of tunnel to be built within three years after proposition is accepted; remainder to be built as soon as first section begins to pay 5 per cent on cost; accounts of company to be subject to the inspection of the commissioners.

The Board on receipt of this communication, unanimously adopted a memorial to the Legislature asking for power to act in the premises.

Immediately after the Metropolitan letter became public a second offer was made by an "American-English syndicate" to build a tunnel to revert to the city after 99 years; fare to be 5 cents with free transfers to surface line (provided the surface companies would make transfer contracts, taking 2½ cents per passenger); the company to pay the city 8 per cent of the gross receipts, and 25 per cent of the rentals received for space for wires, etc.; the company to let local parties subscribe for 30 per cent of the stock.

April 3rd the Metropolis Contract Co. offered to build the tunnel road for $33,000,000 (the city to furnish the money); fare to be 5 cents; free transfers to surface lines, if the latter would make transfer agreements; the company to meet the interest charges and eventually pay the principal of the bonds, leaving the city with a tunnel that cost it nothing.

On the same day an agreement between the Third Avenue Railroad Co. and the Manhattan Elevated Railroad Co. was made public which offers rapid transit at a very early date. The substance of the arrangement is: Transfers to be given from one system to the other for an 8-cent fare; the immediate equipment of the elevated for electricity, and the inauguration of an express service. The transfer arrangement is to go into effect May 1st.

A bill is pending in the Michigan Legislature providing for air brakes on all street cars.

THE SYRACUSE SYSTEM OF PERSECUTION.

Syracuse is a big city, but the mayor thereof is bigger, or at least thinks he is, judging from the undignified and unjustifiable methods to which he has recently resorted to have things his own way. There was a matter of some unpaid paving for which one of the roads there expressed its readiness to settle the moment the correct amount chargeable to it was shown. Transfers were requested which the company put into effect. But the mayor was not satisfied with the transfers, and began to threaten. The company, unable to discern any end to his demands, did nothing. Then the edict went forth that no sand should be used on the tracks, and during the slippery weather the cars went skating past the crossings while passengers chased after them. He thought the speed was too high, and put out a big force of watchmen. He discovered some sort of sanitary order which he interpreted to suit himself and had inspectors riding, to order cars into the barn where the "spit signs" had been disregarded. Finally there came the big snow storm and an old ordinance was excavated which prohibited piles of snow on the street. The snow was deep and the ridges made by the plows were being levelled and removed as rapidly as possible, but still there were some. Then the mayor spends a lot of the city's money in shovelling the snow back on the tracks and arresting 17 of the plow men. It was Sunday, and as the company pulled its cars into the depots the people had a chance to walk. Then the people woke up and the mayor found out to his surprise that the citizens were sick of his foolishness, and thereupon they proceeded to take a hand in affairs, and now the company is getting some of its rights.

LITIGATION OVER PITTSBURG CONSOLIDATION.

Litigation following the consolidation of street railway lines in Pittsburg and Allegheny resulted in a decision, Mar. 27, 1899, by the Supreme Court of Pennsylvania, adverse to Drexel & Co. and Whitney & Stephenson, bankers of Pittsburg, the underwriting syndicate which undertook to float the preferred and common stock of the new corporation, known as the Consolidated Traction Co., of Pittsburg. The suit grew out of an agreement in which Drexel & Co. undertook to underwrite $150,000,000 of preferred shares held by William L. Elkins, P. A. B. Widener, George W. Elkins, William Flinn, Joshua Rhodes and M. K. McMullin. To enable this to be done the trolley magnates issued to the underwriting syndicate 150,000 shares of common stock, of which amount Drexel & Co. were to retain 77,000 shares as payment for their services. The financial disasters of the spring of 1896 rendered the scheme impracticable, Drexel & Co. failing to float the preferred stock at $50 a share. Messrs. Widener and Elkins and the other shareholders demanded the return of the 77,000 shares to the Consolidated company and filed a bill in equity for that purpose.

The bill was dismissed in the lower court, but was reinstated on appeal.

FALK COMPANY'S NEW SUPERINTENDENT.

Mr. Frank W. Carr has taken an interest in the Falk Co., of Milwaukee, and accepted the position of superintendent. Mr. Carr has been the chief engineer and superintendent of eletrical construction for the West Chicago Street Railroad Co. He is a thoroughly posted man in his business, having graduated from Amherst College and the Massachusetts Institute of Technology; later he was an instructor in the University of Minnesota. His work in Chicago is well known, but before he came here he had held some very responsible positions.

Mr. Carr will be general superintendent and chief engineer of the Falk Co., and have charge of all the construction work now under way and to be contracted for. The Falk Co. has just closed a contract for the entire construction and equipment of the new interurban line to be built between Neenah and Oshkosh, Wis. Of this new company, Mr. Geo. J. Kobuseh, of St. Louis, Mo., is president, and Mr. E. E. Downs, of Oshkosh, vice-president and general manager.

Another large order the company now has is the track construction for the Northeast Railway Co., of Kansas City.

MAURICE COSTER GOES TO PARIS.

Mr. Maurice Coster, for three years manager for the Westinghouse Electric & Manufacturing Co. at Chicago, has accepted the position of agent general of the Societe Industrielle d'Electricite Procedes Westinghouse, the French company newly formed to manufacture and sell Westinghouse electrical machinery and apparatus on the continent of Europe. After May 1st Mr. Coster's headquarters will be at No. 45 Rue de l'Arcade (Boulevard Hausmann), Paris. He left Chicago April 9th and sails on the 16th.

Probably no one in the entire electrical fraternity of Chicago has more or better friends than he, and when some thirty of them decided to tender him a farewell dinner at the Technical Club, it will be readily understood that it was something highly creditable. The banquet was under the personal direction of Mr. D. J. Gelder, the

MAURICE COSTER.

club manager, and arranged by a comn ittee consisting of Messrs. S. P. Wells, jr., John Allen, C. E. Billi , L. E. Ritter and C. H. Stranahan. The floral decorations were very elaborate, including a large piece in daffodils by Mr. John R. Wylie, who was unable to be present. Following the dinner, which was an unusually elaborate one, toasts of congratulation and good-will were responded to by each one present Mr. Wm. da La Barre, chief engineer of the St. Anthony Falls Water Power Co., Minneapolis, was one of the out of town guests who came to Chicago to attend.

Mr. Coster is strictly a self-made man. He came to this country from Holland when only 12 years of age, and landed in Boston an entire stranger. He worked his way through Stevens Institute of Technology, where he graduated with honors, and supplemented this with several years' practical study in some of the best machine shops in this country and Europe.

In 1886 he was married to Miss Edith Beckett, of Albany, and went to South America, where he managed a large sugar plantation and refinery. Here he made radical improvements in many of the mechanical processes in use there, but was obliged to leave after three years on account of his family's health. In 1888 he became associated with the Westinghouse company as an engineer in charge of construction and erection of plants, and in 1891 was transferred to the selling department, taking charge of the territory served by the home office. Upon the death of his wife in 1895, Mr. Coster was, at his own request, transferred to the Chicago office as manager, where he has had full charge of a large territory including 10 states. His success here in enlarging the business of his company is well known, while at the same time he has made an unusually large circle of friends to whom his departure is a matter of genuine regret. His experience is such that he is recognized as one of the foremost in his profession in this country, and with exceptional ability, and knowledge of several languages, and acquaintance with prominent engineers abroad, he is sure to make a notable record for both his company and himself in his new field of labor, to which he carries with him the hearty wishes of hundreds of friends. His three children will accompany him to Paris.

MURPHY THIRD RAIL SYSTEM AT MANHATTAN BEACH.

A spur of the Long Island Electric Ry. about 3,000 ft. long at Manhattan Beach has been equipped by the Safety Third Rail Co., of New York, for electric traction by the Murphy system. The current is taken from a third rail divided into sections of about 16 ft. in length, the sections being automatically excited as the car proceeds. The sections are about half a car or train length with collecting shoes or plows at each end of a car. The sectional third rails are so spaced that the car motors are taking current from one section before the circuit to the succeeding one is broken, giving a

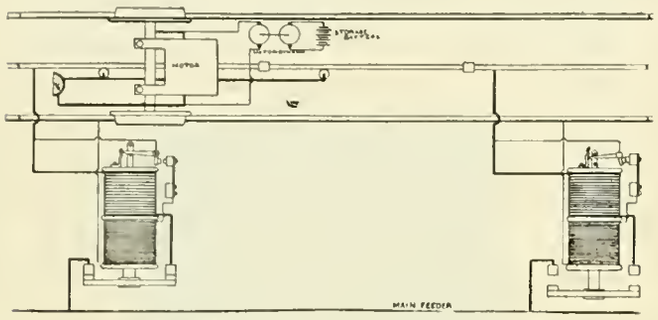
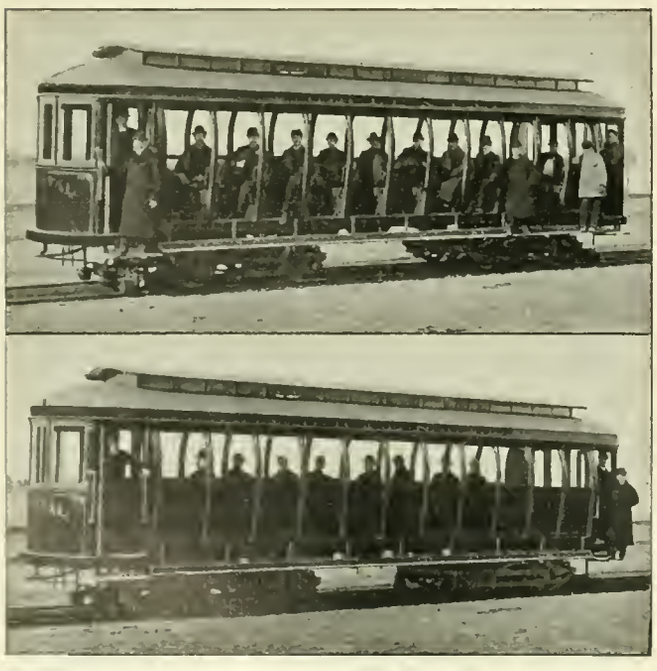


FIG. 1 CONNECTIONS FOR MURPHY SYSTEM.

continuous current supply. The only live sections are the two immediately under the car, and each is insulated from adjoining sections by a block of granite. The bonded track rails constitute the return circuit.

Each car carries a storage battery of 10 cells which are employed when the car is starting to make connection between the feeders and the third rail section over which the car is approaching. To provide for charging these batteries a motor-generator is employed which reduces the line voltage to 20 for the battery. When starting this operation is reversed, the motor-generator taking the current from the battery at 20 volts and generating a 500-volt current to excite the electro-magnetic switch, and it also keeps the car lights going when the current from the power station is cut off. The current from the feeders is then admitted to the car motors which are of the same type and controlled in the same manner as those on trolley cars.

The switch cuts out the sections after the car passes, leaving them dead. The chief feature of the system lies in the construction of the



FIGS. 2 AND 3—DUPLEX CAR.

switch, and in the method taken of preventing arcs. It consists of a solenoid and plunger carrying at its lower extremity two carbon and copper contacts which when the current is flowing are pressed against two carbon disks. There are two circuits in the electromagnet, one of high resistance through which the current acts on the plunger first and the second circuit of large capacity carrying the current to the third rail section. After a car passes a section the circuit is broken at the two lower copper contacts, but no arcing

FIG. 4—SWITCHBOX.

ensues as the upper carbon contacts momentarily remain closed. When this is subsequently broken the motors are no longer taking current through this switch so there is no arc at the switch jaws and the switch opens by gravity.

When the car has been stopped the switch is open and there is no connection between the feeder and the car which can, therefore, receive no current. The motorman operates the controller and thereby connects the motor-generator to the third rail and the current passes through the fine wire of the switch and operates the plunger. The plunger rises completing the circuit between the feeder and the third rail section and then breaks the connection to the fine wire winding of the solenoid. The switch is held closed by the current passing through the heavy solenoid winding to the car motors, and the switch will remain closed so long as the car is taking current from the section to which the switch is connected. When the car leaves the section the switch opens by gravity and is ready for the next car. After the car is started there is no need of the motor-generator to supply current to operate the switches, for there are two sets of shoes on each car connected and spaced far enough apart to span from section to section. The forward shoe as it comes in contact with a section subjects it to the full line potential drawing its current from the preceding section. After starting the car the switches are operated by the current from the power station. The arrangement of the circuits is shown in the diagram, Fig. 1.

The installation at Manhattan Beach is operating satisfactorily, although it should be added there are few difficulties to overcome for there are no grades or crossings on the line which is on a private right of way. The convertible car now running on the line was built by the Duplex Car Co. and is shown both as a summer and a winter car in Figs. 2 and 3. The car is mounted on Peckham's double trucks. The arrangement of the switches in the boxes may be seen in Fig. 4, and in this case the boxes are attached to fences along the track. In commercial work it would be necessary to place them beneath the surface and they would be subjected to the trying effects of flooded tracks and moisture in the earth. The switches may be clustered at any convenient point. It is, of course, necessary to have a switch for each section and with sections 15 or 16 ft. long they become very numerous. If a car were running 50 miles an hour, a speed which is attained on some interurban roads, 280 of these switches would be in operation per minute. The main-

tenance of a great number of these switches, especially when installed beneath the surface would be a large and ever increasing source of expense. Furthermore there might be numerous forms of electro-magnetic switches which would serve the purpose as well as the one represented; the whole claim to originality seems to be based on the switch. The addition of a motor-generator and storage battery to the car equipment is also very objectionable. Where the third rail is in use on the surface this system might be employed to advantage at crossings and other points where it is not desirable

FIG. 5—THE HARMLESS TRACK.

to have a 500-volt conductor exposed. For use in city streets this system would be quite expensive to install and maintain and its reliability has yet to be demonstrated.

As announced in its prospectus the company is anxious to sell large blocks of stock and operating rights, and some of its methods savor strongly of a stock jobbing scheme. The recent column-and-a-half story which was handled by a news bureau and wired to a number of daily papers in different parts of the country, was a very clumsy attempt to disguise in the form of reading matter an advertisement to sell stock.

It would appear to us that the essence of the system is in the switches, and there are engineers in abundance who either question the validity of the patent on this switch, or express their belief that switches already on the market will work equally as well.

MAIL SERVICE IN KANSAS CITY.

The proposed establishment of a street railway mail service for Kansas City, Mo., has been much discussed of late and is warmly advocated. Supt. C. F. Holmes, of the Metropolitan Street Railway Co., says concerning the mail service: "For the benefit of the business interests of Kansas City the company is willing to meet the postal department more than half way in this matter, and we are willing to consider any proposition that may be made to us. But, be it understood, there is no postal regulation authorizing this street railway mail service and no appropriation to pay for its maintenance. The whole thing is conducted upon the 'star route' system, under sub-contracts, and is not officially recognized by the Government; but we can easily make arrangements with contractors which will expedite the mail service and will in no wise interfere with the regular passenger traffic of the Metropolitan company."

The New York Legislature failed to pass the bill providing that electric or cable cars in cities of over 50,000 inhabitants be equipped with fenders.

STREET CAR ACCIDENT DEFINED.

Should one undertake to define just what is included in the definition of the word "accident" as occurring in street railway work, he would find it to be a quite comprehensive term, to express which in satisfactory language is not the easiest undertaking.

Gen. Mgr. C. D. Wyman, of the New Orleans Traction Co., has found that the occasional posting in conductors' waiting rooms of special comments on important rules, is a most valuable adjunct to the rule book; and that, being prominent before the men, it provokes study and discussion, both of which greatly help to fix the matter plainly in the mind of employes. He has recently posted such a bulletin in all his depots, on the subject of accidents, and has kindly granted our request for a copy, which is reproduced below.

ACCIDENTS.

The term **Accident** includes injury to **persons** or **property, collisions, breakages** of all kinds to the **cars, ejections, personal trouble** in car between **employees** and **passengers,** or between **passengers,** and any event of any name or nature occuring upon a trip, wherein damages occur to **persons** or **their property,** to **car,** to **vehicles,** or wherein the possibility of damages may arise from any action of **employees** or **passengers** themselves, whether complained of or not.

Conductors are not permitted to use discretion as to reporting or not any occurence included in above statement, but must report promptly all matters coming within above list.

Reports must be **Truthful** and state **exact** facts, without **fear, favor** or **prejudice,** and no attempt must be made in a report to **shield** any employee, or to **conceal** any of the circumstances surrounding the occurrence reported. Reports must state **facts** which can be **sworn to in court** by the employee reporting or by the party or parties named as witnesses. **Inferences, opinions** and **suggestions** must be stated as such, and not as facts. Report must give:

1st. **Date of Accident and Exact time of day when it occurred.**

2nd. **Exact place of occurrence;** full name and address of party injured, or likely to have been injured, either in person, property or feelings; the owner of property damaged or doing damage to Company's property; if vehicle, name of driver, license number and year of issue.

3rd. **Nature of accident,** and cause of its occurrence. This cause must be carefully ascertained.

4th. **Full name and addresses** of all passengers, bystanders, and employees, as far as possible, whether they saw how the accident happened or not.

5th. **Distance where car stopped,** after the accident happened, from place on the street where accident occured, measurement to be made by stepping the distance from the front end of car to point of accident. This measurement should be witnessed by a bystander, or some one not connected with the Company.

6th. Statement of injuries or damages as well as any expressions of opinion from bystanders regarding the accident.

Above report must be filled out upon blank for that purpose, signed by the Conductor and Motorman, and left at the Station, after turning in the car.

In the event of personal injury, care must be taken to render all the necessary assistance and attention to person injured.

The most **trivial** and apparently **unimportant accident** or **occurrence** in or about the car, even where a person declines to give name, claims no injury, or seems to regard the whole matter as trifling, must be **reported** with as much care as though the damage or affair was of the utmost importance.

All accidents must be telephoned to General Office of Company as soon as possible, and especially in the event of a serious accident, the General Office must be notified **immediately** so that prompt aid may be furnished and investigation begun pending the full report.

It is expected that a report will be made of all accidents or injuries that may occur on the track, or within ten feet of same, whether the car was concerned in the accident or not.

Attention is specially called to questions arising between **Conductors** and **passengers,** as to the **payment** of fare, **character of money offered, change furnished, transfers** or other **complaints** leading to **disorderly,** or **boisterous** conduct, in each of which events Conductor must secure **positive proof** and **eye witnesses,** so as to be able to clearly substantiate the truthfulness of his report in court, particularly before any **ejection** or **arrest** is attempted, and full report of same must be promptly made in accordance with above rules. **No ejection** must be made without **first refunding fare.**

Conductors or other employees **MUST NOT TALK** about, or **GIVE ANY INFORMATION WHATEVER** concerning an accident to any person, other than the proper officer or person delegated with the authority of the Company to investigate the occurrence, and all questions asked of any employee of Company, except by person or persons above named, must be answered by directing the questioner to General Office for information.

Employees must not **visit** an **injured party,** or **family,** to make inquires or discuss accident without authority of Company.

The above rules must be **strictly observed,** and too much stress cannot be laid upon their importance. If any doubt as to their meaning in any respect exists in the minds of employees, they should consult, for their own protection and the Company's, their Station Foreman.

New Orleans, La., April, 1899.

C. D. WYMAN,
General Manager.

The bulletin is on heavy cardboard 17 x 24 in. and, as will be noticed, is printed in very plain type with the emphatic points in more prominent letters.

GALVESTON ROAD TO BE SOLD.

March 24th the court entered an order for the sale of the Galveston City R. R. on September 5th, and fixed the minimum price at $500,000. The bonded indebtedness of the company will approximate $1,200,000, and the floating debt amounts to $180,000. From investigations made by the court, the railway company has not been solvent in 10 years. The decree of foreclosure was strongly contested by attorneys representing local stockholders and New York creditors, but without avail.

EXCITING HOLD-UP AT CARBONDALE.

A gang of six professional burglars, masked, held up the power house and car barn night forces of the Carbondale (Pa.) Traction Co., at 1:15 a. m. Monday, March 27th. The plant is operated until 1:30 a. m., with an engineer and fireman in charge. The station is connected to the car house, where 10 or more of the car crews sleep each night. Between the two buildings is an office in charge of a watchman. The burglars expected to find the day's receipts in the office, but only secured the partial collections of a few late cars, amounting to about $75. The plan was then to rob the men up stairs. Two men men were stationed to guard the front, one the rear, while three entered the boiler room from the rear. They knocked the fireman insensible, and after beating and blindfolding the engineer used him as a shield as they entered the office. The watchman, attracted by the noise, fired until his ammunition was exhausted, receiving a bullet in his foot, but missing the intruders. Some dozen shots were exchanged here. Whenever one of the men upstairs would come to a window the outside guard delivered a volley. An attempt was made to force an entrance into the sleeping room, but was repulsed. The robbers then secured the cash box and fled.

Gen. Mgr. C. E. Flynn was at once notified, and after arranging for the company's surgeon for his injured men, telegraphed to all nearby towns to be on the lookout. It was surmised the gang had boarded a train on the D. & H. R. R., and Mr. Flynn headed a posse of his own men and ran out a special car and made a flying run some 10 miles, hoping to head off a freight train on which the bandits were supposed to be. Had they done so there would have been a lively battle, as both sides were well armed. The freight had just passed, however, but it was learned the gang were aboard. Mr. Flynn then wired to Summit, a little station with two or three houses 10 miles up the mountain. At this place resides a quiet, unassuming old man by the name of William Leech, who was formerly sheriff. The agent awoke him and when the train pulled in, Captain Leech, single handed, was there with a rifle. When the six desperadoes climbed out of a box car he remarked he wanted to converse with them, upon which the crowd began firing. Although only 75 ft. away he was not hit and returned the fire, killing one at the first shot, mortally wounding another at the second, and bringing down a third with the next shot. A fourth surrendered, and two escaped but were captured later in the day. They were all well dressed, and of genteel appearance. On their persons was found complete outfits for safe blowing, including wedges, glycerine, fulminating caps, fuses, etc., sufficient to wreck a large building. All were heavily armed.

The Sacramento (Cal.) Electric, Gas & Railway Co. has contracted with the Yuba Electric Power Co., which has its plant at Folsom, for the exclusive use of 5,000 h. p. This places 10,000 h. p. at the disposal of the Sacramento Co., which will rent to manufacturers and others

IMPROVEMENTS AT PETERSBURG, VA.

The Upper Appomattox Company, which owned the river for both power and water supply for several miles above Petersburg, the Piedmont Traction Company and the Virginia Traction Company, all of Petersburg, have been purchased by R. L. Williams & Co., of Richmond. An electric power plant, driven by water, will be built at once; also eight miles of street railway constructed. The power plant will have a capacity of 1,000 h. p. for present demands, to be increased to 2,000 if required. The new road is expected to be opened by June 1, 1899. Besides furnishing power for the electric railway, the plant will furnish light and power for the city. G. F. Haywood, of Baltimore, Md., constructing engineer.

EXHIBITS AT PARIS IN 1900.

Commissioner General Peck and John H. McGibbons, director of exploitation, of the United States Commission to the Paris Exposition of 1900, have issued the following announcement under date of Apr. 4, 1899:

All who desire to exhibit in the Paris Exposition of 1900 are requested to immediately notify the commission, if they have not already done so, in order that they may be considered in the allotment of space which will soon be made. While there are many applications on file in every line of industry, it is desirable that the American Sections be not only representative of this country but also represent the largest possible number of producers. Both our commercial interests and national pride demand that our works be entered in this most important International Exposition. It is estimated that fully 60,000,000 people from every part of the globe will attend, and it will be an opportunity to greatly increase our foreign trade and to demonstrate that the United States is supreme in the arts of peace.

The Chicago office of the Commission is in the Auditorium Building.

Joseph Leonard, Great Bend, Pa. Dark complexion; brown hair; blue eyes; age, 27; weight, 150 lbs.; height, 5 ft. 8 in.; wears No. 7 shoe.

John Cummings, Logansport, Ind. Sandy complexion; thin curly blonde hair; age, 26; height, 5 ft. 8 in.

William Zerby, Shenandoah, Pa. Sallow complexion; dark brown hair; dark blue eyes; age, 22; weight, 164 lbs.; height, 5 ft. 10 in.; wears No. 8 shoe.

VICTORY FOR SALT LAKE CITY ROAD.

The Salt Lake City Railroad Co. has won in the litigation with property owners which sought to prevent a certain extension of the company's lines. The abutting owners claimed that the company had forfeited its franchise in the street in question and that it had further agreed with the city not to build in this particular street. The Supreme Court, in passing on the question, held that the property owners were strangers to the city contract and could not complain of a violation of it, granting that there really was one; also that the company's franchise could be forfeited only by the state, which did not join as complainant.

The gross earnings of the Columbus (O.) Street Railway Co. for February showed an increase of $4,546, and the net earnings, $4,019.

PERSONAL.

MR. H. H. LITTELL, of Buffalo, is spending some time in California, and expects to return about the first of May.

MR. S. L. NELSON, general manager of the Springfield (O.) Railway Co., was a recent visitor to Chicago and this office.

MR. HORACE C. PEASE has been appointed purchasing agent for a branch of the Metropolitan Street Railway Co., New York.

MR. GEORGE B. HENDRICKS retired from the position of general manager of the Fort Worth (Tex.) Street Railway on April 1st.

MR. C. E. FLYNN, general manager of the Carbondale Traction Co., Carbondale, Pa., was a caller at the "Review" office when in the city recently.

MR. T. W. MEACHEM, president of the New Process Raw Hide Co., of Syracuse, N. Y., was a caller on the "Review" when in Chicago last month.

MR. HENRY SCHWITZGEBEL has been appointed purchasing agent of the Metropolitan Street Railway Co., of Kansas City, succeeding Mr. Satterlee.

MR. J. L. KARNES, claim agent for the Metropolitan Street Railway Co., Kansas City, Mo., was recently presented with a handsome Elks' badge by a number of friends.

MR. JAMES ROSTRON has resigned as chief engineer of the Chester (Pa.) Traction Co.'s power house to accept a similar position with the Sharpless Dyewood Extract Co.

MR WILLIAM A. SATTERLEE, who has been purchasing agent of the Metropolitan road, Kansas City, since 1890, succeeds Mr. Barratt as assistant general superintendent.

MR. L. F. KIRKER, late of the Central Traction Co., Pittsburg, has been appointed general manager of the Wheeling (W. Va.) Railway Co., and assumed his duties March 14th.

MR. KENNEDY ASHWORTH, of Pittsburg, has been appointed general manager of the Park & Falls Street Railway Co., of Youngstown, O., and entered on his duties March 20th.

MR. W. P. QUIGG, general manager of the City Railway Co., Fort Worth, Tex., has been appointed manager of the consolidated system resulting from the sale of that road to the Fort Worth Street Railway Co.

MR. WILLIAM P. GANNON, for several years secretary of the Syracuse (N. Y.) Rapid Transit Co., was on March 14th chosen president to succeed Charles R. Flint, of New York, who recently resigned the presidency.

MR. H. E. CHUBBUCK, who was formerly manager of the Pueblo (Colo.) Street Railway Co., and lately representative of the General Electric Co. at Salt Lake City, has been appointed general manager of the Quincy (Ill.) Consolidated Electric Co.

MR. HAROLD HARSON, lately chief clerk to Gen. Mgr. T. H. McLean, of the Toledo Traction Co., recently removed to Florida; before his departure he was presented with a number of handsome remembrances by his chief and other officials of the company.

MR. FREDERICK UHLMANN, president of the Brooklyn Elevated Railroad Co., has announced that he is not now eligible to any office in that company, as he has sold all of his stock, and consequently will not be interested in the new management of the road.

MR. J. D. PARKER, general manager and superintendent of the Sandusky (O.), Milan & Norwalk Electric Ry., recently tendered his resignation but it was not accepted, and he will continue in his position. Otto Sturtzinger has been appointed as his assistant.

MR J. W. MEAKER, JR., has resigned from his position with the Meaker Manufacturing Co., and will shortly open an office in Chicago, and handle street railway specialties. His experience and popularity and acquaintance in the street railway fraternity will insure him a good business from the start.

MR. GEORGE J. HURD, formerly of Toledo, on April 1st was appointed superintendent of the Janesville (Wis.) Street Railway Co., succeeding Mr. Fred O. Green, who resigned to accept a similar position under Mr. Mark Cummings, at Elkhart, Ind. Mr. Cummings was superintendent of the Janesville line until Oct. 1, 1898.

MR. H. A. REEVES, manager of the street railway department of the H. W. Johns Co.'s Chicago house, after a sickness of three months, has gone to southern California to recuperate. He is reported to be improving rapidly, and expects to be able to return home by May 1st. Mr. A. J. Anderson has ably managed that department in his absence.

MR. THOMAS BARRATT, assistant general superintendent of Metropolitan Street Railway Co., of Kansas City, Mo., has retired from active service. Mr. Barratt is now nearly 70 years of age and has been identified with the Holmes street railways for 27 years, having been in the employ of Mr. Nehemiah Holmes when he was operating horse car lines.

MR. JOHN M. ROACH, vice-president and general manager of the North and West Chicago Street Railroads, accompanied by his family, has been spending a month on his island 26 miles off the Florida coast. Mr. Roach purchased the entire island last year, and is improving it with buildings, walks and an artesian well 1,500 ft. deep. He has his own tarpon and other big fishing waters and is fast making an ideal winter home.

MAJ. RUSSELL B. HARRISON, provost marshall, Seventh Army Corps and Department of the Province of Havana, Camp Columbia, Havana, Cuba, is the present address of a well-known street railway official who was one of the first to enlist. He writes us that the regiments of the Seventh Army Corps are about to be mustered out and that he will shortly return and intends to again enter street railway work, and will be ready to consider a proposition about the middle of May.

MR. CLOYD MARSHALL who for the past two years has so acceptably filled the position of electrical editor of the "Review," resigns to enter business on his own account, and will engage in the manufacture of apparatus for the production of acetylene gas for residence and business houses. While we greatly regret to part with him, he carries into his new work the best wishes of all connected with this publication, as well as the large number of our readers who know Mr. Marshall personally. His company has already entered upon a fine business with excellent prospects for the future.

ELECTIONS.

MR. E. B. SMITH has been chosen president of the Easton (Pa.) Transit Co.

THE HOUSTON (TEX.) ELECTRIC STREET RAILWAY CO. has chosen officers as follows: President and treasurer, A. N. Parlin; vice-president and general manager, H. F. MacGregor; secretary, F. J. DeMerrett; auditor, J. W. Payne; superintendent, E. S. Ellis.

THE TACOMA (WASH.) RAILWAYS & POWER CO., organized to effect a consolidation of the street railway and power

companies of Tacoma, taking effect April 1st, chose the following officers: President, Gordon Abbott; vice-president, L. H. Hale; treasurer, R. T. Paine; secretary, J. N. Keeler.

THE NATIONAL TRACTION CO., which was recently chartered to build an electric railway from Columbus, O., to Indianapolis, Ind., has chosen the following officers: President, J. Q. A. Coover, of Spanker, O.; vice-president, O. P. Waymire, of Springfield; secretary, N. H. Albaugh, of Tadmor; treasurer, S. R. Fergus, of Phoneton. Additional directors are B. F. Weldy, I. F. Hutchins, C. H. Allen and M. C. Reynolds.

THE VIRGINIA ELECTRICAL RAILWAY & DEVELOPMENT CO., Richmond, Va., has chosen directors as follows: W. B. Oliver, H. Irvine Keyser and F. C. Todd, Baltimore, Md.; and Messrs. John L. Williams, James H. Dooley, S. W. Travers, E. L. Bemiss, Langhourne M. Williams, J. W. Rothert, W. M. Habliston and Joseph Bryan, Richmond, Va. Mr. E. L. Bemis was elected president.

THE MILWAUKEE, RACINE & KENOSHA ELECTRIC RAILWAY CO., which recently entered into working agreement with the Milwaukee Electric Railway & Light Co., has chosen officers as follows: President, Matthew Slush; vice-president, A. W. Bishop; general manager, John I. Beggs; treasurer, George O. Wheatcroft; secretary, H. C. Mackay. The last three are officers of the Milwaukee Electric Railway & Light Co.

OBITUARY.

MR. GEORGE Y. LORING, who was for many years superintendent of the Oakland (Cal.) Railway Co., died on March 29th at the age of 76.

MODERN STREET CAR BRAKES.

Now that the modern high-speed motor car has generally superseded the old-fashioned horse car, the demand for a more efficient braking apparatus is recognized by railway companies. The ordinary chain and spindle brake has often proved inadequate for the heavy electric cars of today, and while many braking devices have been invented and tried, but few have proved successful.

We illustrate herewith a simple and ingenious brake, which has been adopted by many roads, and, it is said, fully meets all requirements. It is called the "Sterling" safety brake.

The device is made up of a pinion shaft, socketed to the brake staff and geared to a double sprocket wheel, in the ratio of five to two. By this simple gearing device the motorman's power is multiplied and a quick, powerful and positive action is secured. The

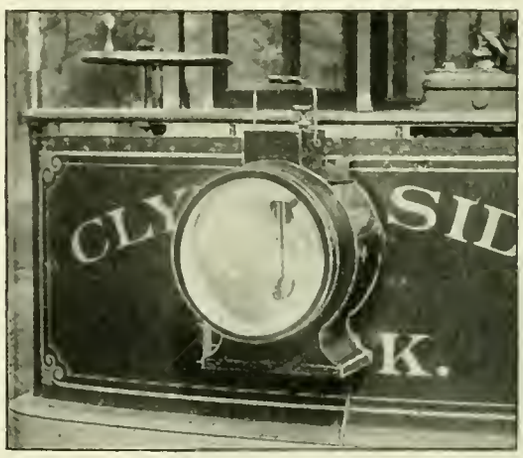
STERLING SAFETY BRAKE.

double sprocket wheel carries two continuous chains, which connect with the brake shoe rod. The double chain connection insures safety, as, in the event of one chain breaking, the other becomes operative instantly. The wear on the chain is equally distributed through the double sprocket wheel, thus avoiding the continual "grinding," wearing through and replacing of chain, common to the ordinary brake. This is quite an important item, as the old-fashioned chain on a spindle shaft wears out on an average in from 6 to 10 months and costs considerable for maintenance. The double sprocket wheel and gears are protected by housing. The pinions and gears are made of steel, the castings of the best gun metal and the chain is a special quality.

The device is extremely simple, having few parts, and none which are liable to get out of order. It is easy and inexpensive to apply and its cost is about one-sixth that of an ordinary power brake. It is in successful operation on hundreds of cars and has proved highly satisfactory in service.

AN ARC HEADLIGHT.

A detachable arc headlight for trolley cars has been invented by H. P. Wellman, and is here shown. The lamps have been in use for two years on the cars of the Ashland & Catlettsburg Street Railway Co., and have given perfect satisfaction. The lamp takes a current



WELLMAN ARC LIGHT.

of from 2½ to 3½ amperes and throws a brilliant light on the track for a distance of one to two thousand feet ahead of the car. The lamp is hand fed, but has an automatic arc starter. If the circuit breaker cuts off the supply of current or the trolley leaves the wire the arc is started automatically as soon as the circuit is closed. A slight turning of the hand wheel to feed the carbons every three or four hours is all the attention necessary. The arc enclosure is constructed in a novel way being particularly accessible for removing carbons or cleaning. It has a complete metallic circuit and can be lifted from its socket on the car dash and swung to the right or left lighting the country on either side of the track, as is sometimes desirable at pleasure resorts, or in case of accident of some kind, or if the car trucks are to be examined. Standard ½-in. carbons for enclosed arc lamps are used and the lamp is very economical in their consumption. The current is reduced through a german silver resistance substantially built of iron and porcelain and once installed it requires no further attention.

With this headlight there is no excuse for a motorman striking an obstruction on the track, as he can see as well by night as by day. This lamp has saved the Ashland & Catlettsburg Street Railway Co. from several serious accidents, notably one in which a wagon containing four occupants with horses rolled down an 8-ft. embankment onto the track within 350 ft. of an approaching electric car, running 20 miles an hour. The motorman at once saw obstruction on the track, and by quick application of the brakes stopped the car in time to avoid a most distressing accident, which would have been unavoidable with an ordinary headlight.

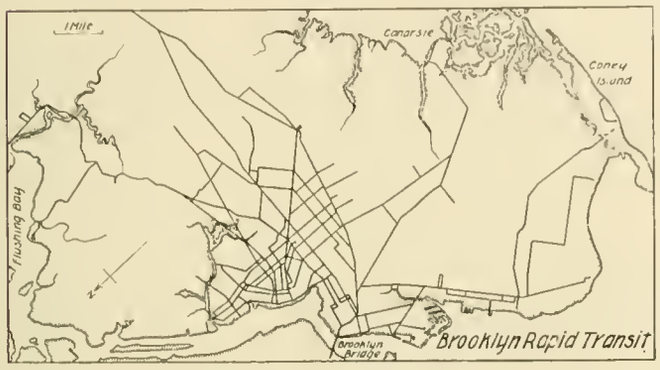
BROWN BROTHERS BUY ANOTHER ROAD.

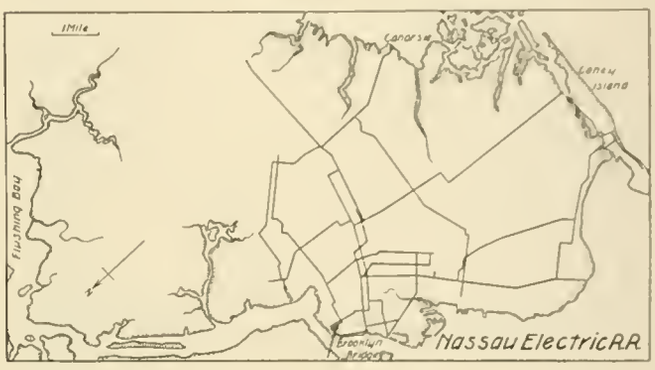
Mr. August Gehner, who purchased the property of the Peoples' Railway Co., of St. Louis, at receiver's sale announced on March 31st that arrangements for the sale of the road to the Brown Brothers syndicate had been completed, and that the transfer would take place as soon as the necessary papers could be prepared. The Peoples' Ry. has 9½ miles of cable road.

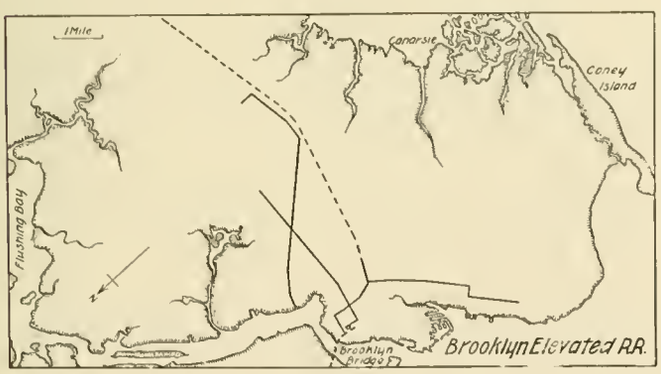
THE BROOKLYN RAPID TRANSIT CO.

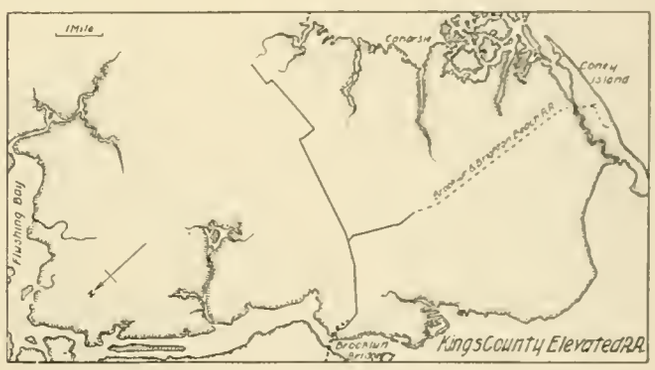
Clinton L. Rossiter, who now stands at the head of what is practically the urban transportation system of Brooklyn, is a man who has won his way rapidly and steadily to prominence and success, but withal in a quiet and unassuming manner; and while doing this he has found time to make warm friends out of his large circle of acquaintances. The same abilities and qualities which characterize the victorious general in the field, are those which we expect to find in one who undertakes to marshall the various transportation systems of a large city, and a strong hand and clear head carry out to success the immense financial undertaking of gigantic consolidations. Such, however, has been the record which Mr. Rossiter has been making, and now that he is bringing into one big family the great urban systems of Brooklyn, it is a pleasure to offer congratulations on the able manner in which the combination has been effected.

The Brooklyn Rapid Transit Co., which since its organization a little over three years ago has operated the largest street railway system of Brooklyn, has within a few months perfected arrangements by which it acquires nearly all of the important transportation lines on Long Island. The stockholders of this company secured control of the stock of the Nassau Eelectric R. R. a few weeks ago, and on March 25th purchased the Brooklyn Elevated; on March 21st the Brooklyn & Brighton R. R. and hotel property was bought, and it is reported that they have closed a bargain for the Kings County Elevated.









These four great systems are shown in their various ramifications by the accompanying maps, and the consituent companies are briefly as follows:

1. The Brooklyn Rapid Transit Co. was chartered in January, 1896, as successor to the Long Island Traction Co., whose property was sold under foreclosure proceedings in 1895. It controls through ownership of capital stock and bonds the following companies:

The Brooklyn Heights Railroad Co., which operates the Brooklyn City Railroad Co.'s lines (seven smaller roads have been at various times consolidated with the Brooklyn City) under a 999-year lease executed in 1893. The Brooklyn Heights owns 1.2 and the Brooklyn City 206.2 miles of track. The Brooklyn Heights operates 2,004 cars.

The Brooklyn, Queens County & Suburban Railroad Co. organized in 1894 as a consolidation of three other companies; it owns and operates by electricity 46 miles of track, and 309 cars.

The Sea Beach Railway Co., which owns and operates 14 miles of track by steam dummies.

The Sea View Railroad Co., which owns and operates 2.3 miles of elevated track by steam.

The total track operated by the Rapid Transit is 269.7 miles. The officers of the company are: President, Clinton L. Rossiter; vice-president, H. C. Du Val; secretary and treasurer, T. S. Williams; general superintendent, Ira A. McCormack. Mr Rossiter has also filled the positions of president and general manager of the Brooklyn Heights and the Brooklyn, Queens County & Suburban Cos.

2. The Nassau Electric Railroad Co. was chartered in 1893 and operated under franchises granted to the Kings County Electric Railway, the Coney Island, Fort Hamilton & Brooklyn Railroad and the Union Railroad Cos. In 1896 it leased of the Kings County Traction Co. for 969 years the property and franchises of the Atlantic Avenue Railroad Co., including the Brooklyn, Bath & West End Railroad Co. The company operated 132.24 miles of track with 926 motor cars.

3. The Brooklyn Elevated Railroad Co. was chartered in 1874. The Union Elevated Railroad Co. was consolidated with it in 1890, and in 1892 the Seaside & Brooklyn Bridge Elevated Railroad Co. leased to the Brooklyn Elevated all the various roads it was to construct. A receiver was appointed for the Brooklyn Elevated in 1897, and the reorganization has just recently been effected. This company operates 41.06 miles of track, 286 cars and 95 locomotives.

When the Brooklyn Elevated passed under the control of the court, its president, Frederick Uhlmann, was appointed receiver; the referee appointed to audit Mr. Uhlmann's accounts complimented him very highly upon the manner in which he had executed the trust, performing, with the help of his counsel, the duties usually performed by the president, secretary, treasurer and board of directors.

4. The Kings County Elevated Railway Co. was chartered in 1879, and its road opened in 1894. It owns 21.72 miles of elevated track and leases 6.67 miles of surface track from the Brooklyn & Brighton Beach R. R.; the company operates 155 cars.

The Brooklyn & Brighton Beach Railroad Co. owns 17.36 miles of road (measured as single track), connecting Atlantic avenue (Brooklyn) and Brighton Beach.

The mileage of the consolidated system of which Mr. Rossiter is the head is 475 miles, and this will doubtless be further increased at an early date by extensions where they are needed and by the acquisition of other desirable roads on Long Island. There are rumors that the control of the stock of the Long Island Railroad Co. will soon pass to the syndicate which controls the Rapid Transit.

The immediate result of the consolidation will be the equipment of the elevated lines for electric traction and the development of the elevated traffic. Mr. Rossiter states that Brooklyn is now to have real rapid transit. He says:

"We intend to make a feature of the elevated lines, and by electrically equipping them the running time will be materially reduced, in fact, it is intended to make the elevated lines so popular that the bulk of the travel will be on the overhead system. Instead of running cars every eight minutes in the rush hours and every ten or twenty minutes or half hour in the middle of the night, we will run cars on the elevated lines thoughout the entire day every two minutes.

"We can do this through the use of the electric system of motor power which will permit us to run one car trains when traffic is light at a very small cost as compared with the present steam system. If we can get the bulk of the travel on the elevated system, this will permit of the reduction in the number of cars operated on the street. I expect to take off at least one-third of the surface cars now operated and this will solve the vexatious problem of the congested state of traffic on Fulton St.

"Every effort will be made to induce people to ride on the elevated cars. The electric elevators will be put in at all the principal stations, so that the long climb upstairs, which has made the overhead system so objectionable, will be avoided. An express train service will be inaugurated, so that on holidays and in the summer time the cars which leave the Brooklyn Bridge at the Manhattan end will go direct to Coney Island without a stop. We will also inaugurate a liberal system of transfers between the elevated and trolley systems so that a passenger can ride the greater portion of his journey on the elevated line and complete it by way of the surface lines."

The Brooklyn Elevated is to be at once equipped with the third rail system; the electrical work on the Fifth Ave. Division is about half completed. Cars will be equipped with motors and shoes, and a part of them will have trolleys also in order that the Coney Island cars may run through. The steam road purchased by the Rapid Transit Co. is to be changed to the overhead trolley system. As soon as the company secures full control of the Kings County Elevated it is to be equipped for electricity.

The Atlantic Ave. line (shown dotted in Map 3) of the Long Island Railroad, which parallels the Kings County Elevated, and connects with the Brooklyn Elevated is to be joined to the latter road by an incline, which is now building, and it is stated that the Long Island R. R. will spend over a million dollars in equipping its lines with electricity.

TROLLEY WAR AT HOMESTEAD.

The borough of Homestead, near Pittsburg, has discovered a new source of income, that of fining the employes of the United Traction Co. and the Monongahela Traction Co., which engaged in a lively contest for the possession of McClure St., in Homestead. Formerly both companies used the tracks, but the United gave up its rights on condition that the Monongahela would enter into certain working agreements. This condition the former claimed was broken, and at 1 a. m. March 26th put a force of men to work cutting down the Monongahela wires in McClure St.; nine of these men were arrested. The company then hauled out a number of cars with horses, and so obstructed the track that no cars were run Sunday. At 10 a. m. the United Traction Co. put men at work to string wires; 21 of these were arrested and each fined $20 and costs.

General Manager Lardner, of the Tri-City Railway Co., Davenport, Ia., has ordered 12 new open cars, to be delivered May 1st.

GREENWOOD NO LONGER MANAGER OF PITTSBURG CONSOLIDATED.

Mr. G. F. Greenwood is no longer manager of the Pittsburg Consolidated, and his position has been taken by Mr. Charles Fitzgerald, who has been connected with the company ever since its purchase of the Citizens' Traction. Mr. Greenwood has not been entirely dropped from the company's rolls, having been given a position as consulting engineer, but will give most of his time to a bridge company of which he is also engineer. Mr. Greenwood's administration has not been a specially popular one from the standpoint of the public and employes, however competent he may be as an engineer.

Mr. Fitzgerald will bear the title of general superintendent, as the office of general manager will be abolished for the present. He is an experienced and successful operator, and came to Pittsburg from Philadelphia some 10 years ago.

CASHIER OF HOUSTON ROAD ROBBED.

Mr. E. M. Champion, cashier and assistant treasurer of the Houston Electric Ry., was sand bagged in broad daylight when leaving a bank with $3,000 of pay roll money and robbed of his money while unconscious. Upon being revived and learning that the money was gone, he tried to shoot himself through the head, but was saved by a friend, who struck the revolver and the ball missed. The company think highly of Mr. Champion and exonerate him from all blame in the matter.

AURORA, WHEATON & CHICAGO.

The Aurora, Wheaton & Chicago Railway Co. has been incorporated with a capital of $1,500,000, and will build electric lines from Aurora and Elgin into Chicago, which it is expected will be strong competitors for the steam roads.

The officers are: President, B. Mahler, of Cleveland, president of the Lorain & Cleveland Railway Co.; vice-president, L. J. Wolf, Chicago; treasurer, M. J. Mandelbaum, Cleveland, a banker and a director in several interurban electric roads; secretary, Edward Dickinson, assistant cashier of the Metropolitan National Bank of Chicago. Others interested are Henry Everett, of Cleveland, president of the Big Consolidated system of that city, and Will Christy, president of the Cincinnati & Hamilton.

These gentlemen have purchased the Northern Electric Ry., which has franchises from 47th St., Chicago, to River Grove, on the Desplaines River. This road has been run at a loss, but now it is the intention of the new company to put the roadbed in first-class condition and give it a northwestern terminus of some importance.

This same company will build two lines of electric railway, one from Aurora and one from Elgin, into Chicago. It has already acquired considerable of the right of way. Vice-President Wolf states that work will be begun during the summer and be pushed as rapidly as possible.

FATAL ACCIDENT AT WORCESTER, MASS.

A car on the Millbury division of the Worcester (Mass.) Suburban Street Railway Co. jumped the rails while crossing a bridge over the Blackstone River on the night of March 15th, and three persons were killed and one injured. A defective rail was the cause of the accident. After the car left the track it bumped over the wooden roadbed for more than fifty feet, when with a side lurch it shot diagonally, crashed through the iron railing of the bridge, and fell into the river about thirty-five feet below. The water was clear of ice and the car was almost entirely submerged, only the roof remaining in sight. The fall broke the car at about the middle and it was this fact that saved one life, that of a 60-year-old passenger. He managed to crawl up part way through this break and was thus saved from drowning. The others, the conductor and two motormen, one on duty and the other on his way home, were not only drowned but were horribly mangled.

It was with much difficulty that the passenger was rescued. He had been pinned in the break and remained with half of his body in the icy water for nearly an hour.

HALF FARES.

A strike of the Beaver Valley Traction Co.'s employes was begun last month, but amicably settled.

The common council of Erie, Pa., has passed an ordinance placing a tax of $25 per year on each street car.

The governor of Tennessee vetoed the bill granting street railway corporations power to conduct a lighting business.

April 1st the Punxsutawney (Pa.) Street Passenger Railway Co. began a 60-day experiment selling eight tickets for 25 cents.

The Oakland (Cal.) Consolidated Street Railway Co. will organize a ferry between San Francisco and Berkeley, Oakland and Alameda.

The Black River Traction Co., Watertown, N. Y., will probably erect another car barn if contemplated additions to its mileage are made.

W. O. Johnson, of Chicago, was on March 13th appointed receiver of the Freeport (Ill.) General Electric Co., operating the street railway.

"Motored" is the new word coined by a Cleveland paper when it wants to make a short cut in describing the collision of a motor car with a wagon.

The United Traction Co., Pittsburg, has received the contract to carry United States mail between Allegheny and Bellevue Station, a distance of five miles.

Mr. Henry Everett, of Cleveland, is understood to be negotiating for the Akron Street Railway & Illuminating Co., and to have made an offer of $1,250,000.

A bill has been reported in the New York Assembly requiring electric railways to equip their cars with fenders by January 1, 1900, with provisions for a fine of $50 per car after that time.

The Buffalo, Hamburg & Aurora Railway Co., which was mentioned in our last month's issue, is negotiating with the Niagara Falls power companies with a view to making a contract.

A bill has been introduced in the Missouri Legislature providing that no city council shall grant a street railway franchise except with consent of the owners of one-half of the abutting property.

The Comptroller of the Currency has ordered an assessment of 100 per cent on the stock of the insolvent National Bank of Illinois; the principal asset of the bank is the Calumet Electric Street Ry.

March 14th the motormen of the Keokuk (Ia.) Electric Railway Co. struck for shorter hours; two cars were kept running, being operated by employes of Mr. Hubinger, president of the company.

W. A. C. Ewan, of New York, proposes to organize a company capitalized at $1,000,000, to consolidate the street railways of Akron, O., and to be known as the Akron Consolidated Traction Company.

The Norfolk (Va.) Street Railroad Co. is now building an extension comprising 2½ miles of track. The company's summer cars have all been repainted and are ready for the opening of the season.

Perry Douds was on March 13th appointed receiver of the Mahoning Street Railway Co., of New Castle, Pa. The company was organized to build between New Castle and Mahoningtown, but never got farther than buying the ties.

The Toronto (Ont.) Street Railway Co. has been fined for running a car which did not have a vestibule for the protection of the conductor; the ordinance in question says that "motormen or others" perating the car shall be protected by vestibules, and the company has taken an appeal, claiming that the conductor does not operate the car.

Ann Arbor, Mich., seems destined to become a great center for electric interurbans. The Detroit, Ypsilanti & Ann Arbor Ry is finished; a contract for constructing an electric road to Lansing has been let; franchises for an interurban to Jackson have been secured, and the promoters for a road to Adrian have been encouraged and assisted by citizens in the towns interested. Should plans for all these roads be carried out Ann Arbor will present a scene of great activity this summer.

HAMILTON PRESIDENT CITY RAILWAY.

D. G. Hamilton, vice-president of the Chicago City Ry., has been elected president to fill the vacancy caused by the death of Mr. Bowen. Mr. Hamilton was, until recently, president of the National Railway Co., operating St. Louis lines.

THEFT OF COPPER.

The prevailing high prices of copper have made the overhead lines and bonds of electric railways very tempting to thieves and the companies are suffering in consequence. A case is reported from Chester, Pa., where the copper rail bonds were systematically removed from the tracks of the Chester Traction Co. in broad daylight. After the loss of the bonds had been discovered it was easy to find the man who took them, as he had been seen at work by many persons to a number of whom he hau said he was an employe of the company. Upon his arrest, he gave the name of Walter Lyons and admitted the theft; he was committed to jail in default of $500 bail.

NEW CHICAGO MANAGER FOR WESTINGHOUSE.

Mr. Arthur Hartwell has been chosen to succeed Mr. Maurice Coster in the management of the Chicago office of the Westinghouse Electric & Manufacturing Co. Mr. Hartwell is an Ohioan and for a number of years was interested in the gas business. About ten years ago he entered the service of the Westinghouse Co. and has been with it ever since. He was some time ago given the management of the Pittsburgh office, but has now been transferred to Chicago, where he fills a similar position. He is already favorably known to many in the electrical fraternity of Chicago, who welcome him as a valued addition to their numbers.

H. M. BRINCKERHOFF.

Mr. H. M. Brinckerhoff, who has been for several months superintendent of motive power and way of the Metropolitan Elevated Railway Co., Chicago, succeeded Mr. W. E. Baker in charge of the operating departments of the road, with the title of assistant general manager.

Mr. Brinckerhoff has had a wide experience in electric railway work. He graduated from the Steven Institute of Technology, taking the degree of mechanical engineer and then spent two years as a workman on line work, car equipping and repairs, power station operation, etc., with the West End road of Boston, and the Belt Line Street Ry., of Utica, N. Y. He was the assistant electrical engineer on the Columbian Intra-Mural Ry., during the Columbian Exposition, and assisted in planning, equipping and operating that line.

Mr. Brinckerhoff took the position of electrical engineer with the Metropolitan Elevated Railroad Co. and held it during the construction and afterwards until appointed superintendent of motive power and way last winter. His friends all wish him continued success in the management of his road.

New Work in 1899.

Electric Railway Extensions, New Buildings and Equipments, Recently Incorporated Electric Railway Companies, and Proposed Electric Railways.

ALABAMA.

HUNTSVILLE.—T. W. Pratt has applied to this city for an electric railway franchise, offering to have three miles of line in operation within sixty days.

BIRMINGHAM.—The Birmingham Traction Co., Alex. T. London, president, and Geo. H. Clarke, manager, will shortly buy ten new closed cars.

BIRMINGHAM.—The Bloomfield & Orchard Lake Railway Co. has a franchise to construct an electric railway to Orchard Lake.

BIRMINGHAM.—The Birmingham Railway & Electric Co. is now reconstructing the lines of its city division, requiring the laying of new cross-ties, new rails and new switches.

GADSDEN.—The Gadsden & Attalia Union Railway Co. has contracted with the Alabama Light & Power Co. to furnish the plant of the railway company with electricity and is changing the line into an electric system.

ARKANSAS.

FORT SMITH.—The Fort Smith Traction, Light & Power Co., Samuel M. Loud, president, and A. N. Sicard, secretary and treasurer, is now equipping its lines with electricity and expects to have them in operation by July 1st. The company is putting in two 100-kw. Westinghouse generators coupled to 150-h. p. Porter-Allen engines. It will operate about seven cars at first and will furnish the city with light.

PINE BLUFF.—Seven miles of electric railway will be built by the Pine Bluff Electric Light & Street Railway Co. This company was incorporated Dec. 6, 1898, with a capital of $300,000.

CALIFORNIA.

LOS ANGELES.—The contract for building the Alhambra Electric branch has been signed by the officers of the Los Angeles Terminal Ry. and the city of Alhambra. The conditions are that cars shall be running within five months.

FRESNO.—The Fresno Railway Co. was incorporated March 16, to build a standard gage electric railway in Fresno County, and carry freight as well as passengers. One branch of the line will run to Clovis and together with other branches the estimated length of the road is twenty miles. The company has a capital stock of $500,000, and the directors are: Alexander Gordon, W. M. Wyatt, W. H. McKenzie, C. W. Jones and S. N. Griffith.

KERN CITY.—The necessary funds for the proposed electric line between this city and Bakersfield are reported to have been secured. The estimated cost of the road is $60,000. H. F. Williams is interested.

LOS GATOS.—E. N. Davis has petitioned the town council for franchise for an electric line to San Jose.

OAKLAND.—The Oakland Railway Co. F. S. Douby, president, and M. M. Martin, superintendent, is substituting electricity for the cable on San Pablo avenue.

SAN FRANCISCO.—The Market Street Railway Co., H. E. Huntington, president, and E. P. Vining, manager, will at once build two new lines.

SANTA BARBARA.—The Santa Barbara Consolidated Electric Co., C. W. D. Miller, president and manager, will between June and Jan. 1, 1900, build five miles of new track and rebuild one mile. It will buy two new coast style combination cars and extend its power house.

PASADENA.—The Los Angeles & Pasadena Electric Railway Co., C. W. Smith, president, and W. H. Smith, manager, will on May 1st begin building two miles of new track and will rebuild two miles.

REDLANDS.—The Redlands Street Railway Co., Henry Fisher, president, and J. H. Fisher, manager, will build four miles of new track between the Hotel Casa Loma and Canon Crest Park, commencing in a few months, and will rebuild four miles of its old lines; two combination cars will be bought.

LOS ANGELES.—The Los Angeles Railway Co., H. E. Huntington, president, and F. W. Wood, manager, is building an extension of five miles to its main line. The company will buy ten new double truck 33-foot cars, and build a car barn of 111 cars capacity.

SAN FRANCISCO.—The San Francisco & San Mateo Railway Co., A. B. Spreckels, president, and W. Clayton, secretary and purchasing agent, will double track its line from San Francisco to Holy Cross cemetery, thirteen miles; work will be commenced May 15th and completed by October 1st. The company will buy thirty-five double truck cars, and may possibly build a new power house of 2,500 h. p. capacity.

LOS ANGELES.—According to report the $75,000 bonus asked for the construction of a trolley line from this city to Whittier has nearly all been subscribed. It is thought that work on the line will be commenced in two months.

LOS ANGELES.—It is said that the Los Angeles & Redondo Railway, an 18-mile steam road, is to be changed to electricity. L. T. Garnsey, president, Los Angeles. The subsidy of $9,000 asked by the Los Angeles Terminal Railway for building the Alhambra electric branch line has been secured from the city and the road is now an assured fact. T. E. Gibbon, vice president of the L. A. T. Railway, Los Angeles, may be addressed.

SAN DIEGO.—The San Diego Electric Ry. is contemplating double tracking the line on Logan and National avenues. The track on Logan avenue will be 2,100 feet long. J. A. Flint, general manager.

VISALIA.—The directors of the Visalia & Tulare dummy line, operating in Tulare County between the places named, are considering the advisability of changing it into a trolley road. The power is to be supplied by the Mt. Whitney Power Co. and new cars will be provided.

PASADENA.—Geo. D. Leighton has secured the right to build and operate an electric street railroad in specified streets in this city.

ALHAMBRA.—A proposition for approval has been submitted to the people of this place by the Terminal Railway Co., which proposes to extend its main line, as soon as electricity is installed, from South Pasadena to this city, a distance of three miles.

FRESNO.—S. N. Griffith is interested in a company to build an electric street railway in this city with branches to the extent of twenty miles. It is said that the estimated cost will be $350,000. The power will be furnished by the San Joaquin Electric Co.

COLORADO.

PUEBLO.—The Pueblo Traction & Electric Co. has been incorporated here with a capital of $500,000. The directors are John F. Vail, Charles E. Gast, John O. Albert, John S. Macbeth and Thomas H. Devine.

BOWLDER.—Application has been made by citizens of this place for permission to build a trolley line through the city.

FLORENCE.—Surveys have been made for the proposed electric line between here and Canon City, the road to be later extended to Soda Springs and the coal camps.

VICTOR.—The Gold Belt line, about eight miles in length, is to be equipped with electricity as soon as the electric plant now building at Goldfield is completed, according to report.

CONNECTICUT.

EAST LYME.—Application has been made for the incorporation of the East Lyme Street Railway Co., which proposes to build an electric railway through the village of Niantic to Crescent Beach, Black Point, Flanders and Oswegatchie. Ex-Representative Calkins of East Lyme and New London is counsel for the company.

MONTVILLE.—The Montville Railway Co. has petitioned the legislature for amendments to its charter to build a 13-mile road north and south to Norwich and New London, and use electricity for motive power. Solomon Lucas, representative.

HARTFORD.—The Hartford Street Railway Co., E. S. Goodrich, president, and N. McD. Crawford, will build three-quarters of a mile of new track in Hartford, commencing work in April.

WATERBURY.—The Waterbury Traction Co., D. S. Plume, president, and J. E. Sewell, general manager, has petitioned the city council for permission to lay tracks on the Watertown road within the limits of Waterbury, and if it is granted work will be begun at once.

NORWICH.—The Norwich Street Railway Co., Billings B. Learned, president, and W. L. Adams, superintendent, will build an extension of one-half mile.

NEW BRITAIN.—The Central Railway & Electric Co., A. M. Young, president, and E. H. Mather, manager, will build two and one-half miles of new track between Plainville and Southington, which is to be completed by July 1st.

NEW HAVEN.—It is reported that a consolidation is contemplated of all the street railroads in this city. Thomas M. Waller, James D. Dewell, Israel A. Kelsey, Harrison Wagner and W. B. Ferguson, representatives of different street railways in New Haven, have petitioned the General Assembly for an act of incorporation permitting them to form a new street railroad company and to build extensions to the present lines. The consolidation would embrace the New Haven Street, the New England Street, the Westchester Avenue, the West Shore and the Fairhaven & Westville Companies.

NORWALK.—The Norwalk Tramway Co. has completed plans for a new storage station and extensions of its systems to be made in the spring. W. R. Thompson, chief engineer, 40 South Main street, South Norwalk.

SOMERS.—A petition has been filed for a charter for an electric railway to be operated between this city and Enfield by the Enfield & Somers Electric Railway Co. George E. Kenney is interested.

HARTFORD.—A charter has been applied for by W. E. Goodwin of Elmwood and Fred C. Rockwell of Hartford, who wish to build an electric line from Hartford to New Britain.

CROMWELL.—F. W. Siebert, Edward W. Shedd and C. Siebert will apply for a charter to build an electric railway in this city.

BRANFORD.—The Branford Electric Railway Co. capitalized at $200,000 has been organized by the Branford Electric Co., to build a line to East Haven. A. M. Young, president.

DELAWARE.

WILMINGTON.—The New Castle & Delaware City Railway Co. has been incorporated with a capital of $100,000, for the purpose of building a line between the points named in the title. The incorporators are: Harry A. Richardson, president of the First National Bank of Dover; Peter J. Ford and Peter L. Cooper, Jr.

DISTRICT OF COLUMBIA.

WASHINGTON.—The Washington & University Railroad Co., F. C. Kennedy, president, and J. D. Croissant, manager, will build an extension four miles, beginning work this month. The company will buy four new cars and build a new car house.

WASHINGTON.—The Capital Traction Co., G. T. Dunlop, president, and D. S. Carl, superintendent, began rebuilding one and one-half miles of its line on April 1st.

FLORIDA.

JACKSONVILLE.—The Main Street Railway Co. has been granted a new charter by the city council, under which the company is authorized to build an extension of its present line. New stock will be issued to cover the cost of the improvement. S. B. Hubbard, president.

GEORGIA.

MACON.—The Macon Electric Light & Railway Co., T. J. Carling, president and manager, is rebuilding one mile of track, and is building a new power house of 1,000 h. p. for railway and lighting work.

ATLANTA.—The Atlanta Railway Co., M. F. Amorous, president, and F. M. Zimmerman, manager, will build eleven and one-half miles of new track between the present time and November, and rebuild twelve miles of old track. The company has recently bought fifteen new combination cars.

AUGUSTA.—The Augusta Railway & Electric Co., D. B. Dyer, president, and W. E. Moore, manager, is going to install three 400-kw. turbine-driven generators.

ATLANTA.—The Atlanta Consolidated Street Ry. has petitioned for the right of way to build an extension along the east side of the East Point road to Oakland City.

IDAHO.

WARDNER. — Articles incorporating the Wardner Kellogg Electric Railway Co. have been filed with the Secretary of State. The company is capitalized at $500,000 and purposes to build an electric railroad from Kellogg through Wardner through the Bunker Hill mine and from Kellogg to Government gulch. The directors are: Bartlett Pressley and Margaret Pressley of Kellogg; Lawrence O'Neill of Murray; B. Flaig of Wardner and William W. Woods of Wallace.

ILLINOIS.

KANKAKEE.—Plans are under way for changing the route of the Kankakee Electric Street Ry. in order to avoid a steep hill on Harrison avenue.

DANVILLE.—The Danville Gas, Electric Light & Street Railway Co. is figuring with contractors for the erection of a depot at the Soldiers' Home.

ROCKFORD.—The Rock River Electric Railway Co., E. M. Hopkins, president and manager, which has offices in Chicago, will commence work at once on twenty-eight miles of electric railway between Rockford and Oregon. A power house of 800 h. p. capacity and a car barn will be built and fourteen cars bought.

QUINCY.—The Quincy Horse Railway & Carrying Co. will build three miles of extensions to be completed by June 1. The company has bought twelve new Brill cars, and will build a new car house of twenty-eight cars capacity.

CHICAGO.—The Chicago City Railway Co. will rebuild eleven miles of track in Halsted street, the work to be completed by July 1. Some new work may be done if the necessary franchises are granted.

JOLIET.—The Joliet Railroad Co., W. F. Milliken, president, and C. C. Rush, superintendent, will build an extension of one mile of new track between Bush Park and Rockdale, and rebuild several miles.

PEORIA.—The Peoria & Pekin Terminal Railway Co., T. J. Miller, president, and L. E. Myers, manager, will build twelve miles of new track between these cities which it expects to have completed by July 1st. Ten 40-foot open cars will be bought, and a car barn, 100x200 feet, and a power house of 1,000 h. p. capacity built.

PRINCETON.—The Princeton, Spring Valley & LaSalle Railway Co. will build twenty-six miles of electric road between Princeton and LaSalle, commencing work as soon as possible; it will buy at least twenty cars.

ALTON.—The Alton & East Alton Railway & Power Co. and the Alton Railway & Illuminating Co., of both of which J. F. Porter is president, will build five miles of track between Alton and East Alton and Upper Alton, commencing work at once and opening the line by July 1st. Two miles of track will be rebuilt using 70-pound rails. Five new 30-foot cars will be purchased and a car barn, 80x125 feet, to hold twenty cars, is to be built.

ROCKFORD.—T. M. Ellis, general manager of the Rockford Railway, Light & Power Co., states that it will build two and one-half miles of new track in Rockford, using 50-pound rails, and increase the capacity of its power house by 250 kw. A line to Belvidere, twelve miles, will be surveyed and it is hoped that the right of way can be secured and construction begun during the present season.

BLOOMINGTON.—The Bloomington & Normal Railway Co., A. E. De Mange, president, and John Eddy, manager, will build five miles of extensions and rebuild three miles, commencing work May 1st. The company has just completed a new car house having a capacity of forty cars.

OTTAWA.—The LaSalle County R. R. to connect Streator, Ottawa and LaSalle will comprise when completed fifty-two miles of track. The affairs of the company are in charge of Naugle, Holcomb & Co., Chicago, who will begin work as soon as the weather permits. Some thirty-two miles of track will be entirely new construction and much of the remaining twenty miles will have to be rebuilt. It is the intention of the company to furnish power for the railway and also for lighting the three cities from a single power station. About twenty-five new cars will be bought.

GALESBURG.—The Electric Motor & Power Co., Fred Seacord, president and manager, is making an addition to its power plant in order to do a lighting business.

PEORIA.—The Central Railway Co. has petitioned the city council for permission to build two branch lines, one to start from its present tracks on Main and Boulevard streets and the other on Depot street. If the franchise is granted the work is to be completed in ninety days.

BELLEVILLE.—The Belleville Electric Railway Co. will extend its line one-half mile into the city limits, and replace one and a half miles of single track road with double track, the material for which has already been purchased. John A. Day, president and general manager.

MOLINE.—The Tri-City Street Railway Co. will lay new rails on the tracks of the blue line from First street to the city limits.

SYCAMORE.—The Lake Geneva, Sycamore & Southern Electric Ry. has petitioned the supervisors of DeKalb County for permission to build through that county. A 20-year franchise is asked for, with a single track road. The company was incorporated in December, 1897, with a capital stock of $155,000. George B. Morris and John B. Whalen are among those interested.

INDIANA.

HAGERSTOWN.—A franchise has been granted the Interurban Traction Co. permitting it to run an electric line through this place, the intention ultimately being to form connections with Indianapolis and Richmond.

TERRE HAUTE.—The Terre Haute Electric Railway Co., Joshua Jump, receiver, and M. F. Burke, manager, will rebuild two miles of track.

FRANKFORT.—The Clinton Traction Co., Geo. T. Dinwiddie, president, and J. W. Morrison, manager, will build ten miles of electric railway in Clinton county. It expects to begin work in four months and open the line next year.

GREENFIELD.—The Indianapolis & Greenfield Rapid Transit Co., John J. Cooper, president, will build a 25-mile line between Knightstown and Indianapolis, commencing work June 1st and completing it by October of this year. It will buy ten cars and build a car barn and power house.

AUBURN.—The Northeastern Indiana Street Railway Co., S. A. Powers, Angola, Ind., president, and W. E. Griswold, Auburn, manager, is arranging to build an electric line between Ft. Wayne and Orland, forty-five miles.

CAMBRIDGE CITY.—The Cambridge City Interurban Traction Co. will build twenty-five miles of lines to connect Cambridge City, East Germantown, Mt. Auburn, Dublin, Milton, Hagerstown and Economy; work is to be commenced in sixty days and the line is expected to be opened by September 1st. The company will buy twenty-five cars and build a car house and a power house of 900 h. p. capacity. Messrs. Kenney & Kepler, Cambridge City, are in charge of the plans.

RICHMOND.—The Richmond Traction Co., Elijah Kessler, manager, will build two miles of new track extending its line to the Fair Grounds.

MICHIGAN CITY.—The Lake Cities Electric Railway Co., I. I. Sipro, receiver, and F. H. Root, superintendent, will build an extension of two miles during the coming summer and make some additions to its power plant.

WABASH.—The Board of Commissioners have granted the right of way for a new interurban electric line through Kosciusko County. Two routes were asked for. One from Rochester to Kendallville, via Warsaw, Vawter Park, North Webster and Albion, and the other from Rochester to Akron, Sevastopol, Burket and Palestine. Right of way has been granted along the highways in both cases, the promoters being permitted to select the route.

WABASH.—It is announced that the sale has been effected of the Indiana Electric Co's. lines in Elkhart, connecting that city with Goshen and including the seven miles of track in Elkhart, the purchasers being Delworth & Kennedy, owners of the South Bend system. The new owners will build an electric street railway from South Bend to Goshen, a distance of thirteen miles, this fall.

ELWOOD.—The Elwood Electric Street Railway was sold January 2d to the Union Traction Co. This company has already completed the line from Anderson to Alexandria, and the council of this city will immediately grant the company the right of way into Elwood. Charles S. Henry, president.

INDIANAPOLIS.—Charles L. Harry, superintendent of the Kokomo Railway Co., has filed petitions with the commissioners in Tipton and Hamilton Counties, asking for the right of way and privileges of building an electric railroad extending from Tipton south through Atlanta, Arcadia and Cicero to this city. E. H. Shirk, president of the Tipton National Bank, is also interested in the proposed road.

ANDERSON.—N. N. Morse, representing Indianapolis capitalists, has petitioned the commissioners for a franchise to build an electric railway from Anderson to Ingalls, via Pendleton.

NEW CASTLE.—The commissioners of Henry County have granted a franchise to the New Castle Electric Railway Co. to build in this city. The franchise requires work to begin before October, 1899. The directors of the company are E. B. Phillips, P. Wisehart, Thad. Gordon, D. P. Jennings and T. B. Millikan.

RICHMOND.—A. C. Lindemuth of this city, as agent for W. A. Pickens of Indianapolis, Ind., has petitioned the council for a franchise to build a railway through this city, using either steam, electric or other motive power.

LEBANON.—The Board of Commissioners of Boone County has been petitioned by a traction company for an electric line connecting Indianapolis with Lebanon,, Logansport, Delphi, Frankfort and Lafayette. It is proposed to ultimately construct a line connecting Chicago with the Indiana gas belt.

INDIANAPOLIS.—The county commissioners have granted a 50-year franchise to D. P. Erwin, David M. Parry and D. M. Ransdell, to build an electric railway over the National Road via Bridgeport. The line is to be completed before September, 1901.

PORTVILLE.—Ellis C. Carpenter of Anderson, representing the Charles L. Henry Union Traction Co., has been granted a franchise for the use of the streets for the proposed new electric line. The right of way has now been secured in all the incorporated towns between Anderson and Indianapolis, and it is thought work will be commenced at once.

LOGANSPORT.—The Indianapolis & Logansport Traction Co. has been granted a 50-year franchise along the Michigan road to the north

county line; the proposed road will occupy the west side of the highway and is estimated to cost $1,000,000. Louis C. Walker, Indianapolis, is counsel for the company.

ROCHESTER.—A franchise has been granted by the commissioners of Fulton County for an electric railway from this city to Winona Lake. This will be an extension of the proposed road from Logansport to Rochester.

MEROM.—It is reported that A. D. Hayworth, of Washington, D. C., and others are interested in the construction of an electric railway from Terre Haute to Merom, a distance of thirty-two miles.

EVANSVILLE.—Henning & Henning of Dayton, O., are said to represent capitalists who contemplate the construction of a suburban line from Evansville to Rockport, Tell City and Cannelton. C. J. Murphy of the Business Men's Association may be addressed.

ALBANY.—Surveys for an electric line between this place and Pennville, passing through Dunkirk, have been completed, and work on the proposed line will begin at once.

WARSAW.—Surveys have been completed for the three-mile electric line between Warsaw and Winona, which Noah J. Clodfelter proposes to build and have in operation by June 1.

RICHMOND.—The Interurban Railway Co. was incorporated March 8th to build from this city to Cincinnati, O., via Scipio. Benj. Starr, president.

IOWA.

CEDAR RAPIDS.—A stock company has been organized and the city council has been petitioned for a 20-year franchise for a street railway in this city. The promoters of the scheme are G. W. Koontz, S. Bradley and C. S. Mercer.

OTTUMWA.—The Ottumwa Electric & Steam R. R. has been incorporated with a capital stock of $200,000 to build an electric street railroad in the city of Ottumwa and vicinity. The company is permitted to use either or both steam and electricity. The directors are: J. H. Merrill, William Daggett, J. B. Sax, J. W. Garner, Samuel Mahon and Calvin Manning, all of Ottumwa.

MISSOURI VALLEY.—A number of prominent citizens and capitalists of this city are preparing for the organization of a company for the building of an electric railway plant and line in Missouri Valley. Messrs. Edgecomb, Deur, Kellogg and Kramer are at the head of the project.

MUSCATINE.—H. W. Hutting has sold half interest in the Muscatine Electric R. R. to L. W. Prior. New extensions and improvements will be added.

KANSAS.

LEAVENWORTH.—The commissioners of Leavenworth County have granted a 50-year franchise to A. A. Fenn and others to construct an electric line connecting Kansas City and Leavenworth. Work is to begin by April 1 and to be completed by Jan. 1, 1900.

LEAVENWORTH.—The Leavenworth Electric Railroad Co., Newman Erb, president, and E. E. Coombs, manager, expects to build a new brick car barn to house thirty cars, and to buy four new open motor cars.

CHERRYVALE.—A franchise has been granted to C. J. Corbin to build an electric railway from Cherryvale to Corbin City, a new town, one mile distant.

KANSAS CITY.—A charter has been granted to the Kansas City & Leavenworth Railway Co. to construct, operate and equip a railway from Kansas City, through Lansing and other intervening stations, to Leavenworth, Kan. The capital stock of the company is $1,000,000. The directors are D. H. Kimberly, Chas. O. Everts, H. C. Ellison, all of Cleveland, O.

IOLA.—The Iola Rapid Transit & Electric Light Co., W. S. Hendricks, president, and A. W. Reck, manager, will build a line from Iola and La Harpe, between May and September. The company will buy five new cars.

KENTUCKY.

FORDSVILLE.—An electric tramway half a mile in length will soon be built by the Fordsville Block Coal Co. Address Ike C. Adair, secretary and treasurer.

COVINGTON.—The Cincinnati, Lawrenceburg & Aurora Electric Street Railroad Co. has applied to the county commissioners for a 50-year franchise and right of way to build and operate a single or double track electric street railroad from Anderson's Ferry to the Indiana state line.

PADUCAH.—The Paducah Street Railway Co. has filed a trust deed to the America Trust & Savings Co. for the sum of $400,000, to be used for the purpose of enabling the street car company to issue additional bonds for improvements.

CARROLLTON.—A company has been incorporated here, according to report, to build an electric line from Warsaw to Milton and from Carrollton to English Station. Myron O. Baxter, president.

LOUISIANA.

NEW ORLEANS.—The Orleans Railroad Co., E. Perrin, president, and V. L. Welloz, superintendent, will shortly add two new cars to the equipment.

NEW ORLEANS.—The New Orleans & Carrollton Railroad Co., J. K. Newman, president, and Geo. H. Davis, manager, will rebuild the St. Charles Ave. line, using 100-pound rails, and build an extension along Carrollton Ave. to Athletic Park.

MAINE.

LEWISTON.—The Lewiston, Brunswick & Bath Street Ry., A. H. Shaw, president, and A. F. Gerald, manager, expects to build a new car barn at Lewiston, 108x154 feet, and a power house, 50x90 feet, equipped with machinery of 1,000 h. p. capacity.

GOULDSBORO.—John G. Moore, J. Montgomery Sears and other well-known capitalists are considering the project of an electric railroad from Winter Harbor, through Gouldsboro and connecting with the Washington County Railroad, a distance of about ten miles; four miles of the proposed railway has already been surveyed.

SACO.—Isaac A. Walker & Son of Philadelphia have been given the contract for equipping and building the Saco River Electric Railroad. The line extends from Saco to Bonny Eagle and is about eleven miles in length.

BANGOR.—The Bangor, Hampton & Winterport Railway Co. is preparing plans to extend its line in the early spring to Winterport and to have it completed by July 1st. President, N. H. Mitchell, 29 Hammond street.

BELFAST.—James Mitchell, a railroad contractor and promoter of Bangor, Me., is to build a five-mile electric railroad this spring between this city and Northport.

BENTON FALLS.—The Benton Falls & Fairfield Ry., which was built principally for freight traffic, and now operating five miles of road, will build a new power station on the Sebasticook, about two miles above Benton Falls.

MARYLAND.

CUMBERLAND.—The Cumberland Electric Railway Co., Geo. L. Wellington, president, and W. M. Roberts, jr., superintendent, is now building an extension to its car barn.

CUMBERLAND.—A new franchise has been granted to the promoters of the Cumberland-Westernport Electric Ry., which requires them to begin work within 90 days, and to have the entire road completed and in operation within two years. E. F. Walker, president, Philadelphia, Pa.

ANNAPOLIS.—The Baltimore, Marley, Mountain Bar Electric Railway Co. has just been incorporated in this city with a capital of $50,000 in shares of $50, to construct an electric railway from this place to Baltimore City and Mountain Bar.

CUMBERLAND.—Surveys have been begun for the proposed electric railroad from this city to Westernport, a distance of 30 miles. Engineer, G. B. Howell, Philadelphia, Pa.

BALTIMORE.—The Baltimore Consolidated Railway Co. has made a survey along the Frederick turnpike from Elliott City to St. Johns college, a distance of about six miles, for a proposed single track extension.

MASSACHUSETTS.

DEDHAM.—Work is in progress on the Norfolk Western Street Ry., on High St. The proposed route is from Medfield to Dedham, via Westwood, nine miles. President, W. W. Mitchell, Medfield, Mass.; engineers, Hodges & Harrington, 60 State St., Boston.

TAUNTON.—The Taunton & Middleboro Street Railway Co. has been organized to build a street railway from the terminus of the East Taunton Street Railway in Taunton through Lakeville to the location of the New Bedford, Middleboro & Brockton Street Railway, a distance of 5½ miles. The directors are Fred C. Hinds, Newton; A. M. Bearse, Middleboro; A. P. Smith, New Bedford, and others.

FITCHBURG.—The Gardner, Westminster & Fitchburg Railway Co. has been granted a franchise to build a street railway to the town line of Westminster.

MEDFIELD.—Contracts will be let in a few days by the Norfolk Western Street Railway Co., for the proposed electric line between this city and Dedham, via Westwood, a distance of nine miles. Engineers, Hodges & Harrington, 60 State street, Boston.

BRAINTREE.—The selectmen of this place have granted a franchise to the Braintree & Weymouth Street Railway Co., to build on Meadow Road and French avenue.

NEEDHAM.—The railroad commissioners have authorized the Natick & Cochituate Street Railway Co. to extend its tracks to Needham. President, H. Harwood, Natick.

PITTSFIELD.—The Pittsfield Electric Street Railway Co. has been given permission by the aldermen to lay additional tracks on North and Wahcomah streets. Manager, P. C. Dolan.

QUINCY.—It is reported that the Quincy & Boston Street Railway Co. will soon build a car house, near Neponset bridge, on Robinson's wharf. The dimensions will be 93x23x144feet, and the cost, $15,000. B. J. Week, purchasing agent and superintendent, 4 Washington street, Quincy.

BRIDGEWATER.—The Brockton, Bridgewater & Taunton Street Railway Co. has petitioned the selectmen of Bridgewater for permission to lay a branch track from the main line to the power station. G. H. Campbell, president, Brockton, Mass.

WAITSFIELD.—This town has voted to issue $19,000 in bonds to aid in the construction of the proposed Mad River Valley Electric Ry. from Montpelier to Warren, via Middlesex, Moretown and Waitsfield, a distance of about 26 miles. F. C. Kennedy, president, Burlington, Vt.

GEORGETOWN.—The Georgetown, Rowley & Ipswich Street Railway Co. has been organized with a capital stock of $180,000, to build 18 miles of street railway. The incorporators are: C. E. Barns, 53 State street, Boston; Edmund B. Fuller, Haverhill, Mass., and others.

HINGHAM.—The selectmen of this city have been petitioned by the Hingham Street Railway Co. for an increased location for a double track from Broad Bridge to Hingham over North and Rockland streets to the Hull line. The plan also includes an extension in Hull to the beach.

LEXINGTON.—A franchise has been granted to the Lexington & Boston Street Railway Co. for a road in this city. It is understood that the company intends to extend its lines from Arlington Heights to Billerica, where connection can be made from the electric road to Lowell.

NORTHAMPTON.—The state railway commissioners have granted a charter to the Northampton & Amherst Street Railway Co., with a capital of $150,000. Among those interested are: F. S. Coolidge, Fitchburg, Mass.; E. F. Blodgett, Leominster; W. H. Gates, Hadley.

WINTHROP.—The selectmen have granted a franchise to the Winthrop & Boston Electric Railway Co.

LINWOOD.—The Linwood Street Railway Co. has been granted a franchise for an electric road between Linwood and Whitinsville. The road will connect at Whitinsville with the Worcester & Blackstone Valley Electric R. R., and will give a through line of 18 miles to Worcester.

EDGARTOWN.—The Edgartown Street Railway Co. has been organized with a capital stock of $30,000 to construct an electric road between here and Cottage City. Wm. H. Butle, of Boston, is interested.

WALTHAM.—The Waltham, Newton & Forest Hill Street Railway Co. has been organized with a capital stock of $200,000 to build a line 13 miles long between Waltham and Boston, via Newton. The directors are, Chas. F. Avery, Newton; Chas. H. Wilson, Brookline, and William M. Butler, of Boston.

WEBSTER.—The Webster & Dudley Street Railway Co., E. S. Hill, president, and John Flint, manager, will probably build some new track this season, but has not fully decided.

WHITINSVILLE.—The Worcester & Blackstone Valley Street Railway Co. has been granted a franchise by the selectmen to extend its line from Rockdale into Whitinsville.

WORCESTER.—The Worcester & Clinton Street Ry. will lease 8½ miles of new track between Clinton and Hudson, to be built at once by a company having the same officers as the Worcester & Clinton, and the new line is practically an extension of this company's interurban road. The Worcester & Clinton Ry. will buy two or three vestibuled cars and five or six open cars, and a new power house is to be built at West Berlin. A. S. Paton, of Leominster, is president, and J. W. Ogden, of Boylston Center, manager.

FRAMINGHAM.—The Framingham Union Street Railway Co. will add two open cars to its equipment.

PALMER.—The Palmer & Monson Street Railway Co., Chas. F. Grosvenor, president and manager, will probably build between Palmer and Monson Ware.

ROSTON.—The Martha's Vineyard Street Railway Co., J. H. Gilbert, president, and John A. Duggan, manager, will build nine miles of new track between Cottage City and Edgarton, commencing work about June 1st. The company will buy three or four cars and build a new car barn. The office of this company is at 60 State St., Boston.

GREENFIELD.—The Greenfield & Turners Falls Street Railway Co., Frank E. Lowe, president and manager, expects to build two miles of new track between Montague and Turners Falls. Work is to be commenced as soon as possible.

SPRINGFIELD.—The Springfield Street Railway Co., J. Olmsted, president, and A. E. Smith, manager, will petition for permission to extend the Belmont Ave. line one-half a mile from the present terminus of the West Springfield line.

MICHIGAN.

ADRIAN.—The Jackson & Adrian Electric Railway Co., H. C. Smith, president, and A. P. Southworth, manager, will build 40 miles of new track between Jackson and Adrian, commencing work May 1st. It will buy 12 cars and build a car barn and power house.

LANSING.—The Lansing, Dexter & Ann Arbor Electric Railway Co., C. A. Mapes, president, will build 61 miles of railway between Lansing and Ann Arbor.

OWASSO.—The Owasso & Corunna Electric Co., I. D. H. Ralph, president and manager, will build three miles of track as extensions to its city lines, beginning work as soon as possible. It will buy two new cars.

SAGINAW.—The Saginaw & Frankenmuth Electric Railway Co., which was organized last fall by capitalists of Saginaw, Mich., to build a 14-mile road from Saginaw to Frankenmuth vit Bridgeport, will commence work as soon as a franchise through Bridgeport can be secured.

MUSKEGON.—The Muskegon Street Railway Co., J. L. Crosby, president, and Fred W. Thompson, secretary, will rebuild two miles of track.

DETROIT.—The Grand Rapids & Kalamazoo Electric Railway Co. will build from 50 to 75 miles of new track between Grand Rapids and Kalamazoo and between Kalamazoo and Battle Creek, commencing work April 15th. From 20 to 30 new cars will be needed. W. W. Hannon is president and A. D. Prosser is secretary of the company.

LANSING.—It is rumored that an electric line will be constructed between Lansing and Grand Ledge and that the water power at the old mill at Delta Center will be used.

BAY CITY.—The Consolidated Street Railway Co. has been ordered to put in new crossings at points where the line crosses railway tracks, the present crossing having been declared defective by the railroad commissioner.

FLINT.—The Michigan Electric Railway Co., A. A. Talmage, president, and W. J. Schaefer, purchasing agent, announces that it will build 100 miles of electric railways near Flint; work is to be commenced by May and a portion of the line in operation by September of this year. Fifty cars, passenger and freight, will be bought; the plans contemplate four car barns and two or three power houses.

GRAND RAPIDS.—The Grand Rapids & Lake Michigan Railway Co., William J. Hess, president, and Robert Hanemann, manager, states that it will build 35 miles of new track between Grand Rapids, Holland and Macatawa Park, commencing work in May. The company will buy 25 new cars, 15 passenger and 10 freight.

DETROIT.—The Detroit, Mt. Clemens & Marine City Railway Co., capital $600,000, Chas. M. Swift, trustee, and the Detroit & Lake Orion Railway Co., John Winter, trustee, have filed articles of association with the secretary of state.

DETROIT.—The Detroit & Northwestern Railway Co. has been incorporated with a capital stock of $500,000 by Edward W. Voight, James A. Randall, Hoyt Post, Seymour Bovounell, Albert H. Wilkinson, James V. Oxtoby and W. F. Voight. The company proposes to build an electric street railway to the cities of Detroit and Pontiac, the villages of Farmington and Northville, in Wayne county, and also in Novi, Southfield, Bloomfield and Pontiac, in Oakland county. The entire road will be about 45 miles long.

MILFORD.—The village of Milford has granted Messrs. Park and Reynolds an electric road franchise through the village.

PETOSKEY.—Surveys are being made for an electric street railway from Cheboygan to this city.

YPSILANTI.—Captain E. P. Allen, of this city, has been granted a franchise by the town board of Saline for an extension of the proposed Ypsilanti & Saline Electric road toward Tecumseh.

LINDEN.—The Michigan Electric Railway Co., which proposes to construct an electric line through this city, connecting Fenton, Long Lake, Holly, Clarkson and Pontiac, has been granted a franchise by the city council. The route covers 87 miles, and the estimated cost of construction is $800,000. The road must be completed by September, 1900.

LANSING.—A corporation capitalized at $350,000 has recently been chartered in this city. It proposes to build a line of road from Freeport, Barry County, to Greenville, Montcalm County. The company will be known as the Grand Rapids, Belding & Saginaw Railway Co. William Alden Smith is interested.

BIRMINGHAM.—The Bloomfield township board has granted a franchise to a number of capitalists to build and operate an electric road from the village of Circle, a small town about two miles north of this place, to Orchard Lake. The road will be single track with necessary switches. George T. Hendrie, of Detroit, may be addressed.

VERNON.—The Vernon township board has granted a franchise to the Long Lake, Durand & Corunna Electric Railway Co. The company now has a clear right of way and expects to begin work next April.

DETROIT.—It is stated by the promoters of the proposed electric railway to Unionville that work will be commenced promptly.

DETROIT.—The Detroit & Pontiac Eilectric Railway Co. has increased its capital stock from $400,000 to $500,000 for the purpose of constructing a double track from Highland Park to Pontiac. The right of way has already been secured and the work of constructing the extra track will commence as soon as the weather permits. S. Hendrie, general manager.

GRAND HAVEN.—The common council has granted a franchise to Grand Rapids capitalists for an electric road from this city to Grand Rapids. The road is to be in operation in July. The power house will be located at Cooperville.

ANN ARBOR.—Westinghouse, Church, Kerr & Co. have the contract for building and equipping the Lansing & Ann Arbor Electric Ry. The road will run from Lansing to Mason, thence to Dexter, and from Dexter to Ann Arbor. C. E. Mapes and Dr. R. J. Shanks, of Lansing, may be addressed.

SUMMIT CITY.—Clark Cornwall, of Jackson, Mich., Arthur Woodard, Ann Arbor, and Walter Josly, of Ypsilanti, have been granted a franchise by the township board of Summit to construct an electric railway to Vandercook's Lake to Summit.

HUDSON.—The Clinton & Hudson Street Railway Co. has been granted a franchise by the selectmen to build and operate an electric railway through this town.

MINNESOTA.

ST. PAUL.—The Twin City Rapid Transit Co. is seeking a franchise in Stillwater for an extension to the recently acquired White Bear Lake line.

MINNEAPOLIS.—The Minneapolis & Champlain Suburban Railway Co. has filed articles of incorporation with a capital of $50,000. The incorporators are: Clifford D. Staples, president; Lorenzo L. C. Brooks, vice-president; F. D. Woodbury, secretary; Emory W. Hill, Collinwood Evans, Henry M. Morton, Anthony Chryst.

MISSOURI.

KANSAS CITY.—The Brooklyn Avenue Railway Co., J. H. Lucas, president, and W. H. Lucas, manager, commenced work April 1st on a three-mile extension to its Northeast and 10th St. line; the company will rebuild eight miles of track. A new car house for 70 cars will be built and 25 new combination cars bought.

KANSAS CITY.—The Kansas City Interurban Railway Co., with a capital of $300,000, has filed articles of incorporation. It proposes to convert the Waldo Park dummy line into an electric road. The organizers are Henry Pfeiffer, of Westport, H. G. Perk, B. H. Chapman and C. H. Mathews and C. H. Chapin, of Kansas City, Kas.

KANSAS CITY.—The East Side Electric Street Railway Co. has been given permission to take up the tracks of the defunct East Fifth street road and to begin work on its own line. J. J. Heim is interested in the new work.

KANSAS CITY.—It is reported that the Metropolitan Street Railway Co. has drawn plans and estimates for the changing of its cable lines into electricity. The change will involve 40 miles of cable track.

KANSAS CITY.—The Central Electric Railway Co., of this city, has been incorporated with a capital stock of $2,500,000 by P. B. Holmes, F. Hagerman and H. C. Page.

ST. LOUIS.—The Midland Terminal Railway Co. has been chartered with a capital of $75,000 to build an electric line, seven and one-half miles in length. The incorporators are: Valle Reyburn, J. P. Rodgers, L. E. Anderson, J. C. Kenny, J. B. Kruse, C. H. McMillan, Henry Vierling and G. W. Wilson.

ST. LOUIS.—The county commissioners have been petitioned by the St. Louis County Street Railway Co. for leave to substitute electricity for the present mule motive power. M. B. Greenfelder, president.

ST. LOUIS.—Surveys are being made for the proposed route of the electric line to Montesano, via Jefferson Barracks. J. D. Houseman, president.

SEDALIA.—Articles of incorporation have been filed by the Sedalia Electric & Railway Co., with a capital stock of $400,000. The directors are: C. H. Reeve, New York; J. C. DeDong, Brooklyn, and J. C. Van Riper, Wm. C. Evans and A. M. Trader, of Sedalia.

WEBB CITY.—The Southwestern Missouri Electric Ry., at present operated from Carthage to Galena, will soon build an additional three-mile line from Webb City to Oronogo.

FENTON.—The McCoy Construction Co. will begin at once the construction of the proposed Fenton & Southwestern Railway, from Fenton to Carondelet, St. Louis, a distance of 28 miles. Thomas F. Sneed, president.

NEVADA.—Quigley & Co. have petitioned the council for a franchise to build an electric street railway and also an electric light and gas plant. It is proposed to extend the line to

Eldorado Springs and other points within a radius of 20 miles. Estimated cost of the road is $100,000.

ST. LOUIS, MO. The Wellston, Creve Court, Lake & St. Charles R. R., J. B. C. Lucas, president, and J. D. Houseman, manager, is building 11 miles of new track between St. Louis and St. Charles and expects to have the line partly open in May. The company will buy 10 large new cars, put up a new barn with a capacity for 20 cars and a power house of 1,000 h. p. capacity.

KANSAS CITY, MO.—The Missouri Electric Railway Co., Henry Smith, president, and F. W. Sears, manager, will build 12 miles of new track. Work will be commenced July 1, 1899, and it is expected to open the line September 1, 1900.

MONTANA.

HELENA.—The Helena Power & Light Co., Henry M. Parchen, president, has made a proposition to the city with a view to building an electric line to East Helena.

BUTTE.—The Butte Consolidated Railway Co., W. A. Clark, president, and J. R. Wharton, manager, it building a 5-mile extension to its park line, which is to be completed May 15th. The company is now building a new car barn; 2½ miles of track will be built.

NEBRASKA.

OMAHA.—The East Omaha Street Railway Co., Dudley Smith, president, and Alfred B. De Long, manager, is contemplating improvements, but has not completed its plans as yet.

OMAHA.—The Omaha Street Railway Co. will rebuild from three to four miles of its lines, using 73-lb. rail. It has recently increased its equipment by 37 General Electric motors and 37 Peckham trucks, and fenders to equip all its cars.

NIOBRARA.—L. B. Rowe has applied to the council for a franchise to build an electric line in this city.

NEW HAMPSHIRE.

PELHAM CENTER.—A company in which W. H. Anderson, of Lowell, Mass., is interested has been organized to build an electric line between Lowell, Pelham and West Windham.

LACONIA.—The Laconia Street Railway Co., H. L. Pierce, president, and L. S. Pierce, manager, will build an extension of five miles, and expects to open it by June 15th. Four new cars have been added to the equipment and the car house has been enlarged. Heretofore the company has rented power, but it expects to build a power house of 500 h. p. capacity.

HAMPTON FALLS.—The railroad commissioners of New Hampshire have been petitioned by the Hampton & Amesbury Street Railway Co. for authority to issue $40,000 of capital stock in order to construct and equip a street railway in Hampton Falls and Seabrook, a distance of four miles.

BERLIN.—The Berlin & Gorham Electric Railway Co. has been chartered to construct an electric railway connecting the two towns named, a distance of about four miles. Carlos P. Day, president.

MANCHESTER.—The Manchester Street Ry. has been granted permission to extend its line to the village of Goffstown.

KEENE.—The act to increase the capital stock of the Keene Electric Railway Co. by $20,000 was approved March 7. The time for completing this road has been extended to March 31, 1902.

GILMANTON.—The Gilmanton & Barnstead Electric Railway Co. has been incorporated with a capital stock of $50,000 to build an electric line, about 10 miles long, between the places named. The incorporators are: Thomas Cogswell, Hiram A. Tuttle, Sherburne J. Winslow, George E. Kent, Charles E. Walker.

PORTSMOUTH.—The stockholders of the Portsmouth & Dover Railroad Co. have voted to authorize the Boston & Maine Railroad Co. to extend the Portsmouth Electric Street Ry. through Newcastle, Rye and Hampton and accept its proposition for the loan of money to complete the road until new stock could be issued to repay the loan.

NEW JERSEY.

HOBOKEN.—President Young, of the North Hudson County Railway Co., advises us that the company will build 21 new cars, 12 open and 12 closed.

BOUND BROOK.—The Lap Joint Railway Track Co., Charles K. Moore, president, will rebuild 10 miles of track, and build a new power house.

PLAINFIELD.—The Plainfield Street Railway Co., Thomas Nevins, president, and J. H. Almirall, manager, will build six miles of new track between Plainfield and Westfield, which is to be completed by June 1.

NEW BRUNSWICK.—The Brunswick Traction Co., which controls all the trolley lines in Middlesex County, and also lines in Somerset and Union Counties, has been merged with the New York and Philadelphia Traction Company, to be operated under the direction of the Brunswick Company. Judge Gottfried Krueger, of Newark; Andrew Radel, of Bridgeport, and E. H. Radel, of Brunswick, have purchased a controlling interest in the New York and Philadelphia Company.

TRENTON.—Surveys have been completed for the first five miles and contracts will be let at once for the proposed electric line of the Trenton, Lawrenceville & Princeton Railway Co. One steel bridge 110 ft. long will be required. Wm. P. Parry, general manager.

MILLVILLE.—The Millville Traction Co. is considering the advisability of extending its line to Vineland this spring. G. B. Langley, president.

PASSAIC.—According to report, the directors of the Saddle River Traction Co. have awarded the contract for the construction of the proposed electric railway from Passaic to Lodi. The line will be double track and be operated as an extension of the Paterson Railway. Colin R. Wise, engineer, Passaic Bank building.

PRINCETON.—The New England Railroad Construction Co., Worcester, Mass., has been awarded the contract for building the electric railway between Princeton and Trenton for the Princeton & Trenton Traction Company. The line will be about 12 miles in length and be equipped for handling both passengers and freight. E. E. Carpenter, general manager.

BRIDGETON.—The Bridgeton & Millville Traction Co. has decided to extend its line to Cedarville and Walter H. Bacon, treasurer of the company, will enter into contracts for the work.

HACKENSACK.—The Union Traction Co., operating eight miles of road between North Arlington and Carlstadt, was recently sold by Receiver William A. Johnson to William C. Giles, of the reorganization committee, for $20,000 above the indebtedness, which is $852,000. It is the purpose of the company to carry out the original plan of extending its tracks to this city.

WESTFIELD.—The Westfield & Elizabeth Street Railroad Co. has been granted a franchise to construct an electric street railway through the city of Rahway. A. A. Gaddis, president.

ELIZABETH.—The city council has been petitioned for a franchise to build a double track electric street railway through this town from Staten Island Sound to Westfield avenue, thence through Union township to the Cranford township line, where it will connect with the proposed road to Plainfield. Senator John Kean may be addressed.

SAYREVILLE.—The Sayreville Electric Light & Power Co. has petitioned the township committee for a franchise for a trolley line from Sayreville to South Amboy. The proposed line, which is five miles, follows the route surveyed by the Brunswick Traction Company.

BRIDGETON.—The Bridgeton & Melville Traction Co., operating 18 miles of railroad, is preparing to build an extension from Fairton to Cedarville in the spring. C. H. Kuhn, president.

HACKENSACK.—The purchasers of the Union Traction Co. have organized under the name of Newark & Hackensack Traction Company, with the following officers: G. W. McCormick, president; W. C. Giles, vice-president, and John H. Coon, treasurer, all of New York.

KEYPORT.—The Keyport & Mattawan Street Ry., now operating about four miles of horse railroad between the two cities named, is considering the advisability of changing the road into an electric line and extending it to Atlantic Highlands. A. M. Brown, manager.

NEW YORK.

BUFFALO.—Geo. P. Smith, general manager of the Tonawanda & Niagara Falls Electric Ry., has applied for a charter for a new line to the Falls.

BUFFALO.—The Buffalo & Depew Railway Co. expects to begin the construction of seven miles of double-track railway between Buffalo and Depew. W. B. Cutter, president; Geo. A. Ricker, chief engineer, 714 Ellicott Square.

BUFFALO.—Application has been made to the council by the Buffalo Traction Co. for permission to build a single track electric railway from Utica street to Rhode Island street, on Chenango street.

ROCHESTER, N. Y.—The Rochester & Sodus Bay Electric Ry. will probably be constructed and in operation before the close of the year, and when completed will make a direct route to the bay.

MT. VERNON.—The Westchester Electric Railroad Co. has filed notice of its intention to extend the lines in Pelham from the Mt. Vernon boundary line to the Boston turnpike and Pelham Manor.

ROCHESTER.—The Rochester Railway Co. petitioned the council for permission to rebuild its North Clinton street line. Double tracks will be substituted on the greater part of the line, and the road will be extended by a single track to the city limit. T. J. Nicholl, general manager.

ROME.—The Rome City Street Railway Co. will probably make some extensions and improvements, but has not yet fully decided upon its plans.

NEW YORK.—The Staten Island Electric Railroad Co., J. H. Swinarton, president, and J. H. Sims, manager, has recently ordered 25 Brill 9-bench open cars.

SEA CLIFFE, L. I.—The Nassau County Railway Co. was incorporated March 18 with a capital stock of $25,000, to construct and operate a street railroad from Sea Cliffe Station, of the Long Island Railroad, 1½ miles to the steamboat landing in the village of Sea Cliffe. The directors are William F. Brown, William L. O. Allan, Edward J. Boyle, G. A. Hamilton, W. J. Hawson, M. J. Keany, J. Hollis Gibson, L. E. Freeman and F. L. Hoyt.

BUFFALO.—The Buffalo, Hamburg & Aurora Railway Co., A. J. Benzing, president, and U. L. Upson, general manager, will build 21 miles of new track between these cities; work has been commenced and it is expected to open the line by Aug. 1, 1899. The company will buy 10 40-ft. cars. A car house 40x108 ft. and a power house, 48x120 ft., of 1,500 h. p. capacity will be built.

HORNELLSVILLE.—The Hornellsville Electric Railway Co., C. Adsit, president, and G. T. Rehn, manager, will rebuild three miles of track.

ELMIRA.—The Elmira & Corning Railway Co., H. B. Rhymer, president and manager, will build between these two places 18 miles. Twelve cars are to be bought and a car barn and power house built.

ELMIRA.—It is said that the contract for the Elmira & Seneca Lake Electric Ry. has been awarded to the American Engineering Co., of Bound Brook. The road will run from Watkins through Montour Falls to Horseheads, there connect with the Elmira & Horseheads Ry.

NEW PLATZ.—The New Platz & Wallkill Valley Railroad Co. will build a short extension, 1-5 mile, in Highland Landing, and will buy a few new cars. Edward Browne, receiver, and E. E. Hawkins, superintendent.

OGDENSBURG.—The Ogdensburg Street Railway Co., Henry A. Sage, president and manager, will build an extension of one mile to its King St. line and rebuild three miles.

SARATOGA SPRINGS.—The Saratoga Traction Co., P. A. Noyes, president, and R. E. Dunston, manager, is building five miles of track between Saratoga and Ballston Spa, and will rebuild two miles.

SARATOGA.—The Saratoga & Northern Electric Ry. has applied for permission to extend

its line to Glens Falls. R. E. Dunton is counsel for the company.

ELMIRA.—The Elmira & Horseheads Railway Co., C. G. Rasmus, president, and J. B. Cahoon, manager, will complete a 1½-mile extension by June 1st, and will rebuild one mile of track.

NYACK. The Nyack Traction Co., H. C. Howard, president, and E. F. Walker, manager, will build nine miles of track between Upper Nyack and Sparkill, to be opened July 1. Twelve 20-ft. cars will be bought, and a car barn 50x150 ft. and a power house 60x80 ft. built.

KINGSTON.—The Colonial City Traction Co., Chas. M. Preston, president, and C. G. Reed, superintendent, is to build an extension two miles of new track commencing in April, and completing it by June 1st. The company will buy six open and six closed cars.

LYONS.—Charles W. Field and Lucius L. Noyes, of the Clyde Electrical Co., have secured the right of way from Clyde, via Rose and North Rose, to Bonnie Castle, on Great Sodus Bay, for an electric road from Clyde, across the Rome, Watertown & Ogdensburg, at North Rose, to reach northern summer resorts on Lake Ontario.

UTICA.—The Utica Suburban Railway Co. has secured the right of way for an extension from Genesee street, Utica, to Capron, to connect with the Belt Line tracks in Upper New York Mills, via New Hartford.

GREENWICH.—The proposed extension of the Greenwich & Schuylerville Electric Ry., from Schuylerville to Stillwater, and from Schuylerville to Ft. Edwards, has been certified by the secretary of state. The road will connect at Stillwater with the Stillwater & Mechanicsville Street Railway and at Ft. Edwards it will connect with the Glens Falls, Sandy Hill & Ft. Edwards Street Railway. Joseph A. Powers, of Lansingburgh, is the promoter of the Greenwich & Schuylerville road.

PHILMONT.—Articles of incorporation have been filed by the Columbia Traction Co., of this place, with a capital stock of $100,000, of which amount $1,500 in paid in, to construct and operate a street railway in Philmont, Columbia County. Incorporators are: Franklin G. Simmons, William C. Allen and Ernest F. Foote, of Rutherford, N. J. Office, 332 Harrison avenue, Harrison, N. J.

SCHENECTADY.—The Schenectady Street Railway Co. has voted to issue $77,000 in bonds for contemplated improvements, to be made this spring. Theodore Stebbins, general manager.

PENN YAN.—A. T. Hubbell, of Baltimore, Md., is said to be promoter of an electric railway between this city and Geneva.

MASSENA.—The Massena Electric Street Railway Co. has been incorporated here with a capital of $100,000, to operate a street surface electric road from Massena Springs Station to the St. Lawrence river, a distance of eight miles. The directors are: Thomas H. Gillespie, R. A. Johnson, E. M. Stathers, Howard Hasbrouck, Edward M. Dolan, Thomas D. Harris, Willard A. Esselstyn and James H. Jones, of New York City, and Robert Swan, of Massena.

MINEOLA.—The Mineola, Hempstead & Freeport Traction Co. has been incorporated to build and operate an 11-mile railroad connecting this city with Freeport with other than steam locomotive power. The company has a capital of $125,000 and the directors are: William J. Newton, Benjamin F. Hamilton, Charles Hills, James A. MacElhinny, William L. Greeley, Frank Harrington, John D. Sweeney, all of New York City, and James A. Stiles, of Hempstead.

BABYLON, L. I.—Surveys have been made and the consent of the property owners secured for the New York and North Shore Railway from Babylon to Northport, a distance of 16 miles. According to report, the company has let the contract for grading the road from Sanford Ave. in Flushing to Jamaica, to T. J. McKenna, of Flushing.

GREENWICH.—The Greenwich & Schuylerville Electric Railway Co., which was chartered in 1895 to build an electric road between the two cities named, is about to begin work. Martin Schenck, president, Albany, N. Y.

MOUNT VERNON. Owing to the greatly increased traffic over the line, the railway between this city and Yonkers will be double tracked at once. The Union Traction Co. of New York is said to control the line.

WHITE PLAINS.—The Tarrytown, White Plains & Mamaroneck Railway Co. has been granted a franchise on the Boston Post Road by the highway commissioners of Mamaroneck for the proposed road through that place. H. T. Jennings is treasurer and counsel for the company.

NEW YORK.—The Fort Dearborn Extension Railway Co. has been incorporated at Albany with a capital stock of $10,000 to operate an electrical surface line from 172d to 185th street on 11th avenue. The directors are: M. G. Starrett, W. F. Plummer, John Lambdon, Andrew Loughlin, D. W. Patterson and Henry Hartwell, of New York; John Kerr and Charles E. Corby, of Brooklyn; and H. A. Himely, Far Rockaway (L. I.), N. Y.

UTICA.—The Utica Suburban Railway Co. has been granted the right to construct and operate an electric car line from Genesee street, near Richardson Place, across to Capron and on to the New York Mills.

OSWEGO.—Reports state that George B. Leonard and others are interested in the construction of a trolley line between Oswego and Syracuse.

HUDSON.—Charles Frisbee has secured the right of way for an electric railroad from Albany to this city. The new company is known as the Columbia & Rensselaer Railway & Lighting Co. The authorized capital is $2,000,000.

SARATOGA.—An extension of the Saratoga Traction Co. is reported soon to be made from the Geysers to Ballston Spa, about five miles. T. F. Hamilton, president.

GLENS FALLS.—It is reported that the Green sawmill on the canal between this city and Sandy Hill will be converted into a reserve power station for the Glens Falls, Sandy Hill & Ft. Edward Street Railroad. E. A. Clerk, chief engineer.

AUBURN.—The grading and masonry has been completed for the interurban trolley between this city and Skaneateles. The rails will be laid early in the spring. President, George B. Leonard, Syracuse.

ALBANY.—It is reported that work on the construction of the Greenbush & Nassau Electric Ry. will be resumed under new management. The proposed route in Greenbush is being surveyed.

ALBANY.—A certificate has been filed with the secretary of state by the New York, Westchester & Connecticut Traction Co., asking for the right of way for an extension of its line from Mount Vernon to White Plains and Bronxville.

AUBURN.—The Auburn Interurban Electric Railway Co. has filed a petition with the secretary of state for permission to build several extensions.

DUNKIRK.—The city council has granted the stock company headed by Daniel F. Toomey the right to build a trolley line to Hickoryhurst. The line must be finished by July 15.

ROME.—The Rome City Street Railway Co. will probably make improvements and extensions, but has not fully decided upon its plans.

NEW YORK.—The New York & North Shore Railway Co. has been given a permit by the board of railway commissioners to construct an electric road from Middle Village, Long Island, the terminus of the New York & Queens County Railroad, through Jamaica, Whitestone, College Point and Bay Side to Manhassett, Long Island.

POTTSDAM.—The citizens of this place have appointed Dr. F. L. Dewey, J. C. Cooke and C. R. Holmes a committee to consider plans for an electric railroad to Hannawa Falls.

MARION.—Surveys are being made for the proposed Wayne Central Railroad between this city and Palmyra, six miles. The company will be incorporated soon. Electric motive power will be used. Le Grand Brown, engineer, Rochester, N. Y.

WATERLOO.—It is understood that a project is on foot for an electric railroad to be constructed from this place to Bonnie Castle via Clyde and Rose. New York capitalists are interested in the project.

SYRACUSE. The Syracuse, Auburn & Western Street Railway is open for bids of 12 miles of complete railway equipment. Address 36 Nottingham building, Syracuse, N. Y.

SCHUYLERVILLE. According to report an electric railway will soon be built between this place and Greenwich. J. D. Powers, of Sandy Hill, N. Y., is interested.

SKANEATELES. The Auburn Interurban Railroad Co., which has been laying tracks in Genesee street, say that it is intended to grade the entire distance between the village and Auburn this fall, and the line will be completed next spring and probably extended to Syracuse.

PEEKSKILL. The Peekskill Traction Co. is about to build its 12-mile electric road, the contract being let to Sanderson & Porter, of New York. The company was incorporated last April. Hanford Smith, of Peekskill, is interested.

ALBANY.—The Albany, Helderberg & Schoharie Electric Railway Co., H. W. Burgett, president, and Chas. E. Bibber, 49 Federal St., Boston, purchasing agent, will build 44 miles of new track between Albany and Schoharie, commencing work May 1st. The company will buy 22 new cars (no freight) and build a car barn and two power houses.

NORTH CAROLINA.

ASHEVILLE.—The Intermontane Railroad Co., J. S. Adams, president, and J. S. Adams, jr., manager, will build an electric power house.

OHIO.

ALLIANCE.—The Alliance Street Railway Co., W. W. Hazzard, president, and W. J. Berry, manager, expects to build a new car barn.

ALLIANCE.—It is announced that the Canton & Alliance Electric Railway Co. is negotiating for the purchase of the Alliance St. Ry., four miles. The Canton & Alliance Co. has been authorized to build an electric line between this city and Canton and expect to have the line completed in six months. W. W. Hazzard, general manager.

AKRON.—The Akron Traction & Electric Railway Co. has been incorporated by Aaron Wagner, Frank A. Selberling, L. C. Miles, F. E. Smith and Ira M. Miller, to build an electric line to Blue Pond. The company has a capital stock of $100,000.

ASHTABULA.—The Pennsylvania & Ohio Railway Co., Thomas Fricker, president, will build 44 miles of new track between Painesville and Conneaut Harbor, beginning work as soon as the weather permits. The company will buy 44 double truck cars and build a car barn and a power house of 1,500 h. p.

BOURNEVILLE.—An electric line is proposed from Bourneville to Bainbridge, 19 miles. J. C. Gregg, of Bourneville, is our informant.

GALION.—The Galion-Bucyrus Electric Ry., 11 miles, of which D. A. Blakeslee, of New Haven, Conn., is the chief engineer, has contracted for the rails, cars and boilers and have settled on the site for the power house in this city.

CLEVELAND.—The Cleveland & Eastern Railway Co., H. P. McIntosh, president, and W. C. Jones, chief engineer, is building 36 miles of new track between Cleveland and Chardon, O., and an extension to Burton, O. It will also buy 12 new combination passenger cars and build a new car barn and a new power house.

CLEVELAND.—Work on the 1-mile extension which the Lorain & Cleveland Ry. proposes to build to North Amherst, will begin as soon as the weather permits. W. E. Davis, manager.

CLEVELAND.—The Cleveland City Railway Co., M. A. Hanna, president and Geo. G. Mulhern, superintendent, will soon ask for a franchise for the Denison Ave. cross-town line.

CLEVELAND.—The Cleveland & Chagrin Falls Electric Co., F. M. Stearns, president, and R. L. Palmer, manager, is now building 14 miles of track between Chagrin Falls and Burton; the work will be completed by May 1st, and the line opened by May 15th. The company

has bought a 750-h. p. Atlas engine and a 400-kw. Siemens & Halske generator.

CLEVELAND.—At a recent meeting of the Lorain & Cleveland Electric Ry. it was decided to extend the line to South Amherst, a distance of seven miles.

COLUMBUS.—The National Traction Co. has been incorporated with a capital stock of $10,000 to build an electric road from Columbus through Madison, Clark, Miami and Preble Counties.

COLUMBUS.—The Columbia Street Railway Co. is said to be considering the advisability of an extension to Dublin.

CLEVES.—It is reported that the Dayton Traction Co. will construct a road from Anderson's Ferry to this city. The necessary right of way has been obtained and it is thought that by next spring the road will be complete from Addyston to Anderson's Ferry.

CINCINNATI.—The Hamilton & Eaton Electric Railway Co. has applied to the county commissioners for a right of way through about 12 miles of the turnpike roads of thic country.

COLUMBUS.—The Westerville & Wortmington Street Railway Co. has secured the right of way between Delaware and Flint, a distance of about 15 miles. It is proposed to complete the road by July 1, 1900.

CLEVELAND.—Jacob B. Perkins, David Morrison, H. W. S. Wood and others, representing a new company, have petitioned the council for permission to build an extensive system in the west and south sides of the city.

CINCINNATI. The contract for building the 40 miles of road for the Cincinnati, Lawrenceburg & Aurora Electric Railway Co. has been awarded to the Tennis Construction Company, of Philadelphia. The Cincinnati, Lawrenceburg & Aurora Co. was incorporated last November, with a capital of $10,000, which has since been increased. There will be two power houses, each equipped with two 500-h. p. Hamilton-Corliss engines, two 400-kw. Westinghouse generators, and four 250-h. p. tubular boilers. J. C. Hooven, president of the Hamilton-Corliss Engine Works, Hamilton, O., Geo. H. Helvey and Fred D. Shaefer are among those interested in the company.

CINCINNATI.—The Cincinnati Connecting Belt Line Ry. has been incorporated by J. G. Schmidlapp, Wm. C. Proctor, Louis E. Miller, G. P. Griffiths and Thomas D. Rhoades, all of Cincinnati. The capital stock is $50,000. The proposed road is to be a double track electric line from a point near Court street and Guilbert avenue in Cincinnati, northwest through the villages of Bond Hill, Norwood, Elmwood, College Hill and Mount Healthy.

DAYTON, O.—The Dayton, Arcanum & Greenville Traction Co., capitalized at $20,000, has been incorporated to construct and operate an electric line between this city and Greenville, Darke County. The incorporators are: Edward A. Parrott, L. Disher, Charles W. Dale, Solomon Good, John W. Good, H. L. Ferneding and J. Elliot Pierce.

CANAL DOVER.—Plans are completed for a new electric road between Newcomerstown and Urichsville, and the right of way has all been secured. There is also to be another new trolley between Massillon and this town.

COLUMBUS.—The Columbus Street Railway Co., R. E. Sheldon, president, and E. K. Stewart, general manager, will rebuild 15 miles of track, and has recently contracted for one 1,000-h. p. engine and one 850-k. w. generator.

COLUMBUS.—Work has been started on the Buckeye Lake Street Ry. and the promoters claim it will be in operation by October 1st.

DAYTON.—The Oakwood Street Railway Co., Charles B. Clegg, president, and Harrie P. Clegg, manager, expects to build a new car barn with a capacity of 20 cars.

GALLIPOLIS.—The Gallipolis & Point Pleasant Railway Co., John L. Vanse, president, and F. R. Vanse, superintendent, will build an extension of two miles, commencing work June 1st.

MAGNETIC SPRINGS.—The Marysville, Richwood, Magnetic Springs & Delaware Electric Ry., W. A. Wright, president, and J. P. Eubanks, manager and secretary, is to build 30 miles of road connecting these points as soon as the surveys and estimates are made. Car barn and power house will be built.

SPRINGFIELD.—The Dayton, Springfield & Urbana Electric Railway Co., Fred Colburn, president, will build 50 miles of new track between these three cities; work has been begun and it is expected to open the line June 20th. The company will buy 20 cars and build two car barns and two power houses, the latter of 300-h. p. and 600 h. p. capacity respectively.

DAYTON.—Surveys have been completed for the Dayton & Xenia Traction Co.'s proposed line from Dayton to Xenia via Alphia and Trebeins, a distance of 16 miles, 3½ miles of which will be double tracked. J. M. Wilson, chief engineer, Dayton.

DAYTON.—The City Railway Co., which recently secured control of the Dayton & Western Traction Co., is surveying for an extension from Eaton to Richmond, Ind. D. B. Corwin, president.

EAST LIVERPOOL.—Surveys are being made for the electric line proposed by J. L. Francis, of East Liverpool, Timothy Dwight, of Chicago, and J. G. Foltz, of Herkimer, N. Y. The road will probably be 20 miles long and will be built via Lisbon.

FINDLAY.—The Findlay Street Railway Co. is making preparations to build the long contemplated line to Fostoria, via Mortimer and Van Buren. C. Smith, general manager.

HAMILTON.—The Hamilton & Eaton Electric Street Railway Co. has been incorporated with a capital of $10,000 to operate an electric railway between this city and Eaton. The incorporators are J. H. Shallenbarger, James A. Weiker, J. E. Anderson, C. F. Elliott and J. C. Unzicker.

PORTAGE.—The council has granted a franchise for the proposed electric railway which is to be built at once by Contractor Leach, of Monroe, Mich.

YOUNGSTOWN.—The Youngstown Park & Falls Street Railway Co., Samuel C. Grier, president, and A. Kennedy Ashworth, manager, will open 3.6 miles of new track between Youngstown and Mill Creek Park on May 10th. The company has bought 12 new cars. It will soon build a rotary transformer sub-station of 400-kw. capacity.

SPRINGFIELD.—The Springfield Railway Co., W. B. McKinley, president, and S. L. Nelson, manager, has contracted for building four miles of new track, rebuilding two miles, and building a new car house; this work is to be completed June 1st. Six new cars have been bought.

YOUNGSTOWN.—The Mahoning Valley Railway Co., M. A. Verner, president, and A. A. Anderson, manager, will build three miles of track between Youngstown and Struthers as an extension of its interurban line. Work will be commenced May 1st, and it is expected to open the line in July. Several new double truck cars will be bought, and sometime during the summer a new power house will be built.

PHONETON.—The National Traction Co., of this city, has been incorporated with $10,000 capital to build along the old National Road from Columbus to the state line. J. O. H. Hooker and D. P. Wyamire are the incorporators.

SANDUSKY.—A syndicate is negotiating for the purchase of the Sandusky, Milan & Norwalk Electric Railway and the People's City line. The transaction is said to be the first step in a plan to build electric railways connecting a large number of northern Ohio cities and towns with Cleveland. John McKelvey, engineer.

STEUBENVILLE.—Preliminary surveys have been completed for a new street railway line between this city and Mingo Junction, and it is said that the line will be built within the next four weeks. It is also stated that the line will be a link in the system which is to connect Pittsburg with Wheeling by way of the towns along the Ohio river.

SPRINGFIELD.—An electric railway between Springfield and Decatur is projected by a Chicago company, represented by F. L. Sparrow.

TIFFIN.—The Marblehead, Port Clinton & Northern Railway Co., of Danbury township, Ottawa County, has been incorporated with $100,000 capital. The road is to begin at Tiffin and run through the counties of Logan, Sandusky and Ottawa to Marblehead. The incorporators are: W. E. Bense, A. W. Wigene and E. W. Guerin.

XENIA.—The Xenia & Spring Valley Transit Co. has been incorporated with a capital of $5,000 to build an electric line between the cities named. The incorporators are: C. J. Ferneding, A. O. Ozier, J. M. Wilson, F. H. Ferneding and Philip A. Kemper.

XENIA.—The Xenia & Wilmington Traction Co. has been incorporated with a capital stock of $10,000 to build an electric road from Xenia to Wilmington, a distance of 18 miles. Albert Emanuel, Frank S. Breene, Samuel Price, Henry P. Bruden and Harry A. Armstrong are among the incorporators.

OREGON.

PORTLAND.—The City & Suburban Railway Co., Tyler Woodward, president, and H. C. Campbell, manager, will build an extension of three miles, commencing work May 1st.

CORVALLIS.—Thomas Welsher, A. Wilheim and Henry Elliott have petitioned for the right of way for an electric railroad between Corvallis and Eugene, via Monroe.

OREGON CITY.—A franchise has been granted by the county court to W. H. Burghardt, to build an electric line from the city limits over the county road to Highlands, a distance of about eight miles. It is proposed to extend this line to Wilhoit Springs, a total distance of 40 miles.

PENNSYLVANIA.

KITTANNING.—The Kittanning & Ford City Street Railway Co., F. A. Moesta, president, is now building five miles of new track between Kittanning, Nealton and Ford City, which will be completed May 30th.

ALLENTOWN.—The Allentown & Emaus Street Railway Co., F. J. Crilly, president, and H. E. Crilly, manager, is building an extension of four miles between Emaus and Macungie. It is expected to open this line May 15th.

ALLENTOWN.—The Inland Traction Co. has been incorporated here with a capital of $200,000 to construct a street railway to Montgomery County, 12 miles in length. Incorporators are: J. H. Pascoe, Allentown; J. B. Alderfer, president; E. S. Landis and E. H. Alderfer, of Souderton, and C. F. Hecklen, Quakertown, Pa.

ERIE.—The Erie Rapid Transit Co., W. E. Hayes, president, and L. J. Chase, manager, will build 20 miles of track, which it is expected will be completed this summer. Ten double truck vestibuled cars will be bought, and a car barn and power house built.

ERIE.—The Erie City Passenger Railway, operated by the Erie Electric Motor Co., has been given permission by the council to extend its tracks to the Behrend paper mill.

ERIE.—R. M. Campbell, of Buffalo, N. Y., has enlisted capitalists in New York City to construct a new electric railway to connect Point Albino and Fort Erie, a distance of 11 miles.

JOHNSTOWN.—The Johnstown Passenger Railway Co., T. L. Johnson, president, and S. E. Young, manager, will add sixteen new cars to its summer equipment.

LANSFORD.—The Tamaqua & Lansford Street Railway Co., L. S. Riley, president, and W. D. Zehner, manager, have bought four new summer cars.

LANSDALE.—The Freland Traction Co., J. H. Pascal, president, and H. E. Crilly, manager, will build 11 miles of new track between Lansdale and Perkasie, to be completed by August 15th. The company will buy 20 cars, 10 open and 10 closed, and will build a car house and a power house of 1,500-h. p. capacity.

LEETONIA.—The Leetonia Railway Co., C. B. Farr, president, and J. L. Snyder, general superintendent, will build 5½ miles of new track between Leetonia and Tiadaghton as an extension of an old line bought of the Tiadaghton & Fahnestalk Railway Co.; four miles of track will be rebuilt. Work was commenced April 1st and the line is to be opened July 1st.

LEBANON.—The Lebanon & Annville Street Railway Co., S. P. Light, president, and C. H. Smith, manager, will build 1¼ miles of new track between Lebanon and Avon, to be opened

July 1st. The company will buy three new cars and build a new power house.

NORRISTOWN.—The Schuylkill Valley Traction Co., C. D. Beebe, president, and R. M. Douglass, manager, will rebuild five miles of track this season, and hopes to build a new power house.

NEW CASTLE.—The Youngstown & New Castle Electric Railway Co., D. L. Miller, president, and W. H. Miller, manager, will build 24 miles of new track between New Castle and Youngstown, commencing work May 1, 1899. The company will also rebuild 24 miles of track. Thirty new cars will be bought, a car barn having a capacity for 50 cars built, and a new power house built at Bedford, Pa.

PUNXSUTAWNEY.—The Punxsutawney Street Passenger Railway Co., S. E. Wilson, president, and L. C. Meyers, manager, is to build an extension of four miles, connecting a number of small towns, and will open the line in the early part of the summer; it will also rebuild one mile of track and make additions to it car barn and power house. Two or three new cars are to be bought.

PITTSBURG.—The Monongahela Traction Co. is now building the new branch from Turtle Creek to Wilkinsburg, and cars will be running by August.

PHILADELPHIA.—The Philadelphia & West Chester Traction Co., A. M. Taylor, president, and J. H. Gibson, superintendent, will soon build an extension of three-quarters mile. A few new cars, snow plows, etc., will be bought. Other improvements will be to enlarge the company's car house, the boiler plant, and the coal storage tracks.

PHILADELPHIA.—The Northern Central Traction Co., has secured franchises for an air line of one and one-quarter miles between Nazareth and Farmersville, where it will connect with the Palmer & Bethlehem Street Ry.

QUAKERTOWN.—The Quakertown Traction Co., C. Taylor Leland, president, and W. H. Davis, manager, will build 21 miles of road between Quakertown and Doylestown, an extension of its present line; work is to be commenced May 15th. The company will buy 12 new cars.

SCOTTDALE.—The Mt. Pleasant, Scottdale & Connellsville Electric Railway Co. will build 18 miles of road connecting these towns. Work is to be commenced in May and completed in six months. Ten cars will be bought and a car house and car barn built.

WEST CHESTER.—The new trolley line between Spring City and Phoenixville is well under way and the work is to be pushed forward as rapidly as possible.

YORK.—The city council has granted permission to the York Street Railway Co. to extend its tracks in certain streets and to operate its cars on these extensions with electric or other motive power.

YORK.—The Dallastown Railroad Co., D. T. Lafeau, president, and S. M. Manefold, manager, is building 1.3 miles between Dallastown and Dallastown Junction, to be completed about May 1st.

BRADFORD.—At the annual meeting of the Bradford Street Railway Co., held on January 9, the directors authorized the purchase of 225 trolley poles, 13,000 ties and ten miles of steel rails, to be used in extending the Congress street branch to Lewis Run.

BLOOMSBURG.—It is proposed to construct an electric street railway between this city and Berwick. The company, which is composed of Philadelphia capitalists with W. McCarroll as president, has filed acceptances of franchises granted by the council. The capital stock of the company is $250,000. Work on the road will begin in about three months. Offices of the company are located at 723 Walnut street, Philadelphia.

CONNELLSVILLE.—The Coke Belt Street Railway Co. has been chartered to build a line thirty miles long connecting Uniontown, Dunbar, New Haven, Connellsville, Bradford, Everson, Scottdale, Mt. Pleasant and South Greensburg in the counties of Fayette and Westmoreland. The company is capitalized at $600,000 and the incorporators are: Wm. H. Allen, J. E. Weller, Bryan Robertson, F. S. Young and D. I. Shaw.

GREENSBURG.—The Greensburg, Jeanette & Pittsburg Electric Ry. has applied for the right of way through Irwin for an extension of its line to North Irwin and Larimer. W. F. Sadler, president.

GLEN OLDEN.—The Swarthmore Electric Street Railway Co., with a capital of $100,000, has been chartered to build a line two miles long, beginning at Collindale borough, through Darby township to this city. Henry A. Noble of Philadelphia may be addressed.

LANSDALE.—The Lansdale & Harleyville Railway Co. has applied for charter to build a trolley line from Lansdale to Harleyville. The company has a capital stock of $50,000. J. S. Geller, president.

HATBORO.—The Hatboro Railway Co. has been incorporated with a capital stock of $30,000 to construct an electric street railway from this city to Willow Grove. The incorporators are James Van Horn, James McGregg, S. J. Garner, Jas. W. Rusling and R. Ashurst, Philadelphia, Pa.

HARRISBURG.—The Harrisburg Traction Co. will soon build an extension from Progress to Linglestown and Cahoe Springs. E. C. Felton, president.

LEWISTON.—William Schwartz, George H. Seargent and J. H. Scott of Baltimore; J. C. Mosser and H. M. Vanzandt of Harrisburg, are the directors of an electric street railway to be run from Lewistown to Yeagerstown, a distance of four miles. Work on the road will begin April 1st and completed June 1st. J. I. Quigley, president.

READING.—Reports from Oley, Pa., state Davis Brothers, engineers of the Reading Traction Co., this city, will soon begin surveys for an electric railway to connect Stoneycreek Mills and Friendensburg.

NORTHAMPTON.—The Northampton Central Street Railway Co. was incorporated March 7th with a capital stock of $72,000. The directors are M. P. McGrath, Worcester, Mass.; Edward J. Fox, William O. Hay, Thomas A. H. Hay, Easton, Pa.

DOYLESTOWN.—The Doylestown Trust Co., receiver of the Doylestown & Willow Grove trolley road, has applied to the court for authority to borrow $12,000 with which to improve the road and add to its equipment.

POTTSVILLE.—The Coal Castle Electric Co. has been incorporated, with a capital stock of $30,000, to build from Beechwood Colliery to Moores Store, Schuylkill County, Pa. The incorporators are: R. Steen Martin, John M. Emery, Norman A. Saylor and others, of Philadelphia.

PHILADELPHIA. — The Lindley Avenue Railway Co. and Fischer's Lane Railway Co. have been incorporated, both with a capital of $12,000. These railways, together with tracks laid and rights which the Union Traction Co. possesses, will complete a through line from Frankfort to Germantown, and with the Germantown & Fairmount Park Ry., to the Falls of the Schuylkill. The incorporators are: Michael Ehret, David C. Golden, William Wharton, Jr., Alex. Rennick and Richard F. Bower, all of Philadelphia.

PHILADELPHIA.—The Union Traction Co. is putting down electrical feeder conduits preparatory to the introduction of electricity on Callowhill street.

POTTSVILLE.—The Schuylkill Electric Railway Co. will soon build a fifteen-mile line from Pottsville up the Hecksherville valley, a populous mining district, through Mine Hill Gap to Glen Carbon. C. P. King, president.

PITTSBURG.—The United Traction Co. will extend its California avenue line from Avalon, its present terminus, to Dixmont. J. D. Callery, president.

POTTSTOWN.—The Montgomery & Chester Electric Ry., capitalized at $300,000, has been incorporated to construct and operate an electric railway between this city, Montgomery county, and Phoenixville, Chester County, a distance of seventeen miles. The incorporators are Daniel S. Mann, 49 North 13th street; W. H. Greebe and C. S. Jarvis of Philadelphia; Geo. F. P. Wagner, Pottstown; J. C. MacPherson, Washington, D. C.

PHILADELPHIA.—The Union Traction Co. has petitioned the council for permission to lay its tracks on Fourth street from Snyder avenue to Titner street and to string wires on Island road and Eastwick avenue, also to permit the Delaware & Schuylkill Electric Railway Co. to lay tracks in the 2d and 32d wards.

PERKASIE.—The Quakertown Traction Co. has been granted a franchise by the council to build in this borough. C. Taylor Leland, president, Quakertown, Pa. Messrs. Trelly and Pascoe of the Inland Traction Co. also have franchises to build from Perkasie to Lansdowne.

PITTSBURG.—The Consolidated Traction Co. is making extensive improvements on its Sharpsburg and Etna branches, according to report, and it contemplates building several extensions up the Allegheny Valley. C. L. Magee, president, Times building.

PITTSTON.—The Pittston & Scranton Street Railway Co. has been incorporated with a capital stock of $75,000 to construct an electric street railway from Pittston to Scranton, a distance of three miles. Jas. A. Steese, president, Harrisburg, Pa.

PHILADELPHIA.—It is reported that plans for the electric railway over the Blue Ridge Mountains are being perfected. The route most likely to be decided upon will connect Penn Mar and Blue Mountain House; from that point run to Blue Ridge Summit, Monterey, Buena Vista and back again to Penn Mar. From the latter point a line will extend to Waynesboro, Pa., and other points in the Cumberland Valley.

PITTSBURG.—The Pittsburg & Allegheny River Railroad Co., capitalized at $30,000, has been chartered to build an electric railroad three miles in length from 32d street, Pittsburg, to Herr's Island. The directors are J. H. Park, C. E. Clapp, George Wright, Jr., John A. Sutton and G. M. Black, Pittsburg; D. E. Park, Allegheny, and W. G. Park, New York City.

SPRING CITY.—Surveys have been completed for the Montgomery & Chester Electric Railway Co.'s branch from Phoenixville to this city, and it is said that work will soon be commenced by the Fairmount Construction Co., 723 Walnut street, Philadelphia, Pa. George F. P. Wagner, chief engineer, Pottstown, Pa.

SCRANTON, PA.—The Nay-Aug Park Street Railway Co. has been incorporated with a capital stock of $50,000 to construct an electric street railway in this city. The incorporators are: James L. Crawford, president; Geo. F. Reynolds, Geo. E. Hill, Clarence E. Reynolds and Thos. F. Penman, all of Scranton.

SOUTH BETHLEHEM.—The Nazareth & Bethlehem Passenger Railway Co. has been granted the right of way in all places asked for and will begin surveying at once. The company proposes to build an electric road direct from Bethlehem to Nazareth. J. H. McGee, president.

FREEMANSBURG.—Pascoe & Crilly, contractors, of Allentown, Pa., have made an application for the right of way through this town. If granted it is expected to build an electric line to connect with that of the Allentown Traction Co. at South Bethlehem.

RHODE ISLAND.

PROVIDENCE.—The Tiverton & Seaconnett Railroad Co., J. A. King, manager, 42 Exchange Building, Providence, will this spring build a 15-mile road between Tiverton and Seaconnet Point.

NEWPORT.—The council has been petitioned by the Newport Street Railway Co. for permission to extend its tracks from Broadway through Marlborough street to the Old Colony Railroad station. President, G. E. Reynolds, Spring and Franklin streets.

BRISTOL.—The contract for building the road from this city to Mt. Hope Park, for the Bristol Land & Improvement Co., has been let to Bibber, White & Co., Boston, Mass., at $20,800.

CUMBERLAND.—The time for the completion of the Cumberland Street Ry.'s proposed line between Lonsdale and Cumberland Hill has been extended from April 1st to July 1st, 1899. Thomas A. Jenckes is attorney for the company.

WOONSOCKET.—The Woonsocket Street

Railway Co. is considering the advisability of an extension to Fairmount. Several bridges will be needed as railroad crossings. E. K. Ray, president and general manager.

PROVIDENCE.—The Union Traction & Electric Co. will extend its line this spring from Westcott through Apponaug and along the shore to Rocky Point.

SOUTH CAROLINA.

CONWAY.—The Conway Sea Shore Railroad Co., F. A. Burroughs, president, and D. T. McNeill, manager, is building fifteen miles of road to be completed by June 1st. Two cars will be bought and a car house built.

TENNESSEE.

CHATTANOOGA.—The Chattanooga Electric Railway Co., J. H. Warner, president, and J. W. McFarland, superintendent, is pushing the improvements of its lines started some time since and will construct a loop system with the new transfer station on Market street.

KNOXVILLE. The Knoxville Traction Co., C. C. Howell, manager, has received permission from the council to tear up the old tracks on two streets and proposes spending $100,000 in improving its lines.

CHATTANOOGA.—The Chattanooga Rapid Transit Co., Samuel W. Divine, president, has leased the belt railway and will shortly equip the Sherman Heights line with electricity and begin the work of construction on the Chickamauga line.

NASHVILLE.—According to report an electric railway from Nashville to Lebanon and Smithville is contemplated by Pittsburg capitalists. E. E. Beard of Lebanon may be addressed.

CHATTANOOGA.—The Lookout Incline Co. has decided to build an electric line on the mountain from Sunset Park to Rock City, a distance of three miles. The proposed road will cost the company about $30,000.

CLARKSVILLE.—Surveys have been completed for the proposed suburban electric car line between this city and New Providence. The distance is about three miles. J. F. Shelton, manager.

TEXAS.

FORT WORTH.—The Glenwood & Polytechnic College Street Railway Co., J. T. Voss, president, has just completed a belt line through the heart of the business and residence portions of Fort Worth, and will soon extend its main line to Tyler's Lake and Park. This company recently installed a new 350-h. p. Hamilton-Corliss engine, built by the Hooven, Owens & Rentschler Co.

The four street railways of Fort Worth have been consolidated into two, the Glenwood & Polytechnic College Street Ry. purchased the Fort Worth & Arlington Heights Street Ry., and the Fort Worth Street Ry. purchased the City Ry.

The probabilities are that each of the two companies will build a number of miles of new track during the coming season.

DALLAS. The Dallas Consolidated Electric Street Railway Co., whose property was recently sold to Mr. G. Van Ginkle of Des Moines, Ia., is to equip a six-mile line, heretofore operated by mules, for electric traction.

BEAUMONT.—The city council has passed an ordinance granting to J. C. Ward and others a 50-year franchise for an electric railway on the streets of Beaumont.

SHERMAN.—The Sherman Construction Co. has been incorporated here to build a 10-mile electric line to the city of Denison.

AUSTIN.—E. A. Ellis and associates have been granted right of way by the council to erect and operate a street railway in this city. The proposed new system will traverse several streets.

UTAH.

SALT LAKE CITY.—The Salt Lake City Railroad Co., A. W. McCune, president, and W. P. Reed, manager, will begin April 15th building two miles of new track and will buy four of Laclede cars.

SALT LAKE CITY.—The Salt Lake Rapid Transit Co., J. S. Cameron, president, is contemplating improvement, but plans are not yet fully matured.

VERMONT.

BURLINGTON.—F. C. Kennedy, president of the St. Johnsbury Street Railroad Co., advises us that he expects to build a new line between Billows Falls and Saxtons River, six miles, and ten miles in extensions to the St. Johnsbury line. Twelve cars will be bought and two small car houses and one power house of 150 h. p. capacity.

BRATTLEBORO.—The Brattleboro Street Railroad Co. will build a new car barn this season and a power house having a capacity of 450 h. p.; of this 300 h. p. is steam and 150 h. p. water power machinery.

BURLINGTON.—C. W. Blakeslee & Sons, railway and macadam road contractors, Ansonia, Conn., have been awarded the contract to construct an electric railway between Burlington and Hinesburg. The road is to be fifteen miles long, and will be used both for freight and passenger traffic. The contract price is $140,000, and the work has already begun.

SALISBURY.—W. T. Dewey, E. D. Blackwell, of Montpelier, Vt., are among the proposed incorporators of the Lake Dunmore Power & Traction Co., which contemplates the construction of a railway through Salisbury, Leicester, Brandon, Pittsfield and Proctor to Rutland.

VIRGINIA.

PETERSBURG.—The Richmond & Petersburg Electric Railway Co. has petitioned the county supervisors of Chesterfield for the right of way for the proposed electric road on Petersburg Turnpike from Manchester to Petersburg. Corbin Warwick and William S. Royal are interested.

RICHMOND.—The Virginia Electric Railway & Development Co., which was incorporated in December, has secured control by purchase of the Piedmont Traction Co. of Piedmont, Va. It is said that improvements and extensions will be made.

NORFOLK.—The Tennis Construction Co., E. A. Tennis, president, Philadelphia, Pa., has been awarded the contract for building the Norfolk & Sewell's Point Electric Railroad. The road will be eighteen miles long, extending north from Norfolk to Sewell's Point. The same company will build the power house and car sheds and furnish the equipment for the road, including ten cars, two 350-h. p. Hamilton-Corliss engines, 300 k. w. Westinghouse generators and four 200-h. p. tubular boilers. Work is to be begun in time to be completed August 1st.

NORFOLK.—The Norfolk & Atlantic Terminal Ry. has asked for a franchise to build an electric railroad in this city. The proposed road is from Norfolk to a point on Chesapeake Bay, opposite Old Point Comfort. D. Lowenburg, president.

FINCASTLE.—Work on the proposed electric railway to connect Fincastle and Cloverdale, Botetourt County, will begin at an early day. It is said that the ultimate terminus will be Roanoke.

PETERSBURG.—The Virginia Traction Co. has been organized in this city with the following officers: T. O. Roy, president, Charlottesville, Va.; Augustus Wright, vice president, Petersburg; R. J. Spartley, treasurer, Petersburg, and others.

LYNCHBURG.—The Virginia Paving Brick Co., T. R. Adams, president, Lynchburg, has been awarded the contract for the construction of the proposed street railway of the Lynchburg Railway & Light Co., to cost about $70,000. This does not include the power house nor power house equipment.

NORFOLK.—The Norfolk & Ocean View Railway Co., R. Lancaster Williams, president, and D. A. Hegarty, manager, will build one mile of new track between North Oakwood and Christians Mills, to be opened May 1st.

NORFOLK.—The Norfolk Street Railway Co., R. L. Williams, president, is building two miles of new tracks on the Lamberts Point division as an extension to its present line.

HAMPTON.—The Newport News & Old Point Railway & Electric Co., W. J. Payne, president, and H. H. Carr, superintendent, will build five miles of new track in Newport News and build a railway, lighting and refrigerating power plant of 1,800 h. p. capacity. Five Jackson & Sharp cars will be added to the equipment.

MANCHESTER.—The council committee appointed to look into the matter of the proposed electric road from Manchester to Petersburg has reported favorably, the company to put up a forfeit of $1,000.

WASHINGTON.

SEATTLE.—The Seattle City Railway Co., A. F. Haas, manager, will begin May 1st to rebuild nine miles of track and will also buy sixteen new cable and electric cars. The company will also build two new car barns to hold thirty cars and one 500-h. p. power house.

SEATTLE.—The Seattle & Tacoma Electric Railway Co. has been incorporated by John Collins and George A. Burch of Seattle, Henry Bucey and H. E. Kanatavoid of Tacoma, to build between Seattle and Tacoma; capital stock, $1,000,000.

INDEX.—N. Rudebeck of Everett, with others, proposes to build an electric railroad from Index to mines in the vicinity, and have it finished within one year.

SPOKANE.—The City Park Transit Co. has applied to the city council for a franchise to extend its Lidgerwood line from Hillyard to Coeur d'Alene Park, about two miles. Other extensions are also contemplated. Frank Neitzel, general manager.

EVERETT.—It is said that agents for John D. Rockefeller are preparing plans for a large electric lighting plant on the Pacific coast. It is proposed to furnish power to operate the Everett & Monte Cristo Railroad, a steam road sixty-five miles long, by electricity. G. Colby, 1 Broadway, New York, president.

SPOKANE.—The Washington Water Power Co., H. M. Richards, president, and D. L. Huntington, manager, is now building a new power house of 3,000 h. p. capacity.

WEST VIRGINIA.

HUNTINGTON.—The Consolidated Light & Railway Co., J. L. Caldwell, president, and W. W. Magoon, manager, will rebuild three miles of track, and it has ordered three new open cars.

CHARLESTON.—The Charleston Railway Co. is reported to have secured a charter for a street railway in this city. The capital stock of the company is $100,000, and the incorporators are J. E. Scraggs and F. W. Sweet.

HUNTINGTON.—The Huntington Connecting Ry. has been incorporated with a capital stock of $50,000 to build a street railway in this town. The incorporators are E. E. Canda, New York; Ely Ensign and W. H. Banks, Huntington.

WHEELING.—The Wheeling Railway Co., T. H. Conderman, president, is to build an undergrade crossing under the Baltimore & Ohio tracks on its Boggs Run line, and make extensions to its car barn and power house. It will buy six Jackson & Sharp summer cars.

MARION.—Permission has been granted by the county court to the new electric railroad from Fairmount to Fairview, which is to be twelve miles long and to be built at once. The final survey has been made.

WISCONSIN.

FOND DU LAC.—The Fond du Lac Electric Co., F. F. Grover, vice president and manager, expects to build four miles of new track before June 1st. It will buy six 18-foot and 26-foot cars and build a new car house.

APPLETON.—William Michelstetter is in correspondence with parties who propose to build a 20-mile electric road between Appleton and Seymour via Freedom and Osborne.

CEDARBURG.—The old Cedarburg plank road as far as the Ozaukee County line and a new electric railway will be built to connect this place and North Milwaukee.

OSHKOSH.—The Citizens Traction Co., E. E. Downs, manager, has agreed to build a street railway between here and Neenah and has deposited $5,000 with the city of Neenah as a guarantee the road will be constructed before July 1, 1899.

BARABOO.—The city council has granted a franchise to the Baraboo, Kilbourn & Devil's Lake Electric Railway Co. to use a street in

this city. The line will cover a distance of eighteen miles. J. P. Cotterell of Milwaukee is interested.

MILWAUKEE. — The Milwaukee Electric Railway & Light Co. has been granted a 50-year franchise for an extension of its Center St. line through the village of North Milwaukee. Work will be commenced as soon as the weather permits and completed by July 1st.

RACINE.—At a recent meeting of the Belle City Electric Ry. the company reorganized and the operation was turned over to the Milwaukee Co. The directors voted to expend about $75,000 on improvements, and it is proposed to extend the line to Lakeside.

KENOSHA.—John W. Wagner, in behalf of the Kenosha Traction Co., has applied for a franchise for an additional right of way. The proposed road is to connect with a road now building from Waukegan to Evanston, Ill.

EAU CLAIRE.—The Eau Claire & Chippewa Falls Electric Railway Co. is considering plans for the extension of its line ten miles north to Bloomer, and fifteen miles from Bloomer to Long Lake, a popular summer resort. H. N. Bates, president.

KENOSHA.—W. H. Schott, superintendent of the Metropolitan Electric Co. has applied to the city council for a franchise to construct and maintain an electric railway in this city.

OSHKOSH.—John Martin of Oshkosh offers to build the proposed Omro, Berlin & Oshkosh Electric railway if $13,000 is raised, $5,000 to be expended in ties and $8,000 in iron.

DEPERE.—The Fox River Electric Railroad Co. has petitioned the city council for a franchise to extend its line into this city. M Joannes, receiver, Green Bay, Wis.

Cleveland, O., street railway employes have formed a union.

The Massachusetts House Committee on Street Railways has reported against vestibules.

The Massachusetts House has refused to further consider a bill incorporating the Street Railway Mutual Insurance Co.

Business men in Davenport, Ia., Rock Island and Moline, Ill., are advocating the adoption of mail collection by the Tri-City street car service.

The Brooklyn (N. Y.) Rapid Transit Co. is said to be negotiating with the Manhattan Beach Improvement Co. for the Manhattan Beach Hotel.

The New Orleans & Carrollton Railroad Co. has purchased the Canal & Claiborne property and will issue $2,000,000 of bonds to pay for the purchase and the outstanding indebtedness of the company.

General Manager Thos. H. McLean, of the Toledo Traction Co., has granted the city permission to affix street signs to its poles. This is done to save Toledo some expense, but it is understood that the poles shall not be damaged and that the company shall in no way be liable for any injury to the signs.

A bill providing that all street cars in Buffalo be heated in winter by electricity was favorably reported by the Railroad Committee of the New York Senate on March 21st.

A conductor of one of the trolley mail cars operating in Rochester, N. Y., has been arrested upon the charge of robbing the mails; marked money from a decoy letter was found in his possession.

The Louisville (Ky.) Railway Co. is defending a $5,000 damage suit because the conductor of one of its cars in an altercation with a passenger about his fare, said: "I know you're beating your way."

The Austin (Tex.) Rapid Transit Co. was compelled to cease operating its electric cars for a time last month because of low water at the city's water power plant. Mules were substituted where possible.

April 1st the Mahoning Valley Street Railway Co., of Youngstown, O., increased wages of employes from 13½ ano 15 cents to 14, 15, 16 and 17 cents. This is an indication that the advance agent of prosperity has been able to deliver the goods.

The Superior (Wis.) Rapid Transit Railway Co. on April 1st put in effect a new wage schedule. The highest increase will amount to nearly 25 per cent and will be received by the employes oldest in service; the new men are to be paid less than the older employes.

ECHOES FROM THE TRADE

THE LACLEDE CAR CO., St. Louis, has received an order from the Brooklyn Street Ry. for 50 cars.

THE PANCOAST VENTILATOR CO., of Camden, N. J., and Philadelphia, pending action on a petition for a receiver filed by judgment creditors, was last month enjoined from contracting debts or receiving or paying out money.

SUPT. T. F. GROVER, of the Fond du Lac (Wis.) Electric Co., has placed the orders for material and equipment; the American Car Co., St. Louis, will build the cars which will be equipped with Westinghouse motors, and the Johnson Co. will furnish the rails.

E. F. DE WITT & CO., of Lansingburgh, N. Y., makers of the well known "Common Sense" sandbox for street cars, for which they have recently taken some particularly gratifying orders, have appointed the W. R. Garton Co., 603 Manhattan Building, Chicago, agent for their goods.

THE ELECTRIC STORAGE BATTERY CO., of Philadelphia, has published as "Circular No. 48" copious extracts from Mr. Joseph Appleton's paper on the "Latest Progress in the Application of Storage Batteries" which he read before the New York Electrical Society in January last.

THE TURNER ENGINEERING CO., of Bucyrus, Ohio, is furnishing the "Turner" water tube boiler, 250 h. p., for the Findlay (O.) Street Ry.; two 200-h. p. for the Central Traction Co.; three 225-h. p. for the Indianapolis Ice & Cold Storage Co. Large boilers of this type recently put into service are showing excellent results.

THE BURLINGTON WOOLEN CO., maker of woolens for street railway uniforms, has been consolidated with two other mills, under the name of the Burlington, Winooski & Colchester Mills, and the goods are being sold by Dudley, Batelle & Hurd, 53 Worth St., New York. Mr. Charles Bowler remains in charge of the railroad department.

THE JOSEPH DIXON CRUCIBLE CO., Jersey City, N. J., has recently issued "Dixon's Teacher's Note Book" which contains an essay on lead pencils, giving their history and interesting details as to the methods of manufacture The Dixon Co. makes upward of 30,000,000 pencils a year. The following pages are filled with matter calculated to interest either the teacher or his pupils.

THE WESTERN ELECTRIC CO. prior to the recent rise in copper, greatly increased its stock of rubber-covered wire and is prepared to meet the demand of the spring trade with reasonable prices and prompt shipments. In addition to its handsome 40-page Fan Motor Catalog the company is issuing a series of four-page bulletins descriptive of the different styles of fans. Bulletin 16 F, on W. E. standard ceiling fans for direct current, has just been issued.

ALFRED G. HATHAWAY, 47 Cuyahoga Bldg., Cleveland, advises us that at present he is very much occupied in building the new works of the Vulcanus Forging Co., of which he is secretary and treasurer. This company will make all kinds of forgings and will give special attention to the demands of railroads; it has now orders from four of the largest railroads in the state for air brake pins, and from the Government for all the special forgings, some 90 tons, for the breakwater at Cleveland. The Hathaway transfer tables will be made at the shops and handled by Mr. Hathaway as heretofore.

THE WATERLOO STANDARD RAILWAY CLOTHS, manufactured by the Waterloo Woolen Manufacturing Co., Messrs. Patterson & Greenough, selling agents, New York and Chicago, are becoming very popular. They are specially desirable for uniforms for conductors and motormen, where strength and durability are most essential. The Waterloo Woolen Manufacturing Co. is one of the oldest and most reliable concerns and has a pride in producing the very best cloths possible. Companies who contemplate selecting uniform cloths, or changing from those now in use, should investigate these goods.

THE GREEN ENGINEERING CO., of 519 Western Union Bldg., Chicago, maker of the Green traveling link grate, and general agent for the Edgemoor Iron Co., is now installing five watertube boilers in 900-h. p. units for the Milwaukee Electric Railway & Light Co. and fitting them with Green grates. These grates are the largest that have ever been built. Among other recent contracts taken by the company, and calling for the widest chain grates built are orders from the Armour Packing Co., Swift & Co., Metropolitan Street Railway Co., Kansas City; West Chicago Street R. R.; Edison Electric Light Co., U. S. Glue Co., of Milwaukee.

ELMER P. MORRIS, 15 Cortlandt St., New York, has recently secured an order from the Elmira & Seneca Lake Electric Ry., Elmira, N. Y., for 45,000 ties, 140,000 lbs. of copper, 650 flexible brackets, 2,000 tons of rails, 900 wooden poles and all of the overhead material and bonds; included in the copper order were 17 miles of figure 8 trolley wire. Orders for iron poles have been taken by Mr. Morris from the Brooklyn Heights R. R., the Union Ry., of New York; the Columbia Ry. and the City & Suburban Ry., Washington, D. C.; the New Jersey Electric Ry., Newark. Other orders for poles were received from Plainfield, N. J., and Phoenixville, Pa.

ADAM COOK'S SONS, 313 West Street, New York, call attention to their original Albany electric motor grease for use on motors and journals. The different consistencies in which this lubricant is furnished make it effectively applicable to any motors now in use, and it is claimed, insures better lubrication, better conditions of journals, and longer wear of brasses than is possible with any other grease on the market. It also saves the burning out of armatures. This is substantiated by the testimony of the many electric street railways the manufacturers are supplying. One large corporation says: "Since using Albany electric motor grease we have had no burnt-out armatures or brasses; when using the best mineral greases we were constantly troubled."

THE CHICAGO FUSE WIRE AND MANUFACTURING CO. announces a steady and increasing demand for its trade mark line of tested fuse wire and links, and that its new method of packing in tin boxes has become very popular alike with the dealer and consumer, as it keeps the wire practically air-tight and insures against any possible danger in handling the stock. Conforming to the National Underwriters' rules, this company is placing its trade mark on each fuse link terminal, and it states that in this branch of the business it has also made great improvements, which not only enhance the appearance and accuracy of the goods, but by a special improved process, it is able to reduce the cost of making, and thus offset the recent advanced cost of material.

THE W. R. GARTON CO., manufacturer's agent, has removed to 603 and 604 Manhattan Building, 315 Dearborn St., Chicago, and has exceptionally well appointed quarters where a good stock of insulating tapes, insulating paints, carbon rheostats, railway material and repair parts is carried. The company is agent for the following manufacturers: Railway Equipment Co., Cincinnati; Massachusetts Chemical Co., Boston; Keystone Electrical Instrument Co., Philadelphia; Billings & Spencer Co., Hartford; C. S. Knowles, Boston; Graphite Lubricating Co., Bound Brook, N. J.; Raster Carbon Rheostat Co., Chicago; Miller-Knoblock Co., South Bend, Ind.; Pittsburg Steel Hollowware Co., Allegheny, Pa.; Jenny Electric Manufacturing Co., Indianapolis, and exclusive sales agent for the "America" incandescent lamp.

THE SAMPSON CORDAGE WORKS, Boston, maker of solid braided cords and cotton twines, has recently issued two small circulars descriptive of Sampson spot cord which is so called from the colored spots on it that constitute the trade mark. This cord is the standard for the suspension of arc lamps and for trolley cord. The sizes generally used for trolley cord are Nos. 8, 9 and 10, which are ¼ in., 9-32 in., 5-16 in. respectively in diameter. The life of cordage is greatly increased if it is protected from the action of the atmosphere, and this has been effectually done by the Sampson Co. by its water proofing, which also gives the cordage a smooth and pliable finish. For small sizes the waterproofing is applied at an additional cost of 5 per cent; with sizes above 3-16 in. no extra charge is made.

J. W. GORMAN'S ATTRACTIONS for the season of 1899 are presented in a 20-page pamphlet recently mailed to street railway companies which will make vaudeville and other theatrical attractions a feature during the coming season. J. W. Gorman, makes his headquarters at 180 Tremont St., Boston, and will be pleased to correspond with street railways, give terms and arrange for appointments; he will meet interested parties at his own expense anywhere in New England.

THE H. W. JOHNS CO. reports the most active street railway trade since it has been in business. The Chicago office reports among its large sales, an order for 10,000 No. 2 "Giant" strain insulators for the Milwaukee street railway company. This makes 19,000 of this special design of strain insulators furnished to that company.

JOHNSON & MORTON, 31-37 Catherine St., Utica, N. Y., are the makers of new type slate lined, fire proof junction boxes, switchboards and panels. They have recently issued a circular description of their standard junction box, and giving directions as to the information desired when making estimates on boxes.

THE DUPLEX CAR CO., Postal Telegraph building, New York, reports that it is every day taking street railway men to see one of its latest duplex cars which is now operating on the line of the Safety Third Rail Co., between Manhattan Beach Hotel and Oriental Hotel. A great many of those who have made an inspection of the car express the opinion that this is the coming car, and many compliments have been received on the construction and finish of the cars of this type that have been built.

THE WESTERN BRONZE TROLLEY WIRE which is handled extensively by the Western Electrical Supply Co., of St. Louis, Mo., is said to be meeting with universal favor for general street railway construction. The company makes numerous claims of superiority for this wire over the standard grades of trolley wire which have heretofore been in general use; the tensile strength is given at about twice that of the ordinary wire, and the life of this wire is also said to be very great as compared with other wires because of the wear being slow and uniform; it has fully the carrying capacity of the copper trolley wire, and is made in all shapes and sizes for any equipment desired. The Western Electrical Supply Co. bases its claims for superiority upon the statements of practical street railway men, who report a saving in both construction and maintenance.

THE WESTINGHOUSE ELECTRICAL & MANUFACTURING COMPANY has been awarded the contract to furnish the power transmission plant to operate a new electric railway between Toronto and the town of Aurora which is the creation of the Imperial Lumber Co. The central power house will be located in Toronto, and current will be transmitted to a sub-station at Aurora, 15 miles distant, at 15,000 volts.

"Q & C CO. SPECIALTIES" is the title of a 50-page illustrated pamphlet recently published by the Q & C Co., of Chicago, New York, San Francisco, Philadelphia, St. Paul, Montreal and St. Louis. It is devoted to the department of engineering and maintenance of way and contains illustrations and descriptions of many of the company's well-known specialties for steam and electric

railways. Among those in which an electric railway manager will be most interested are bridges and viaducts, bolts, car replacers, cold sawing machine, frogs and switches, portable rail saws, jacks, pneumatic tools, rail drills, tie plates and braces, rails and trolley poles. The Q & C Co. has for years carefully investigated new appliances as they appeared on the market and selected the best of each kind, building up in this way a business in nearly all the principal lines of railway supplies. The company's catalog for Department A, as stated comprehends only the specialties falling under the head engineering and maintenance of way; the subdivison into departments with a catalog for each was adopted in order to issue catalogs of convenient size more suited for ready reference wherein were described the machinery and appliances which naturally fall under one head; the company's other publications are issued in a similar attractive style and may be had on application. Among the specialties in machinery handled by the company are the pneumatic oil feeding and saving system and the Q & C-Scott boiler feeder, both of which have been fully described and illustrated in the "Review." The Q & C Co. is special agent the Pennsylvania Steel Co., and for steam and street railway equipment, structural material, steel castings, etc.

THE J. G. BRILL CO. recently received from a railroad official of Bristol, England, a letter telling what Englishmen think of a palace car shipped by the Brill Co. not long ago. The following is an extract: "The car we purchased from you is, I am prepared to say without fear of contradiction, the handsomest car in Europe, and I have repainted it cream and white, with gold lining and decorations, renewed curtains, cushioned the outside seats, india rubber to steps and turkey carpeted the interior. The car is kept for use by the directors and for special festival occasions."

EUGENE MUNSELL & CO., of New York and Chicago, are prepared to separate street railways and electrical manufacturers from their money by giving them in return good India and amber mica for electrical insulation. This firm has recently decided to establish a Canadian factory, and concerning this the Ottawa Citizen, under date of Feb. 9, 1899, says in part: "Yesterday a large building on Wellington street was leased for a term of years, and an agent will be appointed to look after the firm's business at once. It is their intention to forward the mica direct from the mines to their factory here, where it will be looked over and prepared for shipment to New York. Mr. Munsell has not yet decided upon an agent, but the choice will, in all probability be made in Ottawa.

"Ottawa as a mica center is perhaps the best known in Canada across the border, and during the past couple of years an immense business has been carried on between parties in this city and firms in all the large cities of the United States. Of the heaviest buyers from this section last year were Eugene Munsell, whose big factory at New York is the most extensive in America."

THE PAILLARD NON-MAGNETIC WATCHES have been perfected to satisfy the demand of the watch carrying public for a perfect timepiece, one that besides having all the skilful adjustments to various influences of other watches, is also unaffected by magnetism. The present ubiquity of electrical machinery and appliances makes it difficult to protect an ordinary watch against magnetic influences, which act principally upon the balance and hairspring. Carl A. Paillard, an expert adjustor of Geneva, Switzerland, after 14 years of scientific experimenting, has perfected a palladium hairspring and a compensation balance that entirely overcome the difficulties heretofore experienced. The Paillard non-magnetic watches are made by A. C. Becken, of Chicago, in all sizes and grades, and each watch is warranted to give satisfaction as regards durability, workmanship and accuracy, and the price is stated to be no more than for other watches of the same finish which do not have these improvements. The desirability of such watches for street railway men is apparent.

SWART S METAL REFINING CO., Chicago, reports a large and very satisfactory business with street railways. The company always pays the highest market price for old metals, and during the past three months has purchased tons of old copper wire. It also manufactures a high grade babbitt which is meeting with a steadily growing demand.

THE LOMBARD WATER-WHEEL GOVERNOR COMPANY has received an order for three additional type "B" governors for the plant of the St. Anthony Falls Water Power Co., of Minneapolis. These governors are for the three additional units of four Victor turbines each, which are now to be installed. This will make in all 10 Lombard governors in this plant, regulating 40 water wheels. These governors were illustrated in the "Review" for February, 1899.

THE GARTON-DANIELS ELECTRIC CO., of Keokuk, Ia., is every spring rushed with orders for its lightning arresters, and knowing what to expect each year, it endeavors, during the winter months, to prepare as large a stock as possible. This spring the company had twice as large a stock on hand as ever before, but has just doubled the force in order to keep pace with the demand for goods, and still finds that it is shipping faster than it is making them. Additional force will be employed, however, and all orders shipped with the usual promptness, as it is thoroughly appreciated that when a man wants lightning arresters, he wants them badly. This company's new catalog, No. 22, is in great demand, and may require a second edition.

MESSRS. D. L. BATES & CO., of Dayton, O., are among the best known of makers of electric fans, and as the season will soon be at hand when a fan is a necessity for an office man and a greatly appreciated luxury for everyone, this firm has issued an attractive catalog and price list of its ceiling, desk and pedestal fans. They are made in all sizes and wound for any voltage and either direct or alterating current. The designs are attractive, and the high reputation of this firm gives assurance that the fans are as good as they look.

THE STAR LUBRICATING OIL CO., of Cleveland, O., has issued to the trade a neat little pamphlet calling attention to a number of its leading brands. In its compilation care has been taken not to encroach upon a dealer's or user's valuable time rehashing the history of oils. In clearly printed and well displayed marginal notes the important oils and lubricants are given, to be seen at a glance.. Accompanying them are a few words emphasizing the merits of the various oils and relating how and where the best results can be obtained from use. The booklet also contains some excellent testimonials, all from large and prominent manufacturing concerns, who have found it advisable to use the product of this company.

THE ELECTRICAL INSTALLATION CO., Chicago, has closed a contract for its overhead construction for the Northeast Electric Ry., Kansas City, and for the Grand Avenue Division of the Brooklyn Avenue Ry., Kansas City, and also has the contract for furnishing about a thousand iron poles to the Metropolitan Street Railway Co., Kansas City. The company has recently secured a contract for an extension to the Vicksburg (Miss.) Electric Ry., and is now building three miles.

MERCHANT & CO., INCORP., of Philadelphia, New York and Chicago, have recently received an order from the War Department for 786 of their galvanized "Star" ventilators, for use on the official quarters and barracks to be erected at Havana and Matanzas, Cuba. There will be 587 "Star" ventilators 24-in. in diameter, and 199 of 14-in. diameter. Great promptness is necessary in the delivery, which the exceptional facilities possessed will enable them to accomplish. Some idea of the size of the order can be had when it is stated that if these ventilators were placed in a line with their edges touching they would cover a distance of nearly half a mile. Within the last few months this company has also supplied 500 13-in ventilators for the new Government Hospital at Fortress Monroe and Savannah.

The motormen of the Beaver Valley Traction Co., Beaver Falls, Pa., went on a strike March 13th, because of the discharge of four of their number.

The Rome (N. Y.) Street Ry. has been sold to a New York syndicate headed by A. W. Soper, and it is reported that it will be operated by compressed air.

THE
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We are seldom allowed to go unreminded of alleged failure by companies to keep promises made the public or the city, but when the shoe is on the other foot the papers seem to think it is a good joke. An instance of this comes from Montreal where the city and company agreed to divide equally for five years the cost of removing snow from streets, the city being the party to decide how much it was necessary to take away. The result has been that while some $393,000 has been spent in this work, the company has been charged with $255,000 of the amount, or two-thirds of the whole.

In our April issue it was noted that a number of street railways in different parts of the country had announced an increase in the wages of their employes; among these were roads in Minneapolis; Leavenworth, Kas.; Superior, Wis.; Marietta, O., and the Mahoning Valley at Youngstown, O. We have this month to add that the DesMoines (Ia.) City Ry. made an advance of 10 per cent on May 1st, the Parkersburg (W. Va.) Electric Light & Street R. R., and advance of 20 per cent, and the Consolidated Traction, of Pittsburg, an advance of 11 per cent.

In every instance the increase was stated to be due to an increase in traffic, and it may be taken as an indication of the fact that whenever a company can do so it will gladly advance the wages of its employes.

In discussing the "franchise tax" bill passed at the last session of the New York Legislature and at the present writing in the hands of the governor, Senator Ford is quoted as follows:

"The main virtue of the bill is that it proposes to tax these properties as real estate instead of personalty—that means that whatever tax the assessors levy must be paid. It cannot be sworn off nor indebtedness be offset against it. In other words the possessor of the public franchise is placed in the same position so far as the tax laws are concerned, as the owner of a house and lot whose property is taxed, regardless of whether it is producing revenue or not, and without regard to the mortgage that may be upon it, even though that mortgage covers 80 per cent of the value of the property."

Senator Ford is reported as saying that a simple plan is to add the market value of the stock and bonds of the corporation, then subtract the valuation of real estate and other tangible property upon which the corporation is now assessed. The result in his opinion shows the value of the grant or franchise that the corporation has received from the city. This can be assessed at 60 or 70 per cent, as is other real property.

This is truly admirable for its simplicity, but we cannot say so much for justice of the plan to tax a company on its debts.

One of the questions that is just at present greatly interesting the general public is the extent to which liquid air may be used for propelling machinery in the near future. In the April number of McClure's Magazine, Mr. Charles E. Tripler, of New York, was quoted by Mr. Ray Stannard Baker as saying: "I have actually made about ten gallons of air in my liquifier by the use of about three gallons in my engine. There is, therefore, a surplus of seven gallons that has cost me nothing, and which I can use elsewhere as power." We do not doubt but that the great majority of engineers who read this merely expressed a desire to know whether Mr. Tripler had been correctly quoted, and placed no faith in the claim that power may be had for nothing. Others who did not take the statement at its face value thought, that since so much was claimed, that there might be some advantage in using liquid air for driving machinery. Closely following this article came the announcement from Zurich, Switzerland, that a street car propelled by a liquid air motor had been tested, and that if the reports were satisfactory the new power would be adopted.

On another page will be found an article on the production of liquid air and the economy of using it for a working fluid in power machinery, which will prove of especial interest at this time Some of the conclusions there reached, stated in a general way, are as follows:

Up to the present liquid air has been made only by compressing and cooling atmospheric air. With the best apparatus about 40 per cent of the work done in the steam cylinder of the compressing engine is lost in friction and in heating the jacket water of the air cylinders. When the air has been compressed it is carried to the liquefier where a loss of about 95 per cent ensues in the process of liquefaction, the net result being that 97 per cent of the energy of the steam has been lost, and one horse-power-hour gives us about one-third of a pound of liquid air.

Using liquid air in a boiler and engine with the atmosphere as a source of heat, it is shown that what has cost us

one horse-power-hour can not theoretically give us back more than 2.8 per cent of a horse-power-hour. The enormous pressure, over 11,000 pounds per square inch, with which we must deal to get even 2.8 per cent efficiency is too high for practical working, and in practice the re-evaporated air would be used in a motor at a smaller pressure, and probably at a lower efficiency. It would doubtless prove economical to reheat the air before it enters the motor, as is done in some compressed air motors; that is it would be used as compressed air that has never been liquefied would be used. This being true, it should never have been liquefied.

Where air is compressed and then used as the working fluid in a motor any excess of pressure over that at which it is to be used results in a loss. The reason for compressing to the higher pressure is to enable the air to be transmitted through pipes or to be more conveniently stored in tanks. It will only be used when the economy of air at high pressures is greater than other methods of transmitting power.

Liquid air offers no advantage over compressed air, save that when evaporated it will render available four or five times as much energy as may be stored in the same bulk if the air is only compressed to 2,500 lb. per sq. in. But this advantage is only for temporary storage, as the liquid must be open to the atmosphere because of the high pressures resulting if it be kept closed; if kept so exposed it slowly evaporates.

There is no present danger of liquid air relegating electric generators and motors, or even air motors, to the scrap heap.

We all admit that the laborer is worthy of his hire, and would like to see everyone who works for his living get twice as much for his labor as he does now; in fact we would greatly appreciate it were our own income increased. Yet it will not do to overlook the fact that labor is helpless without capital and that the capitalist also is worthy of his hire, and justly entitled to compensation for the use of his money. At the present time when a question as to wages arises between employer and employe the popular sympathy is generally with the employe, and invariably so if the employer is a corporation, regardless of the merits of the case. The familiar expression, "a corporation has no soul," (which probably few but lawyers know is only a statement of the reason why corporations were not subject to the ecclesiastical courts) to the people who use it most means that a corporation is grasping and grinding in all its dealings and deserving of no favorable consideration.

Further, if the employer happens to be a public service corporation, the public, while rendering every aid it can to striking employes who demand higher wages, strikes at the ability of the company to meet the demand by placing burdens upon it in the way of more taxes, and enforced reductions of rates.

On April 8th the employes of the Wheeling (W. Va.) Ry. struck for an advance of 25 per cent in wages, rejecting all offers of compromise. The strikers had the sympathy of the public, and the company could not secure adequate protection from the city and state officials. This road happens to be an interstate line, and also carries the mails, and as a last resort an appeal was made to the federal courts for protection. On April 18th four men were sentenced to 30 days imprisonment and fined $50 each for violating an injunction order. Before passing sentence the court delivered a lecture to the public upon the matter of labor strikes, which will be found on another page. A short extract on the effect of the misguided sympathy of the public is as follows:

> I understand from the public press that this community is in sympathy with what are now known as the strikers. Let me say now that this is a mistaken sympathy upon their part. No community can decide, as such, between the rights of the employer and the employe. They cannot be familiar with the circumstances that have influenced the employer to refuse to accede to the demand of the employe on this occasion.
>
> This misguided sympathy is often a wrongful sympathy, and operates not only to the prejudice of the parties for whom the sympathy is expressed, but to the injury and detriment of the public at large. * * * Whenever any community undertakes to set up for itself a standard and to enforce it by mob violence, communistic orders or by efforts upon their part which are conceived in a spirit of anarchy, and which lead to and end in anarchy, then the time has come when the laws of the land must be enforced to control that spirit of anarchy.

At Bay City, Mich., was another strike which resulted because the company would not reinstate a man who had flatly refused to obey the company's order in a matter which was part of his duty until it was in effect countersigned by the labor union. The strikers here, also, had the sympathy of the community, but this sympathy was not evidenced by mobbing the cars and obstructing the tracks

That the same scenes were not enacted in Bay City as in Wheeling is altogether due to the good sense of the employes who refused to countenance violence of any kind and preserved the most friendly relations with the company during the entire period of the strike.

We would call especial attention of those of our readers who are connected with the management of large electric railway systems to the account on another page of this issue, of the school for motormen, which the Metropolitan Street Railway Company of New York City conducts. The object of this school is not to give motormen theoretical instruction in electricity or mechanics, but is to teach new men their duties in a more thorough manner than is the case where new men are merely "broken in" on the cars.

Instruction is given by means of recitations, lectures and laboratory practice in conjunction with work on the cars in service. The advantages which have resulted from employing as instructors men who are skilled as teachers, is that more competent and better drilled motormen are secured. This is stated to be a great gain to the company in two directions; there are fewer accidents and, therefore, the damage claims account is less, and the wear and tear on the car equipment is less.

ACCOUNTANT'S ASSOCIATION.

The Street Railway Accountants' Association of America has issued its Circular No. 10, dated April 15, 1899. This circular is entitled "An Explanation," and it certainly gives many reasons why street railway companies should be enrolled upon its membership list. The importance of such an association must be apparent to every officer of a street railway company. The whole business of a street railway revolves around the accountant's office and the more ideas the accountant has, the more he rubs up against other accountants, and effects an interchange of views regarding systems and the ways of keeping accounts to the best advantage, the

more efficient does he become, and consequently the more valuable to his company.

In the matter of "blanks and forms" this association has been instrumental in affording great assistance to its members and the exhibition made of such ones as individuals have devised has been one of the chief benefits. The plan of distributing them among members on the principle of a circulating library, members being entitled to keep the documents for one month, has been found practical and helpful. There is no department coming within the accountant's scope which is not fully discussed at the meetings.

The presidents and managers of the street railway companies recognize the value of this association, and speak the most encouraging words in its favor.

WHY SOME PARK AMUSEMENTS FAIL.

Editor "Review": The writer has made a very careful study of the question of parks and amusements operated by street railway companies with a view to increasing travel. Why is it that some of these operations prove such a big success, while others are equally disappointing? Of course there are some localities where it seems impossible to do anything of the kind, just as there are cities where the local theater always loses money. But in the great majority of cases, and with conditions fairly favorable I am satisfied that it is a most valuable adjunct to the summer business. The trouble with nine out of ten of the failures to make such theatrical entertainments profitable or even self-sustaining is that they are not properly managed. The manager of the street railway may be ever so good a man in the work for which he has been trained and in which he is experienced, and yet when he undertakes to run a show may not know the first rudiments of the business, even though he thinks he does. For instance when he charges 25 cents for a 10-cent performance he makes a fatal mistake. If he wants to charge that much he must provide an attraction that is worth it; that is, one equally as good or even better than can be seen for the same money on the vaudeville stage of his own town. Many of the vaudeville theaters stage a program for 25 cents a seat which costs $1,000 a week to produce, and when the park offers one for the same seat price, that only costs $200 a week, the public are not going to pay freely for it.

If you are going to put on a cheap production, which may be as good as is required under the circumstances, why then make a correspondingly low admission, say 10 cents. If you want to go into the work extensively and handle first-class productions and expect to make them profitable, you should employ a thoroughly competent and experienced manager for the work, just as you would do if you were offering the same production in an opera house. When a theatrical manager expects to maintain good admission prices he knows he has got to keep up the standard of his productions, hence when he books, he does it with the special idea in view of the price he intends to make on his house for the season. The price charged at parks can be more variable than is possible when running a theater, and it may be 10 cents one week and 25 the next, but whatever the price, give a production which is worth the money and always endeavor to give the public just as much for their money as you can possibly afford. I am satisfied, however, that where it is desired to go into the amusement line to any considerable extent that the railway manager makes a mistake in trying to look after it himself, and that unless he has had a good deal of experience in the work he will make more money at the end of the season, and give far better satisfaction to his patrons if he will employ some experienced theatrical manager to run it for him. It is not difficult to do this as theaters generally are closed during the season of out door performances, and competent men can be had at a reasonable price who would be glad to fill in time otherwise on their hands. Professional.

SIX-MINUTE HEADWAY ON SINGLE TRACK.

Editor "Review": I would very greatly appreciate any information your readers may be able to give me through your columns, as to their experience in operating a 6-minute headway on a single track line, and how they work it. I have thus far been unable to learn of any road doing this, and it may be none are operating under such conditions; but we have a line in contemplation where during the summer we should want a frequent headway, but during the remainder of the year should not need to run a car more frequently than 20 or 30 minutes each way. Our line is a suburban one to a lake. Single Track.

DAYTON & GERMANTOWN CO.

The Dayton (O.) & Germantown Traction Co. has been granted a franchise and has begun the construction of a new line into Dayton. The officers of the company are J. A. Arnold, president; T. C. Lindsey, secretary, and B. F. Douglas, treasurer. It is promised by the company that the road will be in running order by October of this year and as the men connected with it have had considerable experience in such ventures it is safe to conclude the promise will be kept. The franchise is to be forfeited if the road is not run continuously for a period of six months.

The company intends erecting a large hotel at the Germantown end of the line and it is expected the mineral springs located there in connection with the hotel will develop the terminus into a popular health resort. The road has the advantage of a number of interesting points on its line, such as the Soldiers' Home and the Miami Military Institute, all of which will be benefited as well as affording patronage for the road.

BOSTON ELEVATED BANDS.

Mr. W. M. Perkins, of Somerville, Mass., a conductor on the Union Square line in Boston and a brass band leader, has organized two bands from among the employes of the Boston Elevated Railway Co. The company has provided a band room on Tremont Row, where the members meet for practice. One band has been chosen from the day force and one from the night force; all members are to be uniformed. Mr. Perkins is the leader of the Somerville band, which has become very popular. He studied harmony under the instruction of John K. Paine and has been an organist, choir director and an orchestra leader.

The Rapid Transit Railway Co., of Syracuse, N. Y., has moved its offices from the Snow Building into the Gridley Building, where it occupies the entire third floor.

The Omaha & Council Bluffs Railway & Bridge Co.

The Omaha & Council Bluffs Railway & Bridge Co. is one of the oldest electric railways, having been equipped for electric working in 1888, when the present company was organized to build a bridge over the Missouri River and operate an electric line between Council Bluffs and Omaha; the company succeeded the Council Bluffs Street Railway Co. in the ownership of the street railway lines in that city. The company's lines aggregate 25 miles, measured as single track and are shown diagrammatically in the accompanying map. The arrangement of the lines is peculiar. From the loop A in Omaha (the company has about one mile track in Omaha) to the approach of the bridge at J, the track is double; from J to K, which includes the bridge and its approaches, .6 mile, the track is single; from K to the power house, P, 1.3 miles, and from P to Y, 2.3 miles, it is double; from Y to Z, .4 mile, the track is double; from Z to B is a loop one block wide and .6 mile long. At Z a single track line runs to Fairmount Park at C, about 1 mile. From Y to the C., R. I. & P. Depot at D is another branch about 1 mile, two-thirds of which is double track; on this branch is the C., B. & Q. Depot. At M is a branch running to the Union Pacific Transfer Station. On the main line at the point L is the passenger station of the C. & N. W., and the Illinois Central is soon to build a new station which will make five trunk line stations reached by the interurban line for Omaha. From F to G is a cross line about two miles long connecting the Union Pacific Transfer and the Fair Grounds. There is but one grade, about three per cent for one mile, aside from the approaches to the bridge.

In winter a 10-minute service is maintained on all except the last mentioned line; one-half the cars leaving A at intervals of 10 minutes run around the loop from Z to A, and the other half run from Y to D. From E to C there is a 10-minute service and cars also alternate with the Omaha cars on the loop and the line to D, giving a 10-minute service here. In summer the headway is reduced to five and seven minutes.

The track construction in the improved streets is of 45-lb. girder rails 4 in. deep; it is expected to rebuild all these lines within the next two years. On the bridge strap rails are used. From the river to the point marked L on the map the rails are 40-lb. T laid on 6 x 8 in. x 8 ft. white oak ties spaced 2 ft. center to center; the T rails are above ground. The gage is 4 ft. 8½ in. The track bonding consists of a No. 00 copper wire under each rail to which the rails are bonded, and Benedict & Barnum bonds connecting the rails.

The trolley wire is all No. 00 copper and has never been renewed; the span wires, hangers and poles were renewed last year. Northern pine poles 25 ft. long, with 8-in. tops are used except at railroad crossings, where the poles are 35 ft. long. The company makes its hangers and uses porcelain insulators.

SUBWAY. POWER HOUSE. BOILER ROOM.

The line is divided into four sections, each having a No. 00 feeder. The sections are from A to the power house, from the power house to Y, the loop in Council Bluffs and the Fairmount Park line, and the U. P. and C., B. & Q. branches.

The power house used from 1888 until Nov. 9, 1898, is located two blocks due south of the new one and is equipped with one 150-h. p. and three 200-h. p. compound Westinghouse engines belted to four D-62 T. H. and two 100-kw. Edison dynamos.

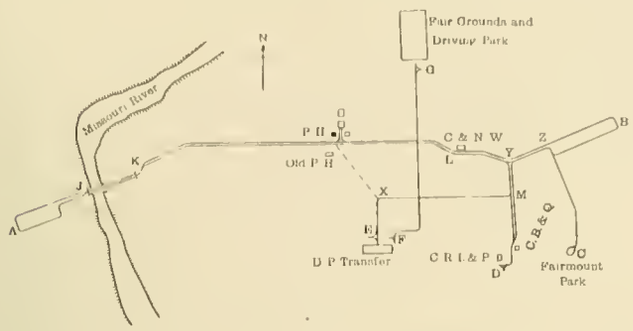
This power station has a good record, not having been shut down a whole day during the 10 years.

The new power house of the company is located on the interurban line adjacent to the office building and car shed and shops. Work on the power house was begun June 10, 1898, and it was completed and the old one shut down on Nov. 9, 1898.

It is a one-story building, 60 x 101 ft., not including the coal shed, with exterior of red pressed brick with sand stone trimmings. The building was designed by Messrs. Fisher & Lawrie, architects, of Omaha. The outside walls are 17 in. thick with pilasters and windows as shown in the half-tone

engravings. The roof is of slate laid on wood and is carried on steel trusses. The engine room occupies the eastern portion of the building; the floor level is at grade along the east front. The boiler room is back of the engine room and the floor is 2 ft. 6 in. lower. It is reached by stairs in the northwest corner of the engine room.

All the upper windows are pivoted and operated from the



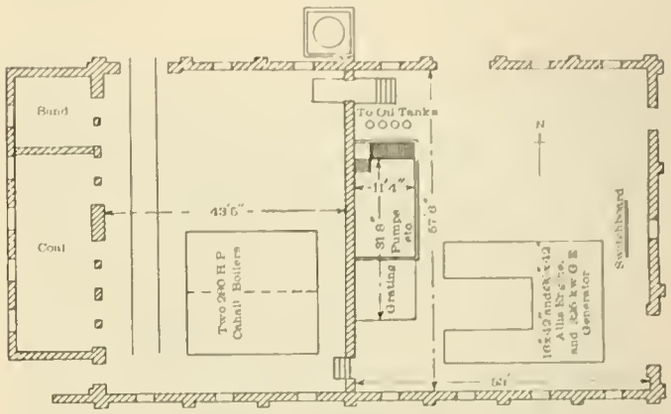
SKETCH OF COUNCIL BLUFFS LINES.

floor by ropes; all windows are provided with screens to prevent the entrance of birds.

For handling heavy weights in the engine room beams have been suspended from the roof trusses so as to permit cross beams mounted on rollers to move from east to west. There are three of these traveling beams required to cover the length of the engine room. From each beam a 5,000-lb. differential chain block, made by Moore & Chisholm, of Cleveland, is suspended on a trolley so as to move from north to south and thus any point in the room may be reached.

The engine room is 53 ft. by 57 ft. 6 in. inside, from the floor to the eaves is 22 ft. 6 in. and to the ridge 40 ft. 6 in. The interior walls are of yellow enamelled brick for about 5 ft. and then plastered. The floor is of Grant slag stone supported on I-beams and brick arches. The design con-

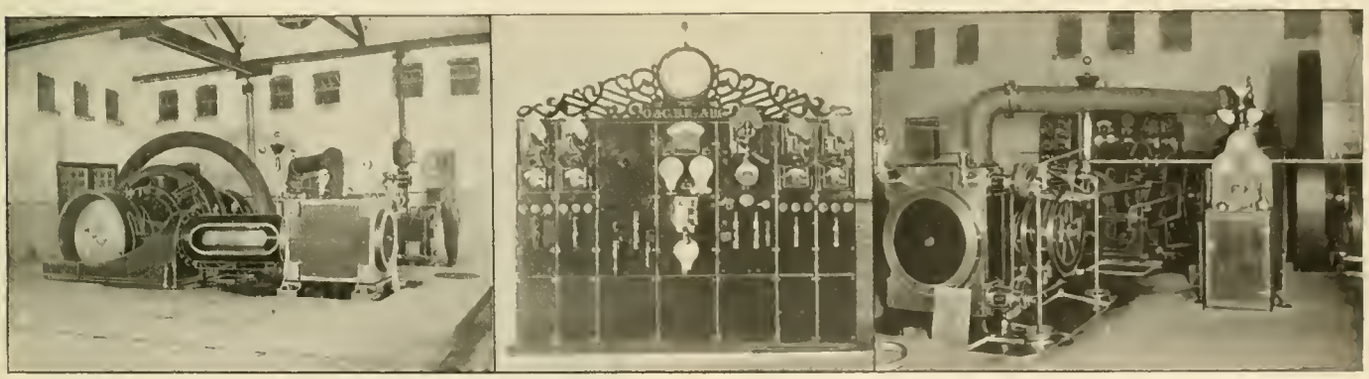
board to which have been piped both engine and cylinder oil from the lubricating system. A push button on this board summons the fireman when wanted. In the engine room only the steam main is carried overhead, the exhaust is under the floor.



PLAN OF POWER HOUSE.

The switchboard stands at the east side of the engine room in the center of the building and is of polished slate with seven panels. It was made in the company's shops. The four outside panels are for the four line sections and each has mounted on it a General Electric magnetic blowout circuit breaker, a Weston ammeter and a knife switch; these four panels also carry the switches for the lighting circuits of the power house. On the center panel is the voltmeter, a recording wattmeter, and three Bristol recording gages, one for the voltage, one for the current and one for the steam pressure. To the right of this panel is the generator panel with an ammeter, circuit breaker, and switches. To the left of the center panel are the terminals leading to the old power house, not now in use. The center panel is surmounted by a clock and a cluster of lamps.

The board stands well out from the wall and has a window



ENGINE AND SWITCHBOARD.

templated two 325-kw. units, and as one only is now installed but half the floor space is occupied.

The unit installed is at the south end of the room and comprises a cross-compound, condensing, corliss engine, with cylinders 16 and 30 by 42 in., made by the E. P. Allis Co., direct connected to a 325-kw. multipolar General Electric generator. The generator is wound for 591 amperes at 550 volts when loaded and 500 volts when running light. The speed is 100 r. p. m. and the steam pressure 150 lb.

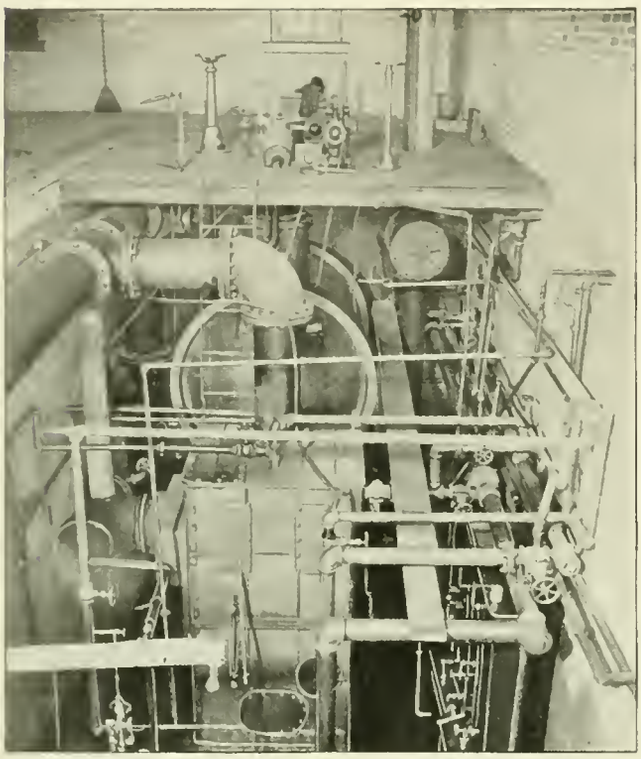
Between the high and low pressure engines is a gage

behind it, giving ample room for working at the back of the board and insuring a good light. On the back of the board all the positive wires and bars are painted red and the negative ones black. From the switchboard all the mains pass down through the floor to the subway; where the wires go through the floor they pass through porcelain tubes into whch sulphur has been poured.

In connection with the switchboard equipment should be mentioned an ingenious device designed by the electrician, Mr. Lovett, to sound an alarm when any of the circuit

breakers open. Two pieces of spring brass, slightly separated, are placed on the lower right hand corner of each circuit breaker so that when it opens the handle will strike them and press them together completing a bell circuit; the bell is mounted just behind the clock.

Under the entire engine room floor where not occupied by walls or engine foundations the earth has been excavated to a depth of about four feet and this cellar is whitewashed throughout and provided with electric lights. The cellar is reached through two circular hatchways, ordinarily kept covered with iron plates, one of which is located in front of the switchboard and the other near the pump pit.



PUMP PIT.

Along the east side of the engine room the excavation is made deeper, so that a man may walk erect, and is paved with brick; at the south wall of the building the passageway thus made is continued to the building line as a subway, an interior vew of which is shown in one of the illustrations. The roof of the subway is high enough for a man to walk erect, and the leads from the switchboard are carried along it as shown. By this arrangement all of the power circuits are placed where the wires can be reached without a ladder. At the other end of the subway is planted a large pole up which the leads are carried. No wires enter the power house save through the subway. The cellar and subway are by no means the least attractive features of this power station.

In addition to the lights at the switchboard the engine room is lighted by four clusters of six 16-c. p. lamps on the walls and by a spherical cluster of 42 lamps suspended in the center of the room; this large cluster was part of an electrical exhibit at the Omaha Exposition, and it serves admirably here.

In the middle of the west side of the engine room is a pit 31 ft. 8 in. long, 11 ft. 4 in. wide and 12 ft. 6 in. deep; it is lined with pressed brick and has a cement floor. Here are located the condenser, feed pumps, water heater, oil filter, oil pumps and practically all the piping of the plant. The piping system has been very carefully designed with a view to providing against stoppage in case a particular line should fail from any cause; the pipes are in plain sight and the valves conveniently located.

Along the east side of the pit are four 8-in. wells sunk to a depth of 75 ft., the bed rock of the Missouri River; the water level in these wells varies with the river level and is never more than 10 ft. below the floor of the pit. In the pit is installed a jet condensor with a steam driven air pump having a pump cylinder 24 x 12 in. Water from the wells flows into the condenser, the lift being small, as stated before. City water is provided for emergency.

A portion of the discharge from the condenser pump goes to a Cochran feed heater, where it is heated to a temperature of 200° F. by the exhaust from the condenser pump. The water level in the heater is regulated by an automatic valve. The discharge not so needed is wasted through a 15-in. tile sewer put in by the company, and running two miles to the river.

Ordinarily the boilers are fed by a pump connected to the condenser pump shaft, but a 7½ x 5 x 6 in. Worthington pump is placed in the pit for feeding the boilers if for any reason the other is out of service.

A small Worthington pump is provided for draining a sump into which any water spilled in the pit drains.

STANDARD OPEN CAR.

An exhaust pipe is carried outside the building and rises outside the wall near the stack; this is for use when the engine has to be run non-condensing. An automatic valve made by the Allis Co. turns the exhaust into this from the condenser in event of the vacuum being lost.

The foundation is in place at the north end of the pit for a duplicate condensing engine, which will be installed when the second unit is added.

The oiling system is very complete and convenient. Oil storage tanks are provided in the cellar at a point just north of the north wall of the pump pit; pipes lead up and terminate in funnels in the engine room floor so that barrels of oil may be rolled in and emptied into the tanks with the greatest ease; from these tanks small Worthington pumps force the oil to two cylindrical tanks 18 in. x 60 in., suspended on the east wall of the boiler room at a height of 30 ft. above the engine room floor. From here the oil feeds by gravity to the cylinder lubricators and the engine bearings (sight feed oil cups are of course provided); from the engine the used oil is returned to a Turner oil filter in the pump pit and after filtration again used. From the tanks on the boiler room wall, which are always warm, pipes are led to faucets in the pump pit and at the engine gage stand previously mentioned, so that oil may be readily drawn when needed for any purpose.

A view of the pump pit and machinery is shown and it will be remarked that the condenser engine is covered by a grating. Rods are carried up from the water and steam valves and terminate in hand wheels as shown. For lubricating this engine, pipes are carried up and arranged around the pipe at the right of the engraving, and the sight feed oil cups placed at the height of a man's shoulder.

The boiler room is 43 ft. 5 in. by 57 ft. 6 in. inside; the height from floor to the eaves is 25 ft., and to roof ridge 43 ft. The floor is of cement. At the south end of the boiler room is now installed one battery of two Cahall boilers, each having 5,608 sq. ft. of heating surface and 119 sq. ft. of grate surface, and rated at 280 h. p. each; one boiler only is used habitually. There is space for two more boilers. Each boiler has in connection with it a Garrigus mechanical skimmer which is reported to give the best satisfaction, as its use results in keeping the boilers free from scale. This device has a floating funnel inside the boiler at the water level and the muddy water is carried down to a precipitating tank where the sediment settles and is blown out from time to time. This discharge is carried to a cistern outside the power house, from which an overflow pipe leads to the sewer.

The steam from both boilers is piped to a wrought iron header. The high pressure steam valves used were made by the Crane Co.

Along the west side of the boiler room are the coal storage and the sand rooms. This extension has a shed roof; it is 13½ ft. wide and at the outer edge is 15 ft. from the floor to the roof.

A switch from the railroad on which the old power station was located to the new power station was built by the company on land bought by it for the purpose and runs just outside the coal room, into which the coal is unloaded directly from the cars. Arrangements will be made for chutes to deliver coal into small cars on a track in the boiler room.

Ashes are to be loaded into a motor car which is kept in the boiler room until full and then run out over the line and used for ballast.

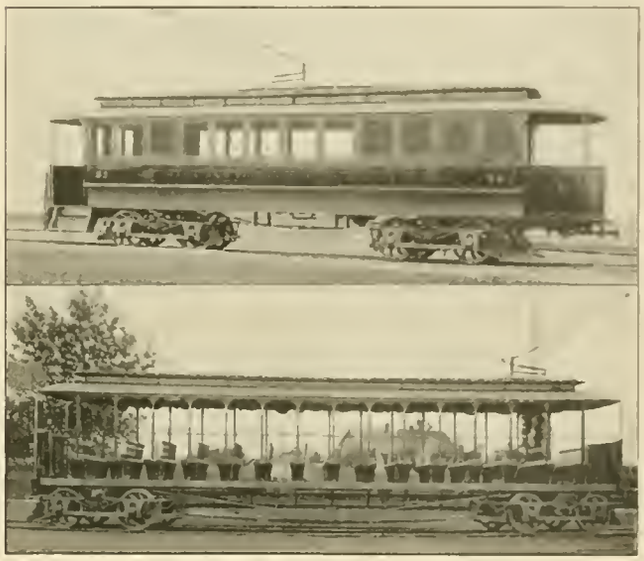
The sand room is about square, occupying the north end of the coal storage space. In this room old rails were placed about 2 ft. from the floor and covered with scrap sheet iron perforated with holes; on this were placed steam pipes a few inches apart. Wet sand is unloaded from the car on to this heater and as it dries out it falls through onto the floor, from where it is taken and sifted for use as needed.

The stack is of steel and unlined. It is erected north of the building with the center line 6 ft. 6 in. from the inside of the wall of the boiler room. It is of uniform diameter throughout, 5½ ft., and 155 ft. high above the grates. The breeching is made of No. 10 steel and is carried along the east wall of the boiler room at a height of 6 ft. 3 in. above the floor.

During the day one engineer, one fireman and one coal passer are all that are needed for the operation of the plant. The night force comprises one engineer and one fireman.

A second switch track with overhead wiring has been built so it is at one point parallel to the steam road switch mentioned and supplies for immediate use may thus readily be loaded onto the construction car from the freight cars.

The rolling stock comprises 18 large and 20 small cars, half of each kind being open and half closed. The long cars



OMAHA & COUNCIL BLUFFS CARS.

were rebuilt in 1896 using two old short open cars, cutting off the ends and splicing the bodies; by using steel angles for side sills and using truss rods cars which have given perfect satisfaction were secured.

The interurban cars are 43 ft. over all; the closed cars seat 44, and the open cars 75 passengers. The long cars are mounted on Peckham 14 B swing bolster, and Taylor trucks; they are each equipped with two G. E. 57 motors, K 11 controllers, Meaker fare registers and Consolidated Car Heating Co.'s electric heaters. Push buttons to signal the conductor are placed on all cars both open and closed.

The small cars are 25 ft. over all and each has two G. E. 52 motors.

The company has just completed equipping its cars with new motors; both summer and winter cars have motors so that no change of motors or trucks is necessary.

As the partition between the car and the vestibule should be covered at night to prevent the lights from shining back of the motorman a spring roller curtain has been ingeniously placed beside the door with the roller vertical and the curtain edge may be buttoned to the sliding door. Then when the door is closed the curtain is drawn, when the door is opened the curtain is rolled up and cannot flap in any draft there may be through the vestibule.

The cars are run one way only and Y's or loops placed at terminal points with a turn table at the car shed. The reasons for running one way only are the saving in car wiring, controllers, gongs, headlights, fenders, sand box mechanism, etc., by having to place them on one end only; the necessity of providing only one vestibule; the ease with which safety gates can be arranged and manipulated.

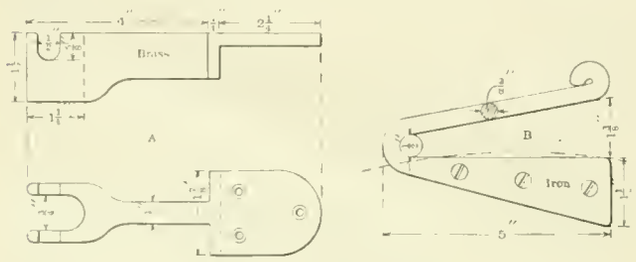
The front ends of closed cars are vestibuled, and a side door provided for the motorman. The glass in the vestibule is double with rubber packing placed between the two pieces of glass; by this arrangement the difficulty usually experienced with frosted glass in winter has been avoided. On

THE MISSOURI RIVER BRIDGE.

open cars a bulkhead with glass is placed back of the motorman.

Ratchet gongs, made by J. H. Graham, and electric headlights made by the company are used. The sand boxes used were designed by Mr. Dimmock and Mr. Tarkington; they are operated by a lever which gives four rates of sanding, sanding either one or both rails as desired, and sanding curves perfectly.

The open cars have wire screens on the left hand side and curtains have been provided so that protection against rain



SWITCH BAR HOLDER.

in summer can be given. As will be noted in one of the illustrations the floor of the open car is high and three steps are provided. A novelty is the grab handle placed on each seat-end panel on the step side of the cars.

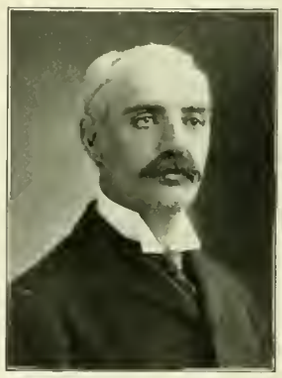
To prevent the iron rod for turning switch points from rattling against the dash and knocking the paint off the holders shown in the figure are placed at each end of the car.

The brass casting A is for vestibuled cars and is screwed to the dash rail; on open cars a casting with a different end is used and is secured to the hood standard. The handle of the switch bar rests in the casting and below it is slipped in the V-shaped forging B screwed to the rounded buffer. On closed cars the switch bar hangs just to the left of the center window of the vestibule on the front end and at the right hand standard on the conductor's end. Each car carries two switch bars.

For operating the section of single track crossing the bridge a block signal system is used.

The Omaha & Council Bluffs Railway & Bridge Co. is capitalized at $1,500,000 and has $600,000 of bonds outstanding. It serves to connect Council Bluffs, with 30,000 inhabitants, and Omaha, which has a population of 140,000. The road now carries about 10,000 passengers per day; during the Omaha Exposition the average was 25,000 per day. In summer the pleasure riding traffic is very heavy.

The officers of the company and heads of departments are: President, N. W. Wells; vice-president, J. J. Brown; secretary, C. T. Stewart; treasurer, J. H. Millard; general superintendent, W. S. Dimmock; master mechanic, W. B. Tarkington; electrician, Israel Lovett; cashier, F. E. Clark; roadmaster and superintendent of bridge, John Cronin.



W. S. DIMMOCK.

The entire direction of the road is in charge of Mr. Dimmock, who is an old steam road man and has held his present position since January, 1894, when the road was very much disorganized, and the company greatly antagonized by the public, and during this time he has introduced many economics and effected many improvements, until at the present time the road is on a dividend paying basis. Comparing the accidents from 1894 to date with those for the previous years they are found to be 80 per cent fewer, which itself speaks volumes for the present management.

TURNTABLE VICTORY IN SAN FRANCISCO.

For several months past legal proceedings have been in progress to secure the removal of a turn table at the down town terminus of the Kearney St. line in San Francisco. The Board of Supervisors and Superintendent of Streets ordered it removed, but the company maintained it was necessary to the operation of its road and refused to do so. The courts have now decided that while the authorities may refuse to grant permission for additional tables that they have no right to remove one for which permission has been granted, during the term of the franchise under which the table, as a part of the road, was installed. The city tried to prove the table was a "nuisance" but failed in its case.

Accounting System of the Omaha & Council Bluffs Railway & Bridge Co.

By the courtesy of Mr. W. S. Dimmock, general superintendent of the Omaha & Council Bluffs Railway & Bridge Co., we are permitted to describe the elaborate monthly report and comparative statement blanks designed by him for the use of this company. In preparing the various forms the object has been to present the accounts in such a manner that the items may be separated, classified and compared and be of value as a guide to those in charge of the operating department as well as a convenient source of information for the directors.

LABOR ACCOUNTS.

In order to classify the items for labor most conveniently two forms are employed for keeping records of the men's time.

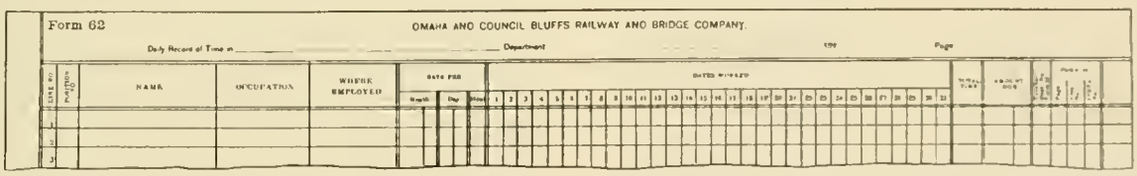
Form 62 is for keeping the time record of men who are employed all the time in one occupation; it measures 17¼ x 11½ in., and has the usual rulings for such forms—name, occupation, where employed, rate of pay, time worked each day, total time, and amount due. At the right hand of the blank is a column for the Department No. of the pay voucher (all payments are made by check and when the man receives his check he signs the voucher; this voucher is Form 52, but is not shown here) and also three volumns for the page and line of Form 54, to which the man's time record is transfered, and the classification number.

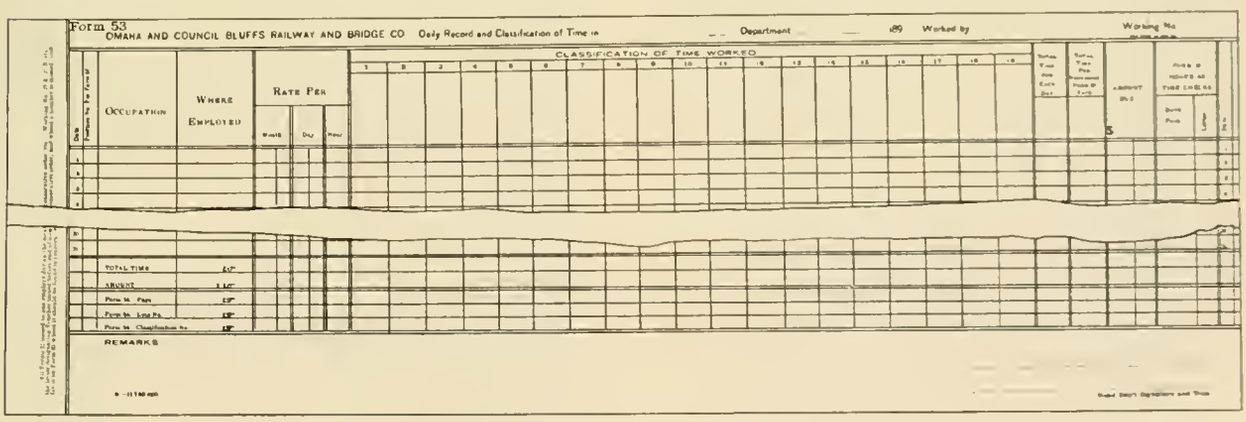
Form 53 is for keeping the time record of one man who is employed in different occupations; there are 19 vertical columns with blank headings for the classification of the time worked, which are filled out by the head of department or foreman with a brief statement as to the work done. At the bottom of this form are spaces for cross references to the page, line, and classification number on Form 54, to which the several totals on Form 53 are transferred. Form 53 is 11½ x 19 in.

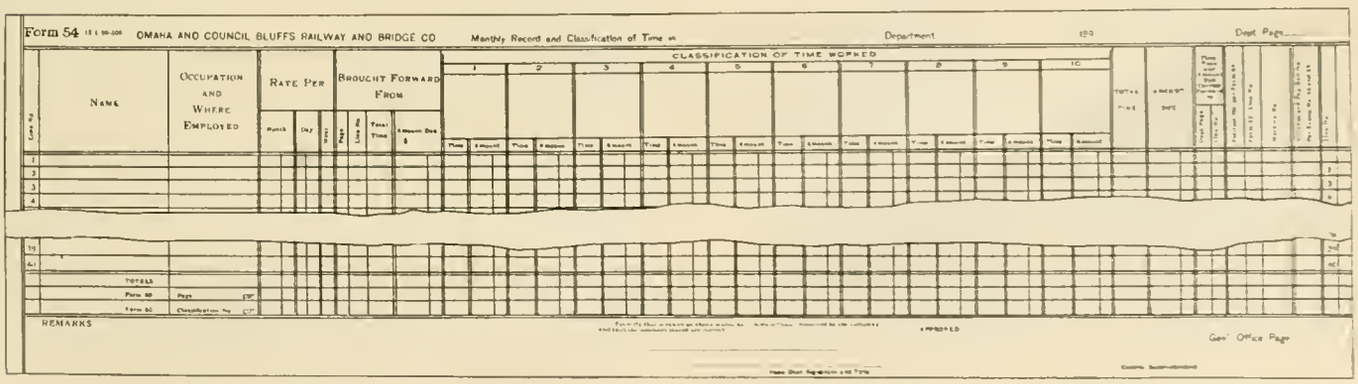
From the several blanks, Forms 62 and 53, the blank Form 54 is filled out, and thus the totals from the several time records assembled and classified. At the right of this form are columns for cross references to the form from which each item was taken, and for references to the vouchers and an abstract of the pay roll, made out on a blank, Form 55, which we do not show. At the bottom are references to the page and classification number on Form 60 (to be described later) to which the classified time totals are carried for the purpose of combining them with the corresponding classified material totals. Form 54 is 12 x 21 in.

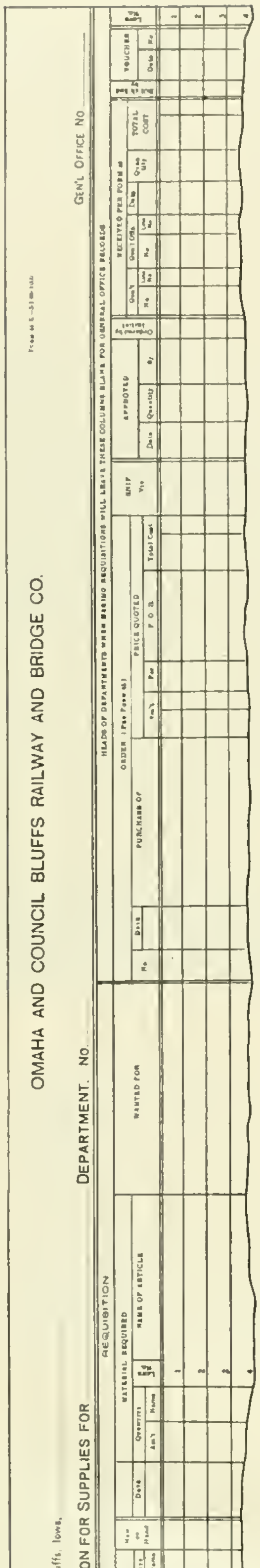
KEEPING MATERIAL ACCOUNTS.

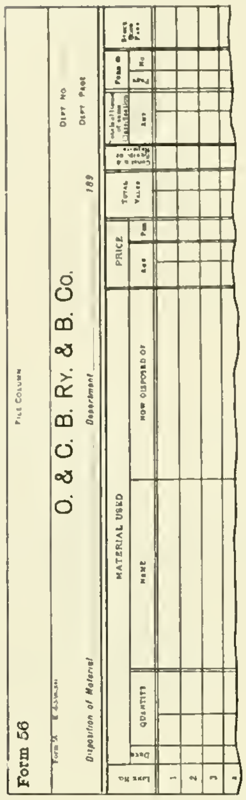
Form 44 is the requisition for supplies. This blank is 22½ x 12 in. Under no circumstances will supplies be furnished except through a requisition made on this blank, and after a requisition is approved no one has authority to

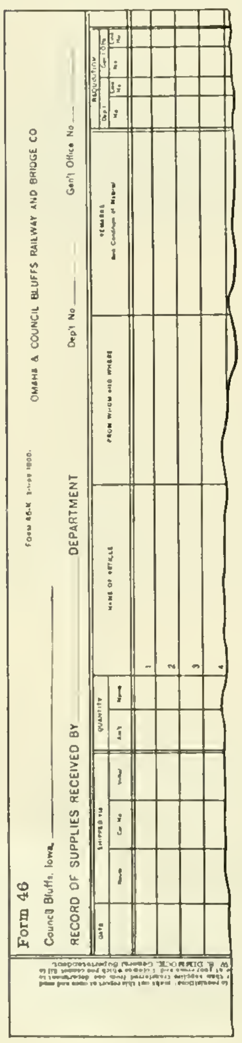












order or purchase supplies, except when authorized by the general superintendent. On the first of each month the head of each department examines the stock of supplies on hand, and orders such as are necessary. When the requisition is filled out a carbon copy is made which serves as a department record. At the same time the head of the department notes the Department No. of the requisition under the name of each supply required in an index book provided for the purpose, and in the front of the index book notes the date or dates of the requisition blank. This index is for the purpose of enabling one to quickly tell when a given supply was last asked for.

When making a requisition the head of the department fills out only the left hand portion of Form 44, leaving the rest blank for general office records. If the heads of departments wish to make a copy of the rest of the blank they may secure it from the general superintendent, if in his opinion it should be of record on their copies.

When prices are secured and approved, and the supplies ordered, the blanks to the right of the column "Wanted for" on Form 44, are filled out up to the column "Ordered by, Initial."

When supplies are received they are to be immediately examined, and if ordered by the person receiving them (which is readily determined from the index book kept by each department) the Form 46 is filled out, after filling out the "Received" columns in the department copy of Form 44. It is optional with the department whether it keeps copies of Form 46. A system of cross-references between the files of Form 44 and Form 46 is made by entering under each item on Form 44 the "DepartmentNo." and "General Office No." of the blank Form 46 on which the record of the receipt is made, and vice versa for each item on Form 46.

By means of these two forms, 44 and 46, a record of the materials is secured up to the time they are put in stock. From Form 44, or the original bills, the items are transferred to a large book known as the "Stock Ledger," where each supply used is carried as an account. On the left hand side are entered the supplies received, entries being made in columns headed as follows:

Form 44. Requisition General Office No.—
Date received.
From whom and where.
Quantity.
Value, price and amount.
Remarks.
Location (i. e., in whose charge the supply is placed).

On the right hand side of the "Stock Ledger" are entered the supply as expended, under heads as follows:

Form 56. Material Used, Date, Page and Line.
How disposed of.
Quantity.
Value, price and amount.
Remarks.
Inventory, Page and Line.

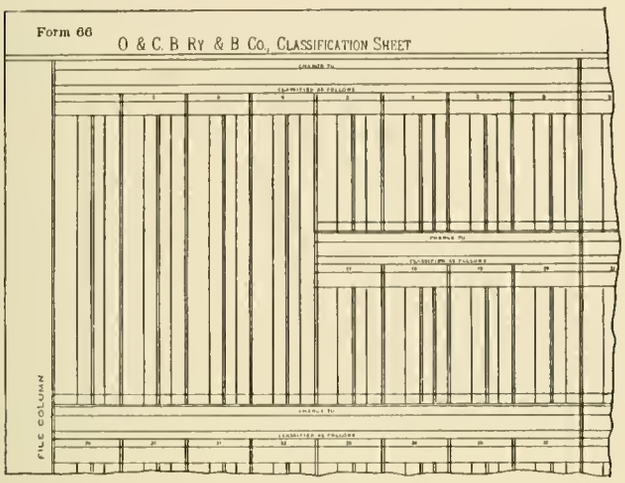
When an inventory is taken, the amount of the supply on hand should balance the account in the stock ledger.

Having got the supply in stock we will now show how the record of the expenditures is made. When material is drawn from stock the workman makes a requisition on a blank, Form 63, 4¼ x 6¼ in., in which he gives on one side the materials wanted and the disposition; on the reverse side is a memorandum of his time. From these forms the

time records mentioned later (Form 53) are made, and the materials expended are carried to a blank, Form 56, on which the prices and values are entered after reference to the stock ledger and the page in that book. The totals on Form 56 are transferred to Form 60, and the page and line to which each item was carried entered in the proper columns. Form 56 measures 10 x 17 in.

MATERIALS AND LABOR COMBINED.

We have now traced the material and labor to Forms 56 and 54, where it is shown what was expended and for what purpose. Mr. Dimmock's experience has shown that there are from 1,000 to 1,200 different things for which an electric railway may have use, and the names of them all are entered



in an index book, where under each item is given the particular classified account to which the supply is to be charged. When Forms 56 and 54 have been completed the material and labor are assembled on Form 60. This form is 12 x 18 in., and is ruled for 10 accounts with 4 subdivisions each, and 2 accounts with 8 subdivisions each, experience having shown this arrangement to be convenient. Cross references showing whence the item was taken (page and line, Form 56 or 54) are made alongside each amount, and names or numbers following the heading "Charge to" and "Classified as follows" show where the total was entered in the monthly report.

MONTHLY REPORT.

The monthly report compiled by Mr. Dimmock after more than two years of hard work and thoughtful consideration is designed to exhibit in the greatest detail the earnings, expenses and statistics for the month; to contain a full and complete answer to any question that may be asked concerning the operation of the road; and above all to present the data in such form that they can be readily found.

This report is a book 13½ in. on the binding edge by 13 in. wide, and contains all told 36 pages of these dimensions. Of these 29 pages are numbered, and suitably ruled for the special objects in view. Preceding the ruled forms is an index of nearly a hundred of the more important headings for which one will have occasion to look, and the numbers of the pages where the items will be found. Thus "Wire" is followed in this index by the numbers 7, 12, 13, 16, 20. On page 7 we find "Wire" as a sub-head under "Maintenance of Electric Lines"; on page 12, it is a sub-head under "Maintenance of Power Circuit"; on page 13 it is a sub-head under "Repairs of Electric Line (Special, i. e., Extraordinary, Charges)"; on page 16 it is a sub-head under "Repairs of Power Circuit (Special Charges)"; on page 20 it is a sub-head under "Power Circuit, Fixed Property Accounts." Other items are similarly treated.

The "Monthly Report" is principally to show three things: 1. The earnings of the road, and the cost of labor and supplies required to operate it; this has nothing to do with the actual receipts and expenditures of money for the month, as the earnings or expenses may have accrued, but not been paid. 2. The monies paid out. 3. The balance sheet showing assets and liabilities.

1. EARNINGS AND EXPENSES.

This statement is found on pages 1 and 2 of the report, and covers the following heads:

Earnings from the operation:
- Passenger.
- Miscellaneous.

Operating expenses:
- Maintenance.
- Transportation.

Income from other sources:
- Missouri River Bridge.
- Power.
- Miscellaneous.

Fixed charges.

Property accounts.

These several heads are subdivided to some extent, but not in great detail on this page. Numbers are placed after each item giving the page where a detailed analysis is to be found.

2. CASH EXPENDITURES.

On pages 3 and 4 of the report are listed the vouchers for bills authorized to be paid, giving name and amount and what for, and the total of the pay rolls. The grand total is the cash expenditure authorized.

3. BALANCE SHEET.

On pages 5 and 6 are the assets and liabilities thus:

Assets:
- Fixed Property Accounts.
- Open Property Accounts.
- Cash Assets.
- Debt Balances.
- Income Charges.

Liabilities:
- Capital Stock.
- Funded Debt.
- Floating Debt.
- Credit Balances.
- Income Credits.
- Earnings.

Each subdivision under these sub-heads has its reference number to a page where the detailed analysis is given, if such analysis is necessary or desirable.

COMPARATIVE STATEMENT AND CLASSIFICATION OF OPERATING EXPENSES.

Pages 7 to 12, inclusive, of the report are devoted to the classification and comparison of the "Operating Expense Accounts." The book is ruled to show the amount of each item for the month for the current year and for the previous

year, and for the increase or decrease; and for ..... months of the current year and of the previous year and for the increase or decrease.

In classifying accounts the general scheme outlined by the Accountants' Association and shown in the "Review" (Sept., 1898, p. 654 et seq.) was followed, but with some modifications rendered desirable by the local conditions which Mr. Dimmock wanted to meet. Thus Mr. Dimmock divides his operating expenses into "RAILWAY," "MISSOURI RIVER BRIDGE" and "POWER CIRCUIT."

Under "RAILWAY" we find 10 sub-heads of "Maintenance" instead of 9 as shown in the accountant's report. They are:

Maintenance of Track and Roadway.
Maintenance of Electric Lines.
Maintenance of Buildings and Fixtures.
Maintenance of Power Plant No. 1.
Maintenance of Power Plant No. 2.
Maintenance of Rolling Stock.
Maintenance of Tools.
Maintenance of Heating Apparatus.
Maintenance of Miscellaneous Construction.
Maintenance of Miscellaneous Equipment.

While the heads here given differ in name the items under them reach virtually the same place as in the Association accounts. The classification is made to conform to that of the Association except in a few cases where local conditions require a change or where the point is debatable.

Each of these sub-heads has under it spaces for 10 items, which spaces are filled out as experience shows most desirable with the names arranged alphabetically. For example under the sub-head "Maintenance of Electric Lines" are:

260. Bonding.
261. Miscellaneous Labor.
262. Miscellaneous Material.
263. Poles.
264. Signal Apparatus.
265. Telephone Lines (private).
266. Wire.

(267, 268 and 269 are left blank for the present.)

The numbers of the items are for convenience in making references, each item having its own number; for "Operating Expenses" the numbers run from 250 to 489. The general head "RAILWAY" includes those from 250 to 449, in which are perhaps 50 spaces that are not named as yet.

Following "Maintenance" naturally come "Transportation" and "General" under which we find:

Operation of Power Plant, No. 1.
Operation of Power Plant, No. 2.
Operation of Rolling Stock.
Train Service.
General Office Expenses.
General Expenses.
Claims.
(Three blank sub-heads.)

These are each followed by 10 numbered items, 351 to 449 inclusive.

Next follow the "MISSOURI RIVER BRIDGE" and "POWER CIRCUIT" each divided into "Maintenance" and "Operation" and the sub-heads divided into 10 items each, 450 to 489.

Following the "Operating Expenses" just mentioned and which, as before stated, fill pages 7 to 12 inclusive, of the report is the head "Special Charges," pages 13 to 16, inclusive, sub-divided exactly as "Maintenance" is sub-divided, except that the word "Repairs" is used instead of "Maintenance" in the headings. The object of having "Special Charges" accounts is to provide a place for unusual operating expenses such as would tend to confusion were they placed in the ordinary "Maintenance" accounts. Examples of special charges would be such operating expenses as are incurred by reason of the bursting of a fly-wheel in the power house, the destruction of lines and tracks by floods or storms, etc. The items under "Special Charges" are 490 to 619, inclusive.

On page 16 the totals from proceding pages are brought forward and a balance struck.

On pages 17 to 23, inclusive, are rulings occupying approximately three-fifths of the page, for the "Fixed Property" accounts, which are at present 19 in number, and each is sub-divided into 10 heads. Including the blank spaces for possible future additions to the property accounts the numbers of the items under these are from 1 to 249.

In designing the ruling for this book Mr. Dimmock carefully considered details and arranged the footing lines so that the bookeeper is saved a great deal of work in looking up what items should be included in any given footing. The footing rulings are single red lines, double purple lines and double green lines. When the bookkeeper meets a single red line, he foots the items immediately preceding it; at a purple line the totals between it and the next preceding purple line are combined; at a green line all the purple totals between it and the next preceding green line are combined.

STATISTICS.

On pages 17 to 23, the space not used for the fixed property accounts is ruled for tabulating various statistics, among which are: Railway Earnings, Bridge Earning, Passengers Carried, Free Passengers Carried, Receipts per Passenger, Cost of Service per Passenger, Expenses and Earnings per Car-Mile, Cost of Power per Kilowatt-Hour, etc. These are all for the month covered by the report and are compared with the corresponding month of the previous years.

On pages 24 and 25 of the report is a detailed comparative exhibit of Passengers Carried and of Bridge Tolls, in numbers and in dollars; Track Mileage, Car-Mileage, Cost of Power, etc.

On page 26 is a statement of the earnings classified under the heads: Trolley Parties and Chartered Cars, Power Rentals, Bridge-Rights-of-Way, Miscellaneous, Operating Expense Credits, Tickets Sold.

On page 27 are miscellaneous accounts as: Bills Receivable, Accounts Receivable, Unpaid Vouchers, Unpaid Pay Rolls, Bills Payable, Accrued Damages, Accrued Track Rentals, Outstanding Tickets.

Pages 28 and 29 are for general remarks and the certificates of the auditing committee.

In order to further explain the methods without reproducing the book it may be well to consider in detail some of the points that would naturally arise.

1. TICKETS.

The company sells books of tickets and the proceeds of course appear as cash on the balance sheet of the month. The item is partially offset by the footing from the "Out-

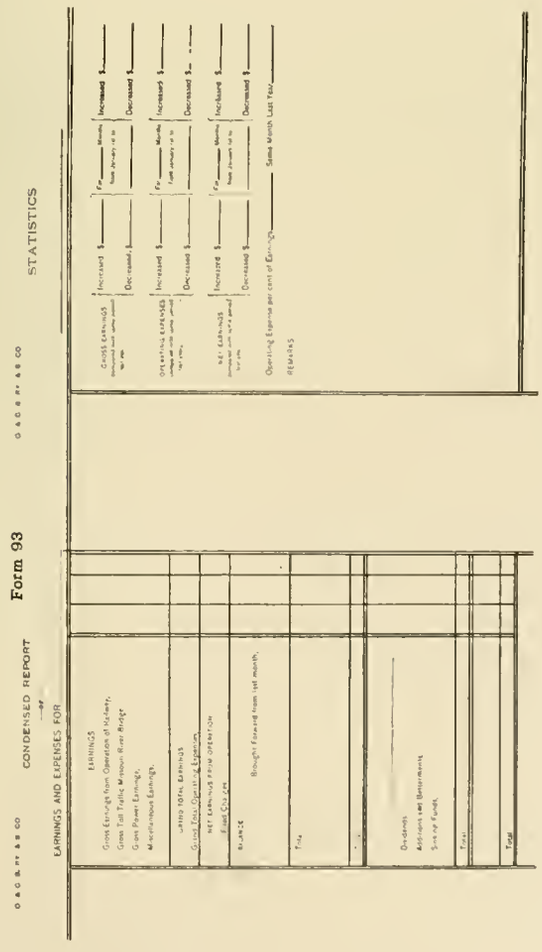
standing Tickets" account. The tickets which were collected during the month appear in the monthly earnings statements on pages 1 and 2 of the report.

2. ACCRUED EARNINGS.

Assume that five persons have chartered special trains during the month for which the charge was $100 each; and that only two have paid for the service. The road has evidently earned $500 from this source, and $500 will be credited to "Chartered Cars" on page 1. A reference to page 26 is made and there appear the names of five persons who used chartered cars. The $200 paid will appear in the cash book, the cash balance being carried to the balance sheet on pages 5 and 6 of the reports as a cash asset. The $300 from chartered cars as yet unpaid constitutes a portion of the cash asset "Accounts Receivable," and a reference to page 27 of the report where the Accounts Receivable are set out shows among other things that Messrs. A., B. and C. each owe $100 for chartered cars.

3. DEPRECIATION.

The company does not make general depreciation charges, but it has some heavy expenses of this nature to meet, notably the paving and painting of the bridge over the Missouri River. About every five years approximately $20,000 has to be spent in putting down a new paving and in



repainting. Accordingly this sum is divided into 60 equal parts and each month charges are made for bridge paving and for painting against the bridge as an operating expense, and the "Bridge Paving Fund" and "Bridge Painting Fund" given proper credits; these credit balances show on the monthly balance sheets as liabilities.

In order to appreciate the completeness and convenience of this report one should be placed in the position of the directors for whose benefit it is made, ask questions, and see how easily and quickly they can be answered by a reference to the report.

CONDENSED REPORT.

Form 93 is a blank 10 x 5 in., and is submitted to the directors with the request that they ask for further information regarding the special questions in which they are most interested. The information asked for is to be found in the "Monthly Report."

Mr. Dimmock, who is an enthusiastic member of the Accountants' Association, has certainly worked out the most complete system of monthly report we have yet seen, and has done so as the result of years of careful study. While it covers minute details which at first thought might appear as costing more than they were worth, a study of the report will show that every item provided for is useful and enables the manager to make an analysis of expenses such as every road will have to make in the near future if further reductions in expenses are expected. The report is comprehensive without running into red tape, and although it includes 29 pages, only one day is required in drawing off the statements from the account books.

AKRON CONSOLIDATION.

Mr. Will Christy, of Akron, O., has taken control of the new corporation resulting from the amalgamation of the reorganized Akron Street Railway & Illuminating Co. and the Akron, Bedford & Cleveland line. Joseph R. Nutt, treasurer of the Central Savings Bank of Akron, is also identified with the Everett syndicate. The bonds and most of the stock of the old company have been transferred to the syndicate. The contract called for the delivery of two-thirds of these securities or the whole deal would have fallen through, but everything has now been arranged and the syndicate is in charge.

It is also believed the Everett people are negotiating for the purchase of the Akron & Cuyahoga Falls Transit Co. In the event that this is the case it is more than propable the tracks of this company will be torn up and those of the new company used entirely.

PUNISHED FOR OBSTRUCTING TRACK.

Ulrich Noa, 18 years old, was recently sentenced to one year's imprisonment in the Green Bay, Wis., state reformatory for obstructing the track of the Fox River Valley Electric Ry. at Menasha, Wis. Noa's home is near Menasha. He placed a stone weighing about 50 pounds on the track, claiming he was drunk and that he did it for a joke; one car was nearly wrecked, but fortunately no lives were lost.

The Syracuse, N. Y., street car lines have lately been suffering from theives of the most persistent character. A gang has been at work for some time past cutting and stealing the trolley wires and track bonds; the police have been unable to get a clew.

CHARLES FITZGERALD.

Mr. Charles Fitzgerald was last month appointed general superintendent of the Consolidated Traction Co. of Pittsburg, Pa., succeeding G. F. Greenwood. Mr. Fitzgerald is widely known among street railway men throughout the country, but is better known in engineering circles. He is a native of Orange County, N. Y. His abilities as a mechanical engineer were first prominently recognized in 1881 by John Roach & Co., the Philadelphia ship builders, at whose works he held a responsible position when only 21 years of age. Three years later he accepted the position of erecting engineer at Robert Wetherill & Co.'s Corliss Engine Works at Chester, Pa., and when that company sent him to erect a power plant for the Citizens' Traction Co. at Pittsburg, in 1889, he was so well pleased with the bustling Iron City that he remained there, accepting the position of superintendent of the mechanical department of the Citizens' Company. Mr. J. E. Rugg, the veteran manager of the West

CHARLES FITZGERALD.

End Street Railway Co., of Boston, was at that time superintendent of operation of the Citizens' and with such a past master for a preceptor, Mr. Fitzgerald made rapid progress in the acquirement of the art of operative management, so rapid, indeed, that when Mr. Rugg resigned in 1895 Mr. Fitzgerald was made general superintendent of the Citizens' and the Fort Pitt Traction Cos. In 1896 these companies were consolidated with the Pittsburg, Duquesne, Central and Allegheny Traction Cos. into the present corporation embracing over 150 miles of track and an equipment equaled by few companies in this country. Mr. Fitzgerald continued as superintendent of three of the included lines and ably assisted in the management of the company until his recent appointment as its general superintendent. The appointment meets with popular approval in Pittsburg, the new chief being held in high esteem by all. He is a prominent member of the Engineers' Society of Western Pennsylvania, probably the most progressive body of its character in the country, and he is regarded as one of the best mechanical engineers in that end of the Keystone state.

Under the possibilities of his now greatly enlarged field of operation his friends are confident of the record he will make, and one and all earnestly wish him success.

The voters of Boston will ballot on the question of replacing the street railway tracks on Tremont St.

MAINTENANCE AND REPAIR OF ROLLING STOCK.

BY J. W. GREER.

A tendency toward extravagance is the besetting sin of the mechanical department of nearly all street railways, and is caused largely by the misapprehension on the part of the master mechanic and his employes as to the net earnings of the property. The mechanic of the present day is an intelligent, reasoning being, and the relationship between him and his fellow employes of the operating department is such that, "in strictest confidence," the conductor will give him the exact amount of the daily receipts of his car. One or two of the confidential statements from each division is all he needs to approximate very closely the gross earnings, as the conductors invariably keep a memorandum of the daily receipts, and these being pooled give the total. The operating expenses are not known outside the office, but the mechanic grabs up his ready pencil and proceeds to plot off an expense sheet to his own entire satisfaction. Of course he never gets beyond a correct estimate of the labor account, a rough estimate of the cost of material, a poor guess as to the cost of the fuel, and an absolute certainty of what the salaries of the president, general manager and secretary ought to be—measured by the amount he is being paid for his own services.

Depreciation, taxes, insurance, sinking fund, interest, printing, stationery, attractions, damages, donations, paving and other city expenses, attorney's fees, and the host of other accounts which make up the legitimate operating expenses of a street railway, are rarely if ever thought of by the mechanic. Consequently, when he strikes a balance between his estimated operating expense and the known gross receipts, he is not much to blame for believing that you are operating a bonanza, and treating the employes unfairly in the matter of wages. He is not slow in disseminating his eye-opening statement among the other employes, and discontent results therefrom. "A little knowledge is a dangerous thing." Where discontent and trouble are not bred by this state of affairs, extravagance is. Feeling that the company is rich and the road making money beyond measure, everything should be kept at the top notch of perfection; so half-worn bearings, pinions, gears, and other supplies are thrown out in a reckless way, because your first-class mechanic always takes a pride in his work, and, believing that the company is able to stand it, desires to have the cars when they leave the shop as good as new.

To remedy the state of affairs above described, it is not necessary to familiarize your employes with the details of your business, or to show them the balance sheet each month; but, as it is impossible to keep the gross earnings from them, why not at least obtain justice for yourself and your methods by allowing them to see that there is more on the expense side of the ledger than they ever dream of? I am aware that there are many successful managers who rigidly live up to the scriptural injunction, "Let not your right hand know what your left hand doeth." But they would, perhaps, have been much more successful had their method been such as to inspire sympathy and interest on the part of their employes, instead of trying to make military automatons of them. Make your master mechanic a member of your "cabinet," and you will find that he will drink in eagerly the business problems that arise; and, in

exchange for every point in business affairs he picks up, he will give you a dozen practical suggestions which will redound to your glory and the good of the company."

If you cannot trust the head of the mechanical department with a general knowledge of your business, then he is not fit to have entire control of the department, which, by its economical or extravagent management, can make or break the road more quickly than anything else except, possibly, accidents.

One of the simplest and most effectual methods of impressing the employes and the public with the fact that a street railway is not a mint, and that there is a side to the business unthought of and unseen by them, is to use strictly the voucher system in making all payments. Have the voucher blank made long and broad enough to contain on its back a distribution sheet showing a complete list of all the accounts pertaining to the operation of every department of the business from office to construction. Pay only with checks attached to one of these formidable documents, and you will find the effect magical. The simple reading of the list of accounts (usually ranging from 60 to 100) that pertain to the operating expenses of a street railway is calculated to surprise the layman or the employe, and often produces a genuine case of sympathy for the much abused and overburdened corporation. Invariably will a perusal of this sheet counteract a tendency toward extravagance and make the thoughtful employe glad that the company has enough left in its treasury every week to make the ghost walk.

I have dwelt at length on a phase of the mechanical department not usually considered in treating the subject in hand, because many years of my life have been spent at the bench and among the men as one of the hands, and, therefore, must perforce know more of the thoughts and feelings that actuate the mechanic than those who have been educated and employed only in connection with the business side of street railroading. Having passed successively through all stages of the business, I am prepared to assert that oftentimes the mechanic, in the faithful discharge of his duties, uses more real brainwork than the whole office force put together. My friend, Sam Jones, says, "It's always the hit dog that howls." Do not howl at the foregoing very unpopular, but nevertheless true, assertion unless you have tried both departments. The intelligent mechanic bears the same relation to the labor problem of street railroading that the farmer does to the body politic of our government.

Treat him as an intelligent, reasoning man should be treated, and he is the conservative element that will preserve the equilibrium of the whole through thick and thin; try to hoodwink him and you gain his dislike and distrust. He then becomes one of the Populist party, with whiskers on and a knife up his sleeve, and it is 16 to 1 that there will be trouble in camp.

Having organized the mechanical department on proper lines, you naturally look for proper results. As a stitch in time saves nine, we can apply the maxim practically by appointing one or more of the best, all-round mechanics as daylight inspectors. One man can properly inspect 40 cars a day, with an average of 10 cars to a division, and having to take station alternately at the end of four divisions; or he can inspect 60 cars, all in one division. The inspector should wear a belt containing a 14-in. combination wrench, a pair of pliers, a screw-driver and a few carbons. He should not be expected to make repairs on cars beyond tightening a loose nut or set-screw, and tightening screws in a connecting-sleeve, window-spring, grab handle, or bell pull. Occasionally a carbon will have to be replaced which has been overlooked by the night inspector.

While the foregoing matters are important and often save serious trouble and expense, yet they are merely side issues with the inspector. His real business is to ride back and forth from the last meeting point to the end of the line, catching each car in turn and closely observing everything about it or connected with it, and nothing on a blank provided for the purpose the needed repairs. These blanks should be of a size convenient for slipping into a pocket, when they are made up in pads, and should be so complete that a word will specify what is needed. The following form is suggested:

(Card 3⅝ x 6½ in.)
X, Y & Z Railway.
Car Inspector's Report.

Car No.... Date.....1899.

Repairs needed.

Wheels .....
Axles .....
Journals .....
Truck .....
Brake .....
Car body .....
Platform .....
Controllers .....
Doors .....
Sash .....
Blinds .....
Signs .....
Glass .....
Seats .....
Paint .....
Cleaning .....
Trolley .....
Motors .....
.....
.....
.....

(Signed).....Inspector.

It will be observed that after the word Wheels, "flat," "loose," "out of gage," "racked," or "not mates" would express all that would be needed, as the case might be. A chalk-mark on the particular wheel would indicate the one alluded to. A rubber stamp on the end of a pencil, bearing the name or number of the inspector would serve admirably for quickly signing the report.

A car in motion and a car standing still are radically different things. Therefore the inspector who rides on a car while he inspects it sees the actual condition of the rolling stock under service, and can grasp many needed improvements which the motorman would never discover; or if he did know something was wrong, he would be unable to locate or express the trouble. Not only the inspectors, but also everyone connected with the mechanical department should be broken in as motormen, so that, in addition to mechanical skill, they can bring to bear that intuitive knowledge which comes of practice in managing a car and the trained senses of touch and sound which guide the motor-

man largely in making up his mind that it is not running right.

The proper regulation of brakes, the tension of truss-rods, the working of joints in the car body, the rattle of glass in the sash, and many other things can be determined only by actually riding on the car under service conditions. It goes without saying that if the inspector takes the controller handle and brake and runs the car a short distance himself, he can discover more of the condition of his car in a minute than the average motorman could tell him in an hour. The writer believes in a riding inspection by daylight, and in work on motors and cars done wholly by daylight. Nothing should be done to the cars at night except to sweep and oil them, to replace carbons, examine and tighten connections, or change trolley poles or wheels. A night gang will usually scrape off enough paint, overlook enough points that need attention, and soldier away enough time to pay over and over again the interest charge on the extra equipment necessary to have the work done wholly in the daytime.

After finding out through the inspector just what needs to be done to each car, the next thing is to do it. In the next of these articles, we shall "take up the white man's burden" by commencing at the beginning, and giving a few ideas on cleaning cars and motors and keeping them clean.

STRIKE AT WHEELING.

On April 8th the motormen and conductors of the Wheeling (W. Va.) Railway Co., 81 in number, struck for an advance of wages from 16 cents to 20 cents per hour. The company attempted to operate some of its cars with non-union men but was obliged to desist because of the riots and disturbances which followed. The car house just outside the city limits where the non-union men were housed was stoned, and several of the cars in the city stoned by crowds of men and boys. It was again attempted to operate cars on the 11th with more success, but no cars were run at night.

On the 11th the company filed a bill in the United States District Court, and Judge Jackson issued an injunction restraining all persons from interfering with the cars or the mails they carry.

In the next few days abuse and intimidation of the new men resulted in the arrest of four men by the deputy marshals sent to enforce the injunction order. These men were tried before Judge Jackson on the 18th and each was sentenced to 30 days' imprisonment and $50 fine.

Before passing sentence the court said:

Before passing upon the cases that have been submitted to the court for its action, I think, under all circumstances, that I should talk to the community at large with reference to the strike, known now as the street car strike, and the first remark that I want to make is, that it seems to me remarkable, in a city as large as the city of Wheeling, with its mayor and police authorities, that that mayor, with all his policemen, has found it impossible to deal to any extent with the obstructions that have been placed upon the tracks of the street railway company.

No evidence has been presented to this court to show any interposition upon the part of the mayor, the chief of police or the policemen under them to protect this property. I have inquired, in reference to that, of the officers of this court, and it is something I cannot well understand. In a city as large as the city of Wheeling, with such a local police force as it necessarily must have for the protection of the interests of every citizen and of every species of property within the limits of the city, I repeat that I cannot well understand why the city authorities have not taken some action in regard to this matter.

Authorities who regulate the welfare and prosperity of a city are supposed to be indifferent as between parties connected with any violations of the law in reference to the rights of citizens, either of liberty or property.

I understand that the state authorities and municipal authorities are just as much bound to protect the rights of the street railway company as the United States is bound to enforce the laws regulating the transmission of its mails over railway property of any kind or character whatsoever.

It is to be regretted that there is a want of action upon the part of the local authorities and that the street railway company has been compelled to appeal to the United States Court to do that which it was the duty of the local authorities to do.

In the administration of the laws of the land, either federal, state or municipal, sympathy is not to be considered. The question of legal right is the question that it is the duty of the officers of either of those three branches of authority to consider and to enforce.

I have been told since my arrival in the city that the reason there seems to be no desire upon the part of the local authorities to enforce the law in protecting the property of the street railway company is, that they sympathize with the strikers. I have also been informed that these men who have struck for higher wages do not appear in the front of this trouble. But they are behind it and they incite and excite a class of the population of the community who have a small stakehold in its interest and welfare, to present themselves in the front to obstruct the operations of this street railway company and thus, to some extent, diminish the value of the company's property.

Let me ask the strikers who have left the service of the company if it would not be more manly upon their part to come forward and present themselves in the breach, instead of getting a lawless and irresponsible element in this community to stand in front as a bulwark to protect them against the execution and enforcement of the laws? Is it manly to incite women, and through them their children, to appear upon the scene and try to obstruct this street railway company in running its cars over its own property?

It seems to me if there is any manhood among those engaged in this strike that they would come out themselves and make their fight, and not ask these poor, unfortunate, infatuated people along the line of this railway to hoot and hollow and excite a mob for the purpose of interfering with the running of the cars of the company.

The court is not here to sympathize. Those who administer the law are not expected to sympathize. Their only sympathy is with justice and right under the laws of the land. That is the proper sympathy.

I am told—just as it appeared before me in the prosecution by the Government of the United States upon an information filed in this court some six years ago, against parties who were prosecuted for obstructing this same railway—that children, and small children at that, are used in piling rocks upon the tracks of the railway company. It appears from the evidence here that rocks are piled on the track in the absence of the officers, and spikes have been driven into the track to derail the cars. Of course, parties who do these things are not going to take witnesses with them, as it might result in their arrest. They do it at a time when the officers of the government who are there for the protection of the property, are absent. Every time a crowd gathers along this railway and hoots and yells at the officers of the government in the exercise of their legitimate duties in enforcing the processes of this court, it is aiding and abetting this strike and those who engage in it are just as bad as the principals who go and drive spikes in the track or tear up the rails to derail a car.

It is the fomenting of a public sentiment that is unhealthful—a sentiment in opposition to the enforcement of the laws of the land—that your people who are under arrest today are engaged in. Why do not all of you think and reflect about this matter? Why cannot you remember that the welfare of society is involved every time there is an effort upon the part of dissatisfied citizens in regard to any matter they are interested in and they produce a strike?

The society of this country has many grades and elements in it. There is the rich man; there is the man who has a comfortable liv-

ing; there is the man who is struggling for existence, and there is the man who can never "make both ends meet." Now, whose fault is it? This is a free country. No man is compelled to work except to save himself and his family from starvation. There is no law, except the law of the Almighty, that compels a man to work. By the sweat of your brow you shall earn what you possess. No railroad company, no corporation or co-partnership of any character and no citizen can compel other people to work for them.

You who are engaged in obstructing the running of cars on this railway are destroying the rights of the people who constructed a road quite as much for your convenience and benefit as for their own profit. Without this railway running through your streets from Bridgeport and Martin's Ferry, in Ohio, to Benwood in our own state, what inconvenience would you be subjected to? Think a moment, what a matter of public benefit this street railway is to you. Suppose the railroad should be obliterated and you had nothing but the trucks and express wagons that are now passing over your streets, for the accommodation of the public, what would be the effect upon your city? You would be retrograding from the condition of an electric street railway back to the old omnibus instead of progressing from the omnibus and old horse car line to the electric railway, and from the electric railway to the next advanced means of transportation that may happen in the future.

This country is a country of progress; it is a country in which all citizens enjoy equal rights; it is a country where every man has a right to labor for himself and be protected in the acquisitions that result from his labor. Now, think of that! No man is compelled to work. He may starve if he chooses to. Neither is any man compelled to work for inadequate wages. But in connection with that there is another thing to consider: If you cannot get what you think is right and fair for your services stop—quit—and let your neighbor come in who is willing to work for the same compensation. He has a right to do it. Why should you interfere with men who are engaged by this company and who are willing to work for wages that you do not wish to labor for? You should not interfere with them.

I am not here, gentlemen, to sympathize with either side in this matter. I am here to enforce the law. It may be that the railroad company is paying more compensation for labor now than the revenues of the road justify. The railway company certainly is the judge of that. It may be that the laborer who is employed is not getting what he thinks he ought to receive. He is the judge of that. If the railway company says: "We are paying you too much and shall have to reduce your wages," you have a right to quit. They cannot compel you to work. If the laborer says to the railway company: "You are not paying me enough; you ought to give me more," and they refuse to do it, you have a right to quit. Nobody interferes with you. That is your right—your inalienable right—under our institutions. But there the thing stops. You have no right to organize a communistic club or a communistic society for the purpose of enforcing that, which, under the law, you are not entitled to enforce.

What are the results of strikes? They demoralize labor. What else do they do? They interfere with values. The property of a city may have a value today, and the property of a railroad company may have a value today, but repeated strikes by labor organizations or communistic associations, or by people who have anarchistic views, reduces what?—the value of property. And when you reduce the value of property you reduce the ability of those engaged in business to pay a fair, remunerative price for labor.

Labor and capital must go hand in hand together. Capital should not be too exacting, nor should labor be too exacting. Capital and labor should deal with each other in a spirit of fairness, but neither should claim the right to dictate terms to the other. You go to your groceryman, and ask him what tea is worth, or what coffee is worth, and he tells you. "Well," you say, "I will go to another place: I think I can do better." That groceryman to whom you went cannot compel you to take his tea or his coffee at the prices he fixed, but you go to the other man, thinking you can do better, and you buy of him. Now, that is the underlying principle between man and man in all the negotiations of life. You ask a man what anything you want to purchase is worth and he gives you the price. You can buy of him or go elsewhere. You have the right to elect whether you will take it or not. You go to a railway company and ask what wages they pay and they will tell you. You can either accept their terms or go elsewhere. Now, you people who have been engaged in running cars on this line and have been receiving 16 cents an hour, or possibly $2 a day, have struck for 20 cents an hour. Your combined efforts cannot force that railway company to pay the advance asked for. This railway company can go out in this great nation of ours and get men from any source. It has been shown that they have already been able to get men from other places—from Philadelphia and Chicago—to take your places.

Now, act with some wisdom; be prudent; go home and think and reflect over this matter, and see if you have not made a mistake. Appeal, always, to your employer, when you think you are not paid a fair price, and consult and reason with him in reference to it. Then, if you and he don't agree in your views, and you can afford to do so, quit him. But don't undertake to take his property out of his hands by strikes; don't undertake to destroy his property by the same means, when you are dissatisfied with the field in which you are employed. That is the way to do it.

The law does not give you any right to go into the courts of the country and say to this railway company, "We are working today for 16 cents an hour, but you must give us 20 cents." You cannot make them do it. The law does not give the railway company any right to go into the courts of the country and say to the laborer, "We have been paying you 16 cents an hour, but you must come down to 12," and force them to do it. The courts cannot do that. Now, there is the whole thing in a nutshell.

If any of the new men engaged in this strike are within the sound of the court's voice (and I have no feeling in this matter except the feeling that I always have for those who feel that they are oppressed), I want to ask them to weigh well what I have said to you here today. This is the same character of talk that I made upon a former occasion in reference to a strike on this road. I have made it for the benefit of the community.

While coming up on the train yesterday afternoon from Parkersburg, I dictated to my stenographer what I consider the pith of this whole matter, and I will read it to you:

"The court is here for the purpose of administering the law relating to this case. It is not here for the purpose of administering sympathy to either the street railway company or to those who have been employed by that company, known now as strikers, who are insisting upon the company increasing the wages for their services.

"This is a free country. The constitution and laws of the country guarantee to every citizen the right to engage in any business that he is disposed to enter into. No limitations or restrictions are imposed upon the individual action of any citizen in regard to this right. In a free country like ours competition in every department of life is open to every citizen. He who by diligent and continuous effort acquires not only a competency but a fortune, has a perfect right to be protected in it. On the other hand, a laborer of the country who maintains and supports himself and family by his daily toil, has an equal right to be protected. Labor cannot, by individual action, or by united action, deprive the employer of his right to fix the price of labor any more than the employer can compel the laborer to work for him for a price less than the laborer feels is remunerative.

"The trouble in this case seems to be that there is an effort upon the part of the employes of this street railway company to force the employer, the railway company, to advance their wages without knowing whether such action upon their part is justified in any respect whatever. Every employer has a right to look into the question as to what he can afford to give for services rendered to him, the matter to be determined and decided by the revenues derived from the business in which he is engaged. No employe can determine that, for the employer alone is possessed of all the facts upon which he must base his decision and action. In this case it must be remembered by the employe that the employer is just as much interested in maintaining the operation of the road and in obtaining revenues from it, as the employe is interested in obtaining a just and fair compensation for his labor.

"Suppose we reverse the situation upon this occasion, and the employer determines to reduce the wages of the employes in the service of the company. The employer cannot compel his employe to serve for a reduced rate of wages. If he cannot, is it right and proper that the employe, who seeks to have his wages and compen-

sation increased, should take such steps as to coerce the employer to comply with his request without knowing whether or not the employer can afford to do so? Even if he could afford to do so, what legal right—what just right—has an employe to undertake to coerce his employer? The employe has the privilege of remaining with his employer or quitting his service. Why don't he elect to do that which the laws of his country justify him in doing? Whenever there is not a sufficient remuneration upon the part of the employer for the services of the employe, let the employe leave the services of the employer and seek other employment.

"I understand from the public press that this community is in sympathy with what are now known as the strikers. Let me say now that this is a mistaken sympathy upon their part. No community can decide, as such, between the rights of the employer and the employe. They cannot be familiar with the circumstances that have influenced the employer to refuse to accede to the demands of the employe on this occasion. This misguided sympathy is often a wrongful sympathy, and operates not only to the prejudice of the parties for whom the sympathy is expressed, but to the injury and detriment of the public at large. In this country the relation of capital and labor is not to be determined by sympathy. Labor will always command capital when capital can afford to pay for it. Capital will always command labor when it feels that it is justified in doing so. The effect of this public sympathy is unfortunate. It serves to stimulate parties who, while they may have some rights, have taken the wrong position in the assertion of them. A legal or an equitable or a just right cannot be enforced in this country of law and order except through the forms of the laws of the country. Whenever any community undertakes to set up for itself a standard, and to enforce that standard by mob violence, by communistic orders or by efforts upon their part which are conceived in a spirit of anarchy, and which lead to and end in anarchy, then the time has come when the laws of the land must be enforced to control that spirit of anarchy. Such is the duty of the court here today. The court is here to enforce law and order. It is here to restrain mob violence and to prevent interference with the movements of the mails of the United States, and to protect the rights of citizens of the United States under the interstate commerce act.

"Every good citizen of the state is interested in the suppression of this violence and in the enforcement of the law. A precedent of this character which defies law and order will result in disaster to the community. If such a thing is countenanced by the community at this time, it is only an inducement for other persons, who may conceive that they have a just grievance, to take the same course, and the time is not far distant when a repetition of similar acts of disorder will end in violence. And I say to the good people of this city that such violence will result in disaster to the community, to its business, to its enterprises, and will drive capital from its borders, which will seek investment elsewhere, and the grass may grow in the streets of your now prosperous and thriving city."

I have talked to you today, gentlemen, from no limited experience. I have passed the notch of three score years and ten. I have dealt with strikes before, and have never found any good results from them. I have dealt with them on the Baltimore & Ohio R. R., on the Norfolk & Western R. R., with that most notable strike of the employes of the Monongah Coal Co., and of the employes of this same company, six years ago, as the records of the court will disclose. I believe I have had one or two smaller affairs to deal with, but those I have mentioned were notable in their character. In every instance where I have been called upon to interfere as a judge of the United States court for the protection of the rights of property, I have found those, who, in their misguided judgment, organized the strike, and those who aided and abetted it, did that which did them no good, and only resulted in some injury to the owners of the property against which the strike was raised.

Take my advice. I feel kindly toward all of you. Born in Virginia, raised in the mother state as well as in the state of my adoption—the state of West Virginia—all my sympathies are with West Virginia. My feelings of sympathy are always with the oppressed and downtrodden. I have been poor myself. I am not rich now. Indeed, I may consider myself a poor man, after devoting nearly twenty-eight years of my life to the public service, on a salary that has barely supported myself and family. Notwithstanding all this, my observations and experiences have been that it is better to endure the ills you have than to fly to those you know not of.

Go home to your families. Be peaceable; be quiet; observe the law; then when you lie down upon your pillow at night you will feel the conscious conviction that you have done well. I have to dispose of these cases I have here today. I regret that I am compelled to enforce the law against these parties. God knows I wish it were otherwise. This court does not like to punish anybody, although he has had a great deal of it to do in his life, but as an example to you all, he must do it.

The marshal and his deputies are going to remain here until peace and order are restored. It is useless to undertake to fight a great government like the United States. Those officers represent the emblem of authority of this great sovereign government. This court today is only administering its laws. Now, think of that, and then say how long you will continue this course. Stop before you get into the clutches of the law, and let order and peace once more prevail in your community.

By the 20th the company had its regular complement of cars running in charge of new men and later reports state that no more attempts at obstructing the cars were made.

BELLOWS FALLS VOTES $1,000 TO ELECTRIC LINE.

In the construction of interurban lines it is frequently necessary to make radical changes in street grades, and such alterations are often of as much benefit to the town as to the road. The action of the Bellows Falls, Vt., town authorities in such a case will be of interest and value as a precedent to quote in other similar cases. The railway had been granted a right of way along a public street, with permission to cut the grade down seven feet. A survey, however, revealed the necessity of a deeper cut, and the town authorities thereupon voted to cut the entire roadway down 12 ft., making a 5 per cent grade, and voting for the work the sum of $1,000 from the city funds. That the action of the town was reasonable and fair is evident, but there are places where the citizens are not aware of the benefits resulting from electric lines, to lead them to as broad gaged a view of the situation.

CONSOLIDATION IN TENNESSEE.

What is known as the Hambleton syndicate of Knoxville, Tenn., at the head of which is Mr. Frank Hambleton, president of the Knoxville Traction Co., is engaged in some extensive negotiations in Nashville. Press dispatches state on the authority of Mr. C. C. Howell, vice-president of the Traction Company, the syndicate has purchased the entire plant of the Cumberland Electric Light & Power Co. It has also bought the majority of the street railway stocks and bonds of the Nashville companies and has options on other properties. One part of the new corporation's plans will be, when it is fully organized, to put up a gas plant both for fuel and illumination. It is stated that there will be from $5,000,000 to $6,000,000 expended in the various enterprises contemplated in Nashville by this big syndicate.

All of the properties controlled by the Brooklyn Rapid Transit Co. show increased earnings for April as compared with the same month of previous years. The total of passenger earnings for April, 1899, is $864,332; April, 1898, $758,353; April, 1897, $707,837. For the 10 months ending April 30th, the gross passenger recipts of the system were: 1899, $8,279,663; 1898, $7,350,538; 1897, $6,870,995.

NEW CAR HOUSE OF THE OMAHA STREET RAILWAY CO.

The Omaha Street Railway Co. has recently completed a new car house which involves a number of novel and interesting features. While the building is practically completed and the company began to use it Feb. 27, 1899, there are yet some finishing touches, such as pointing the interior walls and painting the roof trusses with asbestos paint, yet to be given, the early winter having interrupted the work. The building was constructed after the plans of Messrs. Fisher & Lawrie, architects, of Omaha, and is 124 ft. wide by 380 ft. long, covering over an acre.

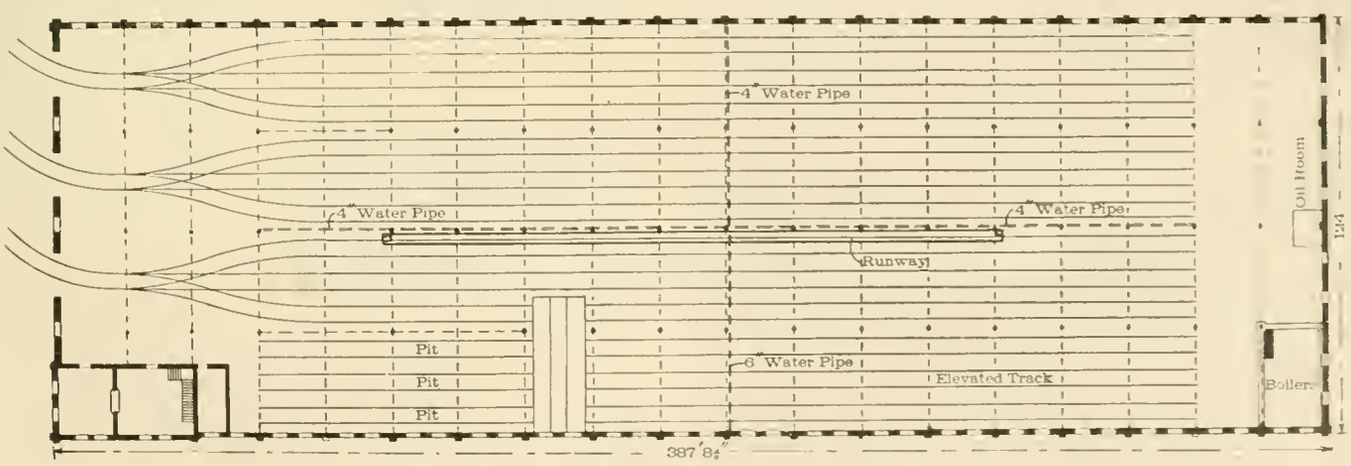
In each of the bays are laid three tracks as shown in the plan, which in the aggregate give 3,300 ft. of track storage. It will be remarked from the plan that to three of the bays access is given by an entrance track and two switches. The tracks of the fourth bay are reached by means of a transfer table. The three tracks to the north of the transfer table in the west bay have the only track pits in the barn; the middle track south of the transfer table is elevated 2 ft. above the general floor level and is the track where most of the work on trucks is done, the elevated track being generally more convenient than a pit. The first bay west of the center line has a cement floor for 60 ft. at the rear end, and the cars are washed at this point.

NEW CAR HOUSE, OMAHA STREET RAILWAY CO.

The walls are of brick, faced with red pressed brick, and trimmed with sand stone, 17 in. thick at the sides and rear end, and 25 in. thick at the front end; the side walls have 13-in. pilasters 19 ft. 8½ in. center to center. In each wall panel between pilasters are two windows so that the building has a light interior even when filled with cars. The front is finished with terra cotta and the general appearance may be seen from the photographic view of the exterior. Three rows of posts divide the car house into four bays. The posts are of pine 12 x 12 in. and are spaced 19 ft. 8½ in. center to center longitudinally. The roof trusses are of timber with iron rods and are shown in the sectional view of the building; from the bottom of the truss to the rail is 16 ft. 6 in. The roof is of matched 2-in. sheating covered with five layers of building felt and gravel.

The work of washing cars and cleaning and adjusting trucks has to be done in winter as well as in summer and an effective heating system was necessary for a portion of the car house. Accordingly two tubular boilers, 54 in. by 16 ft. are installed in a pit at the southwest corner of the building to furnish steam for heating purposes. The radiating surface provided consists of 1,500 sq. ft. arranged in manifolds along the west wall just below the windows and along the west row of posts, the bottom pipes being about 8 ft. from the ground. Last winter was particularly severe and during the coldest weather the men were able to work about the cars with their coats off.

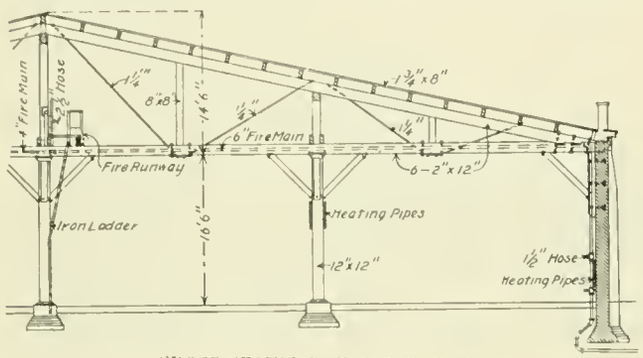
At the south end of the building an oil room is provided which is 8 x 10 ft. and will hold 12 barrels. The walls of this room are of brick and the roof of old rails and cement con-



PLAN OF NEW CAR HOUSE, OMAHA STREET RAILWAY CO.

crete; it is excavated to the depth of several feet below the general floor level so that in event of fire the oil cannot run over the rest of the building.

To provide an efficient system of fire protection for a building of this kind is quite a problem and the very satisfactory solution in this case was worked out by the general manager of the company, Mr. W. A. Smith, after consultation with the fire marshal of the city. A 6-in. water-main enters the building at the middle point of the west wall and is carried up the wall to the roof truss and thence across to the center line of the building; a 1½-in. hose connection is provided on the west wall. Along the center of the building just west of the center line, a runway 4 ft. wide is laid on the chords of the roof trusses; the runway extends to within 100 ft. of each end of the building, and at each end of it is an iron ladder down to the floor. The sides of the runway are pro-



CROSS SECTION OF CAR HOUSE.

tected by substantial wooden railings. At the point where the 6-in. water main intersects the runway is a 2½-in. fire hose connection and a section of hose long enough to reach to the end of the runway. Thus in event of a fire in any part of the barn it may quickly be reached by a stream of water from the bridge, whereas it would be extremely difficult to carry a line of hose in and out among the cars on the floor to reach a car on an inner track.

From the terminal of the 6-in. water main three 4-in. pipes are laid; one is carried to the east wall and terminates in a 1½-in. hose connection and the others along the center line of the building to within 60 ft. of the end walls where 1½-in. fire connections are provided.

The office of the car house foreman and the trainmen's waiting room and a lavatory occupy a space about 20 x 40 ft. on the ground floor at the northwest corner of the building. Immediately above these rooms, and reached by a stairway leading from the waiting room are two rooms, 16 x 20 ft. and 24 x 20 ft., which are provided for the "Street Railway Library and Amusement Club," which is a club of the company's employes. As the company provides the quarters and lights and heats them, the expenses are light; the initiation fee is 50 cents and the dues are 5 cents per month. The club rooms are neatly furnished with chairs, table book cases, etc., and the walls adorned with pictures; the club subscribes to all the leading periodicals and already has the nucleus of a library though organized only a few months ago. The membership is now about 160; employes who are not members are excluded from the clubroom by the company.

A steam locomotive is being used in the construction of the Sandusky & Interurban Electric Ry.

SCHOOL FOR MOTORMEN.

How to best examine an applicant for a position in the train service, and afterwards how to best teach him his duties, are questions which the managers of electric roads, and particularly on the large ones have found difficult of solution. Every manager has probably found that the best and most careful motorman does not necessarily make the best instructor of new men, and that it is quite important to have good instructors as to have good motormen and good conductors. President Vreeland, of the Metropolitan Street Railway Co., of New York, has decided that for a large road, such as his, the best method is to institute a school under the direction of men thoroughly fitted for their duties as instructors, and this plan has been fully developed so as to comprise instruction by lectures, recitations and laboratory practice, given in conjunction with actual practice of the men on cars. It is not the idea of the company to give theoretical instruction in electricty or mechanics, but merely to teach the motormen certain of their duties. Such instruction is ordinarily left for the motorman on the car who breaks in the new man to impart, and in many cases he does not give it.

In order to secure a position as motorman with the Metropolitan Co. the candidate must fill out an application blank, giving age, height, weight, address and references, which is transmitted to Mr. J. J. Swan, who has charge of this matter. Mr. Swan's assistants then look up the man's record,

J. F. Kane. J. J. Swan. J. J. Cahill.
SCHOOL ROOM.

and if his references are satisfactory, he is asked to call and submit to a physical examination by the company's surgeon. The physical examination is particularly rigid with regard to sight and hearing. Having successfully passed the examining surgeon the applicant is given a card to Mr. J. F. Kane, the instructor and superintendent of the motorman's school. On reporting to Mr. Kane, the applicant has his name entered on the application books and receives a book, which contains 88 rules, and enters on his student course.

The man gets a knowledge of rules and is required to know certain of them, particularly those pertaining to his duties, which knowledge he acquires along with the general practice.

On Wednesday, Thursday and Friday afternoons Mr. Kane conducts oral examinations on the rules. Particular stress is from the first laid on the rules concerning bell signals, how to reverse, how to insert fuses, and how to manage the controller. If after examination on the book of rules it is evident that the applicant cannot learn this part of his duties he is dismissed and surrenders his rule book.

The students spend 10 hours per day for two days on the rules and working with the controllers. Laboratory instruction on controllers is given by Mr. J. F. Kent, assistant instructor. Each man is given a number corresponding with the number of a controller with which he is to work.

About 50 controller and brake equipments are arranged in the room and the men operate these according to bell signals given by the instructors. The instructor has the students under his eye and can direct them, point out their errors and observe the progress made. For the laboratory practice, there are no electrical connections to the controllers, but the brake staffs are connected to springs giving the same resistance to setting up as is in practice given by the "Sterling" brakes with which all the company's standard cars are equipped. On a board back of each controller are a switch and a fuse box, which are manipulated in accordance with bell signals.

One bell. This is to stop, and the student turns off his controller and applies the brake.

Two bells. This means go ahead, and the brake is released and the controller handle turned from point to point as directed in the book of rules.

Three bells. This means an emergency stop.

Four bells. Reverse.

Five bells. "Follow Truck," that is, manipulate the controller and brake so as to accommodate the motion of a car to that of a truck which is supposed to be on the track in front of it and have the car so under control that the motorman will avoid a collision in case the truck shall suddenly stop.

The correct position of the motorman is with the right hand on the knob of the brake handle and the left hand on the knob of the controller handle.

After the student has progressed to this point he spends a good portion of the time, this is the time allotted for each class in controllers, on this exercise for three days. It is found that a great many students who pass the oral examinations on rules with ease cannot do the work on the controllers and brakes. They are awkward, are easily confused and cannot remember which way to turn the handle nor to which point to turn it. When the laboratory practice on controllers develops the fact that the student has missed his calling he is dismissed.

After the practice in controller and brake manipulation the student is instructed in the clerical work incident to the position of motorman. He is given a run card and learns how to properly fill it out and to read the time tables intelligently. He returns the run card after filling the blanks just as if he had a car in service, and if errors are made the instructor sets the matter right at the next school session.

Graduates of this school are then placed on a car in service with a sub-instructor for two or three weeks, depending on the proficiency shown, after which, if they prove to be competent to handle a car alone, they are given a position and receive badges and buttons.

CLASS IN CONTROLLERS.

SKELETON CAR.

Mr. Kane states that by means of this school the company is enabled to secure better men, and when given charge of cars they are known to be thoroughly instructed in their duties, and also it is pretty well known how they will conduct themselves in an emergency. When a new man is placed on a regular car to learn his duties from the motorman it is impossible to know how well he has succeeded, and the chances are that all his instruction has been under the most favorable conditions. The company is satisfied that the school gives it better men and saves it thousands of dollars in the accident account to say nothing of the saving of the motors and controllers.

Each Friday night there is a lecture in the school room for all motormen, especially the students, on the general subject of running cars. A skeleton car so arranged as to show the motor equipment and wiring, models of the plow, etc., greatly aid the men in understanding the apparatus with which they work. The skeleton car, shown in one of the illustrations, is fitted with motors, controllers and brakes, and is connected with the trolley circuit so that the instructors can give practical lessons in operating the car, replacing fuses, and a motorman's work in general.

Saturday night lectures are given once or twice per month; these are not especially for new men, but are for

men in all departments of the service, who may be interested in the electrical and mechanical workings of cars. These lectures include talks on electrical and mechanical matters; also talks on general subjects of railroading, talks on discipline and on how a man may become advanced in the railroad service, all by men of high standing in their lines

It should also be mentioned that there is a club room for the use of employes of the company, which contains current weekly and monthly papers and magazines with many special papers on electric and railroad subjects, together with a library of about 1,500 volumes, containing works on electrical and mechanical subjects together with works of fiction. This library is free for employes of the company and the men may take the books home and read them.

Seated at the table in the foreground of one of our illustrations are, beginning at the left, J. F. Kane, instructor; J. J. Swan, paymaster, and J. J. Cahill, assistant superintendent.

THE OMAHA STREET RAILWAY AND THE EXPOSITION.

The fact that a number of cities are to hold expositions and world's fairs within the next year or two will make the following notes concerning the passenger traffic of the Omaha Street Railway Co. during the Trans-Mississippi and International Exposition of interests at the present time. The Exposition was open from June 1 to Nov. 1, 1898, and every day the lines of this company were taxed to carry visitors to the Exposition grounds; the conditions were successfully met and the service rendered gave the greatest satisfaction.

The pasenger traffic on three of the big days was as follows:

Oct. 12, 1898: Running direct to Exposition, 106 motor cars and 40 trailers. Total in service 150 motor cars and 40 trailers. Cash fares collected, 193,760; transfer passengers, 77,504; total, passes and mail carriers not counted, 271,264.

Oct. 11, 1898: Same cars in service as on October 12th. Cash fares collected 183,700; transfer passengers, 73,480; total, 257,180.

Sept. 22, 1898: Running direct to Exposition, 102 motor cars and 36 trailers. Total in service, 145 motor cars and 30 trailers. Cash fares collected, 142,434; transfer passengers, 56,973. Total, 199,407.

The rolling stock with which these immense crowds were so successfully handled comprised:

44 10-bench open cars seating 50 persons.
70 7-bench open cars seating 35 persons.
27 20-ft. closed cars seating 30 persons.
49 16-ft. closed cars seating 22 persons.

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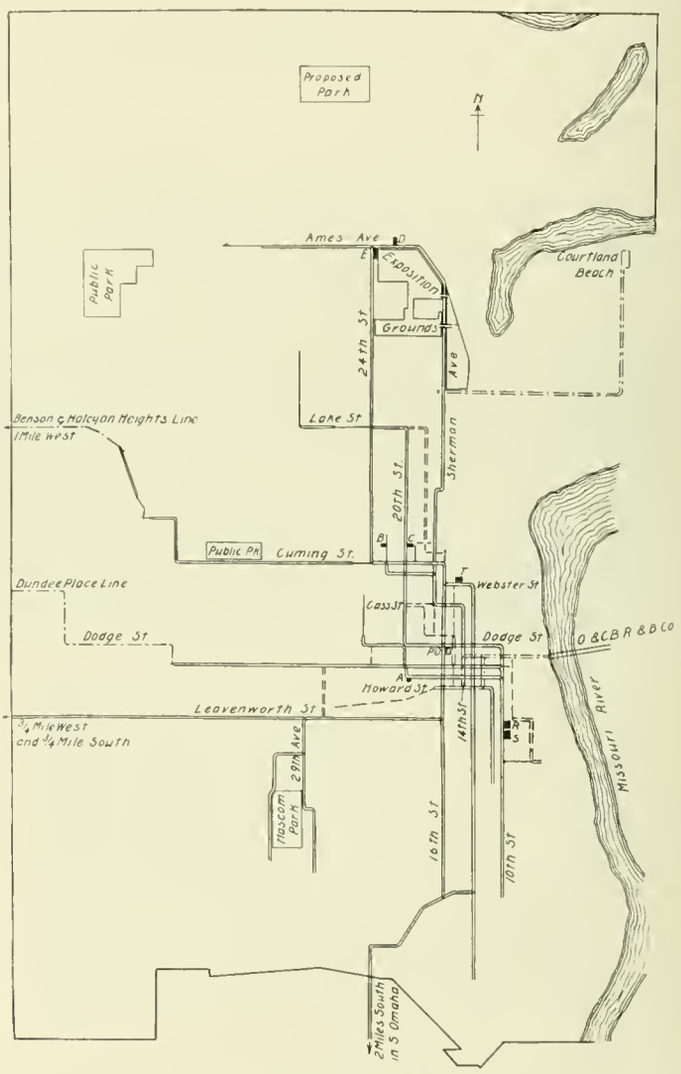
Since the Exposition closed the company has purchased 20 new 20 ft. box cars from J. M. Jones Sons, 37 Peckham extra long trucks and 37 G. E. 52 motors.

To enable the reader to understand the arrangement of various routes the accompanying map has been prepared, showing all the street railway lines of Omaha and the location of the railroad station and the exposition. The Omaha Street Railway Co. is a consolidation of the old Omaha Horse Railway Co. with other companies organized in the 80's to build cable and electric lines, and it now owns all of the street railways in Omaha, except three short suburban lines, the East Omaha with 5½ miles of track, the Dundee line with 1½ miles, and the Benson & Halcyon Heights line with 4 miles, and it furnishes electric power for operating these lines. The Dundee line is owned by the Metropolitan Cable Railway Co., but is an electric road. The Omaha Street Railway Co. operates 80 miles of electric lines, and has a number of old horse lines shown in the map by dotted lines which are not now used.

Referring to the map, R is the terminal station of the Chicago, Burlington & Quincy, the Burlington & Missouri



MAP OF OMAHA LINES.

and the Kansas City, St. Joseph & Council Bluffs Railroads; S, the terminal of the Union Pacific, the Chicago & Northwestern, the Chicago, Milwaukee & St. Paul, the Chicago, Rock Island & Pacific, The Wabash and the Kansas City, Pittsburg & Gulf; T, the terminal of the Missouri Pacific, the Freemont, Elkhorn & Missouri Valley, the Sioux City & Pacific, the Chicago, Minneapolis, St. Paul & Omaha, and the Belt Line.

The four through street railway lines to the Exposition Grounds may be traced out and were as follows:

1. Hanscom Park & N. 24th St. line running to the west side of the Exposition Grounds. On 24th to Cuming; on

Cuming to 16th; on 16th to Leavenworth; on Leavenworth to 29th Ave. and to Hanscom Park. Passengers from the Webster St. station, T, were carried on this line.

2. Sherman Ave. & South Omaha line. On Ames Ave. (north of the Exposition) to Sherman Ave.; on Sherman (this avenue separates the Exposition Grounds into two portions, which are connected by two viaducts over the street) to Cass; on Cass to 14th; on 14th to Howard; on Howard to 16th; on 16th to South Omaha. Passengers were transferred to this line from the Park and the East Omaha lines.

3. Union Depot line. From the west side of the Exposition Grounds on 24th St. to Lake; on Lake to 20th; on 20th to Dodge; on Dodge to 10th; on 10th to the Union Depots, R and S.

4. Sherman Ave. & South Omaha line. From the Exposition to 14th and Howard via Sherman Ave.

Transfers were made from the less important lines to these through lines at junction points. Cars on all routes passing depots transferred passengers to the Exposition lines.

The Exposition Grounds are but two miles from the Post Office, and as these through lines all pass through the heart of the city, the company had the advantage of a short haul. The location of the Exposition so as to be bounded by two lines and cut by a third was also a particularly fortunate one as it gave a large loop terminal.

The business district is that portion of the map where the car lines form a net work.

The shops and power houses are designated on the map by the letters A, B, C, D and E.

A is the old cable power house now used for the general offices and as a car house and repair shop.

B is the power house built by the Omaha Motor Railway Co. in 1889; it is equipped with two simple corliss engines made by the E. P. Allis Co. and eight 80-h. p. T.-H. generators. It was used during the Exposition but is not operated save in emergencies.

C is the electric power house and car barn built by the Omaha Street Railway Co. in 1889 before its consolidation with the Motor Co. and is equipped with the following machinery: One simple engine (removed from the cable plant) belted to a 500-kw. generator. One compound non-condensing corliss engine driving seven 80-kw. and 100-kw. Edison machines. Two Westinghouse compound engines driving four 125-h. p. Edison machines. One cross-compound non-condensing corliss engine, built by the E. P. Allis Co., direct connected to an 850-kw. multipolar General Electric generator; this machine was started June 1, 1898. The boiler equipment of this station prior to last year was 10 60-in. by 16 ft. tubular boilers; when the new unit was installed 10 new tubular boilers 66 in. by 16 ft. were added and a new steel stack 8 ft. in diameter and 125 ft. above the grates built.

D is the shed used for storing cars out of season.

E is a new car house built last fall.

The officers of the company are: President, Frank Murphy; vice-president, Guy C. Barton; treasurer, W. W. Marsh; secretary, D. H. Goodrich; general manager, W. A. Smith; general superintendent, F. A. Tucker.

The North Kankake (Ill.) Street Railway Co., is erecting a new car house 44 x 112 ft. The building is of brick.

OPENING AT FT. WORTH, TEX.

Ft. Worth, Tex., is jubilant over the completion of a nine mile electric belt line which affords rapid transit for people living in the suburbs to the business center of the city. This belt line connects with all the other lines and makes it possible to go anywhere and quickly reach any point in Ft. Worth on well equipped electric roads.

And while the city is rejoicing over the event it is lavishing praise and honor upon Mr. J. T. Voss, the president and manager of the Glenwood & Polytechnic College Street Railway Co. To him is due all the credit for a perfect working and convenient system—something Ft. Worth never had until Mr. Voss went there to stir matters up. Before he arrived the Glenwood & Polytechnic line was but a little over two miles long and had one mule car. To-day this line is 18 miles in length, has 10 motor cars. Mr. Voss

COL. J. T. VOSS.

took the Glenwood & Polytechnic lines as the basis of his operations. He leased the Arlington Heights Electric lines, connected them with the Polytechnic and put the whole system under electrical operation. Mr. Voss' next move was to purchase the old Riverside line and to reconstruct the Mistletoe Heights line. When this had been accomplished and all was in good working order Mr. Voss turned his attention to the belt line. The completion of this recently gives Ft. Worth a street railway system to be proud of.

J. F. Voss has been identified with street railway building and management for more than 20 years. His first experience was driving a horse car in Nashville, Tenn., but though only a young man, he soon became the general manager of three lines in East Nashville. From Tennessee he went to Macon, Ga., and there constructed a steam dummy line which he later sold out at a good profit. His next venture was in Atlanta, where, after five months as general manager of the Atlanta Traction Co., he became president of the Electrical Equipment Co. of that city. It was while in this position business took him to Ft. Worth, and there he met Mr. R. Vickery with the result of giving up his Atlanta connection and going to Ft. Worth. What he has done there has been briefly outlined.

The opening of the nine-mile belt line was made the occasion of great festivity. It was a regular gala day. The city was decorated, the bands played, speeches were made and Col. Voss and his two sons, who have aided him greatly in his work, were warmly toasted.

WAGES INCREASED.

The Consolidated Traction Co., of Pittsburg, May 1st advanced the wages of employes 11 per cent.

The Des Moines (Ia.) City Railway Co. has advanced wages 10 per cent; the order took effect May 1st and affects 200 men.

The Parkersburg (W. Va.) Electric Light & Street Railroad Co. has advanced wages 20 per cent.

D. G. HAMILTON, NEW PRESIDENT CHICAGO CITY RAILWAY.

Mr. D. G. Hamilton, who held the office of second vice-president, was, at a meeting of the board of directors of the Chicago City Railway Co. on Thursday, April 16th, elected president to succeed the late M. K. Bowen. Mr. Hamilton has for many years been prominently identified with street railway management. He was born in Chicago in 1843 and has lived here nearly all his life. For several years he was president of the National Railway Co. of St. Louis. He has long been interested in the Chicago City Railway Co. and is now a heavy stockholder. On the first of the present year he succeeded Joseph Leiter as second vice-president but had been a director in the company for several years.

Mr. Hamilton was graduated from the old Chicago University and began the practice of law, meeting with more than ordinary success. He acquired considerable real estate in the city and has long been recognized as one of Chicago's most able financiers. He has of late years given much of his time to real estate matters and the loaning of money, handling, however, to a great extent his own property. But he has always taken a lively interest in the management of the Chicago City Ry. and was the unanimous choice of the directors for the office of president.

Mr. Hamilton is western director of the Union Mutual Insurance Co., of Maine. He is a member of the board of trustees of De Pauw University and of the University of Chicago. He is a member of several clubs in Chicago, the Union League, Washington Park, and the Chicago being among the number.

HOW INTERURBANS INCREASE BUSINESS.

BY E. E. DOWNS, MANAGER CITIZENS' TRACTION CO., OSHKOSH.

Everything to the contrary notwithstanding, it is not necessarily true that the building of interurban lines retards the progress of the smaller towns to the advantage of the larger ones. It had become almost an accepted adage that the smaller towns suffered from such experiences until effectually disputed by the history of interurban movements in this country. Interurban traffic builds up and does not tear down.

When the Valley line was extended from Appleton to Neenah it was opposed to some extent by the Neenah business men who were misled by the belief that they would suffer by reason of the construction of the road. They thought that it would place them into too active competition with the Appleton firms, and thus lessen their sales. The opposite, however, proved to be true, and the Neenah business men and merchants today are enjoying an increase in their business. When the line to Oshkosh is built the same experience will again be met with, and the merchants on both ends of the line will see an improvement in the volume of their business.

No other conclusion can be drawn for the reason that the new road will place the cities into immediate harmony and touch with the farming elements. Where before it took a long time to reach the cities, the farmer can enjoy the accommodations of a city life at least in one respect by a rapid means of transit.

Not only will the road be of vast importance to the commercial interests of cities in developing new fields upon which to expand, but the vast traveling public will receive accommodations in a quicker and more modern service. When the new road is in operation it will be possible for any traveling agent to step from the very door of his hotel onto a car in this city and equal accommodations will await him on the other end of the line.

Men versed in railway matters, and who are considered authorities on the subject, maintain that the time is not far distant when the interurban road will gradually absorb what is termed the local traffic, while the larger railway corporations will be confined almost exclusively to through travel. They base their claims upon late developments which tend in this direction. Interurban travel is gradually becoming more and more popular. When it is taken into consideration that one can step from his own house and board a car which will carry him to a distant point, it is no wonder that this mode of travel is gradually revolutionizing the railway business.

STRIKE AT BAY CITY, MICH.

On April 6th the employes of the Bay Cities Consolidated Railway Co. quit work and went on a strike. A new man had been employed and one of the old motormen, Kidd by name, was directed to instruct him, which Kidd refused to do without a written permit from the president of the employes union. Thereupon Kidd was discharged and the strike followed because the company refused to reinstate him.

The men invoked the assistance of the State Court of Mediation and Arbitration, of which Hon. Jerome W. Robbins is secretary, and Mr. Robbins at once went to Bay City to confer with the strikers and the company. Mr. Robbins met representatives of the company stating that he was authorized by the men to conclude an arrangement; the company agreed to receive back all the old employes save 11 whose places had been filled by new men, and arbitrate all differences as to wages, hours, etc., and the proposal was accepted by Mr. Robbins, but later was repudiated by the men.

The City Council appointed a committee to confer with the various parties, and the report of the proceedings at a meeting of committee on April 11th is quite interesting. Mr. J. G. Weadlock and Mr. Morrison, assistant general manager, represented the company, and Messrs. Haller and Hasty, the men. The men at first asked that Kidd be reinstated but the company refused to do so until the Court of Arbitration had decided that it should, and the men waived that point. The main point discussed was the keeping of the 11 new men.

A settlement was effected on April 15th, the men returning to work without the company recognizing the union as an organization or reinstating Kidd and other matters of difference being referred to the Court of Arbitration. During the eight days that the strike lasted the most friendly feelings and relations existed between all parties; the men were all of good character and most of them had been in the company's employ for a long time, and the company better than anyone else appreciated their worth, and regretted that they should have been misled by professional agitators into taking a position antagonistic to the legal and moral obligations of the company to the public.

CINCINNATI STREET RAILWAY'S SHOPS.

The large car shops of the Cincinnati Street Railway Co., at Chester Park, are to be enlarged to more than double the present size. The present shops cover an area of 12 acres and the additions now contemplated will increase the space covered to 26 acres. It is the intention of the company to build all the cars used on all its lines. This plan has been under consideraion for several years but was only recently fully decided upon. The absolute necessity for 30 new cars of the winter type has brought the matter to a focus and the work on the new shops will be begun at once and pushed forward with vigor.

President Kilgour states that the works are to be supplied with all the most modern machinery.

FENDER DECISION IN BROOKLYN.

An ordinance of New York City provides that every trolley car running within the limits of the borough of Brooklyn must be fitted with a fender which shall be not more than 3 in. above the tracks. The Nassau Electric Railroad Co. was fined $25 under the ordinance, and on appeal the Supreme Court held the ordinance unreasonable and therefore invalid so far as the 3-in. requirement was concerned.

THE PENALTY OF OVERWORK.

The sudden death of Mr. Bowen has caused more than one street railway official to pause and consider how long he can hold out under the high pressure under which street railway management seems to be necessarily conducted. The Chicago Tribune in commenting editorially on the sad event says:

"The sudden death of Menard K. Bowen, the efficient president of the Chicago City Railway Co., points a lesson and suggests a business truth. The lesson is the danger of overwork, for primarily this was the cause of Mr. Bowen's death. In one sense this may be called a vice of the times. In the hurry and restlessness of American business life, aggravated by the strenuousness of competition and the haste to be rich, business men give little attention to diet, exercise, and the ordinary requirements of hygiene. The lack of proper rest and recreation gives the physical man no opportunity to resume his natural elasticity. The unnatural strain superinduces disease, nature has no assistance in resisting it, and the debilitated body succumbs and not infrequently involves the brain power also, the two being in close sympathy.

"An important business truth is suggested by Mr. Bowen's death. Mr. Bowen rose to the presidency of this large corporation because he was a skilled workman in his chosen field. He had experience as a civil and mechanical engineer, surveyor, construction superintendent, and railroad superintendent; knew how to handle men, understood the laying of cables, the operation of cars, and all the mechanical details of street railroading, besides having the executive ability necessary to the position he held. In a word, he was an expert, and it is experts that are now required by the great corporations, whether banks, business houses, manufactories, electric light companies, telephone companies, or traction companies. The day of handing down the management of business from father to son, regardless of fitness, or of calling into important places men who have been successful in a wholly different kind of business, has passed away. Young men or men of middle life who have demonstrated their capacity and shown their skill in all the details of operation are in request as managers of large enterprises, and Mr. Bowen was one of this class."

* * *

The death of Mr. Bowen recalls an exciting incident which occurred when he was superintendent of the Ninth St. cable line in Kansas City. On Thursday, Oct. 12, 1887, the special car in which President and Mrs. Grover Cleveland were touring the West, reached the Kansas City Union Station. Carriages were in waiting to drive the distinguished guests down Broadway to the Coates House. The streets were packed with people, and several companies of militia were drawn up at "present arms" to keep a passage open along Broadway. Ninth St., on which the cable line runs, crosses Broadway and six cable trains were stopped on one side of Broadway to await the passage of the presidential party. Just as the Cleveland carriage was crossing the tracks a loose strand in the cable caught the grip of the rear car, and the six heavy trains were hurled forward like a battering ram into the almost solid mass of people. Hundreds were knocked down and some badly injured, the Cleveland carriage escaping by a few feet.

The crowds, thinking the trains had been started on purpose, chased the gripmen and conductors from the cars, and followed them down Ninth St. to the power house, crying, "Hang them! Hang them!"

The mob threw the offending cars from the tracks, and, breaking some of them into pieces, used the doors as battering rams against the power house. Superintendent Bowen came out and faced the angry mob of 1,000 people, but he was unable to calm them, and only by summoning a large body of police was serious trouble averted.

A weather report has been ordered placed on every street car on the Lancaster (O.) Traction Co.'s lines at 9:30 o'clock each morning.

There is considerable talk concerning some proposed extension and improvements by the Ogden (Utah) Street Railway Co. One of the extensions may run up to and through Ogden Canon, and there may be also some Hot Springs connections.

THE ELECTRICAL EXPOSITION.

The annual exposition of the Electrical Exposition Co., of New York, now in progress at Madison Square Garden, possesses even more features of interest than were to be found at either of the previous ones. General Manager Nathan has been able to carry out his plans almost as proposed, and has secured many exhibits which are proving exceedingly attractive. The automobiles are creating a good deal of a sensation, many new points of novelty and of special application being shown.

Wireless telegraphy is also attracting much attention, and the experiments are being watched closely not only by electricians but by the general public. The special department devoted to the application of electricity to medicine, surgery and dentistry has a tonic for the doctors. Herein is a field in which the whole world has a vital interest.

Mr. Nathan has drawn upon the Government of the United States with much success. From the War Department there are exhibits of the Signal Corps, the flying telegraph, the switchboard used at Ponce, Porto Rico, and the map of battle line and the kit used at Santiago. Exhibits are also given with the heliograph which is used when wires for flash telegraphic signals, cannot be strung.

Through courtesy of the Navy there are shown night signal systems, battle order indicators, explaining the method of communication between commanding officer and gun crews. Then there is an electric diving lamp used for deep sea diving and samples of the various electrical material used by all vessels of the Navy.

There are some especially interesting exhibits in connection with the late war. The search light which was captured from the "Vizcaya" at Santiago, and was put in operation on the U. S. S. Texas, is there. This is the search light which disclosed the Merrimac in the entrance to Santiago harbor and led to the capture of Lieutenant Hobson. There is also the search light rescued from the ill-fated Maine.

Last year many exhibitors complained of being compelled to locate in the basement. The management has this year arranged to give all principal exhibits space on the main floor and the basement has been used for a number of special and interesting features. There is an electrical theater, an electrical "Cave of the Winds," an electrical grotto and an exhibit of the uses of electricity under water.

FT. WAYNE ELECTRIC CO.

The General Electric Co. has purchased the Fort Wayne Electric Corporation's plant and the business will be continued at the present location. There is no idea of a removal and the Ft. Wayne people can rest easy on that score. The concern has been reorganized under the name of the Ft. Wayne Electric Co. and while it is a branch of the General Electric Co. the officers of the local company are all Ft. Wayne men. Mr. J. J. Wood is the general superintendent and Mr. Hunting, as before, will look after the sales. The works have started up again and 150 men are employed. But this number is simply for the beginning. Just as soon as everything is in complete working order more men will be put to work.

It is stated that the plant is in first rate shape now and there is no question about its paying. There is a prospect of the works being enlarged and it is reported that President Coffin intends to go into the manufacture of electric motors and telephone apparatus quite extensively.

The General Electric Co. did not purchase the Ft. Wayne plant as a speculation but was forced into buying it to protect a mortgage the company held on the plant. In all probability Ft. Wayne capitalists would have bid the property in at the sale had not Mr. Wood honestly come forward and stated frankly that he had some doubts in regard to his patents. This made some of them timid, and although the disposition was strong to have Ft. Wayne still retain the plant they let the sale go on and Mr. Coffin, for the General Electric, was the buyer. But now that it is certain the plant will be kept where it is the Ft. Wayne people are well satisfied.

A motorman on the Louisville (Ky.) Street Railway Co. has sued for $15,000 damages for injury received by reason of an electric shock on May 12, 1898.

In the Power House

This department is devoted to the construction and operation of electric railway power houses. Correspondence from practical men is specially invited. Both the users and makers of power house appliances are expected to give their views and experiences on subjects within the range of the department.

By the courtesy of the B. F. Sturtevant Co., of Boston, we have received data as to the coal consumption at the mills of the United States Cotton Co., Central Falls, R. I., for a period of 15 weeks.

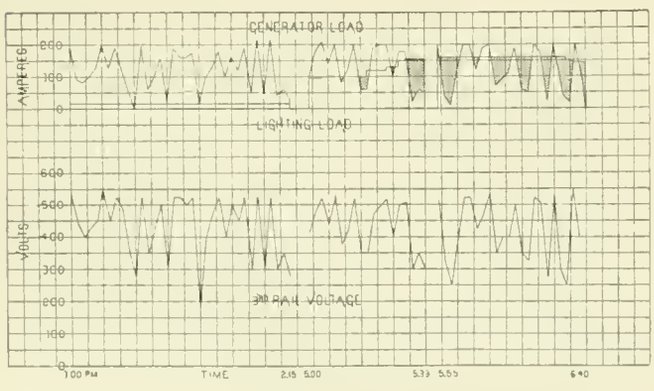
The plant consists of three Babcock & Wilcox boilers of 335-h. p. (rated) each. The engine is a cross-compound Harris-Corliss, developing an average of 1543.84 i. h. p. The remarkably low fuel cost of $5.80 per i. h. p. per year in a plant without economizers, is primarily due to the employment of a low grade mixture costing only $2.29 per ton, the burning of which has been rendered possible by the introduction of mechanical draft. The draft of the chimney, which was previously employed, was insufficient for the free combustion of this fuel, and as a consequence Cumberland semi-bituminous coal was used.

The installation of a Sturtevant fan, costing less than $600, is stated to have effected an annual saving of $6,500 in the fuel bill. The fan is driven by a direct connected engine, the speed of which is regulated by a device of the chief engineer, Mr. Thomas P. Burke, whereby a scarcely noticeable change of steam pressure immediately alters the speed of the fan, and consequently the intensity of the draft, and brings the pressure back to normal.

The fuel was a mixture of 78 per cent buckwheat coal, 15 per cent anthracite dust and 7 per cent Cumberland, the cost per short ton being $2.48, $1.38, and $2.95, respectively. Based on the 15 weeks' test the annual fuel consumption would be 3,907 tons, costing $8,953.23. Per i. h. p. per year this would be $5.80.

* * *

An interesting example of the value of a storage battery as a regulator for lighting circuits is to be found in the equipment of the Hartford station of the electrically operated section of the New York, New Haven & Hartford. The Hartford station is at the end of the third-rail section and its supply of current is taken wholly through the third rail. The voltage of this circuit as shown by the lower curve of the diagram varies from 175 volts to 550 volts. This wide fluctuation in voltage made it impossible to use an ordinary motor-generator set for lighting the station; accordingly a regulating battery was installed.



LOAD DIAGRAMS.

The generating unit consists of a 45-kw. shunt-wound generator direct connected on a common bedplate to a specially compound-wound motor, the compounding being so designed as to run the motor as nearly as possible at constant speed through large variations of voltage in the motor circuit which is derived from the third-rail system of the railroad.

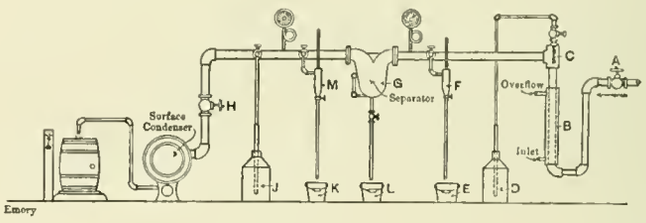
The plant is installed in a small brick structure built against the company's right of way. The battery consists of 62 cells of chloride accumulator, made by the Electric Storage Battery Co., of Philadelphia. Each cell is a tank 23⅜ x 19¾ x 22⅞ in. and contains 11 type G plates 15½ x 15½ in., which fill but one-half the cell.

The battery is directly across the system as a regulator, receiving its charge through the hours of light load as may be seen from the left hand curves in the diagrams and only being required to furnish a small amount of current when the generator current drops, due to the fall of potential in the motor circuit, to a point below the lighting load indicated by the straight line in the diagram. On the right hand of the diagram it is seen that when the lighting load is at its maximum a very considerable portion of the current comes from the battery, the discharging periods being represented by section lining. When the lighting load is at its minimum the motor-generator is shut down and the lighting done from the battery alone, constant potential being maintained by the ordinary method of cutting in reserve cells.

* * *

TESTS OF A STEAM SEPARATOR.

Mr. F. L. Emory presented a paper of this title before the American Society of Mechanical Engineers at its recent meeting in Washington in which were given the results of tests of a separator of the baffle-plate type designed to serve as a live steam separator, as an exhaust steam separator or trap and as an oil extractor. The external appearance of the separator may be seen from the diagram showing the arrangement of the apparatus; the



casting forms a depending bafile plate and has grooves and ridges along which the water flows after impinging on the plate or other walls of the chamber.

In the figure showing the apparatus A is the valve connecting the steam main with the boiler. At B is a cold-water jacket by means of which the steam to be used in the separator test was changed in quality. At C a steam nozzle took steam sample from the vertical pipe to a separating calorimeter D, and the steam's quality was thus known before passing into the separator. The steam gauge and throttling calorimeter F also checked this determination. The steam then passed through the separator G, and the drips were collected at L, the water level in the separator being kept constant. After passing the separator the steam was again sampled by the throttling calorimeter M and the separating calorimeter J, and passed through the valve H, by means of which the velocity was controlled and changed on different runs. The steam condensed by the surface condenser was pumped to the barrel on the platform scales and weighed. The throttling calorimeter on the right was not used with the very wet steam. By using the valves of the drips L and K, and also the steam used by the calorimeter J, the separator itself was used as a check calorimeter. All apparatus was carefully calibrated before the runs.

From the tests of the apparatus as a steam separator at pressure ranging from 1.3 lb. to 86.1 lb. gage pressure the conclusion is

COST OF POWER FOR ELECTRIC RAILWAYS.

Output Measured by Wattmeter in Each Case.

STATION.	MONTH, 1899.	Monthly Output, Kilowatt-Hours.	Cost of Electrical Output per Kilowatt-Hour Cents.						Gals. Cylinder Oil per 10,000 k. w. h.	Gals. Lubric'ting Oil per 10,000 k. w. h.	Lbs. Water per Lb. Coal.	Lbs. Fuel per k.w.h.	Price of Fuel per Ton of 2,000 Lbs.	Kind of Fuel
			Fuel.	Labor	Supplies, Oil, Waste, etc.	Water.	Re-pairs.	Total.						
1	Jan.	1,742,992	.276	.142	.034	.030	.032	.514	3.77	5.74	10.62	2.63	...	Bituminous
3	"	245,992	.504	.258	.075	.015	.004	.856	4.8	8.3	.....	4.74		"
4	"	427,800	.370	.148	.024	.002	.019	.562	2.34	2.94	.....	3.42		"
5. Metropolitan Elevated, Chicago.	"	2,070,537	.333	.123	.017	.024	.017	.514	1.	6.65	3.84	1.75		"
6	"	539,200	.788	.270	.041	...	.182	1.281	...	...	.....	2.59	.947**	Oil.
8	"	929,536	.603	.281	.023	.045	.074	1.027	...	...	.....	...	...	Bituminous
9	"	345,490	.489	.304	.019	.045	.022	.879	...	...	.....	...	...	"
10Central Av., Metropolitan, Kansas City, Mo.	"	.....	....	....	....	...	...	...	...	...	.....	...	...	"

**Price of Oil per Barrel.

drawn that if the separator is kept well drained it will deliver steam dry within 3 per cent. If the steam has less than 3 per cent of moisture initially the separator has little effect as such.

To test its efficiency as an oil extractor the calorimeters and other unnecessary apparatus were removed and steam allowed to flow through the separator to the atmosphere as would be the case in practice with a non-condensing engine.

A known amount of cylinder oil was pumped into the steam pipe slowly as it would be under working conditions, and the efficiency of the separator taken to be the ratio of the oil recovered to that injected. The oil was so intimately mixed with minute globules of water that the weight of oil recovered could be determined only from computations based on the weight and volume of the mixed oil and water and the known specific gravities of the two.

The results of three tests were as follows:

Oil put in.	Mixture taken out.	Per cent of oil regained.
lb.	lb.	
1.86	2.81	58.6
3.05	5.1	53.
1.4	1.82	42.

In round numbers an average of 52 per cent of the oil was recovered, although the mixture that might be used for lubrication again was a much larger amount.

* * *

TREND OF CENTRAL STATION DESIGN.

Abstract of an address before the Northwestern Electrical Association, By B. J. Arnold.

The problem which confronts the power-station designer is almost invariably that of the operation of arc lamps, incandescent lamps and motors for various purposes, with the greatest degree of economy, and with as little expenditure in first cost of plant as possible. This is strictly true of combined lighting and power stations, which present the most difficult cases to handle. When, however, the problem is simply one of the development of electrical energy for power purposes only, such as railway work or transmission work, it becomes much simplified. Since the question of the design of a station is interlinked with and dependent upon the system of distribution adopted, we find ourselves struggling with many of the old questions and some new ones, such as the alternating arc versus the series arc and the constant-potential arc, the polyphase transmission plant versus the direct current, the advisable voltage, either alternating or direct, to adopt for central-station work.

The old belted station we may consider obsolete and come at once to the general types which have been recently installed by competent engineers, and which may be considered as embodying the latest ideas of those skilled in this class of work. In all of these stations we find certain main parts which may be considered as accepted practice. Of course, there are many belted stations running and doing excellent service, which simply speaks well for the engineers and designers, and more especially the manufacturing companies who installed them in the earlier days, because at that time there were few engineers skilled in this branch of work, except those employed by the manufacturers.

The points in accepted practice may thus be summarized:

Water-tube boilers, capable of carrying high steam pressures. This probably will be disputed somewhat by the advocates of other types of boilers, and with some reason, but it nevertheless has become almost standard to use water-tube boilers in modern central stations.

Mechanical stokers, or improved furnaces or grates.

Self-supporting brick or steel stacks, usually steel. A steel stack can be put up for considerably less money than a brick stack, and for all practical purposes it is equally as good, and can be maintained a sufficient number of years to warrant its adoption in almost every case, if properly looked after.

High-pressure steam piping is not duplicated, as was thought necessary by engineers 8 or 10 years ago, practice having proven that one single steam header can be divided so as to make a plant reliable if the engines are properly located with reference to the boilers and the header. Steam piping costs excessively in a power station, and the less of it put in the better, because there is then less radiating surface to waste heat and fewer parts to keep up. The diameters of the steam heaters which are being placed nowadays are somewhat decreased, as compared with those installed four or five years ago.

Large compound condensing steam units. It has become accepted practice to install as large engines as practical, on account of the decreased cost per horse power and the increased economy of a large engine over a small one. They are almost invariably compound engines, where it is possible to condense, and in many cases where it is possible to condense or not. The tendency toward triple-expansion work is not as strong as it was five years ago. It has been determined that for almost all cases a compound engine will get nearly as good economy as a triple-expansion engine, and in many cases just as good; it requires less investment, is less costly to maintain, and the difference in economy of the triple expansion over the compound is so slight that it makes it inadvisable to install, except in exceptionally large sizes. On account of the excessive diameters of the low-pressure steam cylinders in large compound engines it is the practice to install triple-cylinder compound engines; that is, to divide the low-pressure cylinder into two smaller cylinders, the combined area of the two being equal to the area of the large cylinder of a single compound engine.

Direct-connected generators of large capacity. What has been said in general regarding large steam units applies equally to electrical generators, because the larger the unit the greater the economy of the combined unit.

To these chief features of design, which have become so generally accepted as to require little or no discussion, there may be added several features which may be justly called "tendencies" or "trends," which have not yet been universally adopted.

Economizers come under the first heading. There is no doubt, in my judgment, but that there is economy in the use of an economizer, ranging from 5 to 7 or 8 and sometimes as high as 10 per cent. In order to get the benfit of an economizer, ample draft must

be provided. Sometimes an economizer is installed where the draft is poor, the result being no economy and the annihilation of the draft. There is only one solution for this; to increase the height of the stack or introduce mechanical draft.

Mechanical draft. Under this head there are two types, induced draft and forced draft. Induced draft is a device which consists of a large fan or fans, driven by steam engines or electric motors, which are placed between the economizers and the smokestack, or, if economizers are not used, between the boiler flues and the smokestack, the object being to draw or suck the smoke from the boilers through the fan and deliver it into the stack. The advantages of the induced-draft scheme are, first, a lower and less expensive stack can be used; in fact, no stack at all is required except to get the gases above the buildings in the immediate neighborhood of the property; and, secondly, the fires can be handled under any and all conditions. We are all aware that the condition of the atmosphere changes our draft, and in case a stack is no larger than is required, there are days when it is difficult to hold steam, and it becomes necessary to put more boilers into service than would be necessary if a mechanical draft fan were used. Where the economizers can be installed in connection with induced draft an economy is always effected.

Then there is the forced draft, which consists in blowing air under the grates of the boiler and forcing it up through the fire and into the stack, which is supposed to perform the same function that the induced draft does. The objections to it are that inasmuch as it creates pressure in the firebox, the gases are liable to escape out into the room and make a distasteful fire room. Otherwise, the results accomplished are practically the same as with induced draft, and it is considerably less expensive to install, and this is its chief advantage.

Cooling devices. Under this head come cooling towers and cooling tables. During the last two years there has been a tendency to put in these cooling towers, and when properly put in there is always an economy effected, resulting in a net saving of at least 15 per cent in fuel. A tower consists of a series of vertical tubes or sheets, usually within a wrought iron frame, through which air is forced by blowers, driven by steam engines or electric motors, and down through which flows, or sprinkles, or is spread, the water delivered from the condensers. The water coming in contact with the air is cooled and accumulates at the bottom of the tower, and is then pumped into contact with the steam and condenses it. The same water is used over and over, so that only from 5 to 10 per cent will have to be renewed on account of the evaporation. The 5 per cent must be added from the city waterworks, or other outside source.

In place of the cooling tower, where real estate is cheap and available, a table can be erected, consisting of a series of boards laid gridiron-shape, upon which the water is delivered by the condenser pumps and is sprinkled down through the boards, and the air from the atmosphere penetrating through underneath the shelves comes in contact with the hot water and cools it. It then forms a pool at the base of the shelves and is taken from there and pumped back in contact with the steam in the same manner as in the cooling tower. This device can be installed for the same, or less, amount than a cooling tower, and it is advisable to install it where there is sufficient real estate to place it upon, because it requires no power to cool the water, and power is required to drive the fan of a cooling tower.

Motor-driven auxiliaries. Many of the most modern plants are equipped with electrically driven air pumps, boiler-feed pumps and cooling tower motors, if tower is used. There is a question as to whether this is the most economical thing to do or not. I incline toward the belief that there is economy in the use of electrically driven auxiliaries, on account of the non-wasting of heat by pipe radiation, if for no other reason, because the primary objects to be obtained in a power station are to generate the steam with as little fuel as possible, lead it as direct as possible to the steam cylinders, where it is to do its work, and exhaust it into the vacuum as quickly, with as little pipe to radiate heat, as possible; and electrically driven auxiliaries seem to me to accomplish this result better than any other.

Rotary converters. These devices are rapidly coming into use for transmission work, and a number of the most modern railways in Europe and in this country have been equipped in this way during the last year, and with excellent results.

What is known as a rectifier has been used extensively in Europe, and seems deserving of more attention than it has received in this country. This machine accomplishes the same result as a rotary converter without the use of field coils or any revolving parts except commutators.

Boosters have been adopted in a number of Edison central stations and railway plants.

Storage-battery auxiliary. The advantages of this feature have been so thoroughly discussed of late that it will be unnecessary for me to enter further into a discussion of its merits. While some engineers are not yet ready to consider its use established practice, its adoption by many of the leading direct-current stations of this country should prove its usefulness. I say this impartially, because I have no connection with any battery interests at the present time, although I have had until recently.

Having enumerated somewhat briefly the principal factors which are working to shape the design of the future central station, I will briefly describe two types of stations which have lately been built, and seem to represent the latest practice.

1. The composite station, consisting of two or more independent steam units, carrying upon the engine shaft a direct-connected generator suitable for giving light or power, and, in addition, a pulley or flywheel carrying a belt or rope driving a common shaft, to which the other engines similarly drive, and from which small direct-current arc machines or other old-style machines derive their power. This type is admirably adapted for utilizing out-of-date machinery. There have been several large plants of this style installed in the last two or three years by a leading firm of engineers, and the stations, I understand, are giving excellent satisfaction. I refer particularly to the stations at Toledo and Washington, and the solutions of the particular conditions of those cases seem happy ones, because they enable the owners of the properties to utilize all of their old machinery until such times as it may be deemed advisable to change.

2. The second consists of independent engines carrying direct-connected generators. This type is admirably adapted for plants where but one kind of current is delivered, but in case two kinds are required, it becomes necessary to have a generator of each type upon each engine shaft, or have double the number of reserve units that would be required if but one kind of current were desired from the plant. In either case the investment in plant becomes excessive to insure reliability. Two or more kinds of current can be obtained from such a plant by making all of the generating units alike, so far as kind of current is concerned, and driving secondary generators by means of motors running from the main generators.

While the stations first mentioned are good engineering, I believe this is better engineering to eliminate belts entirely, and if there are a number of different types of machines to drive, it is better to produce energy from standard machines of the same character and size, if possible; then drive the older type of high-speed machine, directly connected, from motors; and the efficiency of the combined plant will, I believe, be better than where the belted type is used.

3. There is one other method of construction, which I will not class as accepted, but mention it as a tendency in power-station design, known as the "Arnold system."

(In the discussion following his address Mr. Arnold was urged to say more concerning the Arnold system, and he then added a brief description of such a plant.)

There has recently been a plant installed under this system of 5,000 kw. ultimate capacity, 1,500 of which is now running, and I will describe it, and from the description you may get an idea of what the system is. One engine is installed with a shaft terminating in a flange. Then sufficient room is left for two generators, and then another engine is installed, having a flange on each end of its shaft to which to connect generators. Between the two engines are placed two generators having their shafts in line with the engine shafts. These generators are mounted on hollow shafts or quills carried in their own bearings. Beginning at the end of one engine shaft and extending through the quills, but not touching them, to the other engine shaft is an auxiliary shaft carried in two bearings near its center. With this auxiliary shaft, which is independent of either engine or generator shaft, either one or both the generators between the engines can be connected to either engine when in motion or standing still. This interior shaft does not revolve under normal conditions, but lies idle to be taken up in an emergency,

and under normal conditions you drive directly connected. You can add machines, generators and engines, in line, if you choose, and when you get another engine you have four generators available from each large or interior engine. By making the end engine extra strong, so that it will carry 100 per cent overload, which can very easily be done with slight increased cost, in case the large engine lets down you can run two generators at full capacity from the small engine until the large engine is again ready for work. This requires much less investment in plant than would otherwise be necessary to meet this emergency with independent units of power.

STANDARDS FOR DIRECT CONNECTED GENERATING SETS.

A paper read before the American Society of Mechanical Engineers, by J. B. Stanwood, Cincinnati.

An important factor in America's industrial progress has been the extended application of standards. There are standard dimensions for materials; standard sizes, parts, and capacities of machines; standard gages for close measurements; standard systems of inspection and testing, etc.

These different forms or methods of standardization have usually originated or developed in commercial and manufacturing activities, independent of any governmental instigation or control. They are universally recognized and employed wherever industry and commerce exist throughout our land.

This principle, as carried out in our individual shops and factories, has developed the well-known "interchangeable system" of construction, which, by forcing attention and care upon little things, has further specialized operations, and has stimulated the development of special machines to perform these operations, to the end that the cost of production has been greatly reduced.

Such standardization inside and outside of the shops also aids rapidity of production, inasmuch as standard material can be kept in stock to form standard parts or to complete standard machines, apparatus, or goods, all before these are even ordered.

These results—cheap production and prompt delivery—in connection with a high grade of product (to which these methods contribute) are most powerful factors for securing and maintaining foreign trade. Such influences are particularly active in America today.

In the steam-engine industry these methods have been largely in use; but within the past few years they have been rendered partially inapplicable by a radical change in the environment, due to the introduction of electricity and the employment of high steam pressure.

Whenever new types are undergoing development, before that weeding-out process known as "survival of the fittest" determines what the new type is to be, then standards have to wait until the process is complete. As regards the steam engine, it seems as if in one direction this determination of a type was well nigh completed, and that the time for some standardization had arrived; and, the sooner that this is done, a source of great expense will be avoided, and opportunity for further development and progress extended.

By the introduction of an electrical generator attached to and directly driven by the main shaft of a steam engine a new machine has been evolved. But the introduction of this system has brought a world of complication and expense to both the engine and generator manufacturers, while, to some, serious financial loss has been the result.

The principal cause of these difficulties has been the lack of standard sizes, speeds, and important dimensions of electrical generators, so that the adaptation of the steam engine in each case has been made a special problem, frequently requiring special design and construction.

To complicate the matter, the determination of the sizes and speeds of such generators is usually in the hands of a third party, who is not in touch with either the engine or generator builder. He may be a consulting electrical or mechanical engineer, an architect, a salesman, an agent, or some person presumably skilled in deciding upon the necessary machinery to satisfy certain conditions.

If fortunately there had existed a list of capacities and speeds for electrical generators that was recommended by proper authorities, this list would gradually be used by such persons in securing and specifying the machine to be employed. As it now is, any odd size and speed may be selected by them; as, for instance, to my knowledge, a 45-kw. generator to be operated at 210 revolutions was once specified, almost at random.

If for such a generating "set" bids are taken, then the engine and dynamo contractors who are unlucky enough to secure the order must design a special outfit. Perhaps this is the first time that A's engine has ever been sold to drive one of B's generators, and a new size of engine may have to be built, or vice versa; at any rate a correspondence ensues with an interchange of drawings for a new pattern of sub-base which has to be made. It may happen that the engine shaft has to be enlarged to fit the armature, or the latter has to be changed to fit the shaft. Later the shaft has to be shipped to the dynamo shop to be pressed into the armature, or the armature sent 500 or 1,000 miles to be fitted to the shaft. In all this it is fortunate if mistakes or misfits do not occur.

When the combined plant is ready for erection the engine erector has to co-operate with the electrical erector; usually one waits for the other a few days, under expense, doing nothing. Then begins the adjustment of the engine's speed to suit the generator's speed, which may be slightly fast or slow as the case may be; the governor, too, may be out in a similar way.

All told, these operations form a complicated and cumbersome system, which would be greatly ameliorated if there existed recognized and approved standards for a very few and simple conditions.

What are the features that need standardization? First, for the use of the outside engineer there is a need for a standard series of capacities and speeds; and, second, those parts of the engine and generator which have to be connected or fastened together should be standardized for each different size to facilitate the assembling of the combined machine or "set."

1. (a) Relative to a standard series of capacities and speeds, the different capacities or sizes should be selected to satisfy the usual demands of the market. The number of different sizes should not be too large, in order that the cost of production may not be enhanced by too great a variety of both generators and engines.

In this connection, there might be a standard method of determining the capacity of a generator, which would designate, with a given load or percentage of overload, a given time limit within which a permissible increase of temperature of the field-coils, armature, and commutator can occur.

(b) Relative to speeds, there should be at least three classes of speeds for each size or capacity of generator, corresponding, in the main, to the three classes of engines now on the market. These are known respectively as slow, medium, and high speed engines. By arranging the generator speed in this manner most of the conditions arising in practice could be met. There would be slow speed for factory, manufacturing, or street-railway service, which would be expensive, but durable and easily tended. A medium speed could be used for lighting-plants or conditions where lower first cost and a more limited space exist, but which will require closer attention and will probably be less durable. Lastly, the high-speed "set" would be required for limited space, low first cost, but it will require close attention and will probably be subject to heavier repairs.

Perhaps a series of generators could be arranged so that, by a modification in windings only, a given size for a standard slow speed could be used for larger standard sizes, at standard medium and high speeds.

2. As to the standardization of the dimensions of those parts of the engine and dynamo which are connected together there are: (a) The shaft diameter and armature bore, which should both be expressed in thousandths of an inch; (b) the length of shaft outside of the engine, and the location thereon of the outboard bearing, should be given in inches and feet; (c) the distance from center of armature to sub-base, in inches; and (d) the length and width of generator base, and the size and location thereon of the bolts which attach it to the sub-base, are probably all that are required.

Such a system would materially reduce the complication of construction and erection. A fewer number of engines with their sub-bases and generators would be required. These, in the marketable sizes, could be carried in stock ready for any combination

thereby permitting manufacturers to avail themselves of multiple production, so great a factor in reducing costs, improving quality, and facilitating delivery.

An American system of standards well introduced abroad and at home might give to us a large share of the electrical and engine business of the world.

In this connection, it seems to me that our society and the American Institute of Electrical Engineers are the proper authorities to undertake such an investigation as will, by their recommendation, bring about such a result.

To initiate a movement for this purpose, I do move that the Council be requested to communicate with the American Institute of Electrical Engineers to ascertain if that Institute will agree to appoint a committee to co-operate with a similar committee to be appointed by the American Society of Mechanical Engineers, to determine upon and recommend a standard series of capacities, speeds, and necessary dimensions for electrical generators for direct connection to steam engines.

And, furthermore, if a favorable response be received, then the president be requested, with the concurrence of the Council, to appoint a committee of the proper size to co-operate with the committee to be appointed by the American Institute of Electrical Engineers for the purpose herewith set forth.

ROOM FOR IMPROVEMENT.

When the successful man meets an abnormal condition of affairs he treats it in an abnormal way, and this we presume, is what Mr. E. T. Birdsall did with the abnormal power plant which he described in the course of discussing Mr. Lloyd's paper on "Storage Batteries" before the American Institute of Electrical Engineers.

Mr. Birdsall thus describes his experience:

"In these days when we are struggling to get the last cent out of everything and the last watt out of every pound of coal, it is quite discouraging to run across a peculiar plant, and I did it about a month ago. I was called upon to make a test of a plant to see if it could not be improved, as they thought that there was room for improvement. The plant was in a town of, I think, about 110,000 people. It consisted of two sheds; one contained the boilers and the other the engines and the dynamos. It was alongside of the railroad, so that they dumped the coal right from the cars into the boiler room. They had, I think, three or four horizontal tubular boilers and one Heine. Nothing of the boilers was covered, except by the brickwork at the side. The steam pipe was also bare. They had one cross-compound high-speed engine, non-condensing; two smaller high-speed engines, two Westinghouse standard engines, all belted to dynamos of various vintages. Everything that was a back-number and everything that was queer they had there. They had a wooden switchboard with the finest collection on it that I ever saw. They had one of everything. They evidently had called for samples and put them up. The man who owned two-thirds of the station, after taking me around it, said: 'What do you think of it?' Well, I did not dare tell him; I would have lost my job, as they say, right then and there if I had. I made notes of the machinery and then went back to the office. He said, 'I don't think that it is earning as much money as it should.' Well, that was my opinion, too; that is what I thought then. We went back to the office and went over the earnings. In the station everything was dirty. The boiler room was not fit to pile coal in. It was simply the worst I ever saw; and we went back and went over the books. The man that I was with was president and owned two-thirds of it. Another man was secretary and treasurer and owned the other third, except one or two shares, which somebody's wife owned, in order to make up the board of directors. That was the only station in the town. Upon going over the books we found that they had a capital of $25,000. They had machinery that must have cost them $40,000 at the time when they bought it, when the question was, 'How much has the man got?' not 'What is the machinery worth?' They had capital stock of $25,000 and no bonds. They also had a surplus of $25,000 in the treasury. I saw that with great gratification. Then I saw that they had paid no dividends whatever since the plant started; but they had paid the president an average salary of $20,000 a year, and the secretary and treasurer an average salary of $10,000 a year. He said, 'Where do you see any chance for improvement?' I confess I did not see as much as I did when in the station."

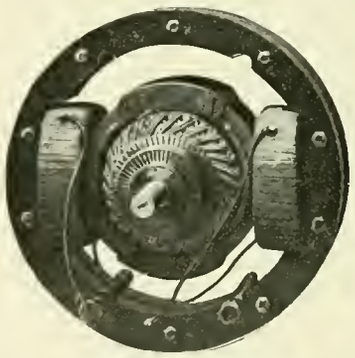
We are sorry Mr. Birdsall did not state what advice he gave in the premises.

A NEW TYPE OF ELECTRIC VENTILATING FAN.

Although the propeller or wing type of ventilating fan has been equipped with various types of electric motors, the design of these motors has hardly received the attention demanded by the importance of the work performed by such machines. The B. F. Sturtevant Co., of Boston, Mass., has of late been giving the entire subject very thorough investigation, and is now presenting a new type of fan wheel and of direct connected motor.

The wheel has been designed to secure the highest efficiency, and consists of blades secured to a light but stiff hub and held in their relative positions by a hoop at the periphery. The delivery edge of the fan wheel is helical, so that the air is picked up at the inlet edge at low velocity, and gradually accelerated to its maximum velocity with the least amount of slip.

The bi-polar type of enclosed motor illustrated in the accompanying engraving is manufactured both as a motor directly connected to a propeller fan and as an independent machine. For the former purpose it is used on all sizes of fans up to and including the 48-in. For larger sizes up to 120 in. four and eight-pole types are employed.



FIELDS AND ARMATURE.

The motor is entirely enclosed, and thereby protected from dust, a most important element in a machine used under these conditions. In order to avoid the excessive temperature which is incident to the operation of most enclosed motors, this type has been very carefully designed, so that a low temperature rise can be maintained without increasing the size and weight above that of the ordinary open type.

This machine is capable of continuous operation for ten hours, with a maximum temperature rise not exceeding 30° F. A practical efficiency of over 80 per cent is obtained even with the small-sized motors, and an excess load of 75 per cent above the rated capacity may be carried without sparking and without change of brushes. The brushes are of hard carbon, in holders of a modified reaction type, which allows of easy adjustment when it becomes necessary to reverse the direction of rotation of the motor. The bearings are self-oiling and self-aligning, and fitted with phosphor-bronze sleeves, which are removable from the outer ends of the boxes.

Officers of the American Air Power Co., of New York City, state that the recent experiments in running surface cars by air power have been entirely satisfactory, and that they will at once equip cars of the Metropolitan Street Railway Co. in 28th and 29th streets.

A decision of the Supreme Court of Massachusetts restrains the Commonwealth Avenue Street Railway Co. from erecting a car house on some of the company's ground in Auburn St., Newton, holding that there exists a restriction that no building other than a dwelling house shall be built there. This is a reversal of a Superior Court decision.

RECENT STREET RAILWAY DECISIONS.

EDITED BY J. L. ROSENBERGER, ATTORNEY AT LAW, CHICAGO.

JURY AND NOT WITNESS MUST DETERMINE ADEQUACY OF BLOCK SIGNALS.

Bergen County Traction Co. v. Bliss (N. J.), 41 Atl. Rep. 837. Nov. 23, 1898.

The opinion of a witness, that the kind of block signals used on a trolley road are not such as to insure reasonable safety to the employes operating the cars of that road, the Court of Errors and Appeals of New Jersey holds, is incompetent and irrelevant; that conclusion being a question for the jury alone to determine from all the evidence in the case.

NOT MINGLED WITH CARS.

General Electric Co. v. Transit Equipment Co. (N. J.), 42 Atl. Rep. 101. Dec. 19, 1898.

Motors, controllers and poles, sold to an equipment company, with the reservation that title thereto shall not pass until they are paid for, the Court of Chancery of New Jersey holds, are not so mingled with the cars to which they are attached that they cannot be separated therefrom and removed and title thus be reserved to them by the seller, as against judgment creditors of the street railway company owning the cars.

THROWING PASSENGER TO THE GROUND BY SUDDEN STOPPING OR STARTING.

Bourque v. New Orleans City & Lake Railroad Co. (La.), 24 So. Rep. 622. Dec. 5, 1898.

If a passenger in alighting from an electric car at point of destination, is thrown to the ground by the suddenness with which same is either stopped or started, and this result is caused or contributed to by those in charge of same, the Supreme Court of Louisiana holds, a case of negligence of the railroad company is made out, for which it must respond in damages.

ELEMENTS IN VALUING FRANCHISE FOR TAXATION.

St. Charles Street Railroad Co. v. Board of Assessors (La.), 25 So. Rep. 90. June 28, 1898. Rehearing, Feb. 20, 1899.

The Louisiana law requiring franchises to operate street railways to be taxed according to their value, makes the earning capacity of the corporation a basis for ascertaining the value at which the franchise shall be assessed, but, the Supreme Court of Louisiana holds, it does not exclude reference to other elements that bear directly on the question of that value.

ABUTTER CANNOT ENJOIN BOULEVARD COMPANY FROM LAYING TRACKS.

Redman v. Monongahela Boulevard Co. (Pa.), 42 Atl. Rev. 133. Jan. 3, 1899.

Abutting owners, the Supreme Court of Pennsylvania holds, cannot enjoin a boulevard company from putting down a double track street railway, laid with ordinary flat rails, in a boulevard which it is constructing under the Pennsylvania boulevard act of 1895, so long as the company disclaims any intention of permitting such track to be used for street railway purposes until permission so to do is granted by the complainants, though it expects the rails some time to be used by a railroad company, and its officers are the same as those of a traction company joined as a defendant.

TERM "RAILROADS" DOES NOT INCLUDE STREET RAILROADS IN OHIO.

Massillon Bridge Co. v. Cambria Iron Co. (O.), 52 N. E. Rep. 192. Nov. 29, 1898.

The Supreme Court of Ohio says that the statutes of that state relating to railroads are separate and distinct from those relating to street railroads, and holds that the word "railroad," in section 3208 of the Revised Statutes, giving a prior lien to laborers and furnishers of materials over mortgages, and in section 1 of the act of March 20, 1889, does not include street railroads.

MOTORMAN MUST LOOK ON SIDES OF TRACK.

City Railway Co. v. Thompson (Tex.), 47 S. W. Rep. 1038. Dec. 3, 1898.

It is the duty of a motorman in charge of a car to look, not only ahead on his track, to see that his way is clear, but, the Court of Civil Appeals of Texas holds, to look on each side of his track, to see that no one is about to get on it, and that no conditions or circumstances present themselves which will evidently compel persons then in his view, passing along the street, to go upon the track in front of his car, as by an ice wagon obstructing the passage on the side of the street.

ELECTRIC STREET RAILWAYS NOT ADDITIONAL SERVITUDES UPON STREETS.

Birmingham Traction Co. v. Birmingham Railway & Electric Co. (Ala.), 24 So. Rep. 502. Oct. 29, 1898.

Electric street railways, such as have now become so well known, the Supreme Court of Alabama falls in line with what it terms a most overwhelming volume of well-considered adjudged case and holds, do not impose any new or additional servitude upon the highway, or streets of towns or cities, for which the owner of the fee is entitled to conpensation, they being built upon street grade, doing no special injury to the fee, and to be regarded as within the implied contemplation of the dedicators at the time of the dedication or grant.

LANDOWNER CANNOT CONTEST LOCATION AFTER TIME ALLOWED.

Stillwater & Machaniesville Street Railway Co. v. Slade (N. Y.), 55 N. Y. Supp. 966. Jan. 11, 1899.

Under the New York Railroad law applicable to street surface railroads the third appellate division of the Supreme Court of New York holds that a landowner cannot contest the location of a street surface railroad, unless he takes the prescribed action therefor within the fifteen days allowed him after the service upon him of notice of the filing of the map and profile, the due process of law to which he is entitled in this respect consisting in affording him a reasonable opportunity to have his grievance redressed, if any he has, which the fifteen days give him.

SUIT CANNOT BE MAINTAINED "FOR THE USE OF" AN ASSIGNEE.

West and South Town Street Railway Co. v. Joseph Capek, for the use of Leo Roeder (Ill.), 31 Chicago Legal News 285. April 11, 1899.

In what is known as "Ackley Case," where the Supreme Court of Illinois decided against the assignability of actions for personal injuries, the suit was brought by and in the name of the assignee. But here is a case where suit was brought in the name of the party injured "for the use of" the assignee. Does the doctrine of the Ackley case apply? The branch Appellate Court, first district, of Illinois, holds that it does, and that an action for injuries cannot be maintained for the use of, when it could not be in the name of, an assignee of the claim in question.

WANTON NEGLIGENCE TO ATTEMPT TO CROSS BETWEEN CARS.

Meyer v. Pittsburg, Allegheny & Manchester Traction Co. (Pa.) 42 Atl. Rep. 41. Jan. 3. 1899.

The undisputed testimony given on behalf of the plaintiff in this

case proved that the plaintiff's husband, being at the side of the street, not at a crossing, and seeing two cars approaching each other from opposite directions, on the two tracks of the road, undertook to cross both tracks at a point between the cars. He was not successful in his attempt, but was struck and killed by one of the cars. After making this statement, the supreme court of Pennsylvania declares there is no possible reason why the defendant should be held liable to pay damages for such manifest and really wanton negligence; and that a nonsuit was therefore properly directed.

CARE REQUIRED OF PERSON PASSING CAR BARN.

Downs v. St. Paul Railway Co. (Minn.), 77 N. W. Rep. 408. Dec. 20, 1898.

Here a boy sixteen years old was struck by a car while he was trotting or running along the sidewalk in front of a car barn and power house; and the Supreme Court of Minnesota holds that a verdict for the defendant was properly directed, on the ground that the boy was guilty of contributory negligence. It holds that he was bound to exercise ordinary care. It may be conceded, it says, that he was not, as a matter of law, bound to stop and look through the doorway before crossing the tracks; but it insists that it was negligence for him to heedlessly trot along in front of the opening, and only two feet therefrom, without doing anything to ascertain whether a car was coming out—knowing that one might come out at any moment.

HANDSOME PLAINTIFFS HAVE SAME RIGHTS AS OTHERS.

Omaha Street Railway Co. v. Emminger (Neb.), 77 N. W. Rep. 675. Dec. 22, 1898.

While it was not insisted that ordinarily there would be error in exhibiting to a jury a limb injured as the one here in question had been, which had been run over between the knee and the ankle, yet it was contended that it was improper in this instance, for the reason that the party suing, a female, was young, handsome, and attractive, and, consequently, that the sympathies of a jury composed of men were unduly excited in her behalf. But the Supreme Court of Nebraska answers that the motto on the coat of arms in that state is, "Equality before the law." This young person, it continues, suffered injuries for which she sought compensation in damages, and she was entitled, in sustaining her claim, to resort to the same proofs that she might have resorted to if she had been aged, ugly, and repulsive. However, the Supreme Court thinks $5,000 sufficient compensation for her, and demands that $5,080 awarded over that sum be remitted.

CITY CANNOT CREATE CIVIL LIABILITY FROM COMPANY TO CITIZEN.

Sanders v. Southern Electric Railway Co. (Mo.), 48 S. W. Rep. 855. Dec. 23, 1898.

A city, to which a portion of the police powers of the state has been delegated, has a right to enact police regulations, and to punish their violation by fine and imprisonment; but the Supreme Court of Missouri, division No. 1 holds, it cannot, under the guise of its police powers, create a liability from one citizen to another, or create a civil duty, enforceable at common law, for this is the exercise of the power of sovereignty, belonging alone to the state. The Legislature may delegate a part of the police power of the state to a municipality, but it cannot delegate the legislative function of making laws that will be binding upon citizens, between themselves, in civil proceedings. And what it here says about creating a liability from a citizen it gives full benefit of to a street railway company.

PRIORITY OF RIGHT OF ERECTING TROLLEY WIRE AUTHORIZES CROSSING ANOTHER WIRE.

Birmingham Railway & Electric Co. v. Birmingham Traction Co. (Ala.), 25 Southern Reporter 102. Feb. 1, 1899.

A street railway company in undertaking to erect its trolley wire along its own right of way, and across the trolley wire of another street railway company, the Supreme Court of Alabama holds, is not violating that clause of the constitution guarantying to the latter company that its property shall not be taken until just compensation be first paid, when the former company acquired its right to erect a trolley wire along its right of way prior to the construction of the road by the company the wire of which it must cross. In other words, the court holds that the mere postponement by the one company of the exercise of its right to convert its system of steam power into that of electric power, which was known to the other company, would not preclude it from exercising it, and invest in the latter company such a superior interest in the use of the street, which it acquired subsequent to the acquisition by the first company of the right to use electricity, as would entitle it to demand compensation for such use.

SUMMER RESORTS DO NOT MAKE ELECTRIC ROADS PUBLIC NECESSITIES.

In re Auburn & Western Railway Co. (N. Y.), 55 N. Y. Supp. 895. Jan. 18, 1899.

A summer resort is, at the best, says the fourth appellate division of the Supreme Court of New York, too ephemeral to furnish a satisfactory basis for declaring a railroad which will accommodate its patrons, by reason of that fact, a public necessity, the patronage from this source necessarily being limited to a small portion of the year. Moreover, touching the relative rights of projected and established roads, the court says that, while it is the undoubted policy of the law to foster and encourage every legitimate enterprise which is at all likely to prove advantageous to the general public, it is, at the same time, the obvious duty of those upon whom the responsibility rests to issue certificates for new roads to exercise a wise discretion in these matters, to the end that one enterprise, however alluring it may seem, shall not be aided and encouraged at the expense of another, which is perhaps equally deserving.

DOUBTFUL CHANCES IN CROSSING IN FRONT OF CAR NOT TO BE TAKEN.

Harvey v. Nassau Electric Railroad Co. (N. Y.), 55 N. Y. Supp. 20. Dec. 6, 1898.

A person is not at liberty, the second appellate division of the Supreme Court of New York holds, to take even doubtful chances of the consequences of crossing the street in the face of danger, or of reliance upon a successful attempt of the motorman to stop the car. If he sees an approaching car, and does not take proper steps, in other words, use reasonable care to avoid it, he is chargeable with negligence. Moreover, the court holds, it is not a rule of law that a street car must be operated beyond the possibility of injury to pedestrians or vehicles. The obligation is to exercise reasonable care in operation, to be watchful and vigilant when approaching street crossings, and have the car well under control. Beyond this the obligation does not extend.

DERAILMENT OF CAR IMPLIES NEGLIGENCE.

Bergen County Traction Co. v. Demarest (N. J.), 42 Atl. Rep. 729. Mar. 8, 1899.

In a suit brought against a street railway company by a passenger for injuries caused by the derailment of the car, the Court of Errors and Appeals of New Jersey holds that proof of the happening of the accident is sufficient to charge the company with negligence, and to place upon it the burden of showing that the injuries were not received through any fault on its part. It is a matter of common knowledge, says the court, that the roadbed of a street railway is so built, and the cars so constructed, that, when there is no defect in either, and the cars are run with due care, the latter will remain upon the track; and, consequently, proof of the derailment of a car, in the absence of evidence to the contrary, justifies the conclusion that it resulted either from improper construction, failure to keep in proper repair, or negligence in operation, though, ordinarily, proof of the occurrence of an accident will not, of itself, support a conclusion of the defendant's carelessness.

RIGHT TO OPERATE CARS OF LEASED LINE ON JOINTLY USED TRACKS.

Coney Island & Gravesend Railway Co. v. Coney Island & Brooklyn Railroad Co. (N. Y.), 56 N. Y. Supp. 508. Mar. 7, 1899.

Under an agreement between two street railway companies, whereby the parties obtained an equal right to use a certain piece of track for all of the purposes for which they might find occasion, either in their business which then existed, or in their subsequent development and extension, there being no limitation, except that one may not be permitted to impair the right existing in the other, the second appellate division of the Supreme Court of New York holds that the operation of the cars of a leased line thereover will not be enjoined, it making a distinction, between such a case and one presenting the ordinary case of a trackage agreement, by which one street railway company obtains the right to the use of the tracks of another at an agreed compensation, wherein it has been held that the agreement does not operate to authorize the lessee to make use of the track for the operation of cars of other lines which it had subsequently leased.

MANAGER CANNOT GIVE OPINION OF COMPETENCY OF MOTORMAN.

Langston v. Southern Electric Railroad Co. (Mo.), 48 S. W. Rep. 835. Dec. 8, 1898.

To permit the defendant's manager, over the plaintiff's objection, to give to the jury his opinion that the motorman in charge of the car when the plaintiff was hurt was in every way competent, and one of the best on the road, the Supreme Court of Missouri, division No. 1, holds was reversible error, the purpose of this evidence being to rebut the charge of negligence made in the pleadings, and which the plaintiff's testimony tended to support, and to show that it was improbable that the car was suddenly jerked forward by any improper action of said motorman. If this competency was to be passed upon by the jury, the court says, they should have been furnished with facts upon that subject, and not the mere opinion of the witness. The experience of the motorman, his opportunity for familiarizing himself with the work, and learning the method of performing the same, and the length of time that he had been engaged in that position, it adds, would have been proper for that purpose.

RULE OF LOOK AND LISTEN INFLEXIBLE.

Cawley v. La Crosse City Railway Co. (Wis.), 77 N. W. Rep. 179. Nov. 1, 1898.

The supreme court of Wisconsin holds that the rule is inflexible and the duty is absolute to look and listen before going upon either a steam railroad track or an electric street railway track, and to see and hear an approaching car if within plain view and hearing, to a person exercising his senses of hearing and seeing with ordinary prudence, to detect it, having regard for the dangers reasonably to be apprehended, and that failure to perform that duty, or, after performing it, to keep out of the region of danger, is negligence per se (in itself); that it is not a mere rule of evidence which a jury may be permitted to consider, and say there was or was not negligence in a given case, according to their notions, but that it is a rule of law to be applied by the court when the facts are undisputed, and by the jury under the direction of the court, when the facts are disputed. The court further suggests that this rule is just as applicable to the crossing of a street railway track operated by a cable.

WHAT MOTORMAN MAY EXPECT WHERE TEAM IS DRIVEN TOWARDS TRACK.

Sanders v. Southern Electric Railway Co. (Mo.), 48 S. W. Rep. 855 Dec. 23, 1898.

A correct proposition of law, the Supreme Court of Missouri holds, is announced by an instruction, which the judge was asked to give the jury, in this case, that, if, from the evidence, they believed that the defendant's servants operating its cars saw the plaintiff driving towards the defendant's track, they had a right to presume that he would not attempt to cross immediately in front of the train; and that if the jury further believed from the evidence that the plaintiff, on approaching the track, saw the car coming, and halted his wagon, and that the defendant's motoneer saw this, then the motoneer had the right to presume that the plaintiff intended to remain halted until the cars had passed him; and that if the jury further believed from the evidence that the plaintiff started up again, and drove onto the track, and that the motoneer stopped the car within the shortest time and space practicable after the plaintiff started up again, then their verdict should be for the defendant company.

WHEN PERSON ATTEMPTING TO BOARD CAR IS INJURED.

Bachrach v. Nassau Electric Railroad Co. (N. Y.), 54 N. Y. Supp. 958. Dec. 13, 1898.

Before the servants of a street railway company can be charged with negligence, the second appellate division of the Supreme Court of New York holds, they should have been either fairly apprised that the person injured in attempting to board the car desired to board it, or that the situation was such that passengers might be naturally expected to get upon the car at the time. In this case, the court reverses a judgment given the plaintiff, for injuries sustained while attempting to board a car, because he failed to show either that the motorman recognized or should have recognized the signal made to him, or that the situation and movement of the car were such that the motorman should, in the exercise of ordinary care, have appreciated the fact that persons might be seeking to board the car as passengers, the reason for the slackening of the speed of the car at the time being entirely accounted for by another cause than anticipation of passengers, and might have been on account of the crossing of another railroad.

TAXPAYER CANNOT ATTACK CONTRACT FOR BUILDING STREET RAILWAY.

State (Randolph and others, Prosecutors) v. Board of Chosen Freeholders of Union County (N. J.), 41 Atl. Rep. 960. Dec. 6, 1898.

The fact that a street railroad company, with which a board of chosen freeholders has made a contract, under the New Jersey act of June 13, 1898, entitled "An act to authorize boards of chosen freeholders to widen, straighten, grade and otherwise improve highways under their control, and to provide for the construction of street railroads therein," to construct a street railroad upon a public highway under its control, has no franchise, apart from such contract, to construct or operate a street railroad upon such highway, the Supreme Court of New Jersey holds, does not give a taxpayer owning land upon the highway a standing to attack the contract. It also holds that the direction contained in said act that commissioners appointed on condemnation of lands taken for the purpose of widening, straightening, or changing the location of a highway in making their estimate and assessment of damages, "shall take into account the benefits conferred by the improvement on the remainder of any lot or tract of land partly taken," is not unconstitutional.

INJUNCTION REFUSED AFTER ROAD IS BUILT AND IN OPERATION.

Becker v. Lebanon & Myerstown Railway Co. (Pa.), 41 Atl. Rep. 612. Nov. 14, 1898.

After the work of location and construction of this railway was commenced, but before the workmen had arrived at the complainant's land, the latter filed a bill, in equity, to enjoin the railway company from constructing and operating the road in front of his premises. No application, however, was made for a preliminary injunction; and the road was in full operation before the company filed its answer, while it was nearly two years and a half later before the complainant took any further step to bring the suit to a hearing. Under these circumstances, and notwithstanding that the company had admitted that it had constructed its track on the turnpike in front of the complainant's premises with-

out legal authority, though not in intentional violation of law, the Supreme Court of Pennsylvania holds, in view of the loss to the company, the inconvenience to the public, the smallness of the injury to the complainant, and its easy compensability in money, that, however clear his right, no injunction should be granted, but he should be left to his remedy in damages.

"LOCATION" OF TRACKS DOES NOT INVOLVE PRIVATE RIGHTS.

State (Moore and others, Prosecutors) v. West Jersey Traction Co. (N. J.), 41 Atl. Rep. 946. Dec. 16, 1898.

A statute (3 General Statutes, of New Jersey, page 3237, section 126) authorized borough councils, upon public notice to all parties interested, to grant or to deny to a street railroad a location of its tracks confortably to its route; such grant, if made, to be upon such lawful restrictions as the interest of the public was deemed to require. Upon notice, consent to a location was given, upon the restriction, among others, "that the limit of this consent shall be twenty-five years from the acceptance of this ordinance." Subsequently, and without notice, a supplement to this ordinance was passed that eliminated the above restriction.

Under these circumstances, the Court of Errors and Appeals of New Jersey holds: That the municipal act of the "location" of a street railroad operated by the trolley system does not involve any private rights.

Such location is a legislative, and not a judicial, act.

Apart from express statutory requirement, notice is not requisite.

The notice required by the act is satisfied when it has been complied with.

Whether the action of council was in bad faith is not a judicial question.

Magie, Chief Justice, and Lippincott and Vredenburgh, Justices, dissent.

STARTING CAR WHILE PASSENGER IS GETTING OFF.

Morrison v. Charlotte Electric Railway, Light & Power Co. (N. C.), 31 S. E. Rep. 720. Dec. 13, 1898.

It was urged in this case that the car, an open one, stopped long enough for the plaintiff to get off, and that, if she got hurt by the car's starting before she got off, it was her own fault—negligence. The company also contended that she got off with her face turned the wrong way, and that this was her fault—negligence; that these contributed to her injury, and were the proximate cause of the same.

But even if it be admitted that 10 or 12 seconds is sufficient time to allow a woman to get off the car, and that she did not move as quickly as she might have done, still the Supreme Court of North Carolina maintains that the defendant was guilty of the grossest negligence in starting the car when she was getting off, in plain view of him. He must necessarily have seen her if he was paying attention to his duties; and if he was inattentive to these duties, and started the car without seeing her, he was guilty of gross negligence.

This being so, and it being shown—admitted—that the plaintiff's injury was caused by starting the car, over which she had no control, the court declares that it is difficult to see how the manner in which she was getting off contributed to, and was the proximate cause of, the injury, or that the length of time—10 or 12 seconds—could have contributed to, and have been the proximate cause of, the injury. Consequently, it affirms a judgment for the plaintiff.

PRESUMPTION FROM COLLISION OF CARS.

Falke v. Second Avenue Railroad Co. and Third Avenue Railroad Co. (N. Y.), 55 N. Y. Supp. 984. Feb. 7, 1899.

This action was brought to recover damages for personal injuries sustained through a collision between a Second Avenue horse car, on which the plaintiff was a passenger, and a Third Avenue cable car, at a point where the roads of the two companies intersect substantially at right angles. The plaintiff got judgment, but the Third Avenue Railroad Co. appealed, and the second appellate division of the Supreme Court of New York has reversed the judgment, ordering a new trial, on account of what it deems substantial error in the following charge to the jury:

"The accident which happened in this case—a collision between two cars running upon tracks which crossed each other—was one which, in the ordinary course of events, would not have happened unless some one had been guilty of negligence, and hence the mere fact that such an accident happened at all raised at once sufficient presumption of negligence upon the part of the defendants to make it incumbent upon them to produce evidence to show, as to each of them, that it, at least, had not been guilty of such negligence."

Doubtless, from the mere occurrence of the collision, the appellate division says, the presumption of negligence arises, and, had the action been against a defendant in the control and operation of both cars, such a defendant would be properly called upon for explanation. In such a case the charge of the trial judge would have been correct.

But in this case, the court goes on to point out, two different parties controlled the operation and management of the cars. There were two actors in the collision, the driver of the Second Avenue car and the gripman of the Third Avenue car. It was entirely possible, and also entirely probable, that the collision might have been due solely to the fault of one of the parties, and that the other might have been in no way to blame. Therefore, the court holds, the presumption of negligence arising from the accident did not tend to inculpate either party. Proof, it says, that one of two or more parties must have committed a tort, or became subject to a contract liability, does not establish the liability of any particular one of the parties, nor subject any party to the burden of explanation.

Of course, continues the court, this would not be applicable to the case of the Second Avenue Railroad Co., which assumed by contract the duty of transporting safely its passengers, so far as human care and foresight could accomplish that result, and of guarding and protecting them, even as against the negligence of other parties. But the Third Avenue Railroad Co. stood in no contractual relation to the plaintiff, and before it could be put on its defense, or called on for explanation, it was necessary for the plaintiff to present proof tending to establish that it was negligent; not merely that it or its co-defendant was negligent.

DUTIES OF STREET CARS AND VEHICLES COMPARED.

Wilson v. Minneapolis Street Railway Co. (Minn.), 77 N. W. Rep. 238. Dec. 5, 1898.

An instruction was given in this case that "street cars are, in the main, governed by the same rules as other vehicles on the street, and their owners have only equal right with the traveling public to use the street." This the Supreme Court of Minnesota holds, misleading and prejudicial. It pronounces it incomplete in that it omits the necessary modifications of the general rule, growing out of the difference in the nature of the two classes of vehicles, such as the construction, motive power, mode of operation, and speed of each.

It is true, as a general proposition, the court says, that a street railway company has no proprietary and superior right to the part of the street whereon its tracks are placed, and that the duty of exercising due care to avoid collisions rests upon it, as well as upon the owner or driver of other vehicles. But the duty, it insists, is relative, and in determining in a given case whether either has exercised ordinary care, attention must be paid to the differences above referred to.

Thus ordinary care and the law of the road require the driver of an ordinary vehicle passing another going in the same direction to drive to the left of the middle of the traveled part of the road. Of necessity, no such duty rests upon a street railway company. If the driver of such vehicle is on that part of the street occupied by the railway tracks, and ahead of the cars, but driving slower than the convenience and accommodation of the public demand that the cars should go, such driver has not an equal right with the railway company to keep along the track. His duty is to seasonably get off the tracks, and let the cars pass.

So, at a street crossing, whether the company has only an equal

right with the traveling public, or a greater or a less right, the court maintains, depends on the circumstances of each particular case—for example—which one acquired the right of way.

As already suggested, the court goes on to say, each must exercise ordinary care to avoid a collision, but it by no means follows that those in charge of the cars must exercise in all cases the same, or at least as much, vigilance as the drivers of other vehicles, in order to discharge the duty of exercising ordinary care. It may be greater or less, according to the circumstances of each case. The amount of vigilance to be exercised by the one in a given case cannot be determined by an arbitrary comparison with that required of the other.

UNREASONABLE FENDER REQUIREMENT.

City of Brooklyn v. Nassau Electric Railroad Co. (N. Y.), 56 N. Y. Supp. 609. Mar. 7, 1899.

While it appreciates the danger occasioned to pedestrians on the highway from the use of trolley cars, and sees the propriety of any regulations or requirements that the Common Council may impose upon the operation and management of such cars for the safety of the public, the second appellate division of the Supreme Court of New York insists that this is always subject to the qualification that such requirements must be reasonable; that is to say—practicable—not from the point of view of expense to the companies operating the cars, but practicable in the sense that they may not improperly interfere with the discharge of the public duty of such companies in transporting passengers.

It is a matter of common knowledge, the court goes on to say, that a trolley car has springs, and a platform, forming a solid part of the car body; that the weight of passengers will depress, more or less, the body of the car, including the platform; that a car in motion will oscillate longitudinally and laterally; that the surface of a city street is not perfectly flat or even over its entire breadth; that there are grades of different degrees, and curves of varying radii, in the city streets; and that the streets themselves have different degrees of convexity.

Bearing these facts in mind, the court holds that an ordinance directing that proper fenders shall be put on all cars is plainly both reasonable and practicable, but the requirement that such fenders shall be within three inches of the tracks is entirely impracticable and unreasonable, the court taking into account further that, while it not only may be possible, but is entirely probable, that in the future mechanical ingenuity will provide devices which will enable these fenders to be maintained at a somewhat uniform height above the street, automatically or otherwise, it is clear that no such device has been invented, or, if invented, its merits have not become so known as to require its adoption.

Therefor the court holds that at the present time, and in the present state of the manufacture of fenders, a direction in an ordinance that fenders shall be maintained three inches above the tracks is unreasonable and void; but, it adds, it is the duty of the railroad companies to comply with the other provisions of the ordinance, and maintain their fenders at the least elevation practicable, the ordinance which it pronounces in other respects valid being one requiring every railroad company operating cars by electricity, in the city, to equip, within 60 days, each car with a safety fender or safeguard attached to the front platform of said car, to be made and modeled in such a manner that it will be impossible for any person or persons to pass under the fender or the platform of said car or cars and come in contact with the wheels of said car.

MILWAUKEE FENDER WORKS WELL.

The Milwaukee Railway & Electric Co. some time since equipped a number of its cars with home-made fenders of the type illustrated in the "Review" for January last, page 45, and reports of a recent collision between a buggy and a car so equipped state that the fender worked admirably; it prevented any part of the wreck from getting beneath the car.

A street car service for collecting mail was put in operation April 1st in Hartford, Conn.

MONTREAL SHIRKED ITS SNOW BURDEN.

There is always an abundance of snow in Montreal during six months of the year, and what to do with it is frequently a serious problem. When in the old horse car days, the tracks were allowed to become buried and the car bodies were shifted onto runners, the question was a simple one; but with the advent of electricity it was necessary to clean the tracks, and the accumulations were of such size that something had to be done. The city, therefore, made an agreement with the company as to a division of labor in the matter. What the experience of the company has been is set forth as follows, by Mr. F. L. Wanklyn, manager of the Montreal Street Ry.:

Section 30, of By-Law 210, which regulates the operations of this company, sets forth:

"The company shall, under instructions from the city, keep their track free from ice and snow, and the city may, at its option, remove the whole or such part of ice and snow from curb to curb as it may see fit, from any street or part of street in which cars are running, including the snow from the roofs of houses, thrown or falling into the streets, and that removed from the sidewalks into the streets with the consent of the city, and the company shall be held to pay one-half of the cost thereof."

In the year 1894 the company entered into an agreement with the city, for five years, by which the amount to be paid by it, as contemplated by the above section, as its half of the cost of removing the snow from the streets occupied by its railway, was fixed at the sum of $1,650 per mile of street per annum, the total cost of clearing the snow on such streets being thus estimated at $3,300 per mile of street.

According to published figures prepared by the city comptroller, Mr. Dufresne, and presented to the Finance Committee, the cost of clearing the snow in these streets has been as follows:

Year.	Total cost.	Paid by Company.	Paid by City.
1893-4	$98,029.38	$57,101.18	$31,928.20
1894-5	75,532.35	46,200.00	31,332.35
1895-6	71,975.87	52,470.00	19,505.87
1896-7	52,361.98	49,557.87	2,904.11
1897-8	102,416.10	50,131.66	52,284.44
	$393,315.68	$255,360.71	$137,954.97

From the above figures it will be seen that upon the basis of equal expenditure the company should have paid the city the sum of $196,657.84, whereas it has paid the sum of $255,360.71, or an excess of $58,702.87; or, to state the matter in another way, the city, instead of expending an amount equivalent to one-half of the estimated cost, viz., $255,360.71, has expended only $137,954.97, thus saving an amount of $117,405.74. The figures for the current season, so far as at present known, show a still more striking disparity than do the above.

The company contends that the city has failed in its obligations in his matter; that it has not expended an amount of money sufficient to efficiently remove the snow, and that it has thereby caused the company great loss and damage, has very seriously prejudiced its car service and thereby caused immense annoyance and inconvenience to its patrons, the citizens of the city of Montreal.

WAGES INCREASED, AND WHY.

March 17th the Joliet (Ill.) Railway Co. posted a notice announcing an increase of 10 per cent in the wages of all regular employes. This is good for the men who get the increase, and good for the company because it is able to pay it. One reason why the company could do this is that it is one of the few which was able to take advantage of the long term franchise permitted by the Allen law. At the time that law was passed the present owners had just secured control of the company, and application for a 50-year franchise was made. As soon as the long time grant was made the company, by virtue of it, floated a bond issue and expended the proceeds in improving the road and putting it on an economical basis.

The Akron Street Railway & Illuminating Co. has been granted a 25-year extension of its franchise.

NEW KANSAS INTERURBAN.

Kansas City, Mo., and Kansas City, Kas., jointly have a population of 250,000 people. Leavenworth lies 26 miles north of Kansas City and has a population of 22,000. Fort Leavenworth, the largest army post in the West, is four miles north of Leavenworth and has a population generally of 3,000 people; between Kansas City and Leavenworth there is the National Soldiers' Home, with a population of 3,000, and Lansing with the Kansas State Penitentiary and a population of 2,000, and then there are all the small towns of Wallula, Conners, Piper and White Church.

For three years local men have been at work trying to secure a franchise between Kansas City and Leavenworth for an electric road. The Home-River Side Coal Co., of Leavenworth, has made a survey between the two cities with a view of building a double track road to carry both passengers and coal and are trying to interest eastern capitalists to take the bonds. State Senator J. C. Stone and Representative Keiffer took out a charter two years ago and tried to induce Chicago capitalists to build a road between the two towns. In 1897 W. E. Winner, of Kansas City, secured a franchise from the Leavenworth County Board to build a road from Leavenworth City to Lansing. This can be connected with the present Leavenworth Street Railway, and takes in the business of Fort Leavenworth. Mr. Winner's road is nearly completed, and it is expected that cars will be running on the same within the next sixty days. They will be operated by the Leavenworth electric road.

A. A. Penn, of Leavenworth, has secured a franchise from the Leavenworth County Board from Lansing, conecting with the Winner road, Wyandotte County line; and in Wyandotte County three franchises have been granted by the County Commissioners, one to the Leavenworth and Kansas City Traction Co., which is now owned by W. E. Winner, one to Mr. Carpenter, of Cleveland, O., and one to F. N. Wilcox, of Cleveland, O. During the last four months three deputations of capitalists from Cleveland have visited Leavenworth and Kansas City and have gone over the proposed road. During the latter part of March of this year they completed arrangements with W. E. Winner to take his present road and continue on to Kansas City, Kas., and connect with the Metropolitan Ave. line, which will give access into Kansas City, Mo. A charter was secured from the state of Kansas last month to operate a road to be known as the Kansas City & Leavenworth Electric Railroad Co.

The incorporators are D. H. Kimberly, C. O. Evarts, W. H. Gabriel, H. C. Ellison and Henry W. Wolcott, all of Cleveland; W. E. Winner, of Kansas City, Mo.; C. H. Chaplin and C. H. Mathews, of Kansas City, Kas.

As soon as the weather permits work will commence. It is not decided yet which of the franchises the new company will use. It is very probable that they will make a new survey between the two cities and perhaps use a part of all of the franchises. The road, when built, will be a direct communication between Fort Leavenworth and Kansas City, Mo., a distance of about 30 miles. The trains will run every half hour and make the run in one hour.

This is one of the most fertile valleys in the United States, and the promoters expect that the building of this road will open out this new territory to factories and new enterprises of every kind. The geological survey made under the supervision of the professors of the Kansas State University last year shows that the whole of this territory is underlaid with bituminous coal such as is now being mined at Leavenworth. The promoters not only contemplate the building of factories, but also the development of the coal industry. The Leavenworth coal mines at the present time give employment to 900 coal miners, but getting access to the Kansas City markets it is expected that this number will be doubled.

Capitalists from Chicago, New York and Cleveland for more than one year have had their agents at work trying to secure a right of way for this electric road. The Cleveland capitalists have been the most persistent. They are men who are also interested in seven roads in the east. It is believed that when completed this will be one of the best paying suburban roads in America.

Mr. F. N. Wilcox, of Cleveland, Ohio, brother of Senator Wilcox, of Colorado, has just completed all the legal matters in connection with the new road, and has returned to Cleveland. He is now waiting for the survey between the two cities which has been ordered.

HANDSOME PARLOR CARS.

The accompanying engraving shows he exterior and interior views of some new parlor cars recently built by the J. G. Brill Co., of Philadelphia, for the Baltimore Consolidated Railway Co., of Baltimore, which are among the handsomest which have yet been built. They are 25 ft. long, or about 37 ft. 8 in. long over all. They are 7 ft. 5 in. wide at the sills and 8 ft. wide at the posts, and the platforms are of unusual length, 5 ft. 6 in. to the dash. The height of the sills is 30 in.; this with the platforms dropped 7½ in. brings the step within 18 in. of the ground, with a 13 in. riser. The platforms have a large zinc lined box; this is furnished with a cushioned cover and is made useful for storage and for seats. The hood has the usual supports as well as a pair of brass brackets finished in grill work; the platforms have the usual angle iron bumpers with brake shaft outside of the dashers. There are no end windows, the space on the sides of the doors being fitted with panels. Each platform is furnished with an electric headlight. The cars were mounted on maximum traction trucks with 4-ft. wheel base. The driving wheels were 33 in. and the pony wheels 20 in. in diameter. The gage is 5 ft. 4½ in.; without motors these cars and trucks weighed 19,060 lb. The in-

PARLOR CAR—BALTIMORE CONSOLIDATED.

side finish of the cars was very handsome, as can be seen from the interior view. A couch and 16 chairs, all upholstered in red plush, form the furniture.

At each window a table was provided, and the tables when not in use are packed away behind the lining panels under the windows, these panels being hinged for the purpose. A buffet is placed in each corner of the car; one of these is provided with an electric heater for warming coffee. The large window in the center of the car has stationary sash; the upper parts of the two windows on each side of the central one are also stationary but the lower parts dropped into the side of the car in the usual manner. Each window post is provided with a push button. The transom lights are all of bevelled edge plate glass. The carpet or rug which covers the parquetry floor is red. This corresponds with the interior finish of mahogany. The roller curtains are of silk faille. The hanging curtains are of velour de Flanders and were lined with cream colored silk. The ornamentation is in gold with dead gold metal work.

The Citizens' Traction Co., of Oshkosh, Wis., has increased its capital stock from $225,000 to $500,000. The object of this increase is to permit the company to operate an interurban line between Oshkosh and Neenah. The name of the company will not be changed.

Pleasure Resorts in 1899.

The town which in these days cannot boast of some kind of an attraction in it or adjacent to it, is sure to be set down as an old fogy place and is considered unworthy of mention in any gazeteer or atlas, or, in fact, in any publication outside of a post office guide. It makes no difference what the attraction is, natural or artificial, it must be something if nothing more than a country graveyard, an old sawmill or a hole in the ground which can be designated as "The Cave." This is so certainly true that something is invariably "discovered" or manufactured which the citizen can point to with more or less pride as the "attraction." Fortunately the whole country is studded with lakes and rivers, and with the inherent desire of the human being to be near water, a town site is almost always chosen with one or the other in easy reach.

The utilizing of electricity as a cheap motive power has induced the construction of a vast number of street railways, and towns in which one can walk from one side to the other in a few minutes' time can boast of having electric roads. In many such cases it is the fact of a resort of some kind being near by which has been the incentive to the construction of such a road. Thus is there frequently a close connection between summer resorts and electric street railways and the hand of one is made to wash the hand of the other. It is a certain thing that the street railway companies of any town will make it a point to reach a resort of some kind, and to such an extent has this feature of the street railway business grown that many companies have bought and are buying available sites for parks and places of summer recreation and are improving them, erecting buildings, making or enlarging lakes and in every possible way are embellishing and beautifying the surroundings to induce visitors to come and thus patronize the road.

In the March and April issues of the "Review" considerable space has been given to the descriptions of these resorts and the attracions provided for the amusement of visitors, and we shall be glad to continue doing so and publish such views of scenery, walks, rustic bridges and pavilions as may be sent.

AUGUSTA, GA.

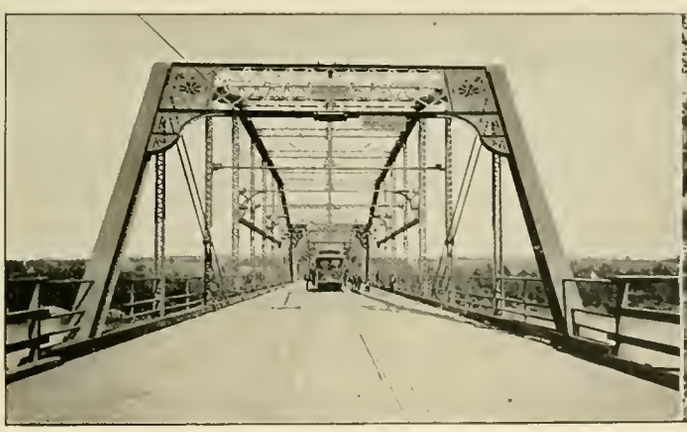
The NorthAugusta Street Railway Co. has built a line connecting the new suburb with Augusta, and when completed this spring it will be three miles long. The road is operated by the Augusta Railway & Electric Co. Connection is made with the North Augusta natatorium having 92 bath rooms. The ladies' side of the plunge is from 2 to 5 ft. deep and the men's reserve from 12 to 15 ft. deep. There are four springboards and other arrangements for enhancing the enjoyments of the bathers. The natatorium is liberally patronized, often 75 to 100 taking a swim at one time. The spring houses in Crescent Park are shown in another view, the largest spring yielding 800 gallons of clear, pure water per hour. The third view is of the iron bridge across the Savannah River connecting Augusta with North Augusta.

ST. THOMAS, ONT.

The St. Thomas (Ont.) Street Railway Co. has planned to give its patrons one of the most delightful pleasure resorts in the entire Dominion. Yarwood Farm has long been noted for its beautiful lakes and its natural and picturesque scenery. This farm lies six miles from the city of St. Thomas and is reached by the St. Thomas Street Ry. The company has recently purchased the farm and has had expert landscape gardeners at work laying out the grounds, and by the combination of art and nature has made a series of parks and amusement grounds rivalling anything in Canada.

NATATORIUM—NORTH AUGUSTA STREET RAILWAY.

At the very entrance to the resort is Yarwood Park. This is what constituted the handsome grounds around the old family residence. This needed no embellishing at the hands of the gardener; it had already been laid out as attractively as possible. The old farm house is a part of the purchase and from it such supplies as hot water and other aids to the comfort of the picnicker can be obtained. From this point, too, there is a splendid view of Lake Pinafore, a large body of clear, pure water which affords the most ample facilities for boating and bathing. The lake is large enough to make the use of steam launches and sailing yachts entirely convenient.



BRIDGE ON LINE OF NORTH AUGUSTA STREET RAILWAY.

SPRING HOUSE IN CRESCENT PARK.

Branching off from Lake Pinafore is a long, narrow body of water, almost a river, but which is in fact another lake and which, from its shape, has been called Long Lake. This also is used for boating, the smaller craft making this their particular location. Part way between Yarwood Park and Lake Pinafore is a natural spring. A fountain house has been constructed over it and here can be found a most delightful retreat, the water bubbling up from the depths of the earth cooling the atmosphere most refreshingly.

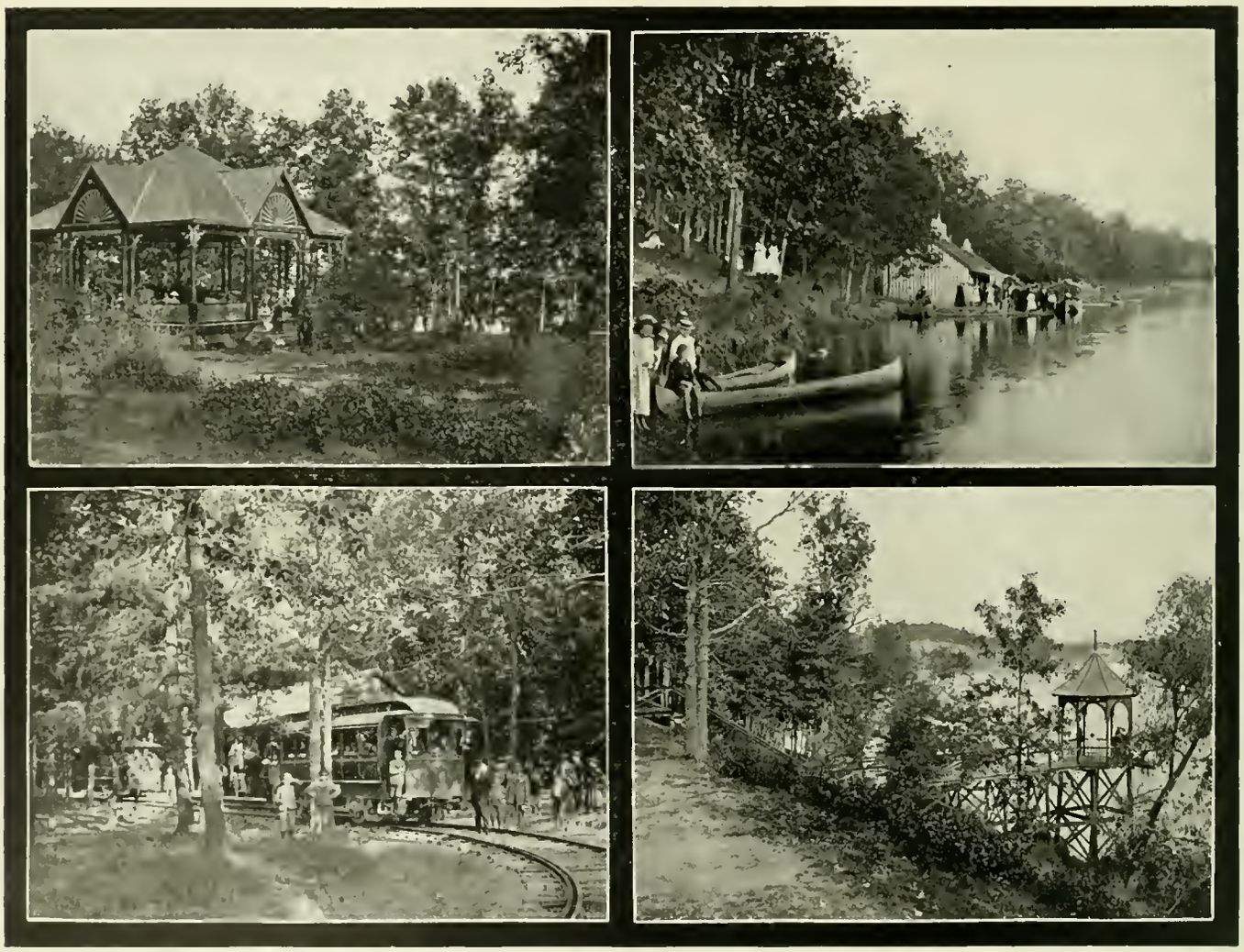
The street car line, after winding around and half encircling Yarwood Park, leads up to the pretty station the company has built at the entrance to Central Park. Here is where the artist has shown his skill. This park is one of the most delightful spots imaginable. Just enough trees have been left standing to afford shade, while the smooth walks are bordered on either side with the gayest and the choicest flowers. One end of this park reaches to the bank of Lake Pinafore and here has been built a large and airy pavilion which can be used as a lunching room for any who prefer it to eating out of doors. Over to the right from Central Park is the bicycle track and athletic grounds and close by are the golf links, the tennis court and the base ball grounds.

The whole section is indeed but a series of parks and playgrounds, the whole constituting one beautiful resort, the equal of which it would be hard to find. The St. Thomas Street Railway Co., J. E. Taylor, manager, owns and controls it all and takes its passengers there, a pleasant ride in comfortable cars for a 5-cent fare.

KANSAS CITY, MO.

In his paper before the A. S. R. A. at the Boston Convention, Mr. Walton H. Holmes, general manager of the Metropolitan Street Railway Co., of Kansas City, gave a short account of his experience with parks, and in conclusion stated that his company had ceased to maintain parks, but that two parks, one city and one suburban, were still operated by private corporations, to which the Metropolitan Co. paid a lump sum to secure the admission of its passengers free. One of these, Fairmount Park, is owned by the Fairmount Amusement Co., concerning which the general manager, Mr. V. W. Flowerree, says:

"Fairmont Park is situated on the Suburban road, between, Kansas City and Independence, at a distance of seven miles from the center of this city, and comprises a tract of ground of 150 acres of rolling land, well shaded and naturally adapted for park purposes. We have an artificial lake of 15 acres. On the grounds are all the usual park attractions, including boating, bathing, fishing,



MOWHAWK PARK, BRANTFORD STREET RAILWAY CO., BRANTFORD, ONT.

BRANTFORD, ONT.

The views in Mohawk Park, owned by Brantford Street Railway Co., shows that nature has contributed much towards making it a delightful resort. Here is the only water chute in Canada, which the company built at an expense of $1,200. The base ball grounds and bicycle track are drawing cards, two large meets having already been secured for this year. Last year there were 68 picnics held here, it being a favorite resort for Sunday schools. The refreshment privileges and those for merry-go-round, water toboggan, boats, etc., are rented. No theatricals are presented, but such attractions as tight-rope walking, tumbling and slack-wire performances drew fairly well last year.

merry-go-round, crystal maze, shooting gallery, etc. In addition to these are summer cottages and a summer hotel. The cottages, of which there are 13, have four rooms, and have always been full every summer. The hotel, which has 50 rooms, has also been well patronized during the park season. We also have a cafe, the privilege of which we lease to outside parties. Our summer theater, which has a seating capacity of 1,600, has been leased to the Walters "Orpheum" Circuit for the coming season—the arrangement being for them to play the same class of vaudeville attractions that they now play at their theater in Kansas City. We also have a very large band stand, with sounding boards and seats to accommodate 5,000 in front. It is left to the discretion of the Orpheum people whether they shall play their entire show inside or out. Under

either condition we are to have both out-door and in-door attractions, the out-door attractions including music, aerial acts and fireworks. The rate of admission to the theater is not to exceed 25 cents, with one-third of the seats free. The out-door seats in front of the band stand to be reserved at a price not to exceed 10 cents with one-third of them free. We charge no admission to the park, the fare on this division of the Metropolitan Street Railway Co. being 20 cents from Kansas City to the park and return. We feel that with the arrangement made with the Orpheum people for the coming season that we will more than double the attendance at the park and fully demonstrated that under such an arrangement the park will be made self-sustaining. In past years we have limited ourselves mostly to musical attractions, which have been quite successful, but as we were unable to follow up from week to week with such bands as we desired and at prices that would make them profitable, we did not think it advisable to depend on music alone this season. We believe with the low rate of admission charged to the theater (this rate with the car fare to the park included being no more than the rate of admission charged by the city theater) and with no competition, that this park ought to become very popular and profitable to both parties interested. Our season opens May 15th and closes September 15th.

"We have always found it profitable to encourage picnics and conventions, especially picnics, and make a special rate for them. We find that picnics are very attractive to children, and as it is necessary for their parents to accompany them such a distance, the traffic of the road is materially increased thereby."

CHARLESTON, S. C.

The Chaleston Consolidated Railway Co. opened the season of spring and summer concerts at Chicora Park on March 26th, the Fourth Brigade Band having been engaged. The concerts are from 3 to 6:30 p. m.

AUSTIN, TEX.

Austin, Tex., has its Hyde Park, an attractive resort reached by the Austin Rapid Transit Railway Co. The resort covers many acres of land and under the management of the railway company has been beautified and made exceedingly attractive. The grounds have been laid out with great skill and every advantage has been taken of nature to give the spot a charm. There is a natural body of water, which by dredging and enlarging has assumed all the proportions of a lake, which affords ample pleasure for any who are fond of the water and a sufficient number of boats have been provided to meet all demands. In the center of this lake is a picturesque island covered with banana and other fruit trees. Rustic bridges have been constructed at various points and in the season in the smaller and auxiliary lakes water lilies grow in great profusion. Especial attention has been given to the cultivation of these lovely flowers, the Victoria Regia growing to such size that the leaves spreading out over the water will support the weight of a six-year-old child. Many of these leaves are five and six feet across.

SCENES IN HYDE PARK, AUSTIN, TEX.

The grounds are about as attractive as it is possible to make them. Lovely walks and driveways wind in and out among the shade trees and the bicyclist there finds not only delightful roads for wheeling but must be enchanted at every step by the scenery which greets his eye. A number of deer and other animals have been added as attractions, and they receive a great deal of attention, notably from children, but from adults as well. The banana readily grows there, as may be seen in one of the accompanying illustrations.

The company has, among all the other improvements, built a handsome large pavilion and in this for about twelve weeks in the summer are given vaudeville and dramatic attractions of a light character such as are well calculated to please the general public and at the same time will never offend the most particular people. There is always, during the season, excellent music and nowhere

could a day be spent more enjoyably than at Hyde Park. The grounds are especially adapted for picnic parties and the company offers the most liberal terms for such concessions. Round trip tickets afford admission to the grounds and to all the varied and interesting attractions offered. We are indebted to Mr. Frank E. Scovill, superintendent of the Austin Rapid Transit Co., for the photographs from which our engraving was made.

BANGOR, ME.

The Lewiston (Me.), Brunswick & Bath Street Railway Co. is adding to the attractions it already has at Merrymeeting Park, on its line. Gen. Mgr. A. F. Gerald has been out West and has purchased a number of animals and birds which will be added to the already interesting menagerie at the park. He secured a monster ox, weighing over a ton. He also bought two rare specimens of the wolf species and two large buffalo. At one point Mr. Gerald was fortunate in finding a collection of wild geese. A flock happened to be flying over the town and hunters were sent out and captured a number of them. When all these attractions have been added to the collection, Merrymeeting Park will be able to make a fine show.

MANCHESTER, N. H.

The Manchester Street Railway Co. is looking forward to a big business this summer. On its line is a pleasant resort located at Lake Massabesic, which has grown very popular since the construction of the road to that point. The railway company owns the ground and the lake but doesn't control the resort excepting so far as seeing that it is conducted properly and is kept in first-class condition so that it may prove a pleasure to the patrons of the road. The company has built a handsome pavilion near the lake, but has rented it. One portion of this building is devoted to a theater which has proved to be so popular an attraction that it is the intention to erect a new and more commodious house of amusement, to be ready for occupancy as soon as the weather becomes warm. Some excellent attractions have already been booked and the management intends having a change of bill each week. A small fee will be charged for these performances.

The admission to the grounds is free to all passengers on the street car line, but those who go there on wheels or in any other manner than by the street car line are obliged to pay.

But the theater is by no means all that attracts people to Lake Massabesic. The bathing, boating, fishing and the merry-go-rounds and other features afford the visitors much delight, to say nothing of the bicycle riding about the grounds.

MARINETTE, WIS.

The people of Marinette are proud of their summer resort reached by the Marinette Gas, Electric Light & Street Railway Co. While the company owns the resort it has made leases to individuals of its various privileges. The resort boasts of a good hotel, a refreshment stand and has the ordinary boating and bathing features. During the summer there is always plenty of good music. The lake is a lovely body of water and all about the scenery is beautiful and attractive. To all passengers who go to this resort on the street railway the admission is free, but to others a charge of 10 cents is made.

POTTSTOWN, PA.

The Ringing Rocks Electric Railway Co. owns and controls its beautiful resort, Ringing Rocks Park, with the exception of the refreshment stands. These have been rented to other parties. The company has made this an exceedingly attractive place and the passenger traffic of the electric road during the summer months is large. There are ample boating facilities offered and the other features, such as the merry-go-round, the switchback railway, and the band music all contribute to make the park popular and a spot where one can find keen enjoyment and healthful recreation. The park is a popular place for picnickers, and the company is always ready to make liberal terms for such affairs. The admission to the park is free.

OWEN SOUND, ONT.

The matter of a summer resort at Balmy Beach, on the Georgia Bay, is being earnestly discussed. It is said that New Orleans and Cincinnati capitalists are looking into the matter and the people are very hopeful that by next year the plans at present outlined will be put into effect.

Property owners at the point named are active in their endeavors to interest outsiders and offer all the ground and help possible to further the enterprise.

One great feature of the culmination of this resort plan will be the construction of an electric railway to the proposed spot. The connection of Owen Sound and Balmy Beach has for a long time been talked of and if the resort plans go through there will be no question of the road being at once built.

MANISTEE, MICH.

The Manistee, Filer City & Eastlake Railway Co. is now improving a tract of 50 acres extending along the shore of Lake Michigan for ¾ mile, and is building boats, bath houses, theater, chutes, etc. There will be 20 swings about the grounds. Admission will be free only to passengers, and no provision is made for bicyclers, as there are few in that locality. Vaudeville performances and concerts will be given this summer.

NEW BRITAIN, CONN.

The Central Railway & Electric Co. owns White Oak Park, a pretty tract of 45 acres about three miles west of New Britain. Dancing and refreshment pavilions with broad verandas are most conveniently situated on the borders of a lake. An attractive bandstand has been added this year which overhangs the lake and faces an amphitheater seating from 300 to 500 persons. The mountain to the south of the park has been cleared this spring, attractive walks laid out, and the park extended in this direction. A number of rustic summer houses have been placed in various parts of the grounds and tables and benches under the oak and hemlock trees. Boating on the lake, swings, cages of birds and animals, a photograph gallery, merry-go-round, bowling alleys, pool tables and many other attractions afford amusement for all. During the afternoons and evenings a good band renders music for dancing. Theatrical performances will be given every afternoon and evening this summer except Sundays. More animals will soon be added to the collection. Admission is free except to bicyclers, who have to pay 5 cents.

MILWAUKEE.

Gen. Mgr. John I. Beggs, of the Milwaukee Railway & Light Co., expresses the following opinion in reference to street railway parks: "We do not believe that it pays street railway companies to run pleasure resorts, and do not engage in such business, our experience being that the same amount of time and energy expended in the care and betterment of the regular business of the company in the long run proves more permanently profitable. If crowds are unduly drawn to some special attraction other points on the lines are apt to be neglected, while it costs more to take care of the congested travel at one point."

TERRE HAUTE, IND.

The Terre Haute Electric Railway Co. rents its park with all concessions. Admission to the park is free to all, but an entrance fee is charged at the casino. The experience last year with theatricals was unsatisfactory.

BETHLEHEM STEEL CO.

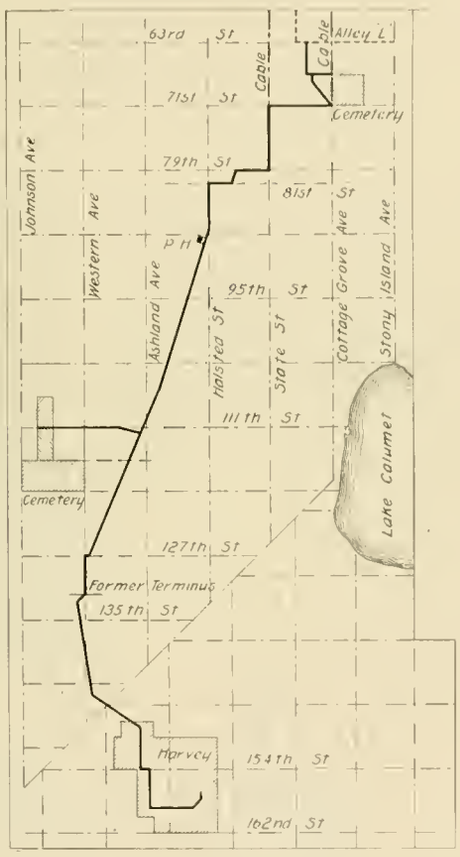
The Bethlehem Steel Co., Bethlehem, Pa., with capital stock of $15,000,000, has leased the property and franchises of the Bethlehem Iron Co. The capital stock of the latter company is $7,500,000, and the new organization guarantees 6 per cent per annum on that amount, to be paid quarterly and to be free from all taxes and deductions. The incorporators held a meeting and elected the following officers: Robt. P. Linderman, president; Abraham S. Schropp, secretary, and C. O. Brunner, treasurer. The directors elected are Robt. H. Sayre and Robt. P. Linderman of Bethlehem; Beauveau Borle, Edward T. Stotesbury, Joseph Wharton and John Lowler Welsh of Philadelphia.

CHICAGO ELECTRIC TRACTION CO.

The Chicago Electric Traction Co., the storage battery road which has heretofore had its terminus at Blue Island, operating between 63d St. and Blue Island (132d St.), is now building an extension south and east to Harvey, running nearly as far south as 160th St., 3½ miles, and nearly 1½ miles east of Blue Island. This extension is all single track; four miles are laid with 80-lb. 7-in. girder rails and one mile with 70-lb. T-rails, on white cedar ties, 6 x 8 in. by 8 ft., spaced 2 ft. between centers. Servis tie plates are used.

The Harvey terminus will be 13 miles from the power house of the company at 88th St. and Vincennes Road, and the round trip of 26 miles is more than the batteries should be required to make in regular service, though on a majority of trips they would probably be able to do it. Accordingly the company is now building a power house at Harvey for the purpose of partially charging the batteries there.

The building is of brick 26 x 70 ft. and one story high. The equipment comprises one 50-h. p. Nash gas engine, using gasoline as fuel, one 40-kw. Eddy generator, made by the Eddy Electric



LINES OF CHICAGO ELECTRIC TRACTION CO.

Manufacturing Co., Windsor, Conn., and a secondary battery of 95 400-ampere hour cells. The generator is shunt wound so that when the load decreases as the batteries become more fully charged the voltage of the generator rises to overcome the counter e. m. f. of the battery. The secondary battery is connected in parallel with the generator in order that abnormal loads may be taken care of.

The station is designed for charging four car batteries at one time. An elevator will be installed to lift a truck up to receive the battery from the car; when lowered the truck with the battery upon it is run over to the charging station and connected with the secondary battery.

Gen. Mgr. E. R. Gilbert advises us that this station will be in operation by June 1st.

The company is also building a new car house in the rear of its station at 88th St., which will give it much needed space for storing cars. The new building will be of iron and steel construction and be 100 x 160 ft. with space for 50 cars.

NEW YORK FRANCHISE TAX.

Every public service corporation in the state of New York is very much interested in the provisions of the Ford bill to tax franchises, which has been passed by the legislature, and is now in the hands of Governor Roosevelt. A hearing was granted on this bill by the governor on May 11th, and among those who were heard was Hon. W. Caryl Ely, president of the International Traction Co. The bill provides that the assessors shall determine the value of the franchises to be taxed.

Following is the full text of the law, the new amendments being in capitals:

Section 1. Subdivision three of section two of the tax law is hereby amended to read as follows:

3. The terms "land," "real estate" and "real property," as used in this chapter, include the land itself above and under water, all buildings and other articles and structures, substructures and superstructures, erected upon, under or above or affixed to the same; all wharves and piers, including the value of the right to collect wharfage, cranage or dockage thereon; all bridges, all telegraph lines, wires, poles and appurtenances; all supports and enclosures for electrical conductors and other appurtenances upon, above and under ground; all surface, under ground or elevated railroads, INCLUDING THE VALUE OF ALL FRANCHISES, RIGHTS OR PERMISSION TO CONSTRUCT, MAINTAIN OR OPERATE THE SAME IN, UNDER, ABOVE, ON, OR THROUGH STREETS, HIGHWAYS, OR PUBLIC PLACES; all railroads, structures, substructures and superstructures, tracks and the iron thereon; branches, switches and other fixtures permitted or authorized to be made, laid or placed in, above or under any public or private road, street or grounds; all mains, pipes and tanks laid or placed in, upon, above or under any public or private street or place for conducting steam, heat, water, oil, electricity, or any property, substance or product capable of transportation or conveyance therein or that is protected thereby, INCLUDING THE VALUE OF ALL FRANCHISES, RIGHTS, AUTHORITY, OR PERMISSION, TO CONSTRUCT, MAINTAIN, OR OPERATE, IN, UNDER, ABOVE, UPON, OR THROUGH, ANY STREETS, HIGHWAYS, OR PUBLIC PLACES, ANY MAINS, PIPES, TANKS, CONDUITS, OR WIRES, WITH THEIR APPURTENANCES, FOR CONDUCTING WATER, STEAM, HEAT, LIGHT, POWER, GAS, OIL, OR OTHER SUBSTANCE, OR ELECTRICITY FOR TELEGRAPHIC, TELEPHONIC OR OTHER PURPOSE; all trees and underwood, growing upon land, and all mines, minerals, quarries and fossiles in and under the same, except mines belonging to the state.

Section 2. This act shall take effect immediately.

Governor Roosevelt was very active in having the bill passed, and it is generally understood that he will sign it and that it will become a law. If so, it will go into effect next year.

HAVANA STREET RAILWAYS.

The Havana, Cuba, street railway system, now owned and controlled by three syndicates, the Internation Bank of Paris, the Harvey Syndicate, of New York, and one in Canada, is to be fully equipped with electricity. Capt. Hallet Allstop Borrowe, who won considerable reputation as a Rough Rider, is general manager of the system, having been placed in charge shortly after the purchase by the syndicates. He has been introducing American methods as far as possible, but it has been decided to wait until fall, after the rainy season, before beginning the work of equipping the road for electricity. The roads, even under the old methods, have been paying good dividends, and Capt. Borrowe believes that, with the adoption of electricity, the Havana street railways will be among the best paying investments in Cuba.

The Terre Haute (Ind.) Electric Railway Co. is improving its car equipment as rapidly as possible. The newer cars are rebuilt, and the older ones broken up as fast as they fall into a condition requiring heavy repairs. Portions of the cars thus broken up, which prove to be sufficiently good, are used again in rebuilding.

MECHANICAL DEPARTMENT

LIQUID AIR AND THE POWER REQUIRED TO PRODUCE IT.

BY A. H. NEUREUTHER.

Experiments in recent years have shown that there are no absolute or permanent gases, liquids or solids. All substances upon the earth would be vaporized if subjected to such a heat as prevails at the sun, and doubtless even the most refactory gases would become solid before reaching the temperature of absolute zero. Doubtless the water now upon the earth was once all vapor or a gas, and perhaps in some millions of years the temperature of the earth will have decreased until all the water will appear as a dry brittle mineral, and the atmosphere will liquefy forming new lakes and oceans.

If a gas be compressed its density is increased, but as long as the temperature is above a certain point it will not liquefy. If, however, the temperature be reduced to a certain point it will liquefy at a definite pressure and at a less pressure if the temperature is further lowered. The temperature above which a gas cannot be liquefied by pressure alone is known as its critical temperature, or point. Air at ordinary temperatures, has been compressed under fully 4,000 atmospheres (60,000 lb. per sq. in.) without liquefying. Oxygen gas, at 17° C., compressed to 4,000 atmospheres, reaches a density of 1.25, but is still in the form of a gas. Density of water taken as 1.00.

Table I from the London Engineer was prepared by Prof. Dewar and gives the density of some gases at temperature of 15° C. (59° F.) and at a pressure of 3,000 atmospheres (45,000 lb. per sq. in.), and also the densities of the liquids. It is seen that it is possible to have a gas denser than its liquid.

TABLE I.

Gas.	Density of gas at 15° C. and 3,000 atmospheres.	Density of liquid at boiling point.
Oxygen	1.1034	1.124
Nitrogen	0.8259	0.885
Air	0.8820	0.940
Hydrogen	0.0879	

Liquid air has a critical temperature of —140° C. (—220° F.) and a critical pressure of 39 atmospheres; at atmospheric pressure the temperature of the saturated vapor of liquid air is —191.4° C. (—312.6° F.); the density of the liquid at this latter temperature is 0.93; the color of the liquid is light blue. The specific heat and the latent heat of the liquid are unknown. Atmospheric air may be considered as the superheated vapor of this liquid.

The two elements of the air, oxygen and nitrogen, liquefy together and produce a nearly colorless fluid, with a slight bluish tinge, which may be kept in an open vessel for several hours before it will all evaporate, the length of time depending on the amount of insulation used to keep the heat of the atmosphere from it. The liquid must not be confined, as it develops an almost irresistible pressure. This remarkable slowness of evaporation is accounted for by the supposition that the evaporation produces such an intense refrigerating effect that it holds the process in check.

As evaporation takes place the nitrogen passes off first, while the oxygen evaporates more slowly, so that as the process goes on the remaining liquid becomes richer in oxygen. When first liquefied the air contains 23.1 per cent of oxygen; when 50 per cent of the mixture has evaporated the residue is 37.5 per cent oxygen; when 80 per cent, the residue is 60 per cent oxygen; 90 per cent, 77 per cent oxygen; 95 per cent, 88 per cent is oxygen.

The specific heats of air as calculated by Professor Linde are given in Table II which was taken from the London Engineer, Nov. 30, 1896.

TABLE II.

Pressure in atmospheres	1	10	20	40	70	100
Temperature + 100° C.	.2372	.2389	.2408	.2446	.2512	.2583
" 0	.2375	.2419	.2465	.2512	.2773	.2986
" — 50	.2380	.2455	.2572	.2785	.3319	.4124
" 100	.2389	.2585	.2844	.3697	.8461	.....
" — 150	.2424	.3105	.5048	.....	.....	.....
" — 170	.2467	.4147	.....	.....	.....	.....

METHODS OF PRODUCING LIQUID AIR.

The usual method employed before the present time in the liquefaction of gases has been as follows: Starting with a very easily liquefied gas, as carbon dioxide, the cold produced by the evaporation of its liquid, was used to refrigerate and liquefy a less easily liquefied gas, under a high pressure (such as ethylene, for example), and the evaporation of the liquid ethylene, was in turn used to refrigerate and liquefy one of the so-called permanent gases, such as oxygen or air. This was an elaborate and very expensive process. It is said that to produce the first ounce of liquid air cost $3,000, and later in the same laboratory a pint was made for $500.

The methods used by Mr. Tripler and by Professor Linde are quite simple as compared with the ethylene method, and are calculated to produce a commercial product.

The first apparatus made by Linde is shown in Fig. 1. The compressor P delivers air highly compressed to the water cooler, L J,

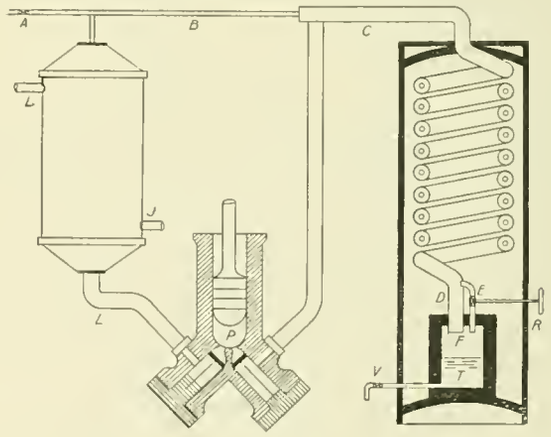


FIG. 1.

where the heat generated by compression is removed. The air then passes through the pipe B, which is inside of a larger pipe C (making a combination called a spiral interchanger, shown by D E) and escapes through the throttle valve R into the chamber T, and thus by expansion from a high to a low pressure, is much reduced in temperature. The air then returns by F through the outer pipe of the interchanger to the compressor, and being in contact with the inner pipe, cools the air as it comes from the intercooler L J on its way to the throttle valve.

Fifteen hours working with this apparatus results in such an accumulated cooling effect that liquid air begins to gather in the vessel T, and may be drawn off by a cock V. To compensate for leakage, or for that drawn off in liquid form, more air is forced in at A by a special compressor.

The latest form of the Linde apparatus is shown in Fig. 2. There are two throttle valves A and B. All the compressed air passes through A, but only about one-fifth passes also through B.

The passage through A causes a drop in pressure from 200 atmospheres to 16 atmospheres (from 3,000 lb. per sq. in. to 240 lb. per sq. in.) and four-fifths of the air in circulation passes back at that pressure through the middle one of the three tubes forming the interchanger to the compressor D. The remaining one-fifth passes through B, and about one-fourth of it gathers as liquid air in the vacuum jacketed vessel C at a pressure which is only enough above that of the atmosphere to allow the liquid to pass out where the

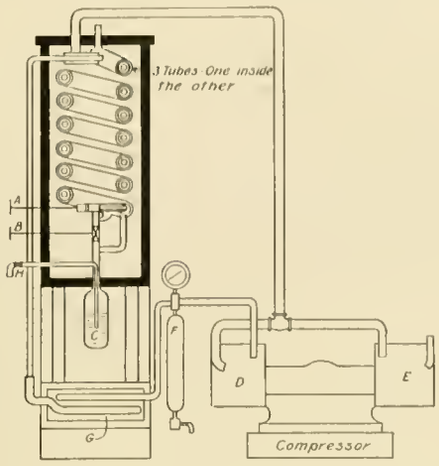


FIG. 2.

stop cock H is opened. The unliquefied or re-evaporated portion passing through B, escapes through the outermost tube of the interchanger. The compressor E takes in fresh air from the atmosphere, compresses it to 16 atmospheres, and delivers it so that it mixes with the air which is returning at that pressure from the middle tube of the interchanger to the compressor D.

The compressed air on leaving each compressor, passes through a coil in a water cooler which serves also to water-jacket the compressor cylinders. A small quantity of water is drawn in along with the air by the low pressure cylinder, and this, together with the natural moisture of the air, is extracted as completely as possible, first by means of a separator F, and then by passing the compressed air through the coil in G in a bath of ice and salt before it goes into the interchanger. It is absolutely necessary that the air be dry, for during the expansion from the high to the low pressure in the interchanger, and moisture in the air will freeze in the expansion valves and clog them, making them useless. The interchanger is inclosed in a case packed with sheep's wool.

Mr. Tripler's apparatus is shown in Fig. 3, and corresponds in principle and action with that of Linde. Mr. Tripler claims priority

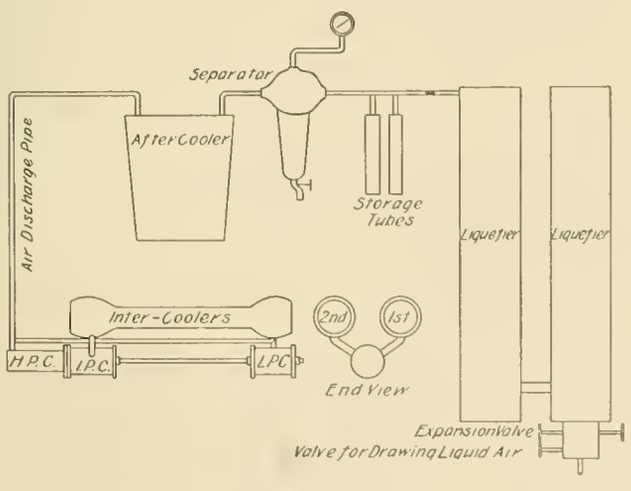


FIG. 3.

of invention, having discovered this method during 1889-90.

In Tripler's apparatus the air is compressed to 2,500 lb. per sq. in. in a three-stage air-compressor, cooling the air between each stage, and after the third stage by the after-cooler shown. Then the air is passed through a separator, then to the liquefying apparatus which consists of a series of coils of pipe arranged in several concentric cylindrical compartments in the two large liquefiers shown. The coils of pipe terminate in a specially designed expansion valve and orifice. The high pressure air entering the liquefier passes through the coils until it reaches the expansion valve. Here the air is expended in the chamber to very nearly atmospheric pressure, and in expanding from the high pressure of 2,500 lb. is reduced in temperature, and this cold expanded air in passing over the coils from which it has just issued reduces the air under the high pressure therein contained to so low a temperature that it is in part liquefied. With this apparatus, it is said, liquid air can be drawn off within fifteen minutes from the time of opening the expansion valve.

Tripler has a three-stage straight line Norwalk air compressor, with 16-in. steam cylinder, and with air cylinders of 10½, 6⅝ and 2⅝ in. in diameter and all of 16-in. stroke. The steam pressure used is from 85 to 90 lb. The capacity of the engine is about 75 h. p.

The cylinders are arranged in tandem, all on the same bed and in the following order: steam cylinder, intake cylinder, intermediate air cylinder and high pressure cylinder. The steam end is a simple steam engine, with adjustable Meyer cut-off valves.

The air is led to the compressor through a pipe, which extends above the roof of the building, in order to get clean air free from dust. Before entering the compressor, the air passes through a washer, which renders it free from dust and saturates it with water. It then enters the intake (low pressure) cylinder which is double acting, where it is compressed to 65 lb. per sq. in. From here it passes through an intercooler and is there reduced to the ordinary atmospheric temperature, it next enters the intermediate cylinder which is single acting, and is compressed to about 400 lb. pressure. From here the air is discharged into a second intercooler where it is again cooled to ordinary atmospheric temperature, and passes to the high pressure cylinder, where it is compressed to a discharge pressure of from 2,000 to 2,500 lb. per sq. in. After passing through an after-cooler, to bring its temperature to that of the atmosphere (or lower) again, the air flows through a separator where all moisture oil, dirt, etc., are removed, and thence it goes to the storage tubes and finally to the liquefier. This apparatus will produce three gallons of liquid air per hour.

POWER REQUIRED TO PRODUCE LIQUID AIR.

From the thermodynamic equations for isothermal compression we find the work required to compress 1 lb. of air from 14.7 lb. per sq. in. to 2,500 lb. per sq. in. is 135,899 ft. lb. For compression under actual conditions, such as are obtained in practice with three-stage compressors with water-jacketed cylinders, it is necessary to add about one-third more, giving the work for compressing as 181,100 ft. lb.

In such a compressor the air on leaving the high pressure cylinder will have a temperature of 352° F., and the volume of 1 lb. will be 0.12 cu. ft. The volume must be displaced against a pressure of 360,000 lb. per sq. ft. to deliver it to the storage tank and for this 43,200 ft. lb. more will be required, making a total of 224,400 ft. lb. If the mechanical efficiency of the engine and compressor be taken as 80 per cent the work developed in the steam cylinder to compress 1 lb. of air to 2,500 lb. per sq. in. is 280,500 ft. lb.

One horse-power-hour is 1,980,000 ft. lb. and will therefore compress 7.09 lb. of air to 2,500 lb. per sq. in.

As previously stated when describing Linde's apparatus, about 19 lb. of the highly compressed air must be expanded to liquefy 1 lb. This apparatus is similar in principle to Tripler's, so we may say that one horse-power-hour will give us 7.09 ÷ 20 = .355 lb. of liquid air.

To the foreging article we wish to add a short discussion of the amount of work which it is theoretically possible to get from liquid air when used in a boiler and engine as water is used in the steam engine. Some absurd claims have been made recently that liquid air, evaporated by the heat of the atmosphere, constitutes a source of power which is so superior to all others as to produce 3 1-3 times as much work as it costs.

Assume a mean temperature of the atmosphere, which is to boil our liquid air, of 60° F. Assuming a working cylin-

der capable of withstanding the high pressures, the liquid air may be vaporized and heated to atmospheric pressure without permitting change of volume (the pressure would then be about 11,200 lb. per sq. in.) and then expanded isothermally to atmospheric pressure. The theoretical work per pound of liquid air computed on this assumption will be in round numbers 156,000 ft. lb.

Another method of working would be to vaporize the air at 60° F., and at such a pressure that when the air is expanded without gain or loss of heat to atmospheric pressure the temperature has fallen to that of the boiling point of liquid air under atmospheric pressure. This would give in round numbers 66,000 ft. lb. per lb. of air. The upper limit of pressure in this case would be 1,120 lb. per sq. in.

A third method of working would be to expand isothermally at a temperature of 60° F., as in the first case, to a pressure of 1,120 lbs., and then adiabatically to atmospheric pressue as in the second case. The theoretical work per pound of air would in this case be about 104,000 ft. lb.

A fourth method would be to expand adiabatically from the pressure of 11,200 lbs. and 60° F. down to the temperature 313° F. (when the pressure would be 148 lbs.). The theoretical work would be about 48,000 ft. lb. in this case.

We are not concerned with the thermodynamic efficiency of these engines since there is an indefinite amount of energy available in the heat of the atmosphere which is serving us for fuel .

Mr. Neureuther has said that in the present state of the art 1 h. p. h. will produce .355 lb. of liquid air. The work to be got from .355 lb. of liquid under the conditions stated is in round numbers as follows:

Case I. 55,000 ft. lb.
Case II. 24,000 ft. lb.
Case III. 37,000 ft. lb.
Case IV. 17,000 ft. lb.

One h. p. h. is equivalent to 1,980,000 ft. lb., hence the portion of the power expended that we can theoretically get back is:

Case I. 2.8 per cent.
Case II. 1.2 per cent.
Case III. 1.9 per cent.
Case IV. .9 per cent.

The mechanical efficiency of the working engine would not be 100 per cent, and hence these small percentages would be still further reduced in practice, even could we get a working cylinder to withstand the pressure of over 11,200 lb. per sq. in., which would be the initial pressure in Cases I, III and IV.

A safe conclusion is that until liquid air can be made at a greatly reduced cost it will not compete with steam as a working fluid in power engines.

The claim made for Mr. Tripler that he can make 10 gallons of liquid air by expending 3 gallons in his engine, is groundless because a new supply of liquid air can be got only by compressing and cooling atmospheric air. The air in the engine will give out in isothermal expansion the work required to compress, isothermally, an equal quantity between the same pressure limits. But in practice the expansion is not isothermal and less than the theoretical amount of work is done by the engine. Also the compression is not isothermal and more than the theoretical amount of work is required. Thus even if all friction is neglected the operation is a losing one.

Liquid air weighs about 58.6 lb. per cu. ft.; compressed air at a pressure of 2,500 lbs. per sq. in. and 60° F. weighs about 13.7 lb. The available energy from the liquid is therefore between four and five times that of the compressed air. This advantage is lost if the air is to be stored for any considerable time; the liquid loses by evaporation, as it must be open to the atmosphere because of the high pressures resulting when it is heated.

OFFICIAL BRAKE TESTS IN NEW YORK.

March 29th the State Board of Railroad Commissioners of New York issued a notice to the owners of brakes for street surface cars inviting them to submit their brakes for test. Applications for permission to compete were received until May 2d. The substance of the notice was as follows:

"The Board of Railroad Commissioners of the State of New York will make a test of braking systems for street surface cars, on cars to be furnished for that purpose by the Metropolitan Street Railway Co., of New York City.

"Tests will be made of such braking systems offered as appear to the commmission to be practicable.

"Applications to have braking system tested, and for permits to equip cars for this purpose, must be made on the accompanying blank.

"All applications must be accompanied by a drawing, tracing, blue print or photograph showing the system complete; also a full description of the same setting forth the details of construction, application to car and method of operation.

"The cars to be furnished will be eight wheel cars with Brill maximum traction trucks fitted with G. E. 1.000 motors with nose suspension; driving wheels 30 in., trailer wheels 20 in. in diameter; length of car body over all 28 ft.; outside measurements of wheel base 17 ft. 6 in. The railway company will furnish space in its car house and pit room for the purpose of fitting up cars, but will not furnish any supplies, labor or machine shop facilities. The general master mechanic of the Metropolitan Street Railway Co. will designate the cars to be equipped and the car house at which the work shall be done.

"These tests will be made in any manner the Board of Railroad Commissioners may determine. While the tests are being made only one representative of the applicant will be allowed on the platform on which the brake is operated.

"All tests of braking systems for stopping a car will be from signal on a basis of W S ÷ D = E, where

E = Efficiency of braking system.
W = Weight of car.
D = Distance between point at which signal is given to point of stop.
S = Rate of speed at time of giving signal.

"The merits of braking system will be determined on the following points:

1. Emergency stop at —— miles per hour.
2. Stop at —— miles per hour, without skidding wheels.
3. Service stop at —— miles per hour.
4. Ease of manipulation.
5. Reliability of system.
6. Operation of the system by the ordinary motorman.
7. Simplicity of system.
8. Liability of brakes operating when they should not.
9. Safety devices in case of failure of any part of braking system.

"Distinctive emergency brakes will be tested on their merits and their non-interference with the ordinary brake."

The Commissioners do not specify in what units the quantities W, S and D will be measured, but for the purpose of discussion we may assume that W is in pounds, S in miles per hour and D in feet. The distance D, it is stated, is the distance between point at which signal to stop is given and the point where the car is stopped. It will consist of two parts: 1. The distance run between the time that the signal is given and the time when the brakes are applied. 2. The distance run while the brakes are stopping the car.

The first distance we may call D_1; it depends solely on speed of the car and the time required for the motorman to set the brakes after the signal is given, and is independent of the weight of the car.

The second distance we may call D_2; it depends upon the mass of the car, the square of the speed when the brakes are applied and upon the retarding force. The moving car has a kinetic energy equal to $\frac{1}{2}$ M v^2 which must be overcome; in the units we have assumed the kinetic energy of the car is .0334 W S^2. This energy is overcome by the average retarding force acting through the distance D_2. The retarding force evidently depends on the braking force, the coefficient of friction of the brake shoes and the friction of the car journals.

Assume a car weighing 30,000 lb. when empty and 40,000 when loaded. Assume that within two seconds after the signal is given the brakes are at once applied with full force; assume that the total braking pressure on the wheels is the maximum recommended in steam railroad passenger service, 90 per cent of the weight on the rails, all wheels being braked, and that the mean coefficient of friction of the brake shoes is 20 per cent. This gives for the retarding force .90 × .20 × 30,000 lb. = 5,400 lb.

Now let this car when empty and when loaded be signalled to stop when running at speeds of 5, 10 and 15 miles per hour, the motorman applying the brakes as quickly as possible, i. e., in two seconds, and with the full force allowable, i. e. ,5,400 lb. The journal friction is neglected. Under these conditions of applying the brake we would expect the braking system to have the same efficiency.

	Car Empty. W = 30,000 lb.		
Speed,	D_1	D_2	D
M. p. H.	Ft.	Ft.	Ft.
5	14.7	4.6	19.3
10	29.3	18.6	47.9
15	44.0	41.8	85.8
	Car Loaded. W = 40,000 lb.		
5	14.7	6.2	20.9
10	29.3	24.7	54.0
15	44.0	55.7	99.7

Now let us compute the "efficiency of braking system" by means of the formula W S ÷ D = E.

	E	
Speed.	Car Empty.	Car Loaded.
5	7,772	9,570
10	6,263	7,407
15	5,245	6,018

According to this the same braking system working with the same mechanical efficiency and applied in the same time will have nearly twice the "efficiency" in stopping a loaded car from 5 miles per hour that it has in stopping an empty car from 15 miles per hour.

The difficulty appears to be that D_1 which depends only on S, and D_2 which depends only on W and S^2 (other things being equal and journal friction neglected) are added together and combined with W and S to get E.

In the absence of a statement of the considerations which led the Commissioners to adopt this formula it appears to us to be but poorly adapted for the purpose of comparing different braking systems because the length of the stop will vary, as shown by the table, with the same mechanical efficiency of braking apparatus and the same skill in operation.

It has ben suggested that W S^2 ÷ D = E instead of W S ÷ D = E would be far preferable.

If the brakes were applied instantaneously the formula $WS^2 \div D = E$ would be correct, but this formula also fails to give comparable results if there is an appreciable time interval between the signal and the application of the brakes. Substituting our assumed values in the formula $WS^2 \div D$ we get:

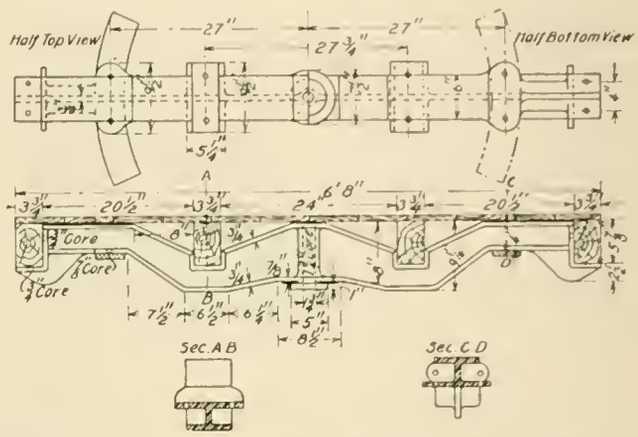
Speed.	Car Empty.	Car Loaded.
5	38,860	48,850
10	62,630	74,070
15	78,875	90,270

That is, $WS^2 \div D$ favors tests at high speed where $WS \div D$ favors low speeds. Both formulas favor loaded cars as against empty ones.

CAST STEEL BODY BOLSTER.

The accompanying illustration shows the cast steel body bolster designed for electric street cars by the Shickle, Harrison & Howard Iron Co., of St. Louis. The company has recently furnished some of these for cars for the Union Depot R. R., of St. Louis, and 100 for cars now building by the Stephenson Co.

One of the problems in designing street cars that are to be carried on double trucks is to keep the floor of the car as low as possible and at the same time allow clearance for the trucks on curves.



CAST STEEL BODY BOLSTER FOR STREET CARS.

This has been accomplished by dropping the bolster where it receives the sills and raising it over the wheels; such a bolster is easily made in cast steel when a similar shape would not be at all practicable if the bolster were built up. The bolster consists of a single casting only and therefore no parts can wear or rattle loose.

THE GRAF FENDER.

Mr. F. J. Graf, of New York, has recently perfected a novel and effective fender for cars, motor carriages and other vehicles, which is intended to embody features of construction designed to meet every possible requirement, and which has already been laid before the attention of the street railways. The device is covered by letters patent in the United States, Canada, Great Britain, France, Germany, Belgium, Austria and Hungary.

This fender has the advantage of being automatic in its operation, and, should the motorman fail to apply a releasing machanism by which it is projected from beneath the front portion of the car, its operation is equally certain and effective by the mere contact with the person struck. By the arrangement of the fender normally beneath the car platform so that it is projected only when needed, the unsightly appearance of some fenders is entirely absent, and, furthermore, such a fender as this cannot well be damaged through collisions, thereby saving to the company quite an item of expense in repairs.

Among the manifold advantages which are claimed for the invention is a certainty of action, impossibility of inflicting injury upon the person rescued, and the placing of the same beneath the body of the car, it being invisible except when operated, and the utilization of the car's momentum to assist in projecting the fender forward.

NEW IOWA ROAD.

Mr. W. F. Ryon advises us that the Spirit & Okoboji Lakes Rapid Transit Co. has been incorporated to build an electric road at Spirit Lake, Ia. The boom in copper and steel has prevented the company from placing contracts. The incorporators are A. N. Keith, Chas. E. Johnson, W. F. Ryon, August Portman and Robert L. Lovett, all of Peoria, Ill., where the office of the company is located, 301 Main St.; Mr. Ryon is secretary and manager of the company.

NEW TRANSFERS ON THE CHICAGO CITY.

By the courtesy of Mr. Geo. O. Nagle, superintendent, and Mr. Leon Jewell, superintendent of time tables, of the Chicago City Railway Co., we have been favored with a series of the new transfer slips recently adopted by that company and copies of the rules governing their use.

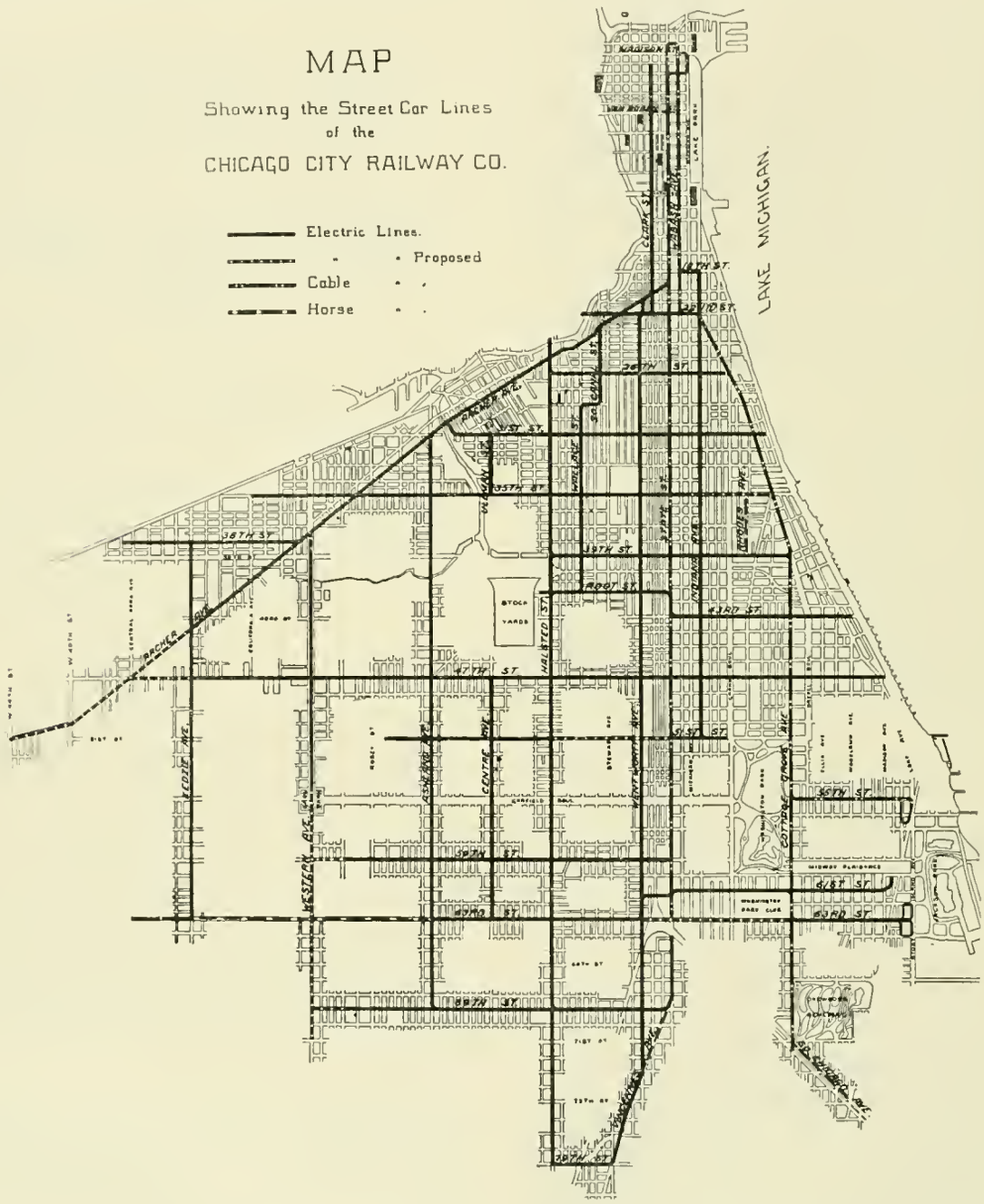
The network formed by the Chicago City lines makes a considerable number of different slips necessary to prevent gross abuse of the transfer privileges by the public, and the present series consists of 25. Each form is lettered and is used on one or more particular lines; the conditions on several lines are such as to require two slips and such second slips are designated by double letters. In some instances the two slips for one line are for use in different directions and in others they are used to distinguish cash and transfer passengers. We reproduce (D), (DD), (G), (GG), (O) and (P) with extracts from the company's bulletin to explain their use. All of the slips except (O) and (P) are 1½ x 4 in.; (O) is 2 x 4 in.; (P) is 1⅝ x 3⅜ in.

"On issuing transfer slips, punch in proper space for transfer point—in the light section to indicate a. m.—in dark section to indicate p. m.—also punch out the hour nearest the time due at terminus of line. Twelve (12) o'clock noon will be considered a. m. and twelve (12) o'clock night p. m."

"On issuing transfer slips to children give one slip for each half fare and punch in space "½ fare" in addition to hour and transfer point—will be honored only for children under twelve (12) years of age; two slips will be given when fares for two children are paid at the same time and registered as one full fare."

"Cash" fares include all kinds of tickets (except transfer slips) good for fare on Chicago City Railway Co. cars, whether "yearly," "monthly" or "registered" tickets.

"A. M. Following Date" to be used by conductors of cars running later than 12:30 a. m. and will be honored accordingly.



D AND DD WENTWORTH AVE.

Transfers "D" will be issued—only on north-bound trips—either for cash fares or transfers and to be punched, for transfer points, as follows:—

In space 1—from cars going north only to 60th.

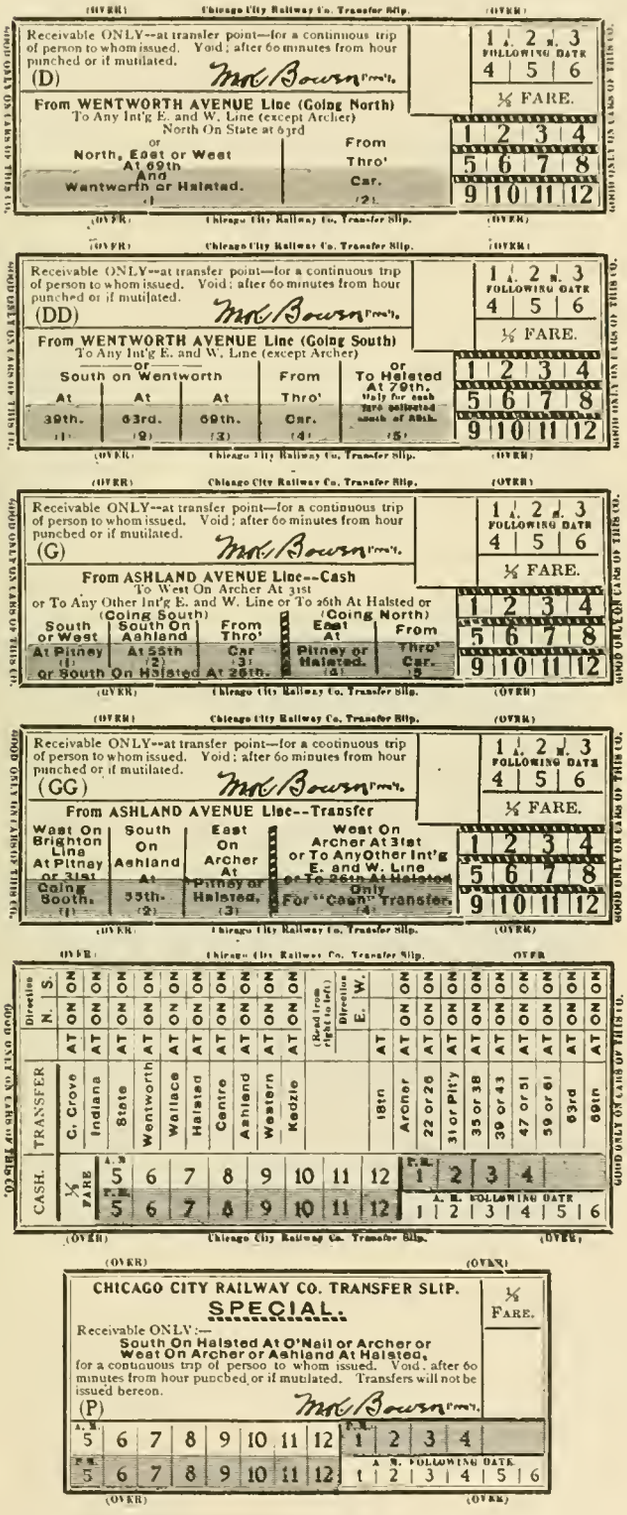
In space 2—from through cars.

Transfer "DD" will be issued—only on south-bound trips—either

for cash fares or transfers, except "To Halsted at 79th" to be issued only on cash fares collected south of 69th. Transfers "DD" to be punched, for transfer points, as follows:—

In space 1—from cars going south only to 39th St.
In space 2—from cars going south only to 63rd St.
In space 3—from cars going south only to 69th St.
In space 4—from through cars.
In space 5—for transferring passengers to Halsted at 79th St.

Transfers from short trip cars to through cars of the same line,



may, on request, be issued to passengers on arriving at transfer point.

G AND GG ASHLAND AVE.

Transfers "G" will be issued only for cash fares and for "Cash" transfers from short trip cars of the same line and to be punched, for transfer points, as follows:—

In Space 1—from cars going south only to Pitney Court.
In space 2—from cars going south only to 55th St.
In space 3—from through cars going south.
In sapce 4—from cars going north only to Pitney Court or Halsted St.
In space 5—from through cars going north.

Transfers "GG" will be issued on transfers and to be punched, for transfers points, as follows:

In space 1—for transferring "Transfer" passengers, to the Brighton line, going south.
In space 2—for transferring "Transfer" passengers, to the through cars, from cars going south only to 55th St.
In space 3—for transferring "Transfer" passengers, to the through cars, from cars going north only to Pitney Court or Halsted St.
In space 4—for transferring passengers, to intersecting "East and West" lines, on transfers (from intersecting lines) which were issued for cash fares.

Transfers "GG" punched in space 1, 2 or 3, may, on request, be issued to passengers (regardless of fare paid) on arriving at transfer point.

O, EMERGENCY.

Emergency transfers will be used only in cases that are not provided for on the regular slips (such as going to and from the depot via an intersecting line). They will be issued either for cash fares or transfers according to the general rules governing the line over which the car is passing.

Conductors will—punch "Cash" or "Transfer" according to fare paid—punch the word "On" (in column N., S., E. or W., as the case may require) opposite the line on which transfer is to be honored—punch the word "At" opposite the proper line to indicate transfer point. If punched "Cash" another transfer may be issued thereon the same as for cash fare.

These transfers will be honored when presented according to conditions printed on back of slip.

P, SPECIAL.

Transfers to the "West Side" will be issued only from north or east-bound cars of the Halsted, Ashland and Archer Ave. lines, for cash fares or on "Cash" transfers received from short trip cars of the same line.

Transfers from the "West Side" will be honored only on south or west-bound cars of the Archer, Ashland and Halsted St. lines, and transfers will be issued thereon only from short trip cars to the through cars of the same lines.

Passengers showing transfers to or from the "West Side" will be allowed to retain transfers and ride free on Halsted St. between Archer Ave. and O'Neil St.

In all cases before the transfer slips are issued to the conductors the date is printed upon them in the rectangle blank shown in our engravings.

TWO NEW WESTERN NEW YORK ROADS.

Two new companies have been organized in Buffalo for the construction of railways. The South Buffalo Railways Co. was incorporated with a capital stock of $500,000. This company proposes to build a road 18 miles long having a northern terminus at a point on the line of the Buffalo Creek Railway Co. and a southern terminus in the town of West Seneca. The road is to be standard gage and operated by steam. The directors are John J. Albright, Edmund Hayes, Geo. L. Williams, Wm. A. Rogers, Franklin D. Locke, John G. Milburn, Raymond Albright, Herbert H. Hewitt and Ralph H. Plumb.

The second company is the Ridge Road & Lake Shore Railway Co., capital $40,000, and the intent is to build an electric suriace railway from West Seneca to Hamburg. The road will be four miles long.

The directors of this company are Henry J. Pierce, Wm. B. Cutter, Clark L. Ingham, J. Henry Metcalf, Walter D. Ingham, Wm. H. Gratwick, jr., John H. Baker, John Otto, jr., and Geo. C. Riley.

The old Hamburg road has been stirred up by this new comer and has begun arrangements for an extension of its line almost alongside of the new route. It is expected to be a race between the two to see which will get the tracks laid first.

WHY MILWAUKEE SHOULD NOT REGULATE FARES.

Mr. H. C. Payne, vice-president of the Milwaukee Electric Railway & Light Co., appeared before a legislative committee in March last, and delivered an argument against a bill then pending to empower the city of Milwaukee to regulate the fare to be charged by his company. The points made by Mr. Payne are equally applicable to many other cities, and we present a portion of his argument.

"At the time of the purchase of the several street railways by the parties now owning the system in Milwaukee, say about the year 1890, there were five roads operating within the limits of the city of Milwaukee: The Milwaukee City Railroad Co., with 40.50 miles; the Cream City Railway Co., with 31.25 miles; the Milwaukee Electric Street Railway Co., with 12.75 miles; the West Side Railroad Co., with 20.75 miles, the Milwaukee & Whitefish Bay Railway Co., with 4.75 miles; total, 110 miles. These roads operated entirely independently of each other.

"There was no transfer system between the several roads, and if a passenger desired to go from a point on one of the lines to a point on any of the other lines, such passenger was compelled to pay two or more fares. The present company is the successor of all of the companies mentioned, and, in addition thereto, has increased the mileage so that at the present time it owns, controls and operates 175.03 miles of track.

"At the time of the purchase of these properties by us, transfers were issued only to a limited extent, there being but five points of transfer within the city, and less than 800,000 people availed themselves of the privilege in any one year. We have increased the transfer points to every place upon our road where the tracks intersect, there being 51 such points. During the year 1896, 7,913,593 people availed themselves of the use of transfers, thereby saving to them in that year $395,679.65. It costs the company just as much to transport a passenger upon a transfer as it does upon a cash fare, and, with no law or ordinance requiring us to do so, we have voluntarily made this great concession to the people of Milwaukee.

"Last year we transported 38,587,157 passengers, of which the number of passengers paying five cents was 30,673,564, and the transfer passengers 7,913,593. The total amount received for the transportation of these passengers in 1898 was $1,511,671.77, or an average fare per passenger carried in 1898 of 3.91 cents.

At the time of the purchase of these properties the total mileage was 110 miles. We have increased that mileage more than sixty per cent, and we now own and operate 175.03 miles of track. We have extended the street railway lines beyond the city limits to all the suburbs, and the electric cars now running to Whitefish Bay, Wauwatosa, North Greenfield, Soldiers' Home, State Fair Park, St. Francis, Cudahy, and South Milwaukee, and to Waukesha and Pewaukee Lake, as well as to Racine and Kenosha; and a line will be built by us this season to North Milwaukee.

"We have not only greatly increased the distance that a passenger can be carried for one fare, but we have voluntarily in many instances reduced the charges 25 per cent by the introduction of the sale of commutation tickets at 7½ cents, where the fare had previously been 10 cents, good for any point on our system inside the city limits of Milwaukee to the villages of Whitefish Bay, Wauwatosa, North Greenfield and Cudahy, and where formerly people desiring to go to West Park paid two fares, we now charge but one fare.

"Attention is often called to the city of Washington, where commutation tickets are sold, but what are the facts regarding the street railway situation in that city? There are but two companies of any importance in that city—the Capital Traction Co. (or the Pennsylvania Ave. line), with 35.96 miles of track, and the Metropolitan (or the F St. line,) with 22 miles of track, making altogether 57.96 miles. The earnings of the Capital Traction Co. in 1897 were $876,210.71; the earnings per mile of track $24,366. The earnings of the Metropolitan Co. for the same year were $737,819.69; the earnings per mile of track, $33,537. Consolidating the two gives 57.96 miles of track, with earnings of $1,614,030.40, or earnings per mile of track, $27,847.

"We have in the city of Milwaukee 141 miles of track, and the gross earnings of the road in 1897 were $1,409,017.04, or $9,994 per mile of track—$205,000 less than the 57.95 miles of railroad earn in the city of Washington, and earnings per mile of about one-third as great.

"Upon the two lines in Washington, upon investigation I found that over 72 per cent of the passengers carried by them rode upon commutation tickets. Assuming that the same results would follow in Milwaukee had we been compelled to sell commutation tickets at the rate of four cents, the loss to us in earnings for last year would have amounted to more than $230,000. Mr. Chairman, the net income of the company last year was but $38,108.67, which would have left us nearly $200,000 short of earning our interest and fixed charges.

"In the city of Washington there is no general system of transfers. Each company gives transfers to its own lines, but if a passenger desires to go to any part of the city reached by another line, such passenger must pay an additional fare, while in the city of Milwaukee there is a universal system of transfers in vogue, and a passenger can go from any part of the city for one fare of five cents."

A CONCRETE BREAKER.

The accompanying illustration shows a machine for breaking up hardened concrete on roads where paving is to be changed or repairs made. It is shown as it was used for breaking the old cable roadbed at Los Angeles. The machine is controlled by Skinner & Miller, engineers, of Los Angeles, Cal.

As may be seen it operates as does a pile driver. It is made just high enough to clear the trolley wires. The hammer weighs 2,500 lb. and the wedge, which cuts the concrete, weighs 200 lb. This wedge is of steel and is connected with the hammer by dowel pins.

CONCRETE BREAKER.

In size it is 10 x 12 in. on the face, next the hammer, and is 14 in. deep. The wedge has been patented and is owned by Messrs. J. A. Fairchild and Geo. R. Wilton, of the Alcatroz Asphalt Paving Co., of Los Angeles.

The hammer is run by an ordinary hoist, the power being a 10-h. p. motor which takes current from the trolley wire. It has a drop of from 8 to 10 feet. The motor, drum and hammer are supported by a frame, mounted upon rollers, and can be moved at will by is own power by attaching a rope to the yokes of the cable track. The hammer is moved laterally by the wheel shown at the left in the illustration.

Messrs. Skinner & Miller state that with this machine they have broken up from 320 to 350 ft. of single track per day of 10 hours; the roadbed was that of a cable railway and the concrete very hard.

THE SITUATION IN DETROIT.

(From Our Special Correspondent.)

Now it is a fight between the courts and the Detroit Street Railway Commission to see whether the municipality of this city has a right to buy and operate the street car system of this city. That is the one question being generally discussed in Detroit and almost all the business interests are united on the anti-ownership side. In the first place the Circuit Court has issued an injunction temporarily restraining the recently appointed Street Railway Commission from taking any action that will result in municipal ownership. Secondly, the commercial organizations of Detroit have employed the leading attorneys of Michigan and through the attorney-general of the state have started quo-warranto proceedings in the Supreme Court to contest the constitutionality of the McLeod law, under which the Street Railway Commission was appointed and by the powers of which municipal ownership was to be maintained in Detroit.

The attorneys on both sides completed their arguments before the Supreme Court on May 6th, but that body has stated that it will not be ready to hand down an opinion for several days, so with the pending injunction nothing definite can be accomplished towards municipal ownership in Detroit for some little time.

In the meantime but little has been accomplished during the past month towards the purchasing of the street railways by the city of Detroit. The experts appointed by the Street Railway Commission have completed their work and place a cash value on the real estate, tracks, power houses, rolling stock, overhead equipment and other properties of the four companies operating in Detroit at approximately $8,000,000. Just what value the experts and Commissioners have agreed upon as a price for the franchises has not been given out, but from the best information obtainable it is a good guess that unless the courts interfere Detroit will buy the street railway properties for about $12,000,000, paying therefor with low interest bonds.

In the street railway world at large it is probably a large mystery why the present owners of the street car systems in Detroit desire to sell out to the city. Today I had a talk with one of the leading street car officials in Detroit and received this explanation: "Some months ago the City Council Committee on Ordinances approached the street car management and requested many things, including better service on some of the light lines, an extension of the transfers, the construction of new lines in some of the suburbs, the lengthening of the hours of use of workingmen's 3-cent tickets and a number of other changes. Now the street car company was asked to make a proposition and leading councilmen stated that if the company did not care to make these improvements the city would buy the lines. As a consequence the company submitted an ordinance granting all the requests, provided a new franchise was given the present companies, with an alternative of municipal ownership. And thus started the present consideration."

Undoubtedly during the coming month the courts will render their decisions and following that the Commission and the street car owners will take final action. If the decision is favorable to the Commission it is almost certain that the city will buy the lines and properties in short order.

Detroit papers report that J. C. Shaffer, of Chicago, is negotiating with Tom L. Johnson for the Detroit street railways and has an option on the system at $9,000,000. Late information is to the effect that the Johnson deal with the city has fallen through entirely and this leads to the supposition that Mr. Shaffer could now buy the roads if he so desired. Mr. Shaffer, however, refuses to make any statement whatever regarding the matter.

The Ohio Central Traction Co., of which Israel A. Kelsey is president, and W. E. Haycox manager, is building 12½ miles new track between Galion and Bucyrus, and will have it completed about the middle of June. The company has bought eight new cars, four each closed and open, and is now building a new car barn with a capacity for 16 cars, and a new power house at Galion with a 400-h. p. capacity.

OPENING OF THE VICKSBURG ROAD.

Vicksburg is one of the oldest towns of the South, but until now has never had any better street car facilities than were provided by a few old rattle-trap boxes and a half dozen mules. But Vicksburg had a set of men who realized that she was capable of better things, and they determined to bring them about. The Society of Ben Bolians was formed, its object being the general upbuilding and

STREET RAILWAY ARCH.

improvement of the city. Through this society the Vicksburg Railroad & Manufacturing Co. was organized and developed so far as the furnishing of the city with electric light. Then it occurred to them that a city of 25,000 population was slow that did not have an electric street railway. Mr. S. F. Mordaunt, one of the enterprising business men, began looking for the right man to construct such a road, and found him in Mr. J. C. Shaffer, of Chicago. A company was formed, and Mr. Shaffer was made president; a

ILLINOIS CENTRAL ARCH.

charter was obtained Feb. 2, 1898. The electric light plant was purchased and the work of construction was begun last November, and on April 24th the road was finished and formally opened, the occasion being made the greatest event in the history of Vicksburg since Grant and Pemberton met there in 1863.

The Vicksburg Electric Street Ry. is eight miles in length. It begins at the city cemetery, runs through the center of the town with diverging lines both to the east and west, and then continuing on south out to Ken-Caryl Park, a 35-acre tract the company has

purchased, and which it is now converting into a handsome resort. There are now 10 open cars running, and the citizens are enthusiastic. They are crowded with passengers who delight in the novelty of street car service.

The company has built and fully equipped a large power house. It has two 250-h. p. Stirling and one 200-h. p. Heine boiler; one 300-h. p. Cooper and one 600-h. p. Russell engine and Westinghouse generators. The North American Railway Construction Co. built the track, the St. Louis Car Co. built the cars, and the Westinghouse Co. furnished the complete electric equipment. This power house was described in our issue of December, 1898.

President Shaffer and a party of friends went from Chicago to Vicksburg, in a special car over the Illinois Central, to attend the inaugural ceremonies. Everything was in perfect order on April 24th, and Vicksburg has never seen such a season of gayety and rejoicing. It was a whole week of festivity. Besides the street car line there was the opening of a new opera house and one day was devoted to decorating the graves of the confederate dead.

But the street car feature was the main one and attracted the most attention. On that day everybody had a free ride out to

VICKSBURG ARCH.

Ken-Caryl Park. The streets of the city were gorgeous with flags, bunting and elaborate arches, and all the bands in Vicksburg and the neighboring cities kept the crowds happy and the air full of music; the band from the U. S. S. Nashville had the place of honor.

While all the arches were handsome, the ones erected by the street car company, the city of Vicksburg and the Illinois Central Railroad Co., were the most attractive. The street car arch was crowned with an old mule car, which was in sharp contrast with the new cars on the streets.

At the Park there was some speech-making, Mr. M. J. Mulvehill, secretary of the company, and S. F. Mordaunt, general manager, being the principal speakers. President Shaffer was eulogized and in response to numberless calls made a few pleasant remarks.

After the speech-making all present were invited to partake of a feast, which had been provided. A gigantic barbecue had been in progress, and the meat with sundry accompaniments and unlimited lemonade was served on tables scattered through the Park. There was enough for all, and everybody enjoyed it.

The whole affair was a most happy one and one that will be long remembered not only by the people of Vicksburg, but by the thousands of visitors.

The Urbana & Champaign Railway, Gas & Electric Co., including the three properties named in the company's title, has been sold to parties in Portland, Me., represented by Mr. W. B. McKinley. The transfer took place May 1st. Under the able management of Mr. B. F. Harris, Jr., president of the properties sold, the plants have been brought to a high degree of efficiency and have become very attractice investments.

IMPROVEMENTS AT ALLENTOWN, PA.

The Allentown (Pa.) & Lehigh Valley Traction Co., of which A. F. Walter is manager, is rebuilding its entire track between Allentown and Bethlehem, and Allentown and Catasqua. It is replacing 45 and 50-lb. rails with 70-lb. and using 6 x 8-in. x 7-ft. ties. The company bought about 900 tons of the rails of the Lackawana Iron & Steel Co. John A. Roebling Sons Co. supplied ten miles of feed wire, 500,000 c. m. A great part of the special work is being furnished by the Loraine Steel Co., of Johnstown, Pa. Particular attention is being paid to the curves and all the steel for them is especially rolled and guarded, even on curves of long radius, in no case are straight rails bent into curves. From the J. G. Brill Co. were purchased 30 No. 21 E trucks, and from the Westinghouse Co. 30 equipments of type B 38 motors to use with them.

Manager Walter says the business of the road is in excellent condition, the receipts being largely in excess of last year at this time. An extra force of men is at work on the improvements, and it is expected all will be completed by July 1st.

APPOINTMENTS ON THE BROOKLYN RAPID TRANSIT ROAD.

President Rossiter has announced the following appointments: J. D. Barton, superintendent of Brooklyn bridge division, vice John Prince; George W. Edwards, superintendent of the Brooklyn "L"; W. W. Wheatley, assistant superintendent of all the lines under General Superintendent McCormack; George Goodwin, superintendent of the Ridgewood division; Charles E. Harris, superintendent of the southern division; Miller Robbins, Jr., superintendent of the central division; Richard K. Holdone, superintendent of Canarsie division; John C. Webb, superintendent of the eastern division; William F. Duncan, superintendent of the East New York division, and Newton W. Bolen, superintendent of the Greenwood division.

STRIKE AT DULUTH.

The employes of the Duluth Street Ry. went on strike on May 2nd, after the arrest of 10 discharged men, who are charged with cutting feeder wires. The company resumed service two days later with outside non-union men, and several attacks were made on the new men. Two attempts to dynamite cars were made in which one car was badly wrecked and several persons injured. The road is in the hands of a receiver who has secured an injunction against interference with the operation of the cars.

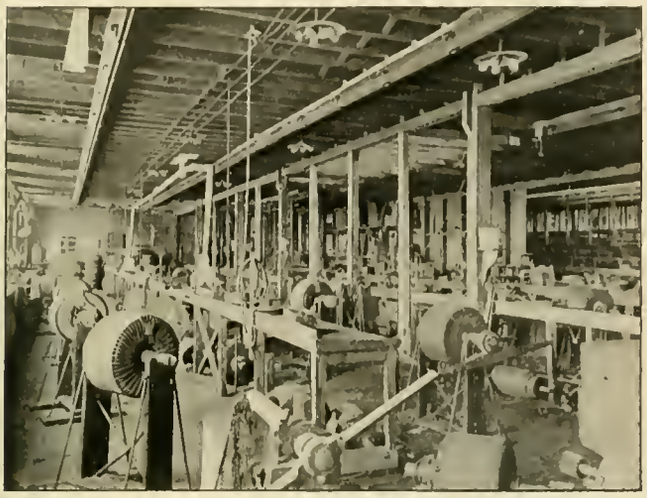
LUBRICATION OF GEARING.

It is a too prevalent idea that almost anything will answer as a lubricant for gear wheels; that the teeth will wear, the rate depending off how well the gearing is proportioned for its work. Gear teeth fail either through excessive wear of the contact faces or by breaking off because of the shocks made possible by the side clearance; the initial side clearance or backlash will vary from 1-64 in. to 1-16 in. in cut gears and from 1-16 in. to 3/8 in. in cast gears, increasing of course with wear of the contact faces.

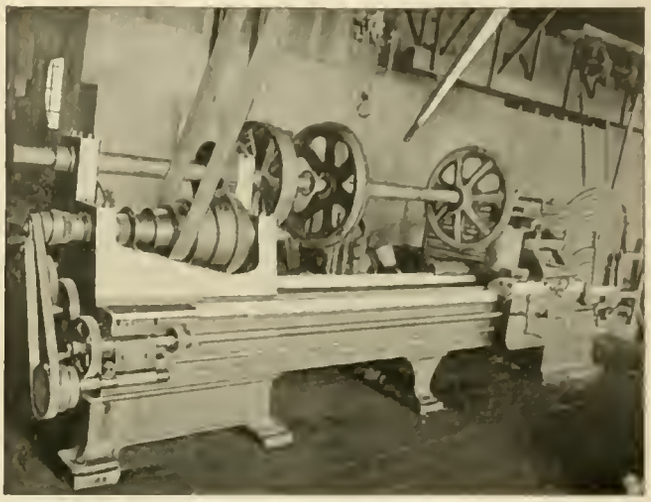
The Ironsides Co., of Columbus, O., has had great success with what it calls "Gear Shield." This compound has been perfected on the theory that the proper lubricant for gears is one which is tenacious and will build up a deposit on the tooth, which prevents metalic contact between the working surfaces and on the back side reduces the side clearance or backlash and provides a cushion which mitigates the effect of shocks due to varying loads. The company states that "Gear Shield" has proved to be equally well adapted for the fast-running gearing of street railway motors and for the slow-running and heavy gearing in rolling mills. In the accompanying illustration the heavy lines denote the "shield" formed on the surfaces of the teeth by this lubricant.

BROOKLYN RAPID TRANSIT SHOPS.

The main repair shops of the Brooklyn Rapid Transit Co. are located on 52d St., South Brooklyn, extending from Second to First Ave., a distance of 700 ft., with a width of 100 ft. The half nearest Second Ave., 350 x 100 ft., is two stories high, of brick. The main floor contains the mill room, part of general store room and the remainder is for car body work. On the second floor are the paint shop, paint stock room, general store room, draughting room and offices of the superintendent and time-keeper. The remainder of the building is of frame and one story high, except for a gallery over the armature room, where insulations, armature coils and fields are made, and another one over the machine shop used as a pattern loft and for putting the rope netting in fenders.



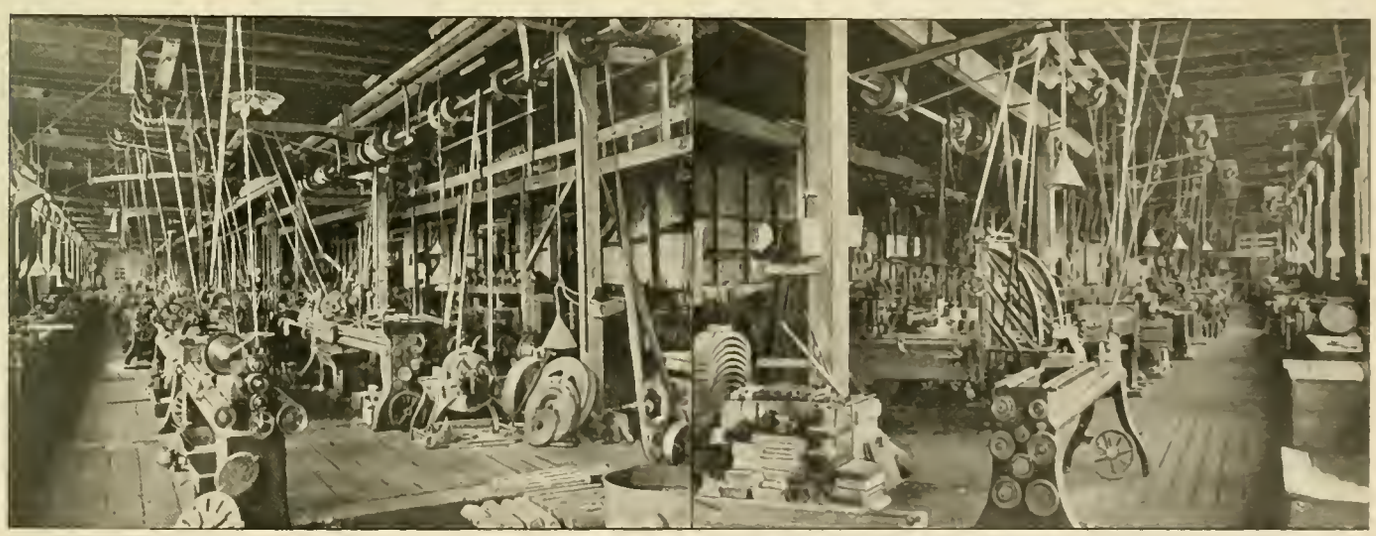
ARMATURE REPAIR SHOPS.



McCABE DOUBLE SPINDLE LATHE.

The armature room, occupying a space of 140 x 40 ft., is a very busy place at present owing to approach of the open car season. Some 300 W. P. 50 armatures are being changed from 13-turn to 9-turn machines with a heavier size wire. The shafts on these re-wound armatures are being changed on the commutator end so that the bearing surface is now 2⅝ x 6 in. in place of 3½ x 3 in. In connection with this alteration an iron sleeve babbitted bearing with a dust cap screwed on the end with a taper thread, is used. A number of Type B. Curtis armatures are being changed from four to six turns.

The machine shop and wheel fitting room are also in the frame building, the former occupying a space 110 x 40 ft., and the latter 50 x 30 ft. The machine shop is equipped with 11 lathes, 1 42 in. planer, 2 shapers, 1 milling machine, 1 horizontal mill, 9 drill presses and the necessary bolt cutters and emery wheels. The latest addition to the machine shop in the way of machinery is a double spindle lathe, made by J. J. McCabe, of 15 Dey St., New York, that swings 26 in. on the lower spindles and 44 in. on the upper. On the lower spindles all classes of small work are easily handled, while on the upper spindles an axle fitted with 33-in. wheels is readily swung and any work necessary to the axle or wheels is easily done without the necessity of removing the wheels. The upper spindles are very convenient for turning out the older types of motors for the large size axles that are now coming into use. Next to the machine shop is the wheel room, equipped with a vertical boring mill, hydraulic wheel press and axle straightener. This room also contains the electric furnace used for heating the 1¼-in. iron pipe that forms three sides of the standard fender. These pipes, 15 ft. long, are run into one end of the furnace, which is 16 ft. long, the proper sections heated, the pipe taken out of the opposite end of the heater, and laid on a suitable form, and then bent to shape with rollers connected by chains to a countershaft with tight and loose pulleys. This countershaft is set in suitable pillow blocks bolted to yellow pine timbers set in the concrete floor. Old motor brushes and electric light carbons are used in this furnace.



MACHINE SHOPS—BROOKLYN RAPID TRANSIT CO.

The law regarding the use of fenders and appliances for protecting life goes into effect in California July 1st.

LACONIA (N. H.) STREET RAILWAY.

The Laconia (N. H.) Street Railway Co., H. L. Pierce, of Leominster, Mass., president; L. S. Pierce, of Laconia, manager, is building five miles of new track to connect Lakeport and The Weirs. The company has recently bought four new 13-bench open cars and is remodeling its old barn, giving it a capacity for 16 cars and is building a power house of 500 h. p. capacity.

This company has a somewhat novel plant for street railway work. It has two Westinghouse gas engines and two generators run in connection with a Stetson storage battery. The new extension of the line is on a boulevard laid out along a small lake to The Weirs and further on to the shores of Lake Winnipesaukee. Previous to last fall the road used horses from Laconia to Lakeport. H. L. Pierce, president of the Pierce Construction Co., of Leominster, Mass., then bought into the company and changed the power to electricity. Mr. Pierce has built and operated a great number of roads, his range of territory reaching all the way from Maine to Texas. He is also the president of the Fitchburg & Leominster Ry., of Fitchburg, Mass.

L. S. Pierce, the manager of the Laconia Street Railway Co., was the electrician and superintendent of overhead construction of the Pierce Construction Co. until he took the position of manager of the Laconia.

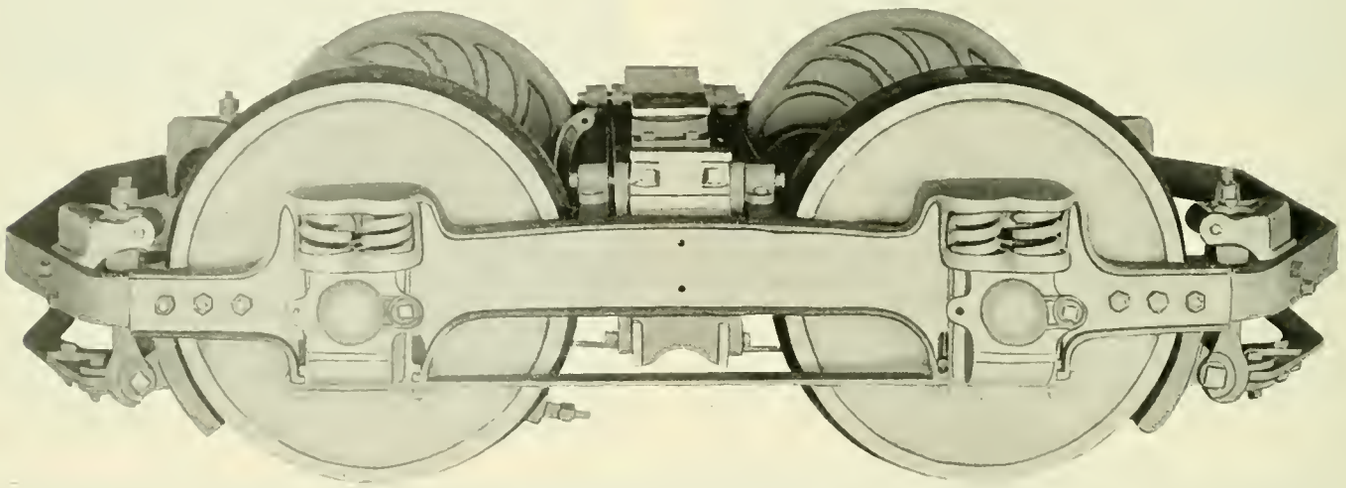
TROLLEY EXCURSIONS—A NEW FIELD.

The day of the tally-ho is pretty well over. Wherever it is possible to construct an electric road it is being done, and trolley rides have become the fad. Eastern Massachusetts is full of these electric transportation lines, and Robt. H. Derrah, of Boston, has been quick to take advantage of them and inaugurate trolley excursions. Mr. Derrah has had considerable experience in connection with transportation companies of this kind, and is entirely competent to promote and manage such excursions.

In planning the construction of electric surface roads, one aim, and a natural one, has been to reach or have on the right of way as many attractive features as possible. The roads throughout Eastern Massachusetts are especially favored in this regard, and a trip over almost any one of them affords a pleasant ride. Mr. Derrah will be glad to arrange with private parties, clubs, picnics, conventions, and any and all people wishing to get up a novel and interesting trolley excursion. He can show maps of routes, give full particulars as to attractions, and will provide any refreshments and entertainment desired. Mr. Derrah can be reached by mail or in person at Room 3, No. 113 Devonshire St. Boston, Mass.

Mr. Derrah entered the service of the West End Street Railway Co., May 3, 1889, when Henry M. Whitney was president, as office boy; when Mr. Little became president in 1893, Mr. Derrah was made chief clerk and held this position until the Boston Elevated Street Railway Co. took charge, when he became executive clerk for President Gaston. When Mr. Derrah resigned, President Gaston sent the following letter to the daily and weekly newspapers of Boston and vicinity:

"Mr. Robert H. Derrah, who has been for the last 10 years connected with the West End Street Ry. and the Boston Elevated Railway Cos., in the office of the president, leaves the service of the latter company today (April 29th) to enter upon business for himself. He has for several years made a special study of the growing electric railway system of New England, and as the publisher of Derrah's Street Railway Guide for Eastern Massachusetts has a wide acquaintance among street railway men. Mr. Derrah is to start upon a new enterprise in this part of the country, the management of electric car excursions for individuals or parties. In England the low price excursion is a popular form of entertainment, and in Boston and its vicinity more attractions of greater diversity can be found than in any other section of the country. While such a business is an experiment in New England, it has great possibilities, and Mr. Derrah leaves the Boston Elevated Railway Co., accompanied by the best wishes of its officials and employes to be first in the new field."



McGUIRE NO. 39 PIVOTAL TRUCK.

HIGH SPEED TRUCK.

We illustrate a type of truck which is the latest production of the McGuire Manufacturing Co., and which is one of a large order being sent to the South Bend (Ind.) Street Ry. These trucks are guaranteed to run 50 miles an hour under a car body of 50,000 lb. weight. The company states that the same load might be carried at a speed of 100 miles with safety.

The truck is built under the Cloud-McGuire patents, which feature it is claimed permits the frame to carry the car body lower than any other of the same strength.

The outlines show simplicity and strength. The only springs in sight are those over the journal box supporting the side frames, but there are elliptic springs housed under the bolster of sufficient capacity to carry the load and insure soft and easy motion. Altogether it is one of the most interesting trucks for electric railway purposes. While it has many desirable points, the three main ones are: First, short wheel base, to facilitate passing curves; second, allowing the car body to be carried as low as the motors will permit; third, motors hung outside of wheel base permits of quick repairs and better inspection. The Peoria & Pekin Ry. has just placed an order with the McGuire Manufacturing Co. for 20 double equipments of this same type truck. The McGuire Co. is running to the fullest capacity, night and day shifts.

The Milwaukee Electric Railway & Light Co. has announced that disabled wheels may be carried on its cars. This is a privilege bicycle riders will appreciate.

The contractors laying the underground trolley on the Boulevard, New York city, are disappointing a great many people, who expected nothing less than ruin to the grass plots adjacent to the track, and much delay to traffic. The work is progressing quickly and smoothly, and as yet no one has had a complaint to make.

ELECTRIC TRACTION AND ITS APPLICATION TO SUBURBAN AND METROPOLITAN LINES.

Abstract of a paper of Philip Dawson. Read before the Society of Arts, London, March 22, 1899.

There is no longer room for doubt that electricity is the one pre-eminently successful motive power for tramways. This is proved by the rapid growth of electric traction. The words "experimental line" have fallen out of use, yet it is only a few years ago that those who ventured to foretell that the trolley system would be generally introduced into this country were ridiculed. There is no country in which electric traction is advancing more rapidly, and in which finer plants are being installed than in Great Britain. The day is not far off when horses and steam will have disappeared from the streets as far as tramways are concerned, and when the horse 'bus as a competitor will be no longer known.

There are practically three methods of handling electrically the traffic on a railway, namely:

1. By locomotives or motor cars hauling a train of trailer cars.

2. By independent motor cars.

3. By a set of independent motor cars formed into a train and handled from the front car or from a so-called controller car. Each car, however, can be separated from the train, and it then becomes an independent motor car.

As regards the supply of the necessary current for the motors, there are three distinct methods:

Firstly. By accumulators or storage batteries which may be carried either on the motor car or locomotive, or on a tender.

Secondly. By having a car containing a stationary engine, dynamo, and boiler, which supplies the necessary current to the motors on the cars comprising the train of which it is part, and as proposed by W. Heilmann.

Thirdly. By continuous or multiphase current supplied directly from a generating station or from a sub-station which, in its turn, gets its supply of energy from the main station, the current being distributed either in the form of direct or polyphase to conductors running along the lines, and from which the power is supplied, through sliding contacts on the cars to the motors.

The two former methods, as far as this paper is concerned, will not be discussed, as sufficient data are not available to justly their being considered.

The system of transmission of energy to the motors by means of conductors laid along the track, will therefore alone be considered.

This method allows of several variations as far as the generation and distribution of power is concerned, amongst which the chief may be set down as follows:

(a) One continuous current generating station supplying current direct to contact rail. Where drop in pressue owing to distance becomes excessive, a negative "booster" may be used—it serves, so to speak, to pump back the current to the station, and is self-regulating, not taking at any period more power than is actually required to pump the current back. Should there be one or two lines too long to enable them to be worked this way, polyphase high tension generators should supply the power to one or more sub-stations along the line, as may be found necessary in which rotary converters are located, which transform the current back into continuous. The polyphase generators to be driven by continuous current motors in the generating station. As an example of such a station, the new Dublin tramway power house may be taken.

(b) One central station generating continuous current with sub-stations in which accumulators are located along the road, and which are charged by means of a booster and special cables. As an example of this system, the Leeds tramways may be taken as designed by, and carried out by, the late lamented Dr. John Hopkinson.

(c) A series of stations, as described under (a) and (b), situated at various distances and connected together one with the other. As an example of this, the tramways and light railways in and round Boston, Mass., may be taken, owned by the Boston Elevated Railway Co., which has absorbed the well-known West End Co.

Data of Boston Elevated Railway:

Track miles operated	305
Number of cars	2,648
Car miles run during 1898	20,787,000
Passengers carried during 1898	172,764,300
Number of power stations	5
Total capacity of power stations in kw.	16,100
Total rated i. h. p. of engines	24,000

(d) A power station generating polyphase currents, which, by means of static step-up transformers, are transmitted at tensions which run from 2,500 to 30,000 volts to sub-stations where static step-down transformers reduce them to pressures of 300 to 350 volts, the current at this pressure enters rotary transformers, which deliver direct current at 500 to 550 volts to the line. As an example of this later system, the Central London Ry., which is now under construction, may be mentioned

(e) A three-wire system with continuous current, the rails or return forming the neutral wire. This has been tried and found wanting, and the engineers of the Central London Ry. most carefully investigated its possibility and decided in favor of polyphase transmission and rotary converters, and rightly so.

From careful calculations and the investigation of what has been done both in Europe and America, there is no getting behind the fact that for any power station which will exceed 4,000 kw. in capacity, the polyphase system is nearly certain to prove commercially the only admissable one. This statement is upheld by such an authority as Mr. H. F. Parshall, M. I. C. E. It is evident that in the particular cases at present under consideration (suburban and metropolitan communication), more than 4,000 kw. will be under consideration; and therefore nothing, as far as the power station and transmission is concerned, but polyphase currents will be considered.

There are two distinct varieties of service to be catered for. One that on a system like the Metropolitan and District, where the stops are frequent and the runs short. The other the case of long distance lines with few stops. In the present paper it is only proposed to consider the first variety. In this case the use of polyphase motors need not be considered, as for work entailing frequent stopping and starting they have not up to date proved satisfactory.

A short examination of the importance of rapid acceleration on lines having stopping places at short intervals is interesting. Practical experience with electrically-driven motor cars, or locomotives on the experimental track of the General Electric Co., at Schenectady, has proved that it is perfectly feasible to attain a speed of 30 miles an hour 10 seconds after starting from a standstill. Assuming a level track, and that during 65 seconds the current is cut off, and the train allowed to coast, that the brakes are then put on, the train will be brought to a standstill 15 seconds later, and the total time from start to stop will be 90 seconds. Under these conditions it will be found that the average speed will have been 23.16 miles an hour, and that the total distance run will be about .55 of a mile. Assuming that instead of attaining the 30 miles an hour in 10 seconds, it took 30 seconds, and that this full speed of 30 miles an hour was kept up for 40 seconds longer, and the brakes then put on, the train would be brought to a standstill in 90 seconds, and the average speed would work out as 21.66 miles an hour, or an average speed of about 10 per cent less than in the previous case, the consumption of power, however, being much greater.

It is evident that the most important point is to attain a high average speed, and to keep the maximum speed attained as low as possible, as by so doing less power is required in braking the train, and also less power is required to run the train. The time between the moment when the maximum speed is attained, and when the brakes are put on, should be at least from four to six times that required for stopping the train, so as to allow for errors in judgment on the part of the driver, and also to enable him to make up lost time. On the Manhattan Elevated Ry., in New York, the trains which are drawn by steam locomotives take 20 seconds to attain a speed of 14 miles an hour, or less than half the speed in double the time as compared with electric traction just mentioned.

A much larger current will be required to attain a rapid acceleration than to attain a slow one, but the current will be required during a much shorter time, and the total energy supplied will be less in the case of rapid than of slow acceleration. This fact must not be lost sight of when calculating the feeders for such a system, and the train service should be arranged in such a way that as few trains

as possible start together. Furthermore, the more rapid the acceleration required the larger will the motors have to be, and therefore there will be a limit, above which it will not be advantageous to push the rapidity of acceleration. In new tunnel lines, such as are now being constructed all over London, it will be evident that it is an advantage to have the stations built with a down-grade for the trains to start, so as to help the motors and reduce the current required at starting, and that similarly it will be an advantage to have an up-grade when nearing a station, so as to reduce the amount of power required in braking. By properly choosing these gradients it is found that a total economy of from 40 to 50 per cent in the total power required by a train may be made. According to Mr. Potter's tests it was found that during acceleration an average power of 32 amperes per ton of weight of train was required.

With a complete train composed of one motor car and two passengers cars, weighing complete 148,000 lb., a maximum horizontal effort of 9,750 lb. was required in acceleration, the maximum current was 780 ampers at 500 volts, the maximum speed attained was 32 miles an hour, and the time taken to attain the speed was 34 seconds, the motor car being equipped with two 200-h. p. motors.

In another case, with a train composed of one motor car, equipped with two 125-h. p. motors and one trailer car, the total weight of train being 103,000 lb., a maximum speed of 31 miles an hour was attained in 37 seconds, the maximum current being 500 ampers, and the maximum horizontal effort required to attain acceleration 5,640 lb. In a series of tests made on the Nantasket Beach line it was found that with a heavy motor car, 51 ft. in length over all, carrying 100 passengers, weighing 31 tons, on an average distance of 2,980 ft., between stations, a maximum speed of 40 miles an hour was attained, the average speed being 18 miles per hour, and the power required was 0.098 Board of Trade units (i. e., kilowatt-hours) per ton mile.

In an experiment with a train composed of one motor car and one trailer car, weighing 57 tons, with an average distance between stations of 4,280 ft., a maximum speed of 37 miles was attained, the average speed being 17 miles an hour, the power required being 0.067 Board of Trade unit per ton mile.

From a comparison of the actual results obtained on the elevated electric railways of Chicago and on the Metropolitan and District line in London, we see that whereas the maximum speed of 25 miles an hour is obtained in 10 seconds with electric traction, it takes 33 seconds to do it with steam locomotives—and that whilst the electrically propelled train could do the distance of 1,880 ft. in 66 seconds, with steam it would take 93 seconds, or nearly half as much time again. If in the case of electric traction the power is cut off the moment the maximum speed of 25 miles an hour is obtained, and the train allowed to coast before the brakes are put on, the distance considered would be done in 76 seconds. The steam driven train even then would take more than 25 per cent more time to do the same distance.

Having tried to show the advantages which electric traction possesses as regards the possibility of increasing the frequency of the trains without decreasing the factor of safety, namely, the distance between two trains, it may be advantageous to see how, from an economical standpoint of generating power, electricity is a cheaper method of operation than steam locomotion. An electrically driven train only requires one man instead of two to drive it, and when the train is not running no power is consumed and no coal or water wasted. Steam locomotives, it is well known, use but very little less coal and water when they are standing still than when they are running, and are much less economical, consuming, as they do in America, from 5 to 6 pounds of coal per indicated h. p. h. On main line English roads it is stated that three to four pounds are consumed, and taking an average power of 400 h. p. per locomotive, and a train plus engine weighing 250 tons, at a speed of 40 miles an hour, we get at the most economical rate about 0.65 lb. of coal per ton mile, or compared to the electric power required by electric traction 13 lb. of coal per Board of Trade unit required, which is enormous—under favorable conditions it would not take much over 3 lb. of coal to give one Board of Trade unit at the switchboard. A properly-designed electric station with large units would probably never consume more than 2 lb. of coal per i. h. p. h., or 2.65 lb. per kw. h. at the switchboard, and engines of the size of 4,000 to 6,000 h. p. would be guaranteed to consume not more than 12 lb. of steam per i. h. p. h. A large station would fully justify a comparatively large initial expense in coal handling and stoking machinery, and the location of the station could be chosen so as to be most advantageously situated as regards both coal and water, the coal without being handled being taken from either the ship's-hold or the railway truck, conveyed automatically to the coal stores and from thence automatically to the fires, the ashes being conveyed away automatically as well. In such a station but very few men would be required, and the cost of power could be reduced below one half-penny per Board of Trade unit, including expenses of every kind.

Comparing again the coal consumption per train mile on large English main line railways, which varies from 35 to 58 lb. of coal per ton mile, corresponding to 28.12 to 46.4 lb. per Board of Trade unit, required to be generated at the power house. The following results actually obtained with slow-speed corliss type engines and standard American railway generators, may be of interest:

Total coal consumed, Brooklyn City Railway Co., per Board of Trade unit, 3 lb.

Total cost, everything included, of Board of Trade unit at switchboard, .5195 cent (about one farthing).

Cost of coal per unit, .2307 cent, about 0.166 of a penny; Union Traction Co., Philadelphia.

Poorest coal, 3½ lb. consumed, per Board of Trade unit at switchboard.

In another case cost of coal, 0.272 cent per Board of Trade unit at switchboard, about 0.186d.

Total cost of unit, all included, 0.591 cent, about 0.296d.

Coal consumption in another case with corliss engine, average for one year, per i. h. p. h., 1.65 to 1.76 lb.

What good slow-speed corliss engines, properly designed for railway work, compared to other engines mean are shown by the fact that by such a change in a large American station the coal consumption was reduced from an average of 8.3 to 4.9 lb. of coal per car-mile.

From a series of figures obtained from the various Chicago electric overhead lines, from 0.16 to 0.135 Board of Trade units are required at the switchboard to drive the trains, the average speed of the trains being 13½ miles an hour, and the maximum speed obtained varying from 28 to 35 miles an hour.

The coal and water consumption, per Board of Trade unit, must necessarily be very low, the losses in the step-up and step-down transformers and in the transmission and rotary converters would not be very great, and it would be perfectly feasible to attain an efficiency of 60 per cent at the motor terminals and of 50 per cent on the power applied to the car axles. Large engines and large gnerators and converters are dsigned so as to take an overload of 25 per cent for any period of time, and be capable of overloading 50 per cent for a short time without injury, and by a selection of proper units a very large economy could be attained.

The elevated railroads of New York and Brooklyn have been losing business during the last few years so rapidly that the financial conditions of the Brooklyn system is serious, and the return on investment of the New York system much reduced, and is still declining. The elevated railroads of Chicago have never been able to earn a satisfactory dividend. The general introduction of electricity in the Chicago system has greatly improved the Chicago situation, in spite of the competition of the surface trolley lines, which parallel the elevated lines in most cases. The elevated railroad problem is resolved into a discussion of speeds, station frequencies, and relative costs of service. Any railroad of this class which aims to maintain a high schedule must choose a motive power in which the possibilities of rapid acceleration are a maximum, and—all other conditions being equal—should choose that particular motive power which will bring about the quickest, acceleration, consistent with the economy.

The Manhattan system is a comparatively simple one, with four main through lines, without branches of importance, while the Brooklyn and Chicago systems are composed of trunk lines with branches, involving more or less complicated switching arrangements. Until about a year ago, the three Chicago companies, the Lake Street, the South Side, and the Metropolitan, had independent termini in the business heart of the city. Now, however, the "Loop," encircling the business district, is used as a terminus for all three lines and for a fourth, the North Western, now under construction, and all the elevated trains of the city pass round this loop on each trip. The Brooklyn elevated system has lately secured a

new terminus on the Manhattan Island side of the Brooklyn Bridge, and experiments are being made with a view to converting the entire Brooklyn system to electricity in the near future. The entire New York system, however, is at present operated by steam locomotives.

The little locomotives in use on the New York system weigh 47,000 lb., of which 31,500 are on the four 42-in. driving wheels, and 15,500 are on the four 30-in. truck wheels. The total wheel base is 193 in., of which 60 in. is rigid. The cylinders are 12 in. in diameter, and have a 16-in. stroke. The grate area is 16.5 sq. ft., and the total heating surface is 4,034 sq. ft. There are 154 flues 1½ in. in diameter and 75 in. long.

The standard Manhattan car weighs 29,088 lb., has seats for 48, and frequently carries 100 passengers. It is mounted on eight 30-in. wheels.

The total weight of a 5-car loaded Manhattan train is about 130 tons. The weight on the drivers is 12 per cent of the total train weight, and with 25 per cent adhesion, the maximum drawbar pull possible for the locomotive to exert is 7,875 lb.

The electric locomotive car of the Metropolitan Electric Railway Co., Chicago, weighs 53,200 lb. complete with motors, or 40,000 lb. exclusive of motors. It is a standard American passenger car with full seating capacity, about one-half of each platform being taken up with the cab and necessary controlling apparatus. The trail cars weigh 33,000 lb. The seating and standing capacity of both motor and trail cars is approximately 90 passengers. The average 4-car heavily-loaded train will weigh about 100 tons, of which 32.5 tons approximately are on the four wheels of the locomotive's motor truck, and 67.5 tons are in the trail cars. From 30 to 35 per cent of the entire train weight is available for traction under these conditions, and the maximum drawbar pull possible to exert without slipping of wheels is about 16,250 lb.

The South Side Elevated Railway Co., of Chicago, is equipped with the Sprague multiple unit system, by means of which two or more cars in a train are equipped with motors and may be operated in unison by a single controller from any point in the train. The company is now operating four-car trains on each of which is a motor truck carrying two motors. The cars weigh about twenty tons each without load, and about 60 per cent of the train weight is available for traction.

There are therefore three distinct types of elevated railway equipment, the steam locomotive using 10 to 15 per cent of the train weight for traction under heavy traffic conditions, the electric locomotive using 30 to 35 per cent, and the multiple unit system using any amount desired up to 60 per cent of the train weight.

The transportation expenses of the South Side Elevated Ry. in Chicago for July, August, and September, 1897, when steam locomotives were employed, were 2.8 cents per car mile, while in the same months of 1898 they were 1.9 cents per car mile, or a saving of nearly 0.9 cent, or about 33 per cent.

The characteristic difference between the acceleration curve of a train hauled by a steam locomotive and one driven electrically is that, whereas the acceleration where steam is used as a motive power increases at first, slowly following a curve which is nearly tangent to the horizontal or time axis, the acceleration curve in the case of electric propulsion is represented by a straight line rising very rapidly, and forming a very small angle with a vertical axis.

It may be interesting to mention a few details regarding the two large power stations which are now being equipped in New York, and which will operate the two large tramway systems of that city, namely, the Metropolitan and the Third Avenue. The Metropolitan Station is now under construction, and will contain eleven direct connected sets each 3,500 kw., room for extension being allowed, and a capacity having been foreseen of nearly double that amount. The following gives the particulars of the General Electric dynamos which will be used.

The machine will have a frequency of 25 cycles per second, at 6,600 volts. It will have 40 poles, and will run a speed of 75 r. p. m. It will be of the stationary armature type, the core being built up of laminations .014 in. thick. Each lamination has two dove-tail projections which fit in corresponding slots in a heavy cast-iron spider. Spaces are left between the laminations at intervals through which currents of air are driven by the rotating field and circulating by intimate contact with core and windings. The armature winding consists of form-wound coils placed in slots in the core and retained by wooden wedges, the edges of which fit into recesses in the teeth. The field frame consists of a cast steel ring supported upon a cast iron spider, to this are bolted laminated core of sheet iron, the pole pieces of which project over and support the copper field windings. The field winding consists of copper strips wound on edge with paper insulation between turns. The insulation is such as to stand a test of 4,000 volts alternating between the winding and the core. The exciting E. M. F. is 125 volts. The collecting rings are of copper, and carbon brushes are used. The armature winding is tested to 12,000 volts alternating. The temperature rise of the machine after ten hours' run at full load is well under 40° C. The efficiencies are as follows:

	Per cent.
1¼ load	96
Full load	95.5
¾ load	95
½ load	92.5
¼ load	88
Inherent Regulation	9

The steam engines which drive these dynamos are cross compound Allis vertical engines, 46-in. high and 86-in. low pressue cylinders, and 60-in. stroke. They will develop 4,500 i. h. p. at the rated economical load, and will be able to work continuously at 6,000 h. p. if required, and for a short space of time they are to be able to work at 7,000 h. p. The crank shaft is of solid steel, bored and forged, with a hole 16 in. diameter the entire length, and it is 37 in. in diameter where the wheel and armature are located. The diameter of the shaft in the bearings is 34 in., and the length of the bearings 60 inches. The fly-wheel will have cast steel centers, and the rim will be built up of steel plates riveted together. The rim will weigh 225,000 lb., and the engine itself, complete, about 600 tons, and it is believed that as good results as 12½ lb. of steam per i. h. p. will be easily obtained. There will be several sub-stations in which will be located step-down transformers of 300 kw. each, which will lower the voltage from 6,600 volts to 350 volts. At this pressue the current will enter rotary converters of 900 kw. each, and will be delivered in the shape of a continuous current of 500 volts to the tramway system.

This company operates some 250 miles of tracks and carries approximately 250 million passengers every year.

The Third Avenue Road is now engaged in equipping all existing horse and cable lines with electric traction, and for this purpose has just given out a contract for a power station which will eventually contain 16 3,000-kw. generators. The generators will be very similar to those described above, and are being built by the Westinghouse Co., who are the sole contractors for the whole work. The engines will be Marine type, vertical, and are being built by the Westinghouse Machine Co. Sub-stations with rotary transferers will be used, as in the case of the Metropolitan system.

To give an idea of what may be done as regards power transmission the following few figures may be useful. The first attempts at this class of work were made during the Frankfort Exhibition of 1891, 300 h. p. being satisfactorily transmitted a distance of 106 miles with a pressure of 30,000 volts. Since that time electrical power transmission has largely increased, and the results obtained have been very satisfactory. 4,000 h. p. at the present moment are regularly transmitted a distance of 85 miles to the city of Sacramento, Cal., at a pressure of 30,000 volts, where they are transformed into low pressure three-phase and continuous current for lighting, power, and traction purposes. At Telluride, Utah, 1,000 h. p. are transmitted 55 miles at a pressure of 40,000 volts; 4,500 h. p. are transmitted a distance of 40 miles to Salt Lake City at a pressure of 15,000 volts; 1,400 h. p. are being transmitted 35 miles to Fresno, Cal., at a pressure of 11,000 volts; 2,000 h. p. are being transmitted 30 miles to West Kootenay, British Columbia, at a pressure of 20,000 volts; 10,000 h. p. are being transmitted from Niagara to Buffalo, a distance of 22 miles, at a pressure of 10,000 volts. All the plants are working and giving satisfaction, and have nothing experimental about them and there are hundreds more such.

In the designing and carrying out of a large system, there are three points which are frequently overlooked and which may cause a disastrous failure. These are good and adequate bonding; thoroughly good insulation, both mechanically and electrically; and trucks suited for the work for which they are intended.

As regards the bonding, the bonds used should be flexible, but, at the same time, should contain no solder or brazed joint, and they should be expanded against the side of holes drilled in the web or foot of the rail, and held in place by pins. Bonds of this description, when properly applied, can be absolutely relied upon, the contact resistance of the bond with the rail not being greater than the resistance of the solid bond.

With regard to the third rail insulators, very good results are obtained by using insulating bolts screwed into base plates which are fixed to the sleepers, cast iron chairs being fixed to the head of the bolts to hold the rails.

THE PHILADELPHIA EXPOSITION.

Among all he expositions to be held during the next few years, either in this country or abroad, there is none which appears to be of more importance and to possess such vital interest for the American manufacturer as the one to be opened in Philadelphia on September 14th and to continue until November 30th. This exposition will have for its main feature the development of American goods made expressly for export, and to emphasize the importance of the event, it is the intention to secure exhibits of foreign products to be placed side by side with those of American make, in order that manufacturers of the United States may readily see just what competition they must meet abroad as well as to show the peculiarties in the demand of the foreign market. This is the first exposition of this character ever held in this country. Its importance from the standpoint of comparison alone must at once be manifest to every American manufacturer, whether he be a locomotive or a snowplow maker or the maker of the smallest novelties imaginable. So long as the products may or can be exported they will be given a place in this great Philadelphia exposition of 1899.

This enterprise has received the sanction of the National Government, and Congress has appropriated the sum of $350,000 in its aid. Philadelphia has given $200,000 and the state of Pennsylvania $50,000. At least $100,000 will be raised by private subscription, and if the bill now pending in the State Legislature to increase the state's appropriation to $250,000 is passed, there will be a total exposition fund of $900,000.

This important enterprise will be under the joint auspices of the Philadelphia Commercial Museum and the Franklin Institute. Nearly every Board of Trade and Chamber of Commerce in the United States has signified its willingness to co-operate and will send delegates to the Commercial Congress to be held in October.

The main buildings are now under construction and will cover eight acres of ground. The space available for the exhibition of products will be at least 200,000 sq. ft. Adjacent to the exposition grounds proper and the main buildings there is a tract of 56 acres which can be used for the erection of detached structures for special exhibits. There will be particular attention given to the amusement features and it is intended to make them as unique and interesting as possible.

The exposition grounds are located on the Schuylkill River within 15 minutes' ride of the City Hall.

W. R. GARTON CO.

This month is the first anniversary of the W. R. Garton Co., manufacturers' agent, which has now headquatrers in the Manhattan Building, Chicago. This company started in business a year ago, and has been phenomenally successful from the beginnings. The facts that only the best of lines were accepted and that both W. R. Garton, the president and treasurer of the company, and Ray P. Lee, the secretary, are men with a thorough knowledge of their business, will easily account for the success achieved. The company represents some 16 different concerns, among them being the Electric Railway Equipment Co., of Cincinnati, which makes a specialty of line material, steel and wrought iron poles, brackets, motor supplies and parts, etc. It also represents the Garton-Daniels Electric Co., the Keystone Electrical Co. and the Morris Arc Lamp Co.

The Keystone Co. is well known and popular in the East, and the W. R. Garton Co. is making its product equally well-known in the West. The Morris Arc Lamp Co. makes a thoroughly up-to-date line of lamps, prominent among them are the alternating and direct current enclosed arcs.

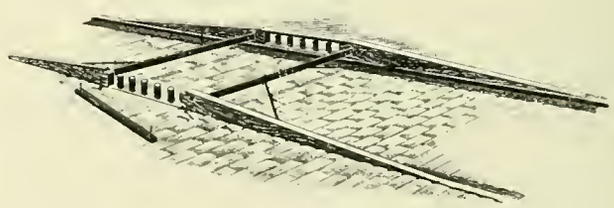
W. R. Garton is the inventor of the Garton lightning arrester, made by the Garton-Daniels Electric Co. Mr. Garton is also a stockholder in that company, and in the Raster Carbon Rheostat Co. He is from Iowa, and for over three years was manager of the railway department of the Central Electric Co. He has been identified with the electrical railway business for 15 years. He has been in Chicago for five years, and during that time has given his attention entirely to the commercial side of electrical matters.

Ray P. Lee, the secretary, is also from Iowa. He graduated from the electrical engineering department of the Iowa State University in 1894, and came to Chicago in 1895. He went into the company when it was organized in May, 1898.

The company also acts as consulting engineer, and in this branch of the business has met with the same success it has as a selling agent.

HOSE BRIDGE.

The Ohio Brass Co., of Mansfield, O., has in its emergency hose bridge a device which can hardly fail to appeal to every street car manager in the country. As the name suggests it is a contrivance to prevent the stoppage of cars in case of fire, where the firemen lay hose lines across the tracks. The accompanying illustration clearly shows the working of the device. The bridge is formed of two parallel trusses 16 ft. long, fastened together by two double hinged joints. When opened, the joints form a cross bar and become a rigid connection between the two trusses. The trusses are flat on the bottom and rest on top of the rail and are held in place by lugs. These lugs are made to fit either a T, a flat, or a



HOSE BRIDGE.

grooved rail. There are no fine adjustments to make and the bridge can be placed in position in 30 seconds.

This emergency hose bridge is no experiment as it has stood the test of practical service and proved entirely satisfactory wherever used. The total weight of the bridge is about 147 lb. and it can be contracted to a width of 9 in. Four of the bridges can be easily carried on the ordinary repair or tower wagon. There are six hose pockets each 4 in. square. The partitions are steel bolts, the lower ends being riveted to the bottom rail, and they form a support for the removable piece of the top rail. The bolts are covered with spindles of hard wood. The rail at the highest point, in the center, is only 5½ in. high.

The bridges have been used for more than two years by different roads and none has yet found the least fault with them. On the contrary the Ohio Brass Co. is able to furnish some exceedingly flattering and strong testimonials from companies that have used them.

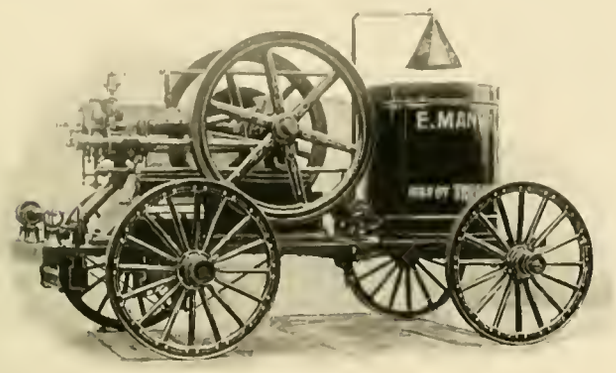
SALE OF TERRE HAUTE ROAD.

The Terre Haute (Ind.) Street Ry. has been purchased by Stone & Webster, of Boston. This firm held an option on the first and second mortgage bonds, and closed on May 5th. The firm took $450,000 worth of first mortgage bonds at face value, and about $300,000 out of $600,000 second mortgage at about a third their face. The property will be improved and be operated by the new owners.

New York city has her surface road trouble just like common cities. A broken stand on the Third avenue line caused a tie-up of 13 hours not long ago.

FALK COMPANY'S FOREIGN WORK.

Buenos Ayres seems as far away as Milolos, and the average street railway man would hardly expect to find the street railway interests of that city not only up to date, but even taking the lead over some of our American cities. However, the street railway interests there are very progressive, and determined that the company shall have the very best to be obtained. In order to perfect its track

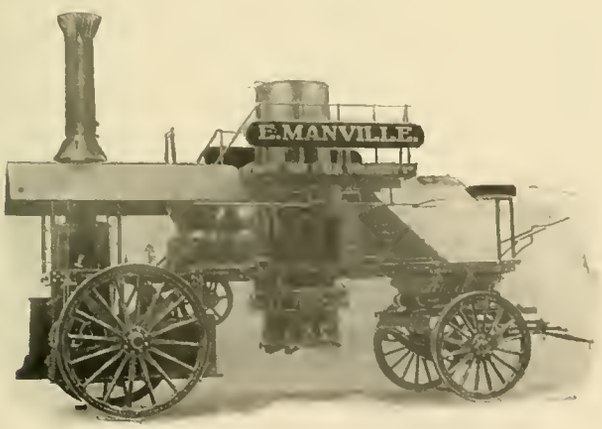


ENGINE.

construction it recently, at considerable expense, sent engineers to study the method of cast welding as introduced by the Falk Company, and the result, as might have been expected, was a decision to adopt the Falk cast-weld joint on all its lines.

To carry out its order speedily and in first-class manner the Falk Company built a special welding outfit which has been constructed in three machines, and equipped with air compressors and all the latest and best appliances for making the castings. Our illustrations in themselves give a good idea of this extremely interesting and complete portable foundry plant.

In its home work the company is busy, and at present is engaged in filling important contracts in Kansas City, for the Metropolitan road, and is also welding the interurban line from Oshkosh to



CUPOLA.

Neenah, Wis. Other welding contracts to be done this season include work in Washington, Hoboken and Canton, in addition to work in New York City which will require three welding outfits.

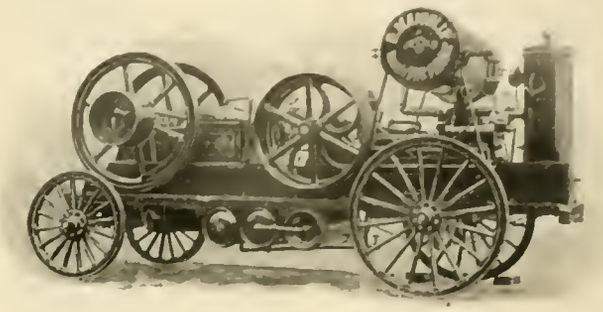
In its department of special work, and gears and pinions, the plant is extremely busy and has been running night and day for some time past.

The directors of the Union Traction Co., Philadelphia, Pa., have ordered a reduction of fare to Willow Grove by way of the Old York road. The reduction is from 15 to 10 cents.

Only one franchise is left in the city of Albany, N. Y., for street car companies, and the Municipal Street Railway Co. lately incorporated with a capital stock of $250,000, has bid for it on the basis of giving a 3-cent fare.

CHICAGO ELECTRICAL EXPOSITION.

The National Exposition of Electric Arts has been incorporated in Illinois with an authorized capital of $50,000. The officers are N. J. Heinbach, president; T. Carrabine, secretary, and W. E. Burnham, treasurer and manager. The company plans to hold an Electrical Exposition in Chicago this fall, at Tattersalls, to open on September 25th and close on October 9th. This exposition will, in a way, be an introduction to the annual convention of the American



AIR COMPRESSOR.

Street Railway Associations, which convenes in Chicago October 17th.

It is the hope to make the electrical exposition very complete, particular attention to be paid to the adaptability of electricity for household purposes. An effort will be made to give displays of writers' telegraphy and to demonstrate the uses of liquid air, the Nernst Electrolitic lamp and the X-ray phenomena.

The exhibition will be one of popular interest, and it is hoped the general public will attend in large numbers. Already a large number of concerns have applied for space.

ELECTRIC RAILWAYS IN GERMANY.

Mr. W. K. Anderson, U. S. consul at Hanover, reports the following statistics on electric railways in Germany:

Up to the end of the year 1891 the number of cities in the German Empire enjoying the advantages of electric street railways was 31; up to the end of 1892, 5; 1893, 11; 1894, 19; 1895, 32; 1896, 44; 1897, 61; and on Sept. 1, 1898, no less than 68. In 35 other cities or districts, railways are in the course of construction or finally determined upon. The entire length of electric lines in operation in Germany on Sept. 1, 1898, was 888 miles, and the total trackage was 1,205 miles. The number of motor cars was 3,190 and the number of trailers 2,128. The length of the new lines in course of construction or about to be begun at that date was 677 miles, and their total trackage 830 miles.

Most of the large industrial cities in Westphalia and the Rhine Province are connected by a network of electric roads, which serve not only for passengers, but for freight traffic.

"NO SEAT, NO FARE," NO GOOD.

One of the cases tried in the Chicago courts last month in which the city was the plaintiff and the West Chicago Street R. R. the defendent, and the cause "No seat, no fare," was decided in favor of the company. The crowding of the cars was clearly shown, and readily admitted by the counsel for the company. But the company proceeded to prove that this was not by any means its fault Counsel said it was the fault of the city itself in not permitting the use of electricity where the cable is now in operation and because it refused to grant more street franchises. Attorney Donahue, for the railway company, introduced a communication from Mr. Yerkes to the city council in which he stated he could not relieve the congestion on his lines until he was given these privileges. The company says the whole blame is on the ordinances which limit the size of the trains, the demands for safety which prevent running them closer together and the lack of privileges from the city.

REPORT OF MASSACHUSETTS STREET RAILWAYS.

The Massachusetts Railroad Commissioners' report giving the returns for 1898 shows that 103 companies reported—10 more than in 1897. At the end of the year 79 of these 103 companies were operating their railways; the lines of 13 companies were operated by other companies under lease or contract; six companies had organized and paid in a portion of their capital stock, but had not begun to build; and five companies had been consolidated with another during the year.

During the year 123.28 miles of main line, 1.03 miles of second main track, and 3.71 miles of side track, making 128.02 miles reckoned as single track, have been added to the street railway mileage reported; all of this was newly built. This makes the total mileage 1,644.66 miles, all of this except 21.71 miles, which are in Rhode Island, are in Massachusetts. Of the total, 13.15 miles were operated by horse and cable, and 7.50 by horse power only.

The average cost per mile of main track (including cost, but not length of side track) is shown by the books of the companies to be $22,537 for construction, $8,957 for equipment, and $11,735 for lands, buildings (including power plants) and other property—making the total $43,229 per mile of main track. These figures furnish but little clew to the cost of any particular railway which ranges from $10,000 in a country town to $97,000 in Boston and $111,000 for the Mt. Tom road.

The average capital investment per mile in 1898 was $44,958; the average for the last 10 years is $45,070. For the 10 companies that carry over 3,775,000 passengers a year, the average capital investment is $66,239 per mile; of these the lowest is $27,951 for the Holyoke Co., and the highest $103,658 for the West End, of Boston.

The gross assets were, $77,607,326, and the gross liabilities $75,889,625 leaving for surplus and special funds $1,023,320 which is an increase in the surplus of $691,199 as compared with 1897. The surplus for 1898 was 4.41 per cent of the capital; the average for 10 years is 3.42 per cent of the capital.

The gross earnings were 18,247,246, and the expense of operation $11,692,731; other expenditures were $6,096,736, leaving $457,769 for the surplus accounts.

The total amount of cash dividends declared last year was $2,076,233, an increase of $110,990 over the previous year. Eleven companies paid 8 per cent; 1 paid 8 per cent on preferred and 7.5 per cent on common stock; 1 paid 7 per cent; 1 paid 6¼ per cent; 19 paid 6 per cent; 4 paid 5 per cent; 1 paid 4.5 per cent; 3 paid 3 per cent; 1 paid 2.5 per cent; 1 paid 2¼ per cent, and 54 companies, new and old, paid no dividends.

The amount of dividend-paying capital was $33,649,950, of which

Capital Stock, Net Income and Dividends, 1889–1898.

YEARS.	Capital Stock.	Net Divisible Income.	Cash Dividends Declared	Percentage on Total Capital Stock.
1889,	$12,290,740	$1,025,758	$838,649	6.82
1890,	14,879,130	1,430,116	963,154	6.47
1891,	19,553,952	1,299,153	1,100,015	5.63
1892,	23,590,536	1,905,680	1,582,697	6.71
1893,	25,883,575	1,993,399	1,716,637	6.63
1894,	26,971,275	1,812,668	1,610,886	5.97
1895,	27,906,685	2,257,355	1,606,196	5.76
1896,	30,727,818	2,280,776	1,802,847	5.87
1897,	32,670,273	2,593,147	1,965,243	6.02
1898,	38,933,917	2,534,002	2,076,233	5.33
Averages,	$25,340,790	$1,913,205	$1,526,256	6.02

Gross and Net Earnings from Operation per Mile of Main Track Owned and per Round Trip Run, 1889–1898.

YEARS.	Average per Mile of Track.			Average per Round Trip.		
	Gross Earnings.	Expenses of Operation.	Net Earnings.	Gross Earnings.	Expenses of Operation.	Net Earnings.
1889,	$13,103	$10,274	$2,829	$2 18	$1 71	$0 47
1890,	13,632	10,197	3,435	2 22	1 66	0 56
1891,	13,178	10,032	3,146	2 24	1 70	0 54
1892,	12,980	9,312	3,668	2 35	1 69	0 66
1893,	12,392	8,582	3,810	2 41	1 67	0 74
1894,	11,972	8,321	3,651	2 39	1 66	0 73
1895,	12,127	8,359	3,768	2 55	1 75	0 80
1896,	11,627	8,274	3,353	2 47	1 76	0 71
1897,	11,187	7,713	3,474	2 41	1 66	0 75
1898,	10,998	7,589	3,409	2 45	1 69	0 76
Averages,	$12,058	8,575	3,483	2 39	1 70	0 69

Gross and Net Earnings from Operation per Car Mile Run and per Passenger Carried, 1889–1898.

YEARS.	Average per Car Mile.			Average per Passenger.		
	Gross Earnings.	Expenses of Operation.	Net Earnings.	Gross Earnings.	Expenses of Operation.	Net Earnings.
	Cents.	Cents.	Cents.	Cents.	Cents.	Cents.
1889,	30.98	25.71	5.27	5.07	3.98	1.09
1890,	31.48	23.87	7.61	5.06	3.79	1.27
1891,	32.03	24.38	7.65	5.03	3.83	1.20
1892,	33.01	23.69	9.32	5.05	3.62	1.43
1893,	31.39	21.74	9.65	5.07	3.51	1.56
1894,	30.28	21.05	9.23	5.04	3.50	1.54
1895,	30.20	20.82	9.38	5.07	3.50	1.57
1896,	27.69	19.70	7.99	5.08	3.61	1.47
1897,	25.68	17.71	7.97	5.12	3.53	1.59
1898,	24.80	17.11	7.69	5.11	3.52	1.59
Averages,	28.85	20.52	8.33	5.08	3.61	1.47

Percentage of Operating Expenses to Gross Earnings, 1889–1898.

YEARS	Gross Earnings from Operation.	Operating Expenses.	Percentage of Expenses to Earnings.	Net Earnings.
1889,	$7,523,575	$5,898,804	78.40	$1,624,771
1890,	8,318,285	6,244,208	74.80	2,104,077
1891,	8,861,841	6,746,304	76.13	2,115,537
1892,	9,798,060	7,029,479	71.71	2,768,581
1893,	10,832,174	7,501,845	69.26	3,330,329
1894,	11,119,846	7,729,059	69.51	3,390,787
1895,	13,184,342	9,088,086	68.93	4,096,256
1896,	14,844,262	10,563,371	71.16	4,280,891
1897,	15,815,267	10,904,040	68.95	4,911,227
1898,	16,915,405	11,672,731	69.01	5,242,674
Averages,	$11,724,306	8,337,793	71.12	3,386,513

Operating Expenses and Net Earnings (Ten Railways) in 1898.

RAILWAYS.	Percentage of Operating Expenses to Gross Earnings.	Net Earnings per			
		Mile of Track Operated.	Round Trip Run.	Car Mile Run.	Passenger Carried.
				Cents.	Cents.
Brockton,	63.21	$2,851	$0 70	8.45	1.82
Globe (Fall River),	62.62	4,091	62	9.29	1.79
Holyoke,	67.41	2,440	59	6.73	1.76
Lowell, Lawrence & Haverhill,	56.51	3,036	1 15	11.30	2.19
Lowell & Suburban,	61.39	2,311	60	7.72	1.95
Lynn & Boston,	57.66	4,085	1 15	10.84	2.17
Springfield,	73.80	2,478	48	4.87	1.31
Union (New Bedford, etc.),	64.00	3,718	46	9.28	1.96
West End (Boston, etc.),	71.54	9,386	83	8.11	1.44
Worcester Consolidated,	73.30	3,435	43	6.77	1.85
Averages,	68.83	$5,424	$0 79	8.29	1.58

Comparative Increase of Railway Mileage and Volume of Traffic.

YEARS.	Railway Mileage	Increase	Per Cent.	Passengers Carried.	Increase.	Per Cent.
1892, . . .	755	–	–	191,171,912	–	–
1893, . . .	874	119	16	213,552,009	19,380,067	10
1894, . . .	929	55	6	220,464,099	6,912,090	3
1895, . . .	1,078	149	16	259,794,308	39,330,209	18
1896, . . .	1,277	199	18	292,358,943	32,564,635	13
1897. . . .	1,414	137	11	308,684,224	16,325,281	6
1898, . . .	1,538	121	9	330,889,629	22,205,405	7
Totals, .	–	783	101	–	136,717,687	70

the average rate was 6.17 per cent as against 6.91 for the previous year. The non-dividend paying capital was $5,283,967. Including this last the average rate for the state was 5.33 per cent, as against 6.02 for 1897. As seen from the table, which gives the dividends for the last 10 years, this is the lowest rate for the decade.

The total number of passengers carried during the year ending Sept. 30, 1898, was 330,889,629, an increase of 6.7 per cent over the previous year; the car miles run were 68,206,418, an increase of 9.7 per cent; the round trips were 6,887,976, an increase of 4.8 per cent; the average passengers per round trip were 48, as against 47 the previous year. Of the ten large roads the Union, of New Bedford, had the lowest number of passengers per round trip, 24; and the West End road the highest, 58; the average for the 10 roads was 50.

The tables give interesting data as to the percentage of operating expenses to gross earnings for the last 10 years, the operating expenses and net earnings of the 10 large companies for 1898, and the gross and net earnings per mile of main track owned, per round trip, per car-mile, and per passenger.

BUFFALO, HAMBURG & AURORA ROAD.

The Buffalo, Hamburg & Aurora Railway Co., Buffalo, N. Y., A. J. Benzing, president, and U. L. Upson, manager, is building 21 miles of new track between Buffalo, Hamburg and Aurora, and expects to complete the work this fall. The company will buy six new cars, straight sides, cross seats, center aisle, with capacity for 44 people. It has a car barn capable of holding 15 cars and a power house with a capacity of 1,400 h. p.

The road is being built by the Continental Construction Co., of Boston, Mass. The track is to be laid with 86-lb. girder rails through the villages, and a 60-lb. T-rails through the country. The cars are to be equipped with motors wound for a speed of 48 miles per hour. The work on this road was begun April 17th, and the contract provides that 13 miles shall be completed by August 1st.

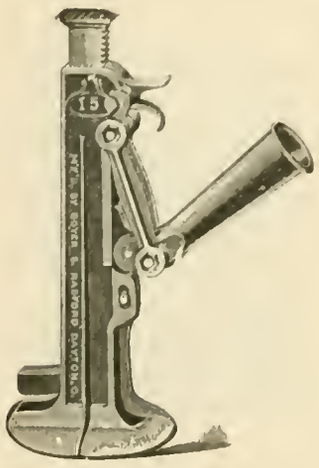
ARE THE CARS OVERCROWDED.

The Montreal Street Railway Co. is engaged in a controversy with the city as to the legal capacity of its cars; the difficulty is of long standing, but the city has only recently started to persecute the company. In January, 1894, the city surveyor prepared cards giving the number of the car, the number of passengers allowed inside and the number outside, and concluding with the sentence: "No one allowed on the front platform and side steps." The company objected to this last statement as not in accordance with the city by-law, and in May, 1894, posted similar capacity cards without the front platform and side step rule. These were only carried for a few days, however, and the matter has been permitted to rest until recently, when the city's representatives began preparations to prosecute the company for overcrowding its cars.

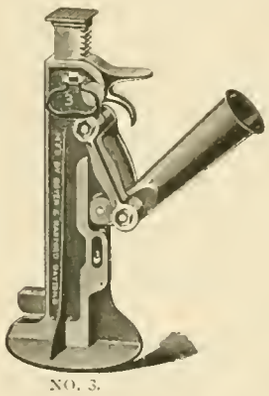
The pavilion at Cayuga Lake near Seneca Falls, N. Y., on the line of the Geneva, Waterloo, Seneca Falls & Cayuga Lake Traction Co., was destroyed by fire on April 18th. Manager W. C. Gray estimates the loss at $1,000, all of which falls on the insurance companies.

MAXON LIFTING JACKS.

Messrs. Boyer & Radford, of Dayton, O., makers of railway supplies, have for a leading specialty the Maxon patent lever and ratchet screw lifting jacks, of which we illustrate three types particularly designed for electric railways. No. 3 is a general purpose jack, well suited for replacing derailed cars, and may be used in track work work also; it is 19 in. high and has a lift of 11 in.; it weighs 60 lb., and has a capacity of 8 tons. No. 20 is a drop track jack with a capacity of 10 tons and a rise of 11¼ in.; the weight is 50 lb. This jack was designed by a practical roadmaster, and has been tested in every way with the most perfect satisfaction. No. 15 is for car barn service; it is 28 in. high, with a rise of 15 in.; the jack weighs 115 lb., and has a capacity of 15 tons. In this size the ratchet bar is reinforced the full length by a 1-in. bolt, to which the head is screwed, thus giving the bar more strength and rigidity.



No. 15.


No. 3.

No. 20.

The Boyer & Radford jacks are widely used, and the firm has received a number of very strong testimonials from companies using them.

NEW OFFICIALS AT INDIANAPOLIS.

Under the reorganization of the Indianapolis Street Ry. the new officers are as follows:

President—Hiram P. Wasson.
Vice-president and general manager—H. J. McGowan.
Second vice-president—Joseph S. Neff.
Secretary—Henry Jameson.
Treasurer—J. A. Lemcke.
Assistant secretary—C. Eldridge Morgan.

Counsel in Indianapolis are Ferdinand Winter and Chambers, Pickens & Moores. Counsel in Philadelphia are William Jay Turner and the firm of Jones & Carson.

LAWLESSNESS IN SYRACUSE, N. Y.

On April 21st, a mob of the citizens of Syracuse, N. Y., with the avowed approval of the mayor, tore up half a mile of the track of the Syracuse Rapid Transit Street Railway Co., stoning the cars which the company attempted to run in the street to protect its tracks. The reason alleged for this lawless action was that the track had been laid with T-rails in violation of the ordinance granting the franchise. Even were this true it would not justify mob law.

PERSONAL.

MR. L. P. BENNETT, of the Ohio Brass Co., Mansfield, O., was a visitor at our office recently on his way west.

MR. T. C. WHITE, of the Central Union Brass Co., Boston, was a caller at our office during his visit to Chicago, last week.

MR. C. K. KING, general manager of the Ohio Brass Co., Mansfield, O., was a caller a few days ago while on a Chicago trip.

MR. E. E. DOWNS, manager of the Citizens' Traction Co. of Oskosh, Wis., was last month called to Boston because of the death of his father, Loren Downs.

MR. ERNEST WOODRUFF was elected president of the Atlanta Railway Co., which is believed to be a step toward consolidation of the local lines.

MR. E. F. WICKWIRE, representing the Sterling Supply & Manufacturing Co., New York, will look after the western territory, and is rapidly making friends and acquaintances here.

MR. A. G. DAVIDS, superintendent of the Schuylkill Valley Traction Co., has been advanced to the position of general manager to fill the vacancy caused by the resignation of Mr. R. M. Douglass.

MR. A. L. WILKINSON, the genial representative of the Ohio Brass Co., of Mansfield, O., was recently married to Miss Laura Abraham, of Bryan, O. The wedding took place at the home of the bride.

MR. JOHN OLIPHANT is successfully representing the Ingersoll-Sargent Drill Co., and has charge of the Cleveland office. He will be remembered as superitendent of the Calumet Electric a few years ago.

MR. F. E. FISHER, who recently resigned as general passenger and freight agent of the Ohio Southern Ry. at Springfield, O., has been appointed to succeed the late Mr. Rush as superintendent of the Joliet (Ill.) Street Ry.

MR. JAMES R. LEDYARD, of Covington, Ky., has been appointed superintendent of the South Covington & Cincinnati Street Railway Co., to succeed Mr. T. M. Jenkins, resigned. The appointment took effect May 15th.

MR. Z. T. HERNDON, of Akron, O., who has been chief engineer of the Detroit & Lima Northern Railroad, has resigned to take a similar position on an electric line now being built between Kansas City and Leavenworth, Mo.

MR. HARVEY R. BOWEN has been appointed chief engineer of the Utica (N. Y.) Street Railway Co. Mr. Bowen has been holding a similar position with the Binghamton Railroad Co. He is now in Utica and will make that place his residence.

MR. ROBERT C. TAYLOR has been appointed chief engineer of the Twin City Rapid Transit Co. He fills the vacancy caused by the death of Wm. Kewely. Mr. Taylor has for several years been construction engineer for the Robinson & Carey Co., of St. Paul.

MR. M. B. RICHARDSON, of Oswego, N. Y., recently purchased at foreclosure sale the Lake Ontario & Riverside Ry., of that city. When the new company has been organized it will include Mr. Shepard, who will, it is said, have full control of the road.

MR. R. M. DOUGLASS has accepted the position of general superintendent of transportation of the Cleveland Electric Railway Co. He has been until recently general manager of the Schuylkill Valley Traction Co., of Norristown, Pa. Mr. Douglass has been in the street car business for about five years and has shown great aptitude for it. His first work was on the Syracuse & East Side Street Ry. He next became superintendent of the Brooklyn Heights Co. and left them to take the management of the Norristown road.

HON. W. S. FORMAN, of East St. Louis, Ill., was elected president and general manager of the St. Louis, Belleville & Suburban Electric Railroad Co. on April 28th. The new president contemplates some extensive improvements on the line, fenders being included in the list.

MR. LEONARD UNDERWOOD, who has been chief clerk to Gen. Supt. W. S. Dimmock, of the Omaha & Concil Bluffs Railway & Bridge Co. for the past year, has resigned to become private secretary to Congressman Geo. H. Burke, of Pierre, S. D., and will be located in Washington a part of his time.

MR. E. C. LONG, secretary of the Peckham Truck Co., was on April 26th married to Miss Cora Alice Phillips, of Poughkeepsie, N. Y. Miss Phillips was a favorite in Poughkeepsie society and the ceremony at the church and the reception afterward were brilliant functions, at which were present many out-of-town friends.

MR. IRA M. LUDINGTON has resigned the superintendency of the Rochester (N.Y.) & Irondequoit railway system. Mr. Ludington has for many years been identified with steam and electric roads in Rochester and only resigns now to give his full time to private interests. It is expected that Chas. L. Williams will succeed him as superintendent and assume the title of secretary and auditor as well.

MR. W. F. HAM, well known to our readers as one of the organizers of the Street Railway Accountants' association, has been made auditor of the entire Brooklyn Rapid Transit system. Mr. Ham was formerly secretary of the Nassau Electric Railway Co. He has entered upon his new duties. Mr. Ham has made street railway accounts his particular study and is recognized as an expert.

MR. JAMES RALEY CRAVATH, of Chicago, was married to Miss Ruth Myra Rew at the residence of the bride's mother, Mrs. Clara E. Rew, in Grinnell, Ia., on Wednesday, April 19th. Mr. Cravath was for several years electrical editor of the "Street Railway Review," and is at present with the Coleman Laboratory of Electrical Engineering as engineer. The newly married couple announce themselves "at home" after June 1st, at 5519 Monroe Ave., Chicago.

MR. WILLARD R. KIMBALL has resigned the vice-presidency of the Syracuse (N. Y.) Rapid Transit Railway Co. Mr. Kimball has for some time past been the controlling element of this corporation, but there has lately been a division among the directors and the anti-Kimball faction held the reins. A new executive committee has been formed and Mr. Kimball has accepted a position in that body. The company has decided to spend $350,000 in improvements on the road.

MR. H. A. REEVES, western representative of the H. W. Johns Manufacturing Co., of New York, returned to Chicago from California on Saturday, May 6th, in excellent health. Mr. Reeves left home sometime last December, a very sick man. He went direct to California, and though he spent the greater part of his time in the southern portion of the state, he has in various jaunts covered nearly every portion of it. He expresses himself as delighted with the country and the climate.

MR. S. FUJITA, a representative of the City Railway Co., of Tokio, Japan, was in Chicago recently. He has been visiting the larger cities of the United States making a study of the street railway system, particularly as regards motive power. He says the people of Tokio object to the overhead trolley on account of the narrow streets and that the underground system is too expensive and dangerous. He believes in the Hoadley-Knight air motor and expects to adopt it at home.

MR. W. M. BROWN, master mechanic of the Twin City Rapid Transit Co., was a caller at the "Review" office when in Chicago recently.

MR. ALEXANDER E. ORR has resigned the presidency of the Board of Rapid Transit Commissioners for New York City, a position he has occupied since 1894.

MR. FRANK X. CICOTT died recently in Detroit, Mich., at the home of his sister. A few months ago he returned from a foreign tour, having gone abroad to look into the chances for the investment of American and European money in tramway enterprises in other countries. He has contributed a number of articles to the press on the subject of tramways. Mr. Cicott was at one time director of the United States mint at San Francisco, Cal., and by reason of his extensive travels among street railway men in this country and abroad has secured an unusually large and pleasant acquaintance.

ELECTIONS.

THE NASSAU ELECTRIC RAILWAY CO., of Brooklyn N. Y., held an election for directors on April 11th. Col. T. F. Williams, Anthony N. Brady and Clinton L. Rossiter were chosen. The old directors did not favor the consolidation of the Nassau and the Rapid Transit systems and the newly elected ones do.

THE UNITED POWER & TRACTION CO., incorporated at Trenton, N. J., elected officers on April 24th. The following directors were chosen: Robt. N. Carson, Philadelphia; Jno. A. Rigg, Reading; T. C. Barr, Orange, N. J.; E. J. Moore, Theo. A. Royal, R. Nelson Buckley, Samuel F. Houston, Samuel Moore, and John T. Windrim, of Philadelphia; Richmond L. Jones and James A. O'Reilly, Reading; Samuel P. Light, Lebanon; Geo. H. B. Martin and F. R. Hansel, Camden, N. J. The board elected John A. Rigg, president; R. N. Carson, vice-president; E. J. Moore, secretary and treasurer, and Richmond L. Jones, general counsel. The new company has acquired control through purchase of stocks of the United Traction Co. of Reading, the Lebanon Valley Street Railway Co. and the Roxborough, Chestnut Hill & Norristown Railway Co.

NEW PUBLICATION.

STEAM ENGINE INDICATOR. Under this title the Power Publishing Co., World Building, New York, has published a book of over 200 pages on directions for the selection, care and use of steam engine indicators and the analysis and computation of indicator diagrams. The text has been largely compiled from the regular editions of Power and edited by Mr. F. R. Low, the able editor of that paper. Large additions have been made, however, and particularly in the matter of tables of convenient constants, of the properties of steam, hyperbolic logarithms, etc. A very useful diagram is a family of hyperbolas, printed on tracing cloth, with the position of the atmospheric line indicated for the usual spring scales, so that the expansion line of a diagram may be compared with theoretical line by slipping the card under the tracing cloth; the hyperbola may be transferred to the card by pricking through with a fine needle-point.

We recommend this book to all persons who seek information on the important subject of which it treats—the selection, use and care of indicators, and the computation and interpretation of diagrams, as a valuable work; we have already had occasion to make frequent references to it, and in every instance have found the desired information well and clearly put. Possibly those who have doubts experience in measuring the clearance of engines will have doubts as to whether the methods described will work as well in practice as on paper. It is to be regretted that the publishers did not cause more care to be exercised in the proof reading, and thus have prevented the numerous typographical errors and defective spacings which mar its appearance; these minor defects will doubtless be remedied in future editions, and should not blind one to the value of the book.

The price of this book is $1.50.

DEATH OF C. C. RUSH.

Mr. Clinton C. Rush, superintendent of the Joliet (Ill.) Street Ry., was struck by a Chicago & Alton passenger train at Lemont on May 3rd, and died two hours after from his injuries.

Mr. Rush had left Joliet early in the morning with the purpose of looking over the ground for the proposed extension of his road from Lockport to Lemont and Willow Springs. He had finished his inspection and was hurrying along the Chicago & Alton tracks toward the depot to catch the train due there at 10:50 a. m. In attempting to dodge an empty bucket left between the tracks by some workmen, Mr. Rush jumped directly in front of the on-coming engine, thinking probably he was getting on the clear track. The engine struck him full in the back and knocked him some distance. He was taken on board the train and carried to Joliet, where shortly after noon he died at St. Joseph's hospital.

C. C. RUSH.

Clinton C. Rush was popular in Joliet and much beloved by every officer and employe of the company by which he was employed. He had been connected with the street railway business nearly all his life. Still a young man, only 35 years of age, he had been in charge of the Champaign, Ill., system and had held the position of superintendent in Bay City, Mich., in Quincy, Ill., and latterly, through Mr. McKinley, secretary of the Joliet road, he was appointed superintendent of that system. He was a thoroughly efficient man. Though he had been in Joliet but comparatively a short time he had made a host of friends among the citizens and the employes of the road esteemed him highly.

Mr. Rush was born Sept. 10, 1864, in Champaign, and his remains were taken there for burial.

COMPRESSED AIR FOR NORTH CHICAGO.

The North Chicago Street Railroad Co. has for some time been desirous of improving its all-night service on the cable lines and is now making a trial of compressed air motor cars with the intention of using them for its owl cars and thus entirely supplant horses.

The Compressed Air Motor Co., of Illinois, in which the American Air Power Co., of New York, is a stockholder, is furnishing the apparatus for the test. The company has installed a compressing and storage plant in the North Clark St. power house of the North Chicago R. R. and provided an air motor car of the same type as those which have been in successful operation on 125th St. in New York City for over a year. This car had its reservoir charged with air before being shipped and when it arrived in Chicago it was run to the car house under its own power.

The machinery here was installed under the direction of Robert Hardie, who is well known as an authority on all that concerns air as a motive power. The work was done by the Fraser & Chalmers Manufacturing Co.

The experiments are being made on the North Clark St. line. The car starts from the "Limits" barns and runs over the cable track to the City Hall, but stops at the power house to be charged with air in order to demonstrate fully the practical workings of the system. The arrangements for charging are of course only temporary. The car used is 28 ft. long, with side seats; it weighs 18,200 lb. In these experiments it is charged to run 10 miles, but can be given air sufficient to run 25 miles and haul a trailer.

The offices of the Compressed Air Motor Co., of Illinois, are in the Monadnock Building and the officers are Henry D. Cooke, president; Alex. C. Soper, treasurer, and Robert Hardie, engineer. The directors are Messrs. Cooke and Soper and W. J. Chalmers, W. E. Selleck and W. Penn Smith.

REMOVAL OF THE STREET RAILWAY JOURNAL.

The New York office of the Street Railway Journal has been removed from 29 Cortlandt St. to 120 Liberty St. The new office is in the heart of the electric district in the lower end of the city where it is convenient to the Sixth and Ninth Avenue elevated roads, the surface lines and the ferries. The new offices are in the Beard Building, where the company occupies the entire half of the eleventh floor. A cordial invitation is extended to all its friends and patrons by the Journal to pay it a visit in its new quarters.

DINNER TO RICHARD McCULLOCH.

The friends of Mr. Richard McCulloch, of St. Louis, Mo., well-known to street railway men as engineer of the National Railway lines in St. Louis, gave him a farewell banquet at the Planter's Hotel, St. Louis, on Thursday evening, May 11th. The occasion was the departure of Mr. McCulloch for Geneva, Switzerland, where he has accepted a position with an electric street railway company.

RICHARD McCULLOCH.

The banquet was an extremely happy affair, the menu all that could be desired, and the menu card handsomely and appropriately designed. On the front cover was a fine portrait of the guest of honor, and at the bottom of each page were illustrations in tint of street cars, steamboats, railroad trains in which means of transportation electricity plays so great a part.

As special guests there were present Mr. and Mrs. Robert McCulloch and the Misses Roberta and Grace McCulloch. The friends tendering the banquet numbered 82, among them being Mr. and Mrs. C. N. Duffy, Mr. and Mrs. W. J. Orthwein, Mr. and Mrs. Arthur S. Partridge, Mr. and Mrs. Corwin H. Spencer, Mr. and Mrs. Frederick B. Brownell and Mr. D. G. Hamilton.

Mr. Richard McCulloch was born in St. Louis County in 1869. He was educated in the St. Louis public school, and in the Washington University of that city. At the latter institution he took the degree of mining engineer in 1891. Very early he became interested in street railway work, and much of his study while in college was in that direction. During his vacations he obtained practical experience on the St. Louis lines. He has filled positions in every department of street car work.

Mr. McCulloch was a member of the United States Geological Survey in Missouri, Arkansas, Indian Territory, Colorado and Montana, and in 1892 was connected with the Mexican National Smelting Co. In 1893 he took an expert course in the shops of the General Electric Co. at Schenectady. In the same year he was appointed engineer of the Cass Avenue & Fair Grounds Ry., St. Louis, and later became the civil and electrical engineer for the management of the National lines. In 1896 and in 1898 Mr. McCulloch presented reports to the American Street Railway Association.

COLOGNE TRAMWAYS IN 1898.

By the courtesy of the Cologne (Germany) Street Railway Co. we have received a copy of the annual report for 1898. This company has 62.8 km. of track, and owned Dec. 31, 1898, 696 horses, 117 open cars and 203 closed cars. During the year 5,317,006 car-km. (3,335,444 car-miles); the expense being 11.37 cents per car-mile; the receipts were 19 cents per car-mile. In round numbers the receipts for 1898 were $632,600 as against $559,000 for 1897.

The Sycamore Street Railway Co., of Pittsburg, Pa., has asked for a franchise to construct a road up Mt. Washington hill. There is a 15-per cent grade and it has been decided to use the "rack" system, such as is in operation on Pikes Peak in Colorado and on other mountain railways. Electricity is to be the motive power.

HALF FARES.

The Brooklyn Rapid Transit Co., has arranged with other Brooklyn lines for a system of transfers which will be of great benefit to the public.

There has been some friction between the Des Moines City Railway Co. and the Government over the mail service, but matters have been satisfactorily adjusted.

There is much earnest talk of a trunk trolley line from Detroit to Port Huron, Mich. If the project is carried out it will be the longest line of its kind in existence.

The Wichita (Kas.) city council has declared the $10,000 deposited with the city by the Church Street Railway Co., as forfeited, as the road was not completed by April 1st.

During the summer and fall the Omaha Street Railway Co. will rebuild about six miles of double track using 73-lb. 7-in. girder rails. Some of this is now under construction.

The Minneapolis Street Railway Co. has declared its determination not to continue the mail service at the price now paid by the Government. The existing contract expires July 1, 1899.

The Wisconsin Legislature has a bill before it providing for the conviction of persons guilty of fraudulently using transfer tickets. The Milwaukee road states that it loses heavily every year by the practice.

The Market Street Railway Co., of San Francisco, has moved its offices from 532 Market St., to the Wells, Fargo & Co. Express Building, 49 Second St. The new location gives the company pleasant and convenient offices.

The trailer system has been abandoned on the Joplin (Mo.) Electric Ry. The cars which have been used as trailers have been equipped with motors taken from the big cars and new ones put in place of those removed.

March 6th the city council of Des Moines, Ia., passed what is called the 7-ft. ordinance providing that hereafter street railway companies shall have pave the street for 7 ft. on each side of their tracks in all street occupied.

The Consolidated Street Railway Co., of Grand Rapids, Mich., has for the second time within a few months raised the wages of its men. The pay is now 15½ cents an hour. Good times and good business is said to be the cause of the increase.

The Columbus (O.) Street Railway Co., learning that the benefit fund of the Columbus Street Street Railway Employes' Beneficial Association was running low on account of extra sickness among members, has given the association a check for $500.

Conductors and motormen on the "White Line" running from Hoboken to Patterson, N. J., quit work April 19th. This is an electric line operated by the New Jersey Street Railway Co. Some change in the trip system was the cause of the strike.

According to a recent decision of the attorney general of New York the Manhattan Elevated Railway Co. is declared the road to be a "railroad" and not a "street railroad" company. This will greatly improve the securities of the company as investments.

The Elwood line of the Union Traction Co., of Anderson, Ind., is now completed and cars will be running in a few days. The Muncie line is hampered by the difficulty in procuring rails. The power house of this line will be at Doleville. Charles L. Henry, president of the company, was recently in Chicago and bought about $45,000 worth of modern machinery with which to equip the

Alexandria power house. It will, however, be several months before this material can be delivered.

An Elkhart (Ind.) judge has rendered a decision which may result in some interesting litigation. He declared that a city has the right at any time to remove a traction company's poles from the streets even if they had been placed there in exact accordance with the terms of the company's franchise.

Transfer tickets are not well adapted for love missives as a new conductor on a Terre Haute, Ind., line has discovered. He wrote something sweet on the back of a transfer which he gave to a young lady with whom he was epris. When she turned the transfer over to another conductor the story of course got out and the laugh was on him.

Mr. Henry Everett is evidenly meeting all the expectations of his friends as the manager of the Big Consolidated in Cleveland, O. It was said the road would greatly increase its earnings in his hands. The gross earnings of the company for the first quarter of 1899 were $425,796 against $407,376 for the same period last year. The operating expenses and taxes have been decreased $8,423, and the net earning for the quarter increased $26,843 over last year.

We are informed that the Freland Traction Co. has in course of construction a line from Lansdale, Montgomery County, Pa., to Perkasie, Bucks County, a distance of 11 miles. The power plant, car barn and offices of the company will be located at Souderton, and arrangements are being completed for the purchase of a six-acre tract at that place. Gleason & Kiely, Syracuse, N. Y., have secured the contract for the ballasting and track construction. The line will be completed by Oct. 1, 1899. John H. Pascal, president; F. J. Crilly, treasurer, and J. Balderfer, secretary.

The Cairo (Ill.) Electric Ry. has issued a new time card which might prove an excellent suggestion to the street car companies of other cities. The card gives a schedule of the leaving and arriving time of cars on the company's various lines, the "owl" car service being particularly emphasized, and on the back of the card is a time table of the arrival and departure of all the trains on the different lines of steam railroads entering the city. This cannot help being a good "ad" for the Cairo Electric Ry. as the card is useful enough to cause everyone to carry it constantly for reference.

FIRE IN BROOKLYN.

A power house of the Brooklyn (N. Y.) Rapid Transit Co., located at Division and Kent Sts., was partially destroyed by fire on the night of May 1st. This building was erected only a few years ago, and was large and complete in all its equipments. At the time of the fire there was about 5,000 tons of coal and 1,400 gallons of oil in the building. The origin of the fire is not known, but it is believed to have started in the oil room; one explanation is that it was caused by an explosion of gas in a coal chute. The damage was confined to the third floor and the roof.

YERKES STREET RAILWAY DEAL.

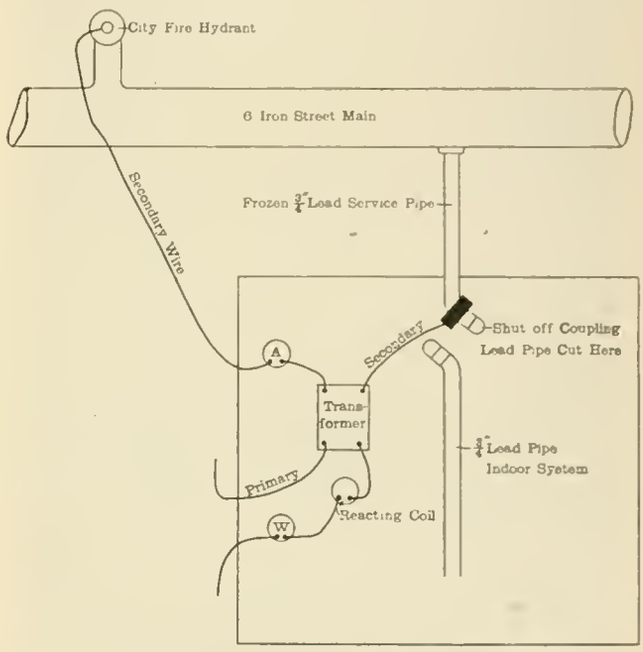
The plans for the purchase of a controlling interest in the Yerkes street railways of Chicago by eastern men, among whom are mentioned Messrs. Brady, Dolan, Elkins, Flower, Ryan, Whitney and Widener, have reached the point where only legal detail remain to be arranged. These gentlemen propose to guarantee 12 per cent to the minority holders of North Chicago stock, and 6 per cent on West Chicago. The old leases on these properties will probably prevent the organization of a new company.

So far as can be learned the elevated roads are not included in the negotiations.

THAWING WATER PIPES BY ELECTRICITY.

During the severe cold weather of last winter electricity was successfully used for thawing frozen water pipes in a number of cities in this country and Canada. Professors Jackson and Wood, of the University of Wisconsin, at Madison, for thawing service pipes made use of currents of from 200 to 300 amperes at 50 to 60 volts, and for 6-in. to 8-in. cast iron mains proposed currents as large as 1,000 amperes at 100 to 250 volts.

The Berlin (Can.) Gas & Electric Co. made use of alternating current of 2,080 volts primary and 104 volts secondary, the apparatus being arranged as shown by the accompanying diagram, which is taken from the Canadian Electrical News. The apparatus comprised a 200-light transformer, simple form of water rheostat, a portable switchboard and measuring instruments. Wires from the primary circuit were carried to the switchboard and thence to the transformer. The secondary wires from the transformer with the rheostat and an ammeter in circuit were then attached to the pipe to be thawed by means of clamps, the frozen portion of the pipe being, of course, made part of the circuit. A voltmeter is connected across the terminal and the rheostat adjusted to give 50 amperes



ARRANGEMENT OF APPARATUS.

for service pipes. Attachment to the pipes may be at any convenient point.

In Ottawa Messrs. Murphy and Bradley, of the Ottawa Electric Co., made use of a 1,000-volt primary current transformed down to 25 volts. Two transformers were used and worked in parallel. The reactive coil and rheostat were dispensed with; an ammeter was placed in the primary circuit because no portable instrument of sufficient range for the secondary was at hand.

Data for four trials were as follows:

1. Secondary, 17 volts; primary, 8 amperes. Connections through 25 ft. of ⅝-in. lead pipe. Water flowed in 3 minutes, full pressure in 6 minutes.

2. Secondary, 21 volts; primary, 5 amperes. Connections through 25 ft. of ⅝-in. lead pipe. Water flowed in 3 minutes, full Water flowed in 8 minutes, full pressure in 10 minutes.

3. Secondary, 22 volts; primary, 9 amperes. Connections through 25 ft. of ⅝-in. lead and 4 ft. of 5-in. iron pipe. Water flowed freely in 2 minutes.

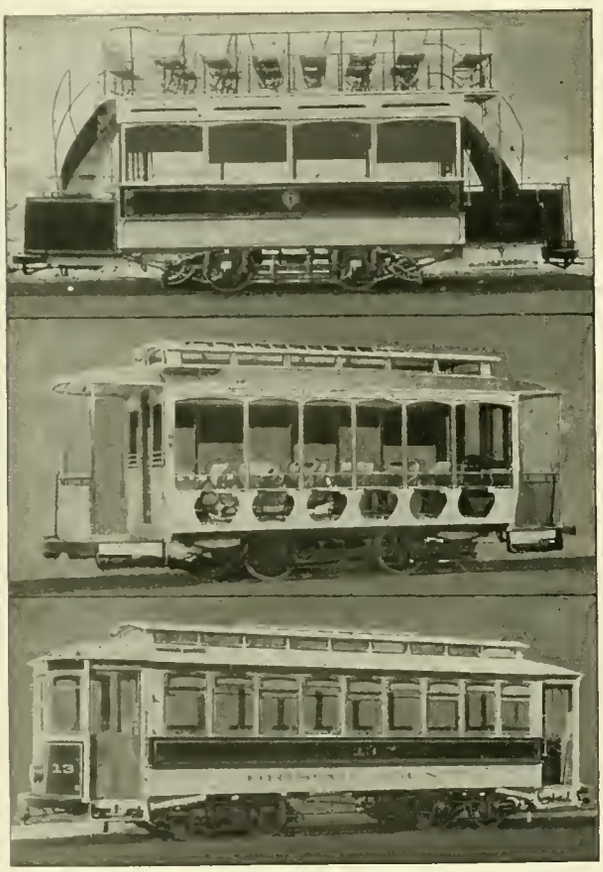
4. Secondary, 23 volts; primary, 7 amperes. Connections through 60 ft. of ⅝-in. lead and 24 ft. of 5-in. iron pipe. Water flowed in 1 minute, full pressure in 3 minutes.

The Des Moines City Railway Co. has advanced the wages of its men 10 per cent from and after May 1st.

RECENT BRILL CARS.

The accompanying engraving shows three cars recently built by the J. G. Brill Co. which are of interest as being of different types. The topmost car is one of a number built for the Hull (England) Electric Co. and has all the latest improvements in details.

The length of body is 16 ft.; the length over all about 28 ft.; width at sills, 6 ft. and the greatest permissable width but 7 ft.; the platforms are rather longer than usual, being 5 ft. 6 in. These cars differ from all those recently constructed in having fixed windows and on this account the glass is of a large size and of course set without separate sash. The inside seats are longitudinal with spring backs and the seats are sovered with carpet. Garden or "walkover" seats are used on the roof; the seats and backs are both of slats. On the lower deck the car seats 22 persons inside; on the upper deck, 29. The cars are finished inside with three-ply maple ceilings and



RECENT BRILL CARS.

cherry over the windows. Spring blinds are used with the usual fittings. It will be noticed that the railing at the sides of the stairs is made much higher than usual to give greater protection to persons ascending or descending the stairways. At the sides the rail is fitted with wire netting, giving the car a much lighter appearance than is usually found in English cars of this type. Galvanized gutters are fitted on each of the hoods. Red, green and white lights are arranged at the corners diagonally opposite the stairways. The trimmings are of bronze with bronze hand rail for the stairway. No. 90 Westinghouse controller is employed. By means of this the motors are turned into generators and form a brake by being short circuited through resistance. This brake is intended for emergency but ultimately more resistance may be added and the use of the electric brake become more frequent.

The car is mounted on Brill No. 21-E truck. With the delivery of this order there will be 57 of the 21-E trucks in operation in the city of Hull. There are two Westinghouse No. 46 motors for 500 volts and they are of the nose suspension style. The wheel base is 6 ft. and the diameter of the wheels 30 in. The Hull roads are of standard gage. One noticeable feature of this car is that of the unusual height which has been obtained in the center of the monitor deck, which is 6 ft. 8 in. from the floor. Angle iron bumpers are used with 6-in. projection in front of the dasher. The cars are to be fitted with electric headlights. The platforms are dropped 6 in. below the floor of the car, thus bringing the steps conveniently low.

The second car is of rather unusual type and was made for the Perth (Australia) Tramways Co. It is a 14-seat center-aisle open car without side entrances; 10 seats have reversible backs. The body is 26 ft. long, and the length over all 35 ft. 8 in. It is mounted on a 21-E truck. The height to the underside of the sill is 28 in., and over the trolley board 11 ft. 8 in. The gage is 3 ft. 6 in.; the wheel base 7 ft. Without motors the weight is 11,465 lb. The truck is equipped with two G. E. 58 motors. Round-corner seat-end panels are used and pantasote curtains are provided for closing the car in inclement weather. The plain appearance in the picture is due to the fact that these cars were shipped "in the white."

The third car is one built for the Mansfield & Easton (Pa.) Street Railway Co. for fast interurban service.

The body is 25 ft. 4 in. long and the car 36 ft. over all. The width at the sills is 7 ft. 5 in. and 8 ft. at the belt rails. The platforms are dropped and by using a 13-in. riser the step is brought within 16½ in. of the head of the rail. Both ends are completely vestibuled, having folding doors which close against the body of the car. The trucks are No. 27 D and have 4 ft. wheel base with 33 in. wheels There are two G. E. 1,000 motors. The interior of the car is finished in quartered oak with quartered oak headlinings and bronze trimmings throughout. The spring seats with reversible backs are covered with crimsom plush; the corner seats are placed longitudinally. The total seating capacity is 36 persons. The center of the car is supported by truss rods which are made of piping instead of solid rods, giving great stiffness and strength with light weight. The weight of these cars, with trucks and motors complete, is 27,825 lb. Brill radiating draw bars, electric headlights supplemented with one headlight for oil, are some of the remaining details. The complete enclosure of the car and its high speed, large seating capacity and steady riding, make it one of the most desirable types which has been turned out for the interurban service.

CHATTANOOGA RAPID TRANSIT CO.

The Chattanooga Rapid Transit Co. resumed operation of its lines May 1st. The question at issue with the Southern Railway Co. has been adjusted and that portion of the road which belongs to the Southern Railway Co. has been leased for 45 years.

The company is now pushing its extension rapidly. By June 1st the six miles of road to Sherman Heights will be equipped with electricity and by July 1st the new road into Chickamauga Park, 4½ miles in length, will be opened. Mr. Divine has secured a franchise to put in a line to the foot of Lookout Mountain, which will be constructed within a year. When this is completed the company will be operating 20 miles of road.

The officers of the company are: President and general manager, S. W. Divine; vice-president, G. M. Davenport; secretary and treasurer, W. D. Royster; auditor, E. D. Lilly; chief engineer, George Fitzwater.

ELECTRIC VEHICLE CO.

The Electric Vehicle Co. has purchased all the capital stock of the Siemens-Halske Electric Co. of America, and Charles E. Yerkes has resigned as president and director of the latter company. He is succeeded by Isaac L. Rice, president of the Electric Vehicle Co. and of the Electric Storage Battery Co., an allied company. The Siemens-Halske Co. was controlled by the Pennsylvania Iron Works, which owned practically all the stock, and in which Messrs. Widener, Elkins and Mahoney are largely interested. The Pope Bicycle Works is also controlled by the Vehicle Co.

The Illinois Vehicle & Transportation Co. has been organized to represent the Electric Vehicle Co. in the West; Samuel Insull will be president of the new company. The stock of the local company is said to be already in demand at 113.

ECHOES FROM THE TRADE

THE WESTERN ELECTRIC CO., of Chicago, has a contract to install a complete electric light plant in the Rose Building, Cleveland, O.

O. P. JOHNSON, of the Star Brass Works, Kalamazoo, Mich., manufacturer of street railway specialties, recently spent several days in Chicago, and was very successful in introducing his goods.

C. TOWNSEND BLAKE, of Philadelphia, dealer in railroad, municipal and gas bonds, is now installed in his new offices in the Girard Trust Building. Mr. Blake has recently added municipal bonds to his list.

A. O. SCHOONMAKER, of 158 William St., New York City, and prominently identified in the mica trade of the country, has appointed the W. R. Garton Co., Manhattan Building, Chicago, as his representative here.

THE E. P. ALLIS CO., of Milwaukee, is now building nine vertical compound engines of 6,600 h. p. each for the Metropolitan Street Railway Co., of New York, two of the 11 units ordered having been shipped in April.

THE PANCOAST VENTILATOR CO. has gone into a receiver's hands. From the showing of the company it would appear that it went on and incurred a large indebtedness when it must have known the accounts could not possibly be paid.

THE WESTON ELECTRICAL CO. is making contracts for its new factory at Waverly, N. J., a suburb of Newark. A railway switch is now being constructed to the spot and ground will be broken in a few days for the erection of what will probably be the most complete manufacturing establishment in the United States.

THE AMERICAN RAIL JOINT & MANUFACTURING CO., of Cleveland, O., has so far this season contracted to furnish different railway companies about 40,000 joints. Contracts have just been made with the Erie & Cambridgboro Electric Railway Co. for 25 miles, the New Orleans & Jefferson, 9 miles; the Kansas City & Leavenworth Railway Co., 20 miles, making a total of about 21,000 joints.

F. H. NEWCOMB, manufacturer of uniform caps, has recently received an order from the Brooklyn Rapid Transit Co. for 5,000 conductors' and motormen's caps. His caps have been adopted as standard. He has also received an order from the West Shore R. R. for a complete equipment of caps for the whole system, and also an order for all caps for the marine department of the New York, New Haven & Hartford R. R.

THE GARTON-DANIELS CO. states that since April 1st the sales of Garton lightning arresters have been over double what they have been in the same period of any previous year, and in order to keep up the stock it has recently doubled the force of employes. It will be able to meet any requirements for prompt shipments. The new kicking coils and lightning arresters for the protection of small motors, fans, etc., are meeting with a large demand.

THE WESTERN ELECTRIC CO. makes ceiling, desk and bracket fans for 500 to 550 volts; also fans for 120 and 220 volts, which can be placed on a 550 volt circuit. Bulletins 16 F, and 17 F, describe the "Standard" ceiling fan, and the desk and bracket fans made by this company. Bulletin 19 F describes the "Arctic" ceiling fan and accessories, and is the fourth of the series of bulletins. A 40-page fan motor catalog giving complete descriptions will be mailed to any person desiring one.

THE AJAX METAL CO., of Philadelphia, is not in any combine. There has been a bearing metal combination formed and the Ajax people were invited to enter, but respectfully declined. It is this concern's intention to run its own business in its own way and keep out of the combination. The company is satisfied it has a superior metal which it can sell at a fair price and prefers doing an independent business to being mixed up with other concerns.

THE ELECTRICAL INSTALLATION CO., of Chicago, has removed its offices from the 11th floor of the Monadnock Building to rooms 1516 and 1517. This company is well known in the field of electric railway construction and equipment. No change has been made in the personnel of the company. J. J. Case is president, A. M. Hewes secretary and treasurer, and J. A. Brett, general manager. They will be glad to see all old or new patrons in their new location.

THE CHICAGO PNEUMATIC TOOL CO. has purchased the patents formerly owned by the Consolidated Pneumatic Tool Co., now defunct. These patents include all the Keller & Wolstencroft types of tool construction and in addition several new applications which have not yet been taken out. These patents originally cost the Consolidated Pneumatic Tool Co. about $40,000, and in purchasing them the Chicago Pneumatic Tool Co. states that it acquires control of about all of the pneumatic tool patents of value in existence.

HAROLD P. BROWN, manager of the Edison-Brown plastic rail bond, has been notified that the United States Government will, for this season's work, use the Edison-Brown plastic bond. For two years the Government has been experimenting with these rail bonds and as a result they were put into practical service on the Indian Head tramways with a light rail and a ballasted track and this service has so thoroughly demonstrated the utility of the Edison-Brown bond that the decision has been made as stated, to use it exclusively.

ADAM COOK'S SONS, 313 West St., New York, announce that very particular engineers who are annoyed by using oil for lubricating purposes will find a welcome change in the engine room if they apply Albany grease to the crank pins. This firm makes a standing offer to furnish a sufficient quantity of the compound and an "Albany" grease cup free of charge to all engineers who desire to test the matter. Aside from the extra cleanliness obtained in the use of this standard lubricant the saving in dollars and cents in the oil bill is a substantial one and well worthy of investigation.

THE SPRAGUE ELECTRIC CO., of New York, has issued an exceedingly handsome catalog giving a number of fine half tone illustrations of the Lundell fan motors. The cooling device has almost ceased to be a luxury and become a necessity everywhere. It is a necessity in the factory or workshop, in the engine room and in all places where great heat is generated. It has become a necessity in the hospital and the sick room. It is a luxury in the theatre, the church, the business office and the home, but at the same time it has become a luxurious necessity. The Lundell fan motor has met with the greatest success in every field where it has been placed. The United States Government has adopted it for its vessels, its hospitals and its workshops.

THE DUPLEX CAR CO. has recently received orders that make it necessary to extend the factory arrangements. Many of the cars it is building for foreign delivery are arranged with a single seat on one side of the aisle and a double seat on the other. The

company informs us that most of the orders received for both foreign and domestic delivery are for finely finished and furnished cars. The prevailing demand is for the best cars as well as equipment. Many managers have believed that the "Duplex" car would prove to be popular when it was better known, and we congratulate the company on its excellent prospects for a large business.

THE WADHAM'S OIL & GREASE CO., of Milwaukee, is still meeting with most satisfactory success in the sale of its graphite curve grease, for use on street railways. This grease has been found to be exceptionally good for its purpose and is endorsed by all companies using it as the best article in the market. And added to the real excellence of the grease in itself, the low price at which it is sold is another reason for its great popularity. The company also makes a full line of motor and car greases and lubricating oils, but especial attention of street railway companies is called to its graphite curve grease.

THE AMERICAN STEEL & WIRE CO., of New Jersey, has purchased the business and manufacturing plants of the Washburn Moen Manufacturing Co., of Worcester, Mass. Mr. Geo. A. Cragin, who has been the manager of the latter company's office and warehouse at Houston, Tex., writes that he has connected himself with the new company and will make his headquarters at Chicago. The Houston agency will be closed as soon as the pending business matters can be settled. Mr. Cragin has for many years been identified with the Washburn & Moen Manufacturing Co. and will be a valuable man in the new company.

THE GOHEEN MANUFACTURING CO., in its new pamphlet, shows a number of photographic representations of iron work structures which have been protected by its "carbonizing coating." This material has become very popular and the demand has increased to such an extent that the company has been compelled to enlarge its plant. The demand during the four months of this year has been exceptionally heavy, eclipsing any similar period in any past year. The company claims to be the only maker of a chemically combined paint and on its "carbonizing coating" it has certainly earned a most excellent reputation, both in this and in foreign countries.

THE SIMONDS MANUFACTURING CO., of Pittsburg, Pa., of which J. C. Carry in the Fisher Building is the Chicago representative, is one of the big concerns in the country manufacturing electric railway supplies and builders of all kinds of special machinery racks, worms, worm wheels, gears and pinions. The company has recently issued an attractive booklet with an embossed silk cover, which says: "We'll Talk on Wheels and Railway Supplies." The little book does talk and shows a number of handsome cuts of wheels and gears and tells a story which must interest all who use these things. The letter copy is brief, sharp and right to the point and is well worth attention.

THE PEARSON JACK CO., 67 Federal St., Boston, has recently issued a small circular giving a brief description of its well known jacks and a few of the many strong testimonials received by it from roads using them. Mr. John Doyle, superintendent of track for the Chicago & West Michigan Ry. says, under date of Apr. 29, 1899: "A set of your jacks have been in use on the C. & W. M. wrecking car for the last year, and they have given the best of satisfaction. I consider them the best device on the market, and no wrecking cars should be without them. Our men became expert in the use of these jacks in a very short time, and can replace a car on the tracks in less time than with any other device." These jacks have a capacity of 50 tons per pair and weigh only 85 lb. each.

THE JOSEPH DIXON CRUCIBLE CO., of Jersey City, N. J., is issuing a neat little periodical, published once a month, called "Graphite." In each issue may be found much valuable and interesting information regarding this peculiar commodity now so commonly used in the arts and manufactures. Many people who have been bothered because their lead pencils were greasy would be surprised to learn that graphite, of which lead pencils are made, is also used very extensively as a lubricant. The little paper strongly emphasizes the advantages of using the "Dixon Graphite Axle Grease" on one page and on the next tells the reader what excellent pencils the "Dixon's American Graphite" are. There are nearly 40 different preparations made by the company, in all of which graphite is the prime feature.

THE MEAKER MANUFACTURING CO., of Chicago, is now shipping to the Omaha & Council Bluffs Railway & Bridge Co., Council Bluffs, Ia., a complete equipment of the new Meaker registers. These registers were illustrated and described in the "Review" for October, 1898, page 765. The Omaha & Council Bluffs road has long used the Meaker registers and while these have given the best of satisfaction the management was prompt to appreciate the superiority of the new type and placed an order with the Meaker Co. The objects accomplished by the new type of register are: An additional check is placed on the conductor, who is unable to read the grand total. Competitors or other interested persons are unable to keep a record of the business. The manager is able to easily check the bookkeeping of the office.

WESTINGHOUSE, CHURCH, KERR & CO., of New York, have received a contract from the Third Avenue Railroad Co., of New York, for a temporary plant to be built at once, to be in running order within a few weeks, for providing power until the permanent plant is completed. This temporary equipment consists of six 750-h. p. Westinghouse vertical steam engines, to be direct conected to six Westinghouse generators of 500 kw. each. It also comprises water tube boilers aggregating 4,000 h. p. fitted with Roney mechanical stokers. They also have a contract from the Laconia Street Railway Co., Laconia, N. H., for two Westinghouse gas engines—one of 85 brake h. p., and the other of 50 brake h. p., to be belted to generators; these engines are to be subjected to the severe loads of street railway service.

PURDUE UNIVERSITY, the technical and agricultural college of Indiana, has recently issued its register for the present year, which shows a considerable increase in the number of students and of the courses offered. Purdue is eminently a school of technology and its mechanical and electrical laboratories are among the most complete in the country. In railroad engineering especially it stands first; the work done here on steam locomotives is well known and the deposit at Purdue of the experimental apparatus of the Master Car Builders' Association offers opportunities for investigation in the field which cannot be equalled elsewhere. The electrical laboratory is well equipped and among the apparatus are street railway motors, controllers, etc., offering facilities for investigations in this branch of railroading also.

MANNING, MAXWELL & MOORE, of New York, with branch offices in Chicago and Pittsburg, have issued a very exhaustive catalog for 1899, illustrating the Shaw electric traveling cranes Mr. A. J. Shaw made the plans for the first electric crane ever constructed. This was more than ten years ago and since then all other kinds have been abandoned. Since then also great improvements have been made in this contrivance so indispensable to every power plant, locomotive and machine shop and foundry or wherever heavy carrying is necessary. The Shaw Electric Crane Co., the works of which are at Muskegon, Mich., makes two types of electric cranes, the single motor and the multi-motor and in these types this company has achieved the highest degree of excellence. These cranes combine all the features calculated to prove the most efficient for general work and it is also prepared to adopt special features desirable for special service. The catalog issued is fully illustrated with photographic views of various cranes in use in its own works and also many of those in operation in other large machine shops, foundries, locomotive works, and in a number of the United States arsenals and ship building shops.

THE WESTERN ELECTRIC CO., of Chicago, Ill., western agent for the S. K. C. system, Stanley Electric Manufacturing Co., of Pittsfield, Mass., has recently published a bulletin which should

prove vastly interesting to all users of lighting transformers. The Western Electric Co. claims to be first in having introduced high-grade transformers and although there has been at times a strong temptation to meet the competition of cheap types it has been resisted, the company believing it to be to its own interest and to the interest of all users of electrical appliances to make and sell only the best. That the best is the cheapest in the long run has often been proved and this company has found that policy to be the wisest. The bulletin, 101, just issued is full of information regrading transformers and should be in the hands of everyone interested.

WESTINGHOUSE, CHURCH, KERR & CO. are not only engineers and contract for the designing, furnishing and installing of complete plants of every description, but are also the selling agents of the popular Roney mechanical stoker. This stoker has been in use for over 15 years and its advantages over hand firing cannot be questioned. There are various stokers in use, but there is only one Roney. The success of this one, the satisfaction of all who have and are using it is a guarantee that it is one of the best in the world. The Roney stoker possesses all the following essential characteristics: Simplicity of construction and operation, accessibility, smokelessness, large excess capacity and the ability to burn all grades of hard and soft coals. The company has just issued a complete catalog giving in full all the advantages and by clear and carefully drawn illustrations, show its perfect working and construction.

THE BURT MANUFACTURING CO., of Akron, O., makes oil filters and in a catalog it has recently issued makes the startling statement that consumers of oil waste on an average from 50 to 75 per cent of all they buy. The company claims that this percentage of oil is wasted because of the dirt and grit which get into it and that by the use of a filter this waste can be saved and used over and over again until the last drop has been consumed in actual use. The company manufactures the "Cross" filter, which it is so certain will be approved that it agrees to send them on 30 days' trial and at no expense to the user. The company has been making the Cross filter for nine years and has from time to time improved it until today it is claimed to be the best, most perfect working filter on the market. It is in use in 23 countries and has been endorsed by many of the largest manufacturing concerns in the world. The offer of a 30 days' trial should be sufficient for any one interested.

THE WHEELER CONDENSER & ENGINEERING CO., at 120-122 Liberty St., New York City, will open a western office during the month of May at 1642 Monadnock Block, Chicago. It has always done a large business in the West, and has felt the need of headquarters in Chicago for some time. Mr. William S. Love, for several years connected with the Abendroth & Root Manufacturing Co., will have charge of the office. Mr. Love goes to his new position with the best wishes of the Abendroth & Root Co. It will interest the readers of the "Review" to know that the Wheeler Condenser & Engineering Co. has just closed a contract with the Alley "L" road in Chicago for three additional Barnard cooling towers, making eight in all. This installation will take care of all the condensing water for 12,000 h. p. of engines, and will be the largest installation of cooling towers of any design in the United States. The fact that the Alley "L" road installed towers of the same pattern it has been using for the last two years is evidence of what the management thinks of them. The new twine mill of the McCormick Harvesting Co., and the new wood department will be equipped with three Wheeler surface condensers of 2,500 h. p. each, contracts for which were let last week.

THE GENERAL ELECTRIC CO. has issued its report for the year ending Jan. 31, 1899. It shows that the total sales during the year were $15,679,430.86, with a calculated direct profit of $2,584,896.61. The increase in orders was 21 per cent over the year before. During the year large additions were made to the company's plants at Schnectady, N. Y.; Lynn, Mass., and Harrison, N. J., the total

cost of which was $897,739.58, and this entire amount was met out of current receipts and written off the books. A portion of the gross income for the year, amounting to $324,462.03, was acquired by the sale of certain securities which the company held on the books at $746,498.36, which brought $1,070,960.39, and this money, the report says, was not needed in the business, and was devoted to the purchase of $300,000 of the company's own debentures, to extensions to the factory plants, and to acquiring of stocks and bonds in subsidiary companies, amounting in face value to $814,221.

The unmatured and unsettled balances due to the company at the end of the year were $4,447,311.10, and the sum is but little in excess of the sales of the last three months of the year, which amounted to $4,151,904.62. The report says that in the settlement of old accounts during the year a net gain of $44,816.80 was realized over the sum at which they were carried on the books, and that of the $2,432,860.88 old notes and accounts receivable which were written off three years ago at a nominal value of $1 an account $1,374,703.69 remains, which stand on the books at $131. From settlements of this class of accounts the company received during the year $62,190.62.

EXHIBITION OF MAGANN AIR BRAKE.

One of the interesting features of the meeting of the Railroad Air Brake Men's Association at Detroit last month was a trip over the Detroit & Pontiac electric road arranged by William D. Ray, of the G. P. Magann Air Brake Co. A special car equipped with the Magann brakes was provided and the guests were given an opportunity to see the working of the system and to inspect the apparatus. On March 15th car No. 5 left Birmingham with a pressure of 230 lb. of air in the storage tank. After two round trips, making a total mileage of 104 miles and a total of 300 stops the pressure in the storage tank was 70 lb. On March 16th a run with 165 stops reduced the air pressure 88 lb.

SPECIAL CAR WITH THE MAGANN AIR BRAKE.

G. Fryberger, a motorman of the Toledo (O.) Traction Co., dropped dead from heart disease while on duty April 28th.

The Indianapolis lines have adopted a new ticket system. Besides the distinguishing feature of the color, blue and yellow, there is a complicated system of numbering to prevent counterfeiting.

MANHATTAN STATIONS WITH ELEVATORS.

A few months ago President Gould, of the Manhattan Elevated, New York, made inquiries of a number of the larger property holders along Sixth Ave. as to terms on which his company could install elevators in their buildings to furnish more convenient access to the elevated stations. One of the abutting owners, Mr. Morgenthau, said that if the Manhattan Railway Co. would arrange an exit on its platform from his second floor, he would install the elevators at his own expense; further, while he would prefer to place them near the rear of the building, he would consent to put them near the front if the railway company insisted upon that location. Mr. Morgenthau stated that such an arrangement would make his second floor as valuable as his first floor is now, and double the present value of the first floor.

The advantages of such elevators would be mutual. Ordinarily the traffic on the elevated is rather light during shopping hours and such a convenience to patrons as these elevators would be, enabling a person to get from one of the big stores to another without climbing stairs and without exposure, would bring to the elevated a large number of short haul passengers, which are a profitable class to handle. On the other hand, the elevated would bring people to the department stores and deliver them inside the building without cost, whereas the department stores gladly pay large sums to get people to enter their doors.

When an arrangement is so attractive that both parties are willing to pay for it, there can be no doubt as to its speedy accomplishment.

XENIA-DAYTON ROAD.

Mr. J. W. Neff, vice-president of the Rapid Transit Co., Xenia, O., advises us that his company has contracted with the Fairmount Construction Co., of Philadelphia, to build and equip the road between Xenia and Dayton. The road will be 15¾ miles long. The grading is completed for five miles and two miles of track laid. Contracts are all let for the power house and electrical equipment and it is hoped to have the road in operation by July 15th.

To secure an issue of $300,000 of 20-year, 5 per cent gold bonds the company has executed a mortgage to the Fidelity Insurance, Trust & Safe Deposit Co., of Philadelphia, trustee.

THE Street Railway Review.

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The importance of using a really effective method of destroying tickets which have been once used is shown by the experience of the Birmingham (Ala.) Railway & Electric Co. It found that its tickets were being sold on the street three for 10 cents, or even two for 5 cents; investigation showed that these were tickets that had been used and thrown away after being torn in pieces. Some enterprising person had picked the pieces out of the trash boxes and pasted them together.

So many committees from city councils of Great Britain have visited this country during the past few years in search of information on the best methods of operating street railways, it is somewhat surprising that our own American city fathers have allowed a good thing to go so long unworked. The city council of Chicago are about to vote $10,000 for the purpose of sending as many of its number to Europe as the appropriation will cover, to pay a visit to the old folks at home and incidentally to "study" trams and other subtle ways.

The improvement in prices of materials continues, iron and all its manufactured products being in especially strong demand. Special work of all kinds is being ordered in large quantities, and manufacturers are working night and day to fill orders. In this branch many delays are occurring in delivery on account of the inability of the shops to secure rail sections with which to work. The foreign demand for rails is large and increasing. There is every indication that a still further advance in prices of all kinds of iron and steel will be made.

The United States Circuit Court, which granted a temporary injunction in October, 1898, restraining the city of Cleveland from enforcing its 4 cent street car fare ordinances, on May 16th, continued the order in force till a hearing could be had on a petition to make the injunction perpetual. This decision was placed on the ground that the city had no authority to change the rates of fare until the present franchises of the company should expire. The right to so change fares had been reserved in the first ordinance passed by the city, but the court held that these earlier ordinances had been repealed by subsequent ones making no reservation. The question of the reasonableness of the 4-cent rate was not passed upon.

The trust craze has received a serious setback in the refusal of the banks to accept the truck stocks as collateral, and investors are not now as eager to subscribe as in the beginning. A notable example was the Carnegie syndicate, which probably is as meritorious as any of the combinations from a business standpoint, but which was unable to secure subscription to its $625,000,000 of consolidation stocks, and Mr. Frick and his associates were forced to make the subscription themselves.

There is invariably a day of grief ahead for hundreds of investors in the watered stocks which have been poured out on a gullible public during the past six months, and a check to these schemes is a matter of public congratulation.

The syndicate which has organized the Massachusetts Electric Companies has in so doing effected the amalgamation of more street railway companies than have ever before been consolidated at one time; the mileage is also the largest operated by any single company. Thirty-three railway and electric companies in New Hampshire, Eastern Massachusetts and Rhode Island are concerned in the consolidation, and the operation of all these properties, which are by local conditions very closely connected in interest, will be of like advantage to the public and the owners; the former will receive conveniences previously impossible, and the expense of administration will be decreased. It also insures a harmony of action in all matters pertaining to legislation.

At its last session the Wisconsin Legislature passed a very stringent anti-pass law, which will be found on another page of this issue. The law prohibits all parties, whether individuals or companies, from giving free passes of any description to state or city officials and employes, or to political committees, and prohibits these classes from accepting or making use of such free passes, all under heavy penalties. One of the first results has been that street railway companies are requiring policemen, firemen and other city employes, who have heretofore been carried free, to pay fares when they ride on the cars.

An interesting question has been raised at Superior where the street railway issues transfer tickets which bear the announcement: "This transfer ticket is a gratuity and is accepted as such by the passenger." The claim is made that public officers cannot accept such a ticket, because it comes within "any free pass, frank or privilege of any sort."

The franchise tax act has received the signature of Governor Roosevelt, and there appears to be a wide disparity of opinion as to the extent of the additional burden thus placed upon street railways of New York State. The amount of income from this source is widely estimated at from 14 million to 27 million dollars. The franchises are to be taxed on the same basis as real estate, which will therefore make the assessment 60 per cent of value. The law takes effect next October.

The attention of managers and claim agents is called to the latest news of that man of many names, whom the "Review" has for convenience christened the "grab-handle man," which appears on another page of this issue. After operating his swindle with success in many different cities he last winter fell in with the public spirited officials of some Massachusetts roads, who at considerable trouble and expense set about teaching him a lesson. He is now serving his second term in a Massachusetts house of correction, and we trust that the other charges against him may be prosecuted when he is again at liberty.

We print this month the names of several other companies which have voluntarily advanced the rate of wages to their men. It is not only an evidence of the better business which makes it possible to do this, but also of the disposition of the managers to pay as high a rate as the earnings of the companies will warrant. Contrary to a somewhat general impression there are few managers but would gladly pay just as high a wage scale as they can, for they not only appreciate a good quality of service, but are interested in the welfare of their men to an extent much greater than the men themselves often realizes. There are some roads, however, which have not as yet been able to lift themselves out of the difficulties into which they were forced during the protracted period in which the earnings were less than expenses and interest charges. Until these loans can be paid off and the properties put in former condition it will be hard for such roads to be as liberal as they would like.

Judge Marean, of the Supreme Court, of New York, has recently rendered a decision dismissing an action brought to prevent the running of express cars on the electric trolley lines on Long Island. The court says that the public "having discovered that the transportation of freight can be made more economically than by former methods, there is no meritorious reason why it should not enjoy that advantage.

The language of Judge Marean, is exactly in accord with the views concerning freight traffic in cities which we have repeatedly urged in these columns. There can be no more objection from an esthetic point of view to handling goods in a trolley car than in a wagon, and the wear and tear on the streets is vastly less. Wherever the experiment has been tried it has proved popular, and we predict that a great number of street railways will develop this branch of the business in the near future.

In this connection it is of interest to note that the Philadelphia & West Chester has a charter permitting it to carry certain classes of freight between Newton Square and Philadelphia. The company charges ¼ cent per quart for carrying milk, and has a revenue of $600 per month from this source.

The reports of the Railroad Commissioners of Massachusetts and Connecticut show that the total electric railway mileage (measured as single track) in the two states is nearly 2,100 miles, and though this fact is well known, probably few were aware that one can travel four-fifths of the way from Boston to New York on electric cars. The description on another page of this issue of the trip by trolley taken by a street railway man between these two cities is of more interest than as a mere recital of a novel pilgrimage. It is the longest trip ever made on electric lines, and yet if any one had suggested the possibility of such a thing only a few years ago he would have been laughed at. The development of the interurban electric railway is one of the most interesting and promising subjects of the day, both sociologically and physically. It is the bridge which connects the resident of city and country as the steam roads have never done, nor can do to an equal extent. By it farm life is deprived of many of its disadvantages which belong to isolation, and an interchange of people and ideas is obtained. The victim of an accident no longer need suffer for hours while some one struggles through impassible roads to call the doctor. Now the telephone does the calling and the electric car swiftly brings the needed aid to the sick and injured. The expansion and development of these lines during the next five years will be a subject of wonderful interest, and the result of untold benefit.

One of the points to be remarked is that the fare for 209 miles by electric cars averaged 1.34 cents per mile, while for the 43 miles by steam cars it was 2.12 cents per mile. For speed the statistics are more favorable to the steam roads; on the steam roads the average speed was 28.1 miles per hour, on the electric roads it was 12.3 miles per hour. This latter figure, however, is very creditable.

The present month marks the retirement of Mr. Charles T. Yerkes as president and director of the North and West Chicago Street Railroads and the controlling factor of the dozen or more street railway companies which go to make up the Yerkes System of Chicago. Mr. Yerkes' attention was first turned towards street railway investments in 1875, and he became associated with the men at the head of the street railways in Philadelphia, who were afterwards with him in the development of Chicago properties.

Mr. Yerkes located in Chicago in 1881, opening a branch of his Philadelphia bank, and was at once attracted by the great possibilities of the street railways. The North Side system appeared to him to be one whose improvement was easiest and most imperative, and in 1886 he succeeded in getting control of it. The era of reorganization and construction which has made the name of Mr. Yerkes famous was at once begun. First he arranged with the city for the tunnel under the Chicago River at LaSalle St., rebuilt this to conform to the requirements of the cable system, and built 17 miles of cable road, which included a loop in the business district. Two years later he secured control of the West Side system and securing the Washington St. tunnel, rebuilt it and installed the cable system on the West Side; later a new tunnel was built at Van Buren St. and a second cable route to the west division of Chicago was opened.

Mr. Yerkes was extremely desirous to equip all of his lines for mechanical traction and made extensive experiments with steam and gas motors in the endeavor to find a satisfactory substitute for horses on the feeder lines of his system. The overhead electric trolley finally solved the

problem, and in the five years since April, 1894, when a trolley ordinance was passed by the council the growth of the Yerkes System has been little less than marvelous. Today it comprises over 530 miles, of which 47 are operated by cable and 6 by horses. It is to be regretted that electricity as a motive power was not deemed practicable in 1886 when Mr. Yerkes first obtained control of the North Chicago lines, for then the enormous investment in the cable construction might have been avoided.

Mr. Yerkes has also been the moving spirit of the Lake Street and the Northwestern Elevated Railroads.

To no man is the city of Chicago more indebted for the transportation system which it today enjoys, to which rapid growth and prosperity are largely due, and yet no man has been subjected to more bitter vituperation by the press and people of Chicago than has Mr. Yerkes. Such treatment as this is undeserved, yet it is what a public benefactor usually receives as the reward of his labors. Mr. Yerkes takes a philosophical view of the matter; at the meeting of his stockholders called to ratify the lease to the Chicago Union Traction Co. he said in the course of an address reviewing the last 13 years:

> I never expect to have any appreciation for the things that I did. I have the feeling within myself that I am doing what is satisfactory to myself and therefore I do not ask for applause. I do not want it, for the men who applaud me today are likely to curse me tomorrow, if things do not go as they want them to go. But, as I say, the stockholders cannot help seeing these things with satisfaction, and if we had had better opportunities instead of having to literally fight for every step we made, we would have had many more improvements today than we have.

Mr. Yerkes' retirement marks the end of an era in the development of the urban transportation systems of Chicago and the city will be fortunate indeed if the succeeding years show an equal progress.

STREET RAILWAY ACCOUNTANTS' ASSOCIATION.

The whole of America is a pretty large field and when the Street Railway Accountants' Association of America was organized in the spring of 1897 the members had little doubt but that the name would be broad enough to include the membership. Not long since we noted that the Glasgow Municipal Tramways had joined the Association, and we have just been advised that the Central London Ry., London, Eng., has recently become a member. The Schenectady (N. Y.) Railway Co. has also joined.

CHANGES AT SEATTLE, WASH.

The plant of the Seattle (Wash.) Steam Heat & Power Co. has been purchased by parties interested in the Union Electric Co., and a large power plant is to be erected on recently acquired property, though it has not yet been determined whether it will be built by the Union Electric Co. or a new company. Negotiations are pending for the consolidation of the various street railway, electric light and power companies of Seattle.

The new management of the Nashville Street Railway, which recently bought the controlling interest in the Nashville & Suburban road, assumed control at midnight May 9th.

MUNICIPAL OWNERSHIP IN DETROIT PRACTICALLY SECURED.

$15,325,000 Is the Price to Which Both Sides Have Agreed Pingree's Neat Scheme to Get Around the Adverse Decision Which the Supreme Court May Render City Council Pledged to Carry Out Pingree's Plan Twelve Mile Haul for Three Cents.

Fifteen million, three hundred and twenty-five thousand dollars, cash, that is the price agreed upon which the municipality of Detroit is to pay for the street car properties located in her midst, and now every indication is that the deal will be closed in short order.

The Detroit Street Railway Commission, through its experts, after a thorough examination of the properties, decided that the actual value of the properties was $7,866,737.42, the same being divided as follows: Roadbed and tracks, $4,350,183.42; overhead construction, $760,939; power houses, $807,139.36, repair shops, tools and supplies, $83,994.08; rolling stock, $1,102,212.39; car houses and real estate, $523,248.30; other buildings and fixtures, $179,016.87. The owners of the street railway system did not exactly agree to these figures, claiming that the experts allowed too much for depreciation from the original cost, on account of operation and also that the real estate was worth more than it was valued at. Mr. T. L. Johnson, representing the bond and stock owners, by his invoice, placed the value of the real and personal properties at $8,062,737.

For the purpose of computing the value of the franchises and in making all negotiations, a compromise valuation of $8,000,000 was decided upon and at that figure the negotiations were carried on.

Prof. W. A. Bemis, of Kansas City, in making calculations on the value of the franchises, considering the years they have yet to run, used $8,000,000 as his valuation of the properties. An examination of the company books showed a net earning, except interest charges, for the year ending April 1st, 1899, of $805,833. Of this amount he calculates that it will require $55,000 per year for the next ten years to care for the increased traffic that will develop in the outlying districts of Detroit, leaving at the present income $750,883 to care for the interest charges and create a sinking fund for the retirement of the purchase bonds.

Regarding increased traffic, Prof. Bemis calculates that it will average 4 per cent per year and by taking the present earnings of each individual line, deducting therefrom the interest charges and adding thereto the annual increase of 4 per cent, by considering the number of years each franchise has to run, Prof. Bemis fixes their entire money value at the sum of $8,478,553, giving the properties a total valuation of $16,478,553.

With this approximate valuation of the street railway properties, the Detroit Street Railway Commission has carried on its negotiations with Mr. T. L. Johnson as the representative of Mr. R. T. Wilson, of New York, until a final agreement regarding price has been arrived at, as stated above.

Mr. Wilson has agreed to accept $15,325,000 cash, or the equivalent therof in bonds and if paid in bonds issued by the Detroit Street Railway Commission, same bearing 4 per cent interest, he claims that it will require at least $16,800,000 to represent the equivalent.

The municipal owernship commission of Detroit has agreed to this and with the proper ordinances, resolutions

and other data the entire matter was presented to the Detroit City Council on June 6th.

Owing to the fact that the Supreme Court of Michigan has failed to hand down a decision on the constitutionality of the McLeod law, by which municipal owernship was to be made possible, Governor Pingree has adopted a new method to bring about the trial of this pet idea. As the city of Detroit cannot legally now enter into the purchase of the street railways, the system proposed is for the three members of the Detroit Street Railway Commission, Messrs. Pingree, Schmit and Stevenson, to jointly form a corporation to be known as the Detroit Municipal Ry. As such a proposed organization these three commissioners have asked the council to grant them an ordinance to buy, build and operate street railways at 3-cent fares—5 tickets for 15 cents—and at any time the City Council may request the Detroit Municipal Ry., without compensation, shall transfer all of its property to the city, or commission representing the city.

Should the council approve of this move, and that is almost a foregone conclusion, then all of the street railways in Detroit will be transferred to the Detroit Metropolitan Ry. for the purpose of consolidation. The Metropolitan company will then issue 4 per cent bonds to the amount $17,500,000, which will cover all of the outstanding obligations of the three companies operating in Detroit. To further secure these bonds the Detroit Municipal Ry. will ask the city council to pass a security franchise calling for 5-cent fares; six tickets for a quarter except on the Detroit Railway, at present a 3-cent line; payment to the city of a tax of 2 per cent of the gross receipts, and with this as a consideration the Metropolitan Ry. will turn over to the Municipal Ry. all of the street railway properties in Detroit and suburbs and $700,000 in bonds besides, to make it a good bargain. These bonds are to be held by the Municipal Ry. for future improvements.

Should this plan meet the approval of the city council, then municipal ownership will have been accomplished without the consent of the Supreme Court of Michigan.

Should the time come in the future when the operating expenses will warrant, then the city council shall have the power to reduce the rates of fare below 3 cents. The Municipal Ry. must make quarterly reports to the council, giving a detailed statement of all monies received and from what source; of its expenditures and for what purpose made, as well as all other information required.

If the plan as outlined is carried out, it is the intention to convey the properties to a city commission as soon as one can secure a legal existence, but Governor Pingree figures that this will mean municipal ownership in fact if not in name, so he is satisfied with the arrangement.

Street railway men not acquainted in Detroit will be interested in some facts that this change in operating will bring about. Under the universal transfer plan, a number of lines will give a ride of twelve miles for 3 cents. Where now the three lines are operated separately, although under the same management, in the future they will interchange transfers and thereby greatly reduce the revenues of the individual lines.

Prof. Bemis, the "franchise expert" and political economist from a Kansas university, estimates that by reducing fares it will be five years before the receipts of the Detroit railways advance from what they today, and considering that there is but $105,833 difference between the present net earnings and the interest charges under the new heavy mortgage, many who have been warm supporters of the proposed municipal ownership plan are very much afraid that it will be a failure. The local opposition to municipal ownership among business men and the heavy tax payers, is as strong as ever, but the aldermen representing labor wards are afraid to oppose the plans of Governor Pingree.

Many a ward boss in the past few years has reached the political graveyard for opposing the supposed "reforms" of Pingree, and the present law-makers of Detroit as a rule will think of what might happen should they endeavor to prevent the passage of the necessary ordinances that will bring about municipal ownership under private operation, or any other method, a long time before much opposition can be concentrated.

The Citizens' Committee that has charge of the fight to prevent the purchasing of the street railway properties by any form of a municipal commission, is undecided just what to do to prevent the present plans being carried out successfully. The new move was a surprise, as it was generally supposed that all negotiations were off pending the Supreme Court decision; however, the attorneys that are employed by the business interests of Detroit state positively that the fight will be kept up vigorously as soon as the city council attempts to take any kind of action.

From the present outlook, June will show many developments in the attempt to secure municipal ownership in Detroit.

CLEVELAND 4-CENT FARE CASE.

In the "Review" for November, 1898, it was announced that the city council of Cleveland had passed ordinances limiting the street railway fare on the Big and Little Consolidated roads of that city to four cents, with tickets at the rate of seven for 25 cents. The ordinances were passed Oct. 17, 1898, and the companies at once petitioned the United States Circuit Court for an injunction restraining the city from enforcing the ordinances, thus preventing test cases being brought in the state courts. A temporary injunction was granted October 30th, and on May 16th this was continued until after the companies should have been heard or a petition to make the injunction perpetual.

The authority to regulate fares, which is claimed by the city, rests on a reservation made by it in some ordinances granting franchises in 1879. Since that date other franchises have been given to these companies by ordinances in which no right to regulate the fare was reserved.

The court said it was apparent that the reservation of the 1879 ordinance was inconsistent with grants made in 1885. If the ordinances passed since 1879 are to be construed as statutes they are so far inconsistent with that ordinance as to operate as an appeal. In every instance when additional rights were granted the companies agreed to carry passengers farther for the same fare and that this constituted valuable concessions to the people by the companies.

"The relations between the city of Cleveland and the complainant companies, as the successors of the various companies out of which they are formed, have been so far changed by the various contracts entered into since 1879 that the city is estopped from claiming that the reservation contained in the ordinance of 1879 can now be used to either increase or diminish the rate of fare upon a small portion of the lines."

The Street Railways of Washington, D. C.

Which Will Be Operated by the Washington Traction & Electric Co.

The street railways of Washington, D. C., which up to the present time have been operated by 10 independent companies, are about to be combined under the single ownership of what is locally known as the Crosby-Stevens syndicate. This company, which will be officially known as the Washington Traction & Electric Co., has already purchased most of the street railways in the city and suburbs of Washington, and will shortly purchase all the remaining roads with the single exception of the Capital Traction Co., which is to remain independent of the consolidation. In addition to its railway interests the new company also controls the United States Electric Light Co., of Washington, and the Potomac Electric Power Co. The property of the following railways has either already been acquired or arrangements for the purchase made by the new company: Metropolitan Railroad Co., the Columbia Railroad Co., Anacostia & Potomac River Railroad Co., Georgetown & Tenallytown Railway Co., Brightwood Railway Co., Washington & Great Falls Electric Railway Co., Washington & Rockville Railway Co., Washington Woodside & Forest Glen Railway Co., Capitol Railway Co., and the City & Suburban Ry. of Washington. The latter railway is not to be purchased immediately, but will eventually join the consolidation.

Through service from the suburbs to any part of the city of Washington for a single fare is one of the principal reforms to be inaugurated by the new company. To accomplish this the lines within the city will be all equipped with a uniform underground electric system and the lines outside the city limits will be run on the overhead trolley system. At the points where these two systems meet the suburban car will run over a pit in which an underground trolley will be adjusted to the bottom of the car, enabling it to continue in to the heart of the city over the underground lines. Much of the underground construction of several of the lines included in the consolidation has already been completed, although considerable still remains to be done. The condition of the suburban lines, however, is generally poor, many of them having been built in the comparatively early days of electric railways, and these are to be completely reconstructed and re-equipped. The contract for this work on the suburban roads has recently been awarded to the firm of J. G. White & Co., of New York and Baltimore.

The purchase of the consolidated roads has been made by the United States Mortgage & Trust Co., of New York, of which Geo. W. Young is president. Mr. Young has visited Washington frequently of late in the interests of the consolidated company. The general offices of the Washington Traction & Electric Co. are at 1417 G St., N. W., which is also the office of the Potomac Electric Power Co.

The reorganization and construction of these roads is in the hands of Oscar T. Crosby, F. C. Stevens, Charles H. Lieb and H. D. Mirick. While the members of the syndicate have been very reticent in regard to the future plans of the consolidated lines, it is apparent from the work now in progress that the Potomac Electric Power Co. will be the general supply station for all of the suburban lines, those in the neighborhood of the station receiving a direct 500-volt current, while those further away will receive a biphase high tension current, which will be transformed down to a 500-volt direct current at convenient distributing points. Whether the same plan will be adopted on all the roads of the consolidated company is not known at present.

THE METROPOLITAN RAILROAD CO.

One of the most important systems to be acquired by the new company is that of the Metropolitan Railroad Co., which was the first company in the city to equip its lines with the underground trolley system. The main line of the road, called the F St. division, starts at 15th and East Capitol Sts. and extends to 36th St. and Prospect Ave., a distance of 6½ miles. This line, running east and west, divides the city directly in the center. On the route of the F St. division are the National Library, the United States Capitol, the

FIG. 1—METROPOLITAN CAR BARN.

Baltimore & Ohio Depot, the Interior Department, the Postoffice Department, the Patent Office, the Treasury Department and all of the prominent hotels. This line also passes within two squares of the White House, Lafayette Park separating the line from the White House grounds. From this point the route runs through the most beautiful section of Washington, known as the West End.

The next longest division of the Metropolitan system is the Ninth St. line, which begins at 4½ and P. Sts., S. W. It passes the Arsenal grounds, runs along the entire Potomac River front, and returns to 4½ St. Passing the Baltimore & Potomac Depot and Central Market it turns into Ninth St. On this busy thoroughfare are situated the Interior Department, the Postoffice Department, the Masonic Temple and many other noted buildings. The line terminates opposite the National Baseball Park.

The third division of the Metropolitan road is called the Columbia Ave. extension. This line starts from the Capitol, and runs over the F St. division to Depot Circle. It branches off at this point, passing along Connecticut Ave. to Columbia Ave., and through the latter avenue to 18th St.

At the east terminus of the road, corner of 14th and East Capital Sts., is located the extensive car barn illustrated in Fig. 1, covering three acres of ground. This building,

which measures 433½ ft. in length by 280 ft. in width, is handsomely finished, being faced with red pressed brick, and contains in addition to the storage room for cars the company's executive offices, a paint shop, carpenter shop, machine shop, armature winding room, compressed air plant and testing room. Fig. 2 gives a general view of the interior of the car barn as seen from the east end of the building. The two extreme tracks at either side of the barn form a loop, the east bound cars running past the outside of the building and around through the building onto the west bound track. The remainder of the tracks inside the barn are all pit tracks for overhauling the machinery underneath the cars, and a transfer table at one end of the building is used to move the cars from one track to another. Figs. 3 and 4 show the carpenter shop and paint shop, respectively. These are equipped with all necessary tools, etc., for repairing and painting the cars. Over each track in these shops is a double overhead trolley line, carrying a trolley with flexible leads which can be attached to the car, thus enabling it to be moved about the shops or from the shops to the car barn without the use of horses or man power.

Two views of the machine shop are illustrated in Figs.

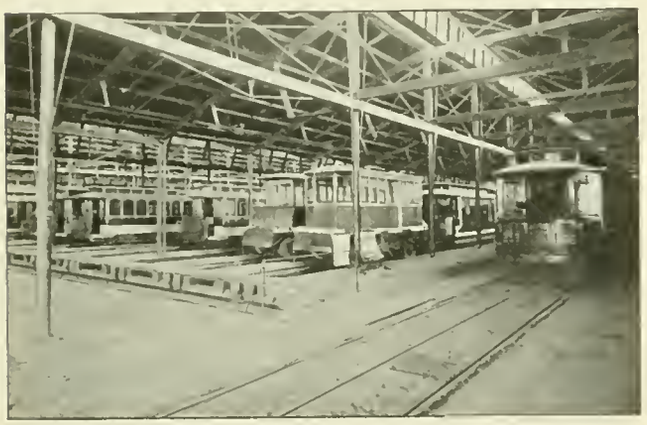


FIG. 2—INTERIOR OF CAR BARN.

5 and 6, which show different portions of the shop. This department is particularly well equipped for doing any kinds of machine work incident to a street railway. It contains 2 forges, 1 sawing machine, 1 standard emery machine, 1 drill press, 1 wheel boring machine, 1 32-in. Niles lathe with 9-ft. bed, 1 small 8-in. lathe, 1 Gould & Englehardt shaper, 1 hydraulic press, 1 Hartford grinder and 1 buffing wheel. These machines are run by a 20-h. p. General Electric motor. The armature and field winding room, which is situated directly over the machine shop, is shown in Fig. 7.

An important labor saving device in handling the machinery under the cars and transporting it between the repair pits and the machine shop is shown in Figs. 6 and 8. At the left of Fig. 8 a car is shown over the pit, in which armatures are removed. A track runs along the bottom of this pit on which a small truck runs, and this truck has a carrier upon it which moves vertically upon a threaded shaft. In operating this device the track is rolled directly beneath the motor and the vertical carrier is raised up against the armature. The armature bearings are then unfastened and the carrier with the armature upon it is lowered and the truck rolled out from under the car into the position shown in Fig. 8. The armature is then raised by a block and fall carried on a pair of wheels which run on an overhead track, and, as shown in Fig. 6, the armature is easily conveyed to any part of the machine shop upon this track. The car wheels are removed from the cars in a similar manner, and carried to the machine shop by the same device. Fig. 8 shows the method of lowering the car wheels into the pit by removing a section of the floor and track directly under the wheels after the car has been jacked up.

The machinery under the cars is cleaned by means of compressed air. The air plant is at one side of the car barn. This comprises an air compressor and a large tank, from which a supply of air under 60 lb. pressure is always available. The air from this tank is piped to different points in the repair pits to which a flexible hose and nozzle can be coupled. By turning the air through the nozzle on any part of the machinery, all dirt, copper dust, etc., is at once removed from even the smallest crevices, leaving the machinery much cleaner than any amount of wiping would accomplish, and in a small fraction of the time required to clean it by hand. The seats and cushions of the cars are thoroughly dusted in the same way by simply passing the compressed air nozzle over them.

These time and labor saving devices are made necessary by the company's rule to thoroughly overhaul every one of its cars twice a month, whether they show any need of repairs or not, and this means that about eight cars per day must be handled over the repair pits. This is accomplished by a comparatively small force of men, owing to the complete facilities which are provided for handling and repairing the machinery. Connected with the car-barn is a stable which contains an emergency wagon, horses and apparatus for making repairs along the line in case of trouble. Fig. 9 shows this wagon on which are seated the chief electrician, Mr. Chamberlain, and his crew. On the wagon is also shown a bridge, which is used to elevate a fire hose above the roofs of the cars, in case of a fire occurring along the route. At the starter's office is a transparent illuminated time table, which is easily visible in the darkest night, and at this point are also two Bristol recording voltmeters, which give records of the pressure on the line throughout the day.

Fig. 10 shows a view of the testing room situated on the second floor of the car barn. The board is supplied with current at 110 volts, 250 volts, and 500 volts, ammeter, voltmeters, wattmeters and other apparatus for testing incandescent lamps, insulation of cables, and other electrical supplies purchased by the company.

The company has in all 307 cars, including open and closed motor cars and trailers, 3 mail cars, 3 sweepers, 2 snow plows, and 1 sand car. The cars were built by the American Car Co. and the J. G. Brill Co. On the F St. division of the road there are 36 trains, composed of a motor car and a trailer, and 20 single cars in regular service. On the Ninth St. division 30 trains of two cars are operated, and on the Columbia Ave. extension 20 single motor cars are used, there being no loop at either end of the line for trailers.

The Metropolitan lines are operated from two generating stations, one of which is located at 2411 P St., N. W., and the other at 4½ and O Sts., S. W. The P St. station which supplies current to about one-half of the system, is a large brick building, faced with pressed brick, containing an engine room, boiler room and considerable extra space, which has not yet been utilized. The engine room, the di-

mensions of which are 60 x 80 ft., is illustrated in Fig. 11. It contains a 10-ton traveling crane, worked by hand power. The equipment of the engine room consists of three McIntosh & Seymour engines of the compound condensing type, which are directly connected to General Electric multipolar generators. Two of these engines have cylinder measurements of 22 and 42 x 42 in., and run at a speed of 90 r. p. m. These engines have a rated capacity of 750 h. p. and then come three generator panels. In the center is the station panel with a Weston ammeter and Thomson recording wattmeter, which measure the total station current. To the right of this are six feeder panels, and on the end of the board is an emergency panel. The latter is changeable with either of the feeder panels, and has a water rheostat in series with it, so that in case of a short circuit the feeder on which it occurs may be thrown onto the emergency panel

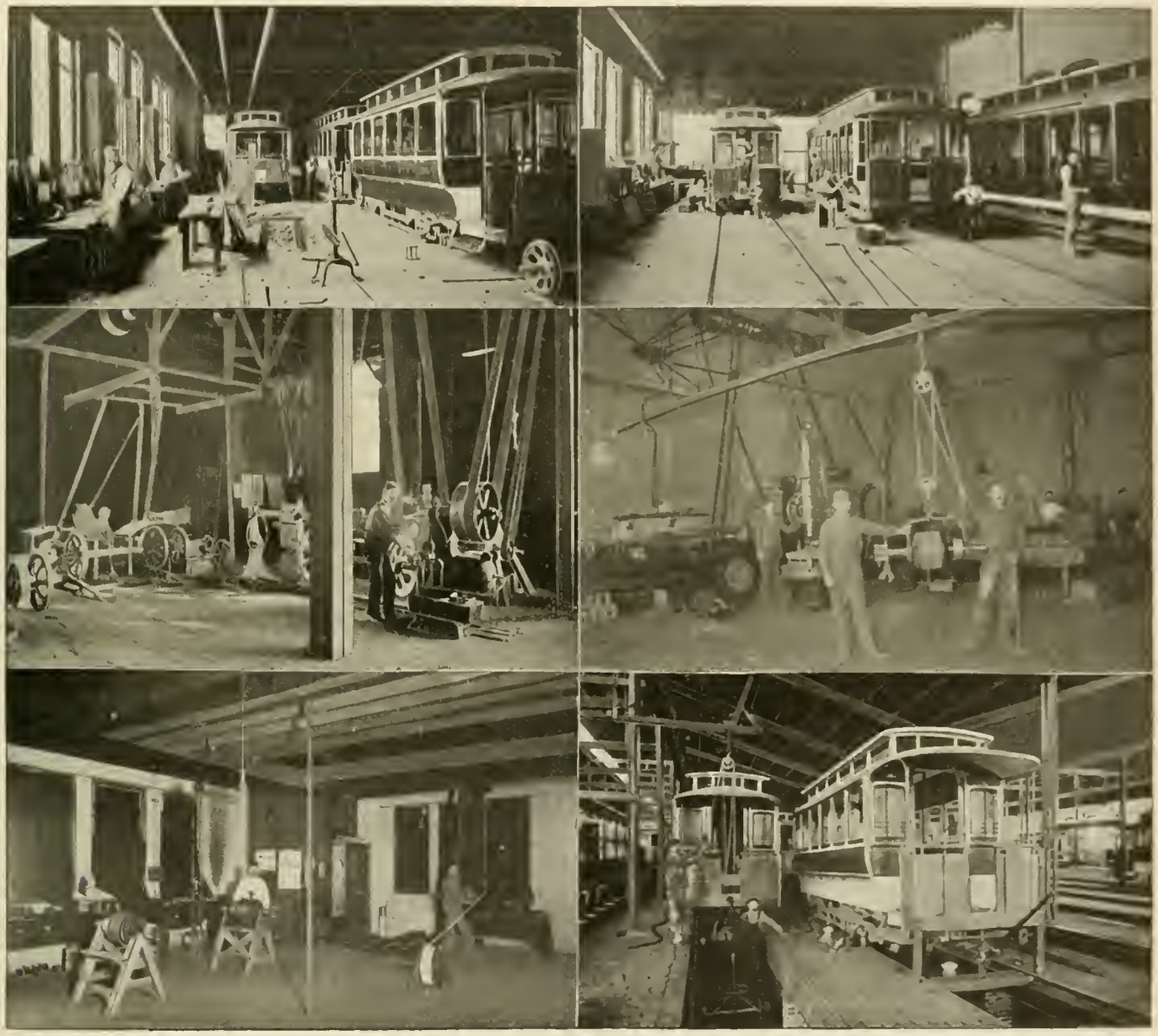


FIG. 3—CARPENTER SHOP.
FIG. 5—MACHINE SHOP.
FIG. 7—MOTOR WINDING ROOM.

FIG. 4—PAINT SHOP.
FIG. 6—MACHINE SHOP.
FIG. 8—CAR PITS.

and each is connected to a 500-k. w. 10-pole generator. The third engine measures 26 and 50 x 48 in., makes 90 r. p. m., and is rated at 1200 h. p. This engine is connected to an 800-k. w. 12-pole generator. The pressure at the station is 600 volts.

The switchboard is constructed of slate upon an iron frame, and is of the standard General Electric pattern. The first panel on the left hand end of the board is a negative panel, which is a common return for all the circuits. The next panel controls the lighting circuits for the building, and the resistence varied by raising or lowering an iron plunger into the water so that the short circuit, if not too heavy, may be burned out.

The engine room also contains three Worthington jet condensers, which, on account of there being no water in the neighborhood, are supplied from a Worthington cooling tower having a capacity of 30,000 lb. of steam per hour. The fans in the cooling tower are driven by a General Electric motor of special design, its chief feature of interest being a possible variation of 100 per cent in speed. It will also

operate on any intermediate speeds. It is of the 6-pole type, and is direct connected to the fan shaft.

The boiler room is situated directly behind the engine room and measures 60 x 80 ft. It contains 6 water tube boilers; 3 are rated at 200 h. p. and 3 at 300 h. p. each. Three are set with Murphy automatic smokeless furnaces, and three with plain furnaces. These are fed by two Worthington pumps, 9 x 5¼ x 10 in. in dimensions. They are

FIG. 9—EMERGENCY WAGON.

brass fitted throughout, and discharge their water through a Wainwright feed water heater.

The boilers are connected to a steel self-supporting stack 6 ft. in diameter and 125 ft. high. The piping is fitted throughout with Chapman valves; Blake atmospheric valves are used on the engines.

The lighting current of this station is from a 30-k. w. General Electric marine set. This plant is in charge of Mr. H. S. Bolten, chief engineer.

condensing engines, measuring 17 and 32 x 48 in., which run at 94 r. p. m. These are rated at 500 h. p. each, and each is direct connected to an 8-pole General Electric generator of 300 kw. capacity. In the adjoining room is a McIntosh & Seymour compound condensing engine with a 10-pole General Electric generator exactly similar to the two 750-h. p. units in the P St. station. The switchboard, Fig. 13, is exactly similar to the one previously described, with the exception of having one more generator panel.

There are four Nordberg jet condensers set in the basement below the engine room, one being directly behind each engine. These take water from the Potomac River, on the banks of which the station is situated. There are five water tube boilers, three of 250 h. p. each, and two of 300 h. p. capacity, all set with plain furnaces and connected to a brick stack. When the boiler plant was enlarged it was feared this stack would be too small, so it was fitted with a forced draft fan but up to the present its use has not been required.

There are two Snow pumps, 7 x 4 x 8 in., used for pumping water from the hot well to a tank, and these pumps are also piped so as to feed the boilers if necessary. Ordinarily the boilers are fed by a Dean pump, 10 x 6 x 12 in., and they are also fitted with two Metropolitan injectors, having a 2-in. discharge.

The building is lighted by means of a 6-pole, 110-volt General Electric generator direct connected to an Armington & Sims engine. The chief engineer of this station is Mr. C. S. Wilson.

The track and underground work of the Metropolitan Railroad Co. is very substantial as will be seen by reference to Fig. 14, which shows a cross section of the track and conduit through a manhole. The track rails are 7-in. girder rails weighing 83 lb., made by the Pennsylvania Steel Co., and these and the slot rails are laid on heavy cast iron yokes bedded in concrete. The manholes are built with

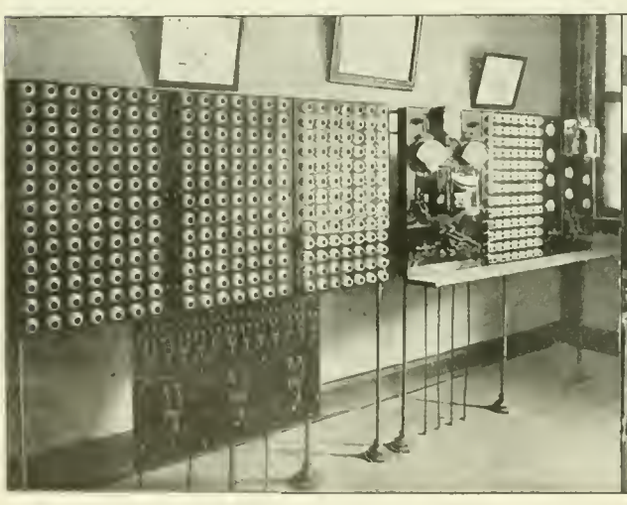


FIG. 10 TESTING ROOM.

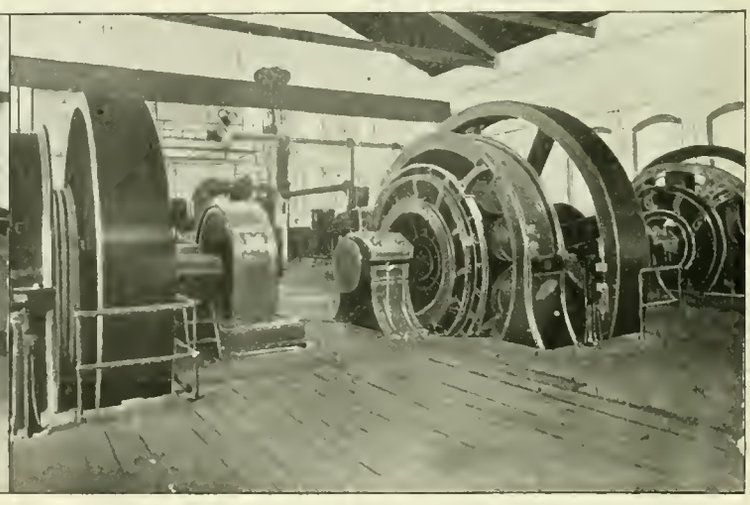


FIG. 11—McINTOSH & SEYMOUR ENGINES, P ST. STATION.

The other half of the Metropolitan lines are supplied from the 4½ St. station already mentioned, which is a brick building similar in general appearance to the P St. station, there being also considerable similarity in the equipments of both. The engine room of this station is divided by a series of brick arches into two district rooms. In the first room, Fig. 12, there are three Greene compound con-

either heavy brick or concrete walls 4 ft. square, surmounted with a heavy cap stone on which the iron manhole box is set. Fig. 14 also shows the method used for draining the conduits, and the manhole connection to the sewer, the drainage all being carried off through terra cotta pipes. The line of ducts is also shown entering the manhole. The ducts used in this construction are the single ducts made

by the H. B. Camp Co., and the four-tube ducts of the Potomac Terra Cotta Co. The cables are lead covered, varying in size from 300,000 cm. to 1,000,000 cm. Fig. 15 shows a section of the insulator used and the method of hanging the conductor rails. The insulators are heavy porcelain cylinders, with a coarse screw thread on both the inside and the outside. An iron cap with a flange that supports the weight of the insulator and conductor rail is screwed on the outside of the insulator and a bolt is screwed in the center hole of the insulator. Both the screw threads fit but roughly, and Portland cement is poured around each of the threads to make a solid joint. The lug to which the conductor rail is bolted is fastened on the insulator bolt between two nuts, which give it an opportunity to be raised or lowered and the hole in the lug through which the insulator bolt passes is made oblong so that the space between the conductor rails can be adjusted. The conductor rails are T-shaped, 22 ft. long, and are fastened to the insulators at the ends and in the center. The plow is about 2 ft. long, 8 in. wide, and just thick enough to pass along the slot. Two shoes at the bottom of the plow press out sideways between the conductor rails. The frame of the plow is made of thin steel bars and it is provided with two pairs of leads, one pair with fuses in circuit and the other pair without them. The fused leads are generally used, but in case the fuses blow the other pair of leads are connected to the car temporarily to bring it home to the barn.

The terminals which connect the feeder ends to the conductor rail are made in two parts, one of which is bolted and soldered to the rail, and the other bolted and soldered to the cable. The two connecting parts which are smoothly finished are clamped solidly together with bolts. With the old terminals formerly used much trouble was experienced by the burning of the metal due to the high resistance where the terminal was bolted to the rail without being soldered. With the new soldered terminal no trouble has been experienced.

FIG. 12—ENGINE ROOM, 4½ ST. STATION.

FIG. 13—SWITCHBOARD, 4½ ST. STATION.

The conduit and track construction was all done by Mr. E. Saxton who has laid all the underground conduit for the street railways of Washington. The character of Mr. Saxton's work is widely and favorably known, and ranks him among the best constructing engineers in the country. The success which has attended all of his work as a street railway contractor is very flattering indeed.

The Metropolitan road is the only one of the consolidated roads that is completely equipped and in full running order, all of the other roads being in various stages of reconstruction. During the National Peace Jubilee, celebrated in Washington for three days last month, the Metropolitan Co. decorated two trains of cars very handsomely in honor of the army and the navy. The ceilings of the cars were completely covered by rows of red, white and blue bunting, radiating out from clusters of incandescent lamps. The exterior decorations of these trains is shown in Fig. 16. On

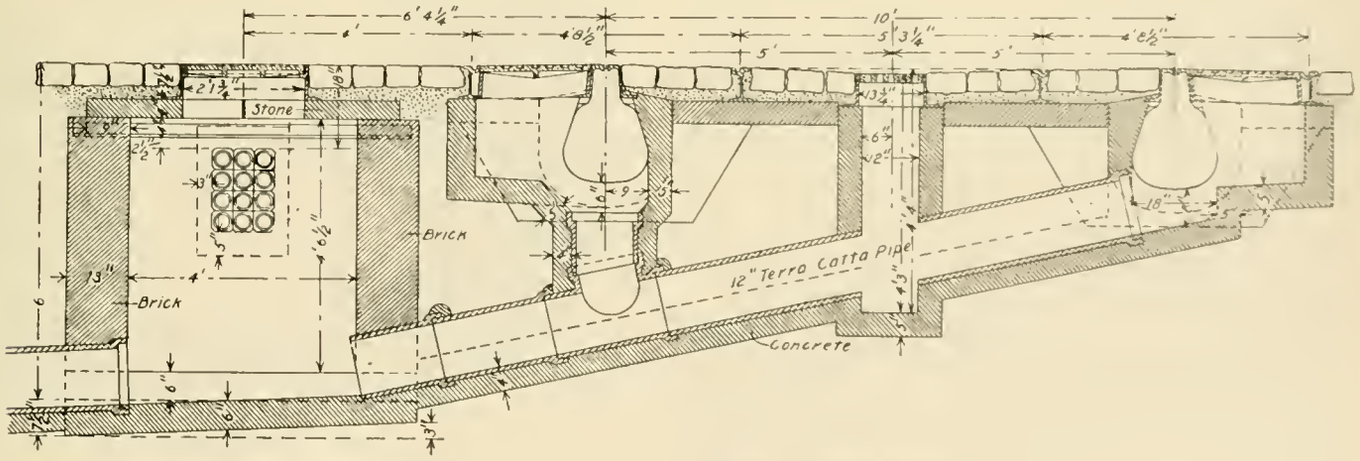


FIG. 14—CROSS SECTION OF METROPOLITAN ROADBED AT MAN HOLE.

the hoods of the front cars an American flag was set in a kind of transparency, the flag being kept unfurled by means of a fan motor revolving at one end of it. The army car bore the names of Miles, Shafter and Wheeler in illuminated letters, and the navy car the names Dewey, Sampson and Schley. The edge of the car roofs carried a solid row of red, white and blue lamps, and at the top of each side post was a cluster of white and colored lamps. The trains presented a very handsome and brilliant appearance and created much enthusiasm along the route.

The officers of the Metropolitan Railroad Co. are: R. D. Weaver, president; A. B. Grunwell, vice-president; G. B. Coleman, secretary, general manager and purchasing agent; Wm. J. Wilson, treasurer, and F. H. Chamberlain, chief electrician.

R. D. WEAVER.

G. B. COLEMAN.

Mr. Robert D. Weaver was elected president of the Metropolitan Railroad Co. July 14, 1897. Mr. Weaver is essentially a self-made man, having by his own energy and ability alone, climbed the ladder of success, and today stands at the top, one of the recognized solid and influential men of Washington. He left school at an early age and at once began his business career. For seven years he was associated with his father, and by the exercise of the best of business methods he rapidly accumulated a fortune. Later he became identified with street railway matters and has successively and successfully filled several offices with the Metropolitan. His policy has ever been a liberal one and through it he has made the Metropolitan one of the best street railway properties in the country.

Mr. G. B. Coleman has been connected with this company since he was a boy. He began as a bookkeeper, but soon showed as much ability as an executive officer as he did as the keeper of the company's accounts. He was gradually advanced from one position to another until he was elected as secretary. In October, 1896, Samuel L. Phillips resigned the presidency and Mr. Coleman was made general manager of the road in addition to the secretaryship. He was again elected to both positions in 1897.

Thoroughly efficient, energetic and progressive, Mr. Coleman has proved himself to be the right man in the right place. As manager of the road he has given the public a service that has pleased them, and in making it profitable he has pleased the stockholders. Added to his business qualifications, Mr. Coleman is personally a courteous and pleasant man. He is always ready to listen and his decisions are invariable wise and just. In business or in social circles it would be hard to find a more generally popular man than Mr. Coleman.

COLUMBIA RAILWAY CO.

The Columbia Railway Co., at present operating as a cable road, is now equipping its main line for the underground trolley system; considerable of the new construction work is already finished and the company expects to change over to the electric system by July 1st. This line starts at the Treasury Building on New York Ave, running to Ninth St., then on K St. to Seventh St., from Seventh St. to Fourth St. on Massachusetts Ave. and thence to 15th St. and Florida Ave., N. E. This line measures 2.8 miles, all double track. From the Florida Ave. terminus, where the power house is situated, a new suburban extension is being built, which extends to the east corner of the District, a distance of 4.2 miles. This is also a double track road and is being equipped with a double overhead trolley system, which was made necessary by the company's charter, which prohibits the use of a ground circuit. The new extension is being laid with 85-lb. T-rail of the American Society of Civil Engineer's section, on cross ties with stone ballast.

The power house, which is now undergoing a complete change, will contain two Allis tandem compound condensing engines, 22 and 42 x 42 in., running at a speed of 90 r. p. m., and rated at 750 h. p. each. These engines will be direct connected to two 525-kw. 10-pole General Electric generators. Two Worthington jet condensers will be used in this plant and six water tube boilers are being installed in three batteries of two boilers each. The Q. & C. oiling system will be used in this station.

The underground system of this company, and in fact, all the city lines, is in all essential points identical with that of the Metropolitan. In changing from the overhead to the underground system the company has procured a new device which will avoid all delay at this point. The device is a kind of automatic plow carriage which is fixed under the car. When the end of the overhead line is reached the overhead trolley is pulled down and the carriage automatically picks up an underground plow placed in the slot, without making any stop.

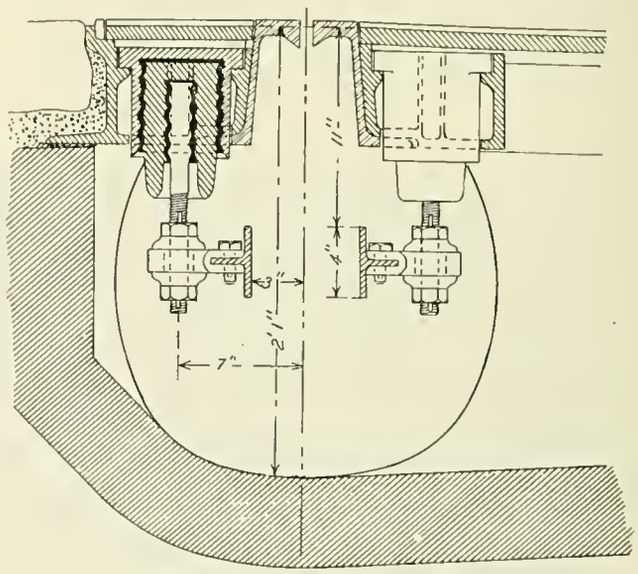


FIG. 15—INSULATOR AND RAILS.

The company has in all 52 cars for both lines. The new open cars for the suburban line, which have just been received, were built by the American Car Co., and are being

mounted on Brill double trucks. They are 42 ft. long over all and seat 44 passengers. They are built with leather cross seats and have a center aisle with twin doors. The cars are built without side steps and brass rails are fixed along the sides to compel the use of the platforms for entering and leaving the cars. These cars are each equipped with four G. E. 1,000 motors, and they all have Van Dorn couplers for running the cars in trains.

The officers of the Columbia Railway Co. are: Nathaniel Wilson, president; E. G. Davis, vice-president, and Theodore J. King, secretary, treasurer, superintendent and chief engineer of construction.

CITY & SUBURBAN RAILWAY OF WASHINGTON.

The City & Suburban lines, which will soon be a part of the Washington Traction & Electric, comprise four divisions, much of which is still in course of construction. First comes the East Washington division starting at 13th and D Sts., N. E., and running through the city east and west to the Treasury Department, at 15th and G Sts., N. W. Second is the New York Ave. division, which starts from the Pennsylvania Depot at Seventh and B Sts., passes through the city out New York Ave., to Brookland, running through Eckington, and is the only line in the city running to the Catholic University of America, and the Soldiers' Home. The third division is the North Capitol St. line which intersects the East Washington division at First and G Sts., N. W. It then runs out North Capitol St. to the Soldiers' Home and over the tracks of the New York Ave. division to Brookland. The fourth division, called the Maryland division, runs over the East Washington division from 15th and G Sts., N. W., to Fifth and G Sts., N. W., thence over the New York Ave. division to Rhode Island Ave. and out Rhode Island Ave. to the district line. From this point the line runs into Maryland, passing through Highlands, Hyattsville, Riverdale, College Park and Cakeland to Berwyn Heights, which is the present terminus of the road, although the company contemplates the early extension of this line to Laurel, a village situated half way between Washington and Baltimore. On the completion of its lines the company will have 36 miles of track in operation, that part within the city being on the underground trolley system, and the suburban lines on the overhead trolley system.

The underground construction of this company is essentially the same as that described above, except that some of the iron work is a little heavier. The track rails, made by the Lorain Steel Co., are 95-lb. girders, No. 216, and the conductor rails are stiffened by two webs on the back of the flange. The cables used are the lead covered, paper insulated cables of the National Conduit & Cable Co. The ducts are the iron cement lined ducts manufactured by the same company.

The suburban parts of the lines are particularly well built, as shown by the illustration, Fig. 17, which gives a view on the Maryland division just beyond the district line. On this division a speed of 40 miles per hour is attained in order to compete with the steam railroad service which it parallels. On this section a 95-lb. T-rail is used, laid on ties 8 in. square, with 8 in. of stone ballast below the ties and 8 in. between them. Center poles of iron are used, which carry a No. 0000 trolley wire. The rails are bonded with "Protected" rail bonds, the terminals of which were compressed in the rail webs under hydraulic pressure of 30 tons, which is the new method of the Protected Rail Bond Co.

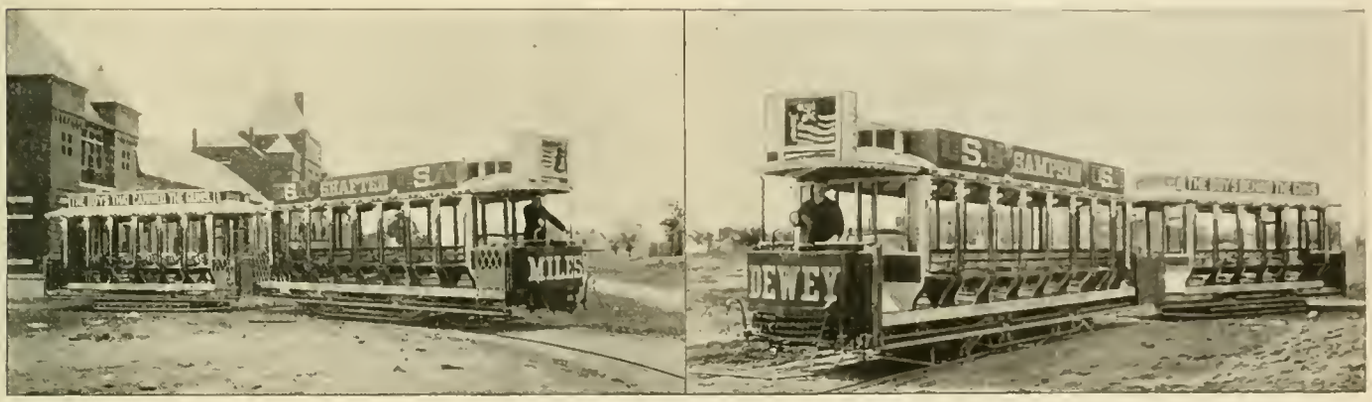


FIG. 16—METROPOLITAN TRAINS DECORATED FOR THE PEACE JUBILEE.

The company will operate 75 cars altogether. Of these 20 are short cars with single trucks and 10 are combination cars with Peckham maximum traction trucks. There are also 30 Laclede cars with 28-ft. bodies on Laclede double trucks as shown in Fig. 18. These have a center aisle with cross seats and are upholstered in plush. Ten closed vestibule cars have center aisles and cross seats and contain a separate smoking compartment, and the remaining five cars are open cars with 28 ft. bodies. The cars are all equipped with Westinghouse No. 49 motors, two on each city car and four on each suburban car; electric headlights, International double registers, Peckham trucks with 33-in. wheels and Parmenter fenders and wheel guards. Each car is also equipped with both an overhead trolley and an underground contact plow, and carries a changing switch used in changing form the metallic circuit to the grounded circuit or vice versa. On the City & Suburban the entire system is equipped with "International" registers which have given excellent satisfaction.

The City & Suburban Co. has no power house of its own, but purchases its current from the Potomac Electric Power Co., whose station is at 33d and K Sts., N. W. A two-phase current is delivered at a tension of 6,500 volts to three transformer station upon the line of the railway, one being located in the city in Washington St., one at Eckington

and one at Hyattsville. The Washington St. transformer station contains three 300-kw. rotary transformers of Westinghouse make, and the other two stations contain one each of the same units. At these points the 6,500-volt biphase current is transformed down to 600 volts direct current for use on the line. The transformer stations are not yet finished, although the machinery has been in operation for about three weeks under temporary wooden shelters. The first car on this road started on the East Washington division and the Maryland division on May 27th. The remainder of this company's lines are being rapidly pushed to completion. The officers of the company are:

FIG. 17—VIEW ON CITY & SUBURBAN LINE.

T. J. Hayward, president; W. Kelsey Schoepf, vice-president and engineer; R. I. Todd, superintendent and electrical engineer; S. C. Cooper, treasurer; Dana Stevens, secretary, and W. A. Heindle, principal assistant engineer.

BRIGHTWOOD RAILWAY CO. AND WASHINGTON, WOODSIDE & FOREST GLEN RAILWAY.

The Brightwood Ry. runs from the city line at Florida Ave. to the district line, a distance of 3.84 miles, and is a double track road with single overhead trolley construction. It has two short branches, one running to the Rock Creek Cemetery and the other, which is half a mile in length, runs to Tacoma. At the district line, where the Brightwood road ends, the Washington, Woodside & Forest Glen Ry. commences and runs out to Forest Glen, a distance of 4.11 miles. These two companies operate together 11 motor cars and 3 trailers, those on the Brightwood road running under 10-minute headway, and on the Forest Glen road under 15-minute headway. Since the purchase of these roads by the syndicate the old power plant has been discarded and they now run on a converting plant supplied with a 6,500-volt current from the Potomac Electric Power Co. This current is transformed down to 600 volts direct current by two General Electric rotary transformers of 150 kw. capacity each. Both of these roads are to be entirely reconstructed and equipped with new material and apparatus throughout.

GEORGETOWN & TENALLYTOWN RAILWAY CO. AND WASHINGTON & ROCKVILLE RY.

The Georgetown line, which is an old single overhead trolley line, starts at 32d and M Sts., N. W., and runs to the district line over 32d St., Wisconsin Ave. and the Tenallytown road, and continues to Bethseda Park; an extension of this line runs to Glen Echo and Cabin John Bridge. The road is about seven miles long to Bethseda Park, and the branch from the district line to Cabin John Bridge is five miles long. Both lines have double tracks throughout.

The Washington & Rockville road will extend from Bethseda Park to Rockville, a distance of seven miles. This road is not yet built, but its route is now being surveyed.

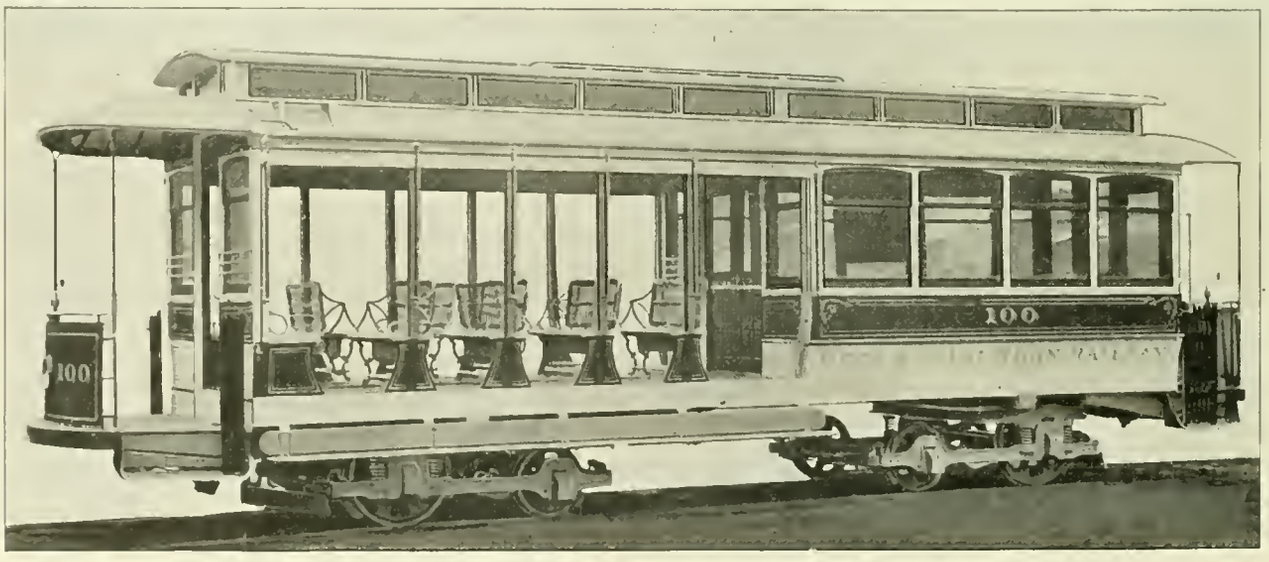


FIG. 18—LACLEDE CAR ON CITY & SUBURBAN LINE.

The Georgetown line has at present 21 motor cars, 15 with single trucks and 6 with double trucks. Part of the cars are equipped with G. E. 1000 motors and the others with Westinghouse 12 A motors. Six cars operate from 32d and M Sts. to the district line and three cars from this point to Bethseda Park. This road is supplied by a direct 500-volt current from the Potomac Co., whose station is very close to this line. On the Glen Echo branch of this road there is a small power house containing two Westing-

house 60-kw. dynamos driven by a Westinghouse upright compound engine of 100 h. p., and a 200-kw. General Electric generator run by a 350-h. p. Westinghouse upright compound engine. In case of a heavy load this station current is thrown onto the line in parallel with the Potomac current. This whole system, like all the suburban lines, is to be entirely discarded and rebuilt.

THE WASHINGTON & GREAT FALLS RAILWAY CO.

This line starts at the Union Depot, 36th and Prospect Sts., N. W., and runs to Cabin John Bridge, a distance of 8 miles, of which 5½ miles is a double track and 2½ miles a single track. This road does not pass through any streets as it owns its own private right of way over the whole route. It passes through Glen Echo and intersects the Georgetown & Tenallytown line about one mile from Cabin John Bridge. The road is to be entirely reconstructed and will be made a double track over its whole length. It operates at present 12 motor cars and 8 trailers, and it is supplied with a direct 500-volt current from the Potomac Electric Power Co.

THE CAPITOL RAILWAY CO.

The Capitol Ry. is a short road running from the Navy Yard to Congress Heights, a distance of about 2¾ miles, of which 1 mile is double track and 1¾ miles single track. This line, though short, has a large variety of motive powers. First comes a horse line and next an underground system, with surface contacts of iron raised a little above the pavements every 10 ft.; then comes a bridge with double overhead trolley wires carrying a trolley upon them from which a flexible cord depends to be attached to the cars, and finally a single overhead trolley completes the list. Only the horses and the single trolley system are now in use, there being three horse cars and three trolley cars now in operation. The trolley cars are equipped with Steel Motor Co. car motors on du Pont trucks.

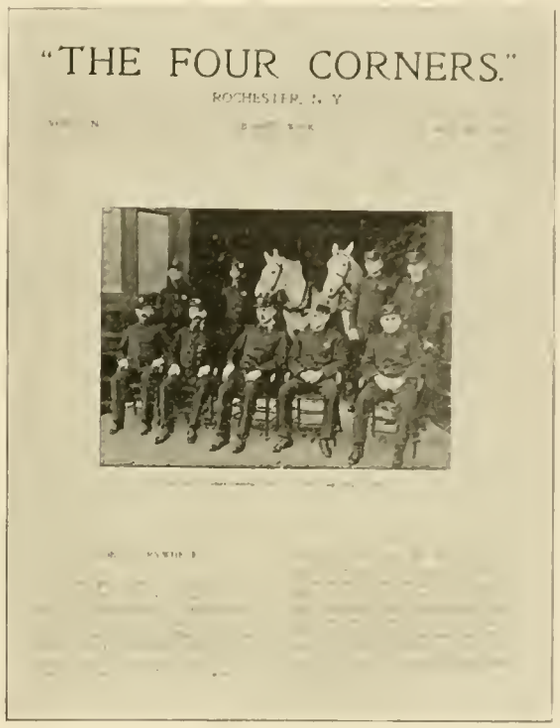
This company supplies its own current from a power house which is altogether out of proportion to the size of the road. It contains two engines of the Columbus Iron Works, one of 350 h. p. and one of 150 h. p. The large engine is coupled direct to a 200-kw. Siemens & Halske generator and the small engine is belted to a 100-kw. dynamo of the same make. Two Wickes Brothers return tubular boilers rated at 80 h. p. each and a Worthington feed pump complete the station equipment. The road is to be rebuilt and run from the plant of the Potomac Electric Power Co.

THE ANACOSTIA & POTOMAC RIVER RAILROAD CO.

The only remaining lines of the consolidated system are the Anacostia and Belt lines, these two companies having been consolidated some time previous to their purchase by the syndicate. The Belt line runs mainly in the city, while the Anacostia road is a suburban route. Both are old horse car lines and present no features of interest at present, as both lines are to be torn up and rebuilt with the underground trolley system inside the city limits and with the overhead system in the suburbs. Their power will be supplied from the Potomac Co.

ROCHESTER RAILWAY'S WEEKLY PUBLICATION.

The article in the April "Review" suggesting a plan by means of which the street railway company may effectually and cheaply reach its patrons, has already been adopted in Rochester, N. Y. Gen. Mgr. Nichols has been the first to put the scheme into effect, and the result is an extremely neat and inviting little sheet of four pages, which, by its miniature size, if nothing else, will instantly attract the attention of readers. The pages are each 7 x 9 in. with two columns to the page. The front page of the first issue is devoted to a sketch of one of the crack companies of the fire department, with a fine half tone of the men and horses.


"THE FOUR CORNERS."
ROCHESTER, N. Y.

ORGAN OF THE ROCHESTER N. Y. RAILWAY CO.

The remaining pages are devoted to announcements, time tables, and advertisements. An interesting feature is the "kickers' column." The publication is called "The Four Corners," and is published weekly and distributed on the cars.

Mr. Nichols writes us that the paper is a great success and that it must be increased in size or issued oftener.

ANOTHER FRAUD.

Last month a 16-year-old boy was arrested while selling tickets for the street car lines of the Birmingham (Ala.) Railway & Electric Co., at the rate of three for 10 cents. The tickets sold proved to be old tickets which had been pasted together. It had been the custom to destroy used tickets by tearing them in two and then throwing them into the trash box. There the pieces of tickets were rescued, pasted together and put on the market at bargain counter prices.

The employes of the Toledo (O.) Traction Co. were notified on May 20th of an increase in wages of 5 per cent.

THE GRAB-HANDLE MAN.

Mr. Benjamin J. Weeks, superintendent of the Quincy & Boston Street Railway Co., writes us from Quincy, Mass., under date of June 7th:

"Enclosed please find clipping from the Quincy Daily Ledger, of June 6, 1899, which will explain itself. This man is the original grab-handle man that was described in your paper September, 1897, and was identified from the cut in your paper. He has changed in appearance somewhat since that time and now wears glasses, and does not wear a beard."

The clipping is as follows:

Grabhandle man John Deitz, otherwise known as Shultz and Zimmerman, the grab-handle man who operated extensively among the street railways of the state and defrauded them out of various sums, was given a hearing before Judge Humphrey, in the District Court this morning, for obtaining $25 from the Quincy & Boston Street Ry. by false pretenses.

Superintendent Weeks testified that Deitz claimed to have fallen from a Houghs Neck car in October, 1898, by a grab handle coming off as he was about to alight from the car. He said he lived on Quincy Ave., and claimed to be badly injured.

Dr. Jones examined the man's injuries and was convinced that he was a fraud, but the company paid the fellow $25 rather than have a law suit, as there was some question as to the liability.

Conductor Dunham, Executive Clerk Gardner, of the company, and Claim Agent McAloon identified the fellow. Mr. McAloon also said he had examined the car after the accident, and he had gone to every house on Quincy Ave. but could find no one by that name.

Mr. Tarbox, of the Lynn & Boston, identified Dietz as the man to whom he had paid $40 to settle a claim for a similar accident. Mr. Snow, a conductor on the South Framingham road, also identified the fellow as having been the one who fell from his car last year by the grab handle coming off, and Mr. Sullivan, of the South Middlesex road, identified the fellow as the one who tried to work his road. He had identified him, however, by a photograph, and refused to pay, but had him arrested and sent to jail for six months for vagrancy.

Deitz remained mum during the hearing, and all he would say was that he did not understand. He evidently understood the sentence of nine months in the house of correction, for when it was pronounced by the clerk, Deitz murmured, "I am getting all my money's worth."

The method of Deitz, "or whatever his name may be," was to board a car and when the conductor was not looking to unscrew the nuts of the grab handle. He would then, when the conductor was forward, signal the car to stop, and as it slowed down would jump off with the grab handle in his hand and fall down. He would then claim damages, and in most cases the roads would settle rather than have a suit.

The "Review" has had occasion to make mention of the grab-handle man in four previous issues: September, 1897, page 559; August, 1898, page 583; December, 1898, page 852; January, 1899, page 3. In our issue of January last was noted the sentence of six months in the reformatory imposed upon this man for vagrancy at the prosecution of the South Middlesex Street Railway Co., of South Framingham, Mass. At that time it was stated that the Quincy & Boston would probably prosecute Dietz when his sentence had expired.

We trust that the Lynn & Boston will meet Dietz when his term has expired.

ANOTHER THEFT OF COPPER.

The Fair Haven & Westville Railroad Co., New Haven, Conn., recently suffered the loss of 700 ft. of insulated feeder wire. Current was on the line at the time, and the thieves were evidently sufficiently skilled in the art and well enough equipped with tools to escape injury.

CHICAGO UNION TRACTION CO.

The consolidation of the North and the West Chicago Street Railroad Cos., to which brief reference was made last month, is now so nearly completed that it is almost safe to speak of it as a fact. The Chicago Union Traction Co. has been organized with a capital stock of $32,000,000; of this $12,000,000 is preferred. This company has leased the property of the North Chicago and the West Chicago, the stockholders of these companies having approved the leases on June 2d. The rentals are to be equivalent to 12 per cent on North Chicago stock which is $237,600 each quarter, and to 6 per cent on West Chicago stock which is $197,835 each quarter.

To secure the payment of these rentals $10,000,000 of the stocks of the two companies which the Chicago Traction buys from Mr. Yerkes and $2,000,000 in cash will be deposited with the Illinois Trust & Savings Bank. Mr. Yerkes receives $9,000,000 cash, $1,000,000 preferred and $500,000 common stock of the Union Traction.

At the meeting of the North Chicago Street Railroad Co. Mr. Yerkes explained the situation; in substance he said:

The Chicago Union Traction Co. has made a proposition to the North Chicago Street Railroad Co. to lease its property for a long term of years and to pay the North Chicago stockholders a dividend of 12 per cent a year. The lease provides that there shall be placed in trust as security for this lease, and for that from the West Chicago Street Railroad Co., securities of those companies of the value of $10,000,000. The Traction company will also have $2,000,000 in cash, which will be used for improvements and extensions of the systems and whatever other matters are necessary for extending the street railroad properties. So there will be really $12,000,000 behind the leases. The Traction company will have a capital of $12,000,000 preferred and $20,000,000 common stock, and the preferred stock will be paid for at par, the proceeds being this $12,000,000 spoken of. It is provided that the $10,0000,000 of securities shall remain in trust for all time as security for these leases. The trust agreement provides that if there be default in the guaranteed dividend at any time so much of this deposited stock as necessary may be sold to make up the deficit. The leases to be authorized today will not be turned over to the Traction company until it deposits the $10,000,000 of securities, raise the $2,000,000 of cash and in all respects comply with the bargain.

The lease of the North Chicago is dated June 1, 1899, and is to be of force so long as the grantor company shall have any charter rights. An abstract of the lease is as follows:

First, that the North Chicago sells and transfers to the Traction a certain lease dated May, 1886, from the North Chicago City Railway Co. to the North Chicago Street Railroad Co., the Traction in all respects assuming the place of the North Chicago Street Railroad Co. under said lease. Second, that the North Chicago grants and leases to the Traction all its lines of street railroad, as the same now are or as they may be constructed, and all personal property, real estate, rights and privileges, for the term above mentioned, including the 2,501 shares of stock of the North Chicago City Railway Co., subject to the mortgage of $1,500,000 secured on same. The Traction has the right to vote this stock. The Traction may sell any real estate of the North Chicago Street Railroad Co. or of the North Chicago City Railway Co., the proceeds arising from such sale to be put in trust and to be expended for other real estate or to be applied to payment of the indebtedness of the corporation whose real estate is sold. Third, the Traction shall operate the street railroad lines and equipment and keep all property in good repair and condition, delivering the same at the end

of the lease in as good condition as when it was taken over, ordinary wear and tear excepted. Fourth, the personal and real property of the railroad company shall be appraised by two appraisers, one appointed by each party, and an inventory filed. The rental shall be $237,600, to be paid on the first days of July, October, January and April in each year, beginning July 1, 1899, also the cost of maintaining the corporate existence of the grantor, not to exceed $3,000 a year, and the payments to the North Chicago City Ry. under the old lease. The railroad company agrees to renew at maturity its outstanding indebtedness at request of the Traction. The West Chicago lease is in the same form. It transfers to the Traction the old Chicago West Division and Passenger Railway leases, and provides for a rental to the West Chicago of $197,835, to be paid the 20th day of each August, November, February and May, beginning Aug. 20, 1899.

The outstanding capital stock of the North Chicago is $7,920,000; outstanding bonds amount to $7,431,000; it guarantees bonds of the North Chicago Electric, Chicago Electric Transit, North Side Electric and Evanston Electric companies to the amount of $1,228,000 but as all these lines earn their interest the guarantee imposes no burden on the North Chicago. In 1898 the fixed charges of the North Chicago were $543,666. It owns and operates 94.33 miles of track of which 75.27 are electric and 18.12 cable. Gross receipts for 1898 were $3,015,323 and operating expenses $1,390,681; the surplus for the year was $210,019, after paying 12 per cent on the stock.

The outstanding stock of the West Chicago is $13,189,000; outstanding bonds, $18,168,000; the company guarantees $3,058,000 of the bonds of the Cicero & Proviso, Ogden Street, Chicago & Jefferson Urban Transit, Chicago Electric, Transit and North Chicago Electric, which however impose no burdens. In 1898 its fixed charges were $1,198,000. It owns and operates 202.70 miles of track, of which 165.68 are electric and 30.42 cable. Gross receipts for 1898 were $4,031,903 and operating expenses $2,017,946; the surplus for the year was $24,617 after paying 6 per cent dividend.

Notwithstanding the various statements current to the effect that Mr. Yerkes has disposed of all of his Chicago railway properties he still retains his interests in the Chicago Consolidated Traction Co. and in the Lake Street, the Union, and the Northwestern Elevated roads, which together with the holdings of his personal friends and business allies give him control of these properties. It is stated that the near future may see a combination including all the elevated and surface lines in Chicago and vicinity.

Such a complete consolidation was the ambition of Mr. Yerkes; that he was not able to accomplish it is for the most part due to the fact that he has had to fight the municipal authorities to secure every improvement he has made.

It is understood that the stockholders of the Chicago City Ry. placed so high a valuation on their holdings that the attempt to include the south side system in the Union Traction consolidation was abandoned for that reason.

April 26th W. F. Ryan, of Peoria, purchased the People's Street Ry., of Chillicothe, Ill., and on the same date sold the rails, etc., for scrap. The original cost of the property was $13,000; it sold for $800. The company had but two prosperous years, 1892 and 1893, and abandoned operations last fall.

W. F. KELLY GOES TO NEW YORK.

Mr. W. F. Kelly, who for seven years has been general superintendent of the Columbus (O.) Street Railway Co., resigned that position on May 19th to go with the Emerson McMillin Co., of New York. Mr. Kelly has long been associated with Mr. McMillin in his various street railway interests.

W. F. KELLY.

Mr. Kelly is an Ohio man by birth. He graduated from the Ohio Wesleyan University, and was a teacher for several years; he was admitted to the bar and has done considerable legal work. He learned the practical side of street railway operation as an employe of the Thomson-Houston Co., and went to Columbus in 1891 as electrical engineer for the Columbus Consolidated Street Railway Co.

At the time of the reorganization of the company in June, 1892, he became general superintendent of the whole system, a position which he has filled to the present time. He has always continued to discharge the duties of electrical engineer in addition to keeping a general supervision of the business interests of the road.

It is largely due to the efforts of Mr. Kelly that the employes of the road have been brought up to their present high standard of temperance, morality and efficiency. He has made the men feel that he is interested in their welfare and has been largely instrumental in bringing about the good discipline of the employes and their pleasant relations with their employers. He has already done away with the practice of securing positions for men for political reasons. The employes of the company are appointed and retained for their merit alone.

Mr. Kelly's business associates and his many friends in Columbus greatly regret that he is to leave them, but join in wishing him continued success in a larger field.

MUNICIPAL STREET RAILWAY FOR CONNECTICUT.

The very important question of the municipal ownership of the street railways has been agitating the citizens and the Aldermen of New Haven, Conn. The matter finally reached a stage where a vote was taken on the report of the council committee appointed to inquire "into the feasibility of the municipal ownership of public franchises," and the minority report favoring such ownership won the day.

This committee went into the subject extensively and the report was very exhaustive. One plan adopted by the committee had been the holding of public meetings to which the citizens were invited. The minority claimed that the meetings were largely attended and that the audiences were exceedingly enthusiastic in showing their preference for such a plan. The report of the majority was directly in opposition to this, but the Council, with only three dissenting votes, adopted the minority report.

The Montreal (Que.) Street Railway Co. is building 100 open cars of new and handsome design and new lines are being opened and old ones improved all over the city.

DEATH OF ROBERT GILLHAM.

Mr. Robert Gilham, general manager of the Kansas City, Pittsburg & Gulf R. R., died at Kansas City, Mo., May 19th. Mr. Gillham had been ill for only a short time with pneumonia.

While Mr. Gillham was connected with a steam road when he died, his energy, during his busy life, has been almost entirely directed toward street railway interests. He was born in New York City Sept. 25, 1854, and during his earlier school days showed a strong inclination for the profession of civil engineering. He completed his studies for this career at the Classical and Mathematical Institute at Hackensack, N. J., and in 1874 began practice in that city.

In 1876 he went to Kansas City, where he built the Kansas City Cable Ry., which included the steep incline up the bluff to the Union Depot. Mr. Gillham was not only the engineer of this system, but he was the financier as well, and secured all the money necessary to build the road. He

ROBERT GILLHAM.

also built the Kansas City Elevated Ry., was the chief engineer of the company and was elected its vice-president. He also raised the funds for and built the Eight St. tunnel, which was completed in May, 1888.

But Kansas City was not the only place which has had the benefit of Mr. Gillham's energy and abilities. He built the Omaha cable system, the 16th and Lorimer St. viaducts and the Denver Cable Ry., in Denver, Col. In the East he built the Montague Street Cable Ry., at Brooklyn, N. Y., and the Cleveland Cable Ry., at Cleveland, O.

In 1893 he returned to Missouri, and accepted the position of vice-president of the Kansas City Elevated Ry. and was instrumental in bringing about the consolidation of that system with the Metropolitan Street Railway Co. In 1894 he took the receivership of the Northeast Street Railway Co. and put the property on a paying basis in about two years.

In 1895 he began his connection with steam roads. He was appointed the chief engineer of the Kansas City, Pittsburg & Gulf, and had charge of the construction of this road from Kansas City to Port Arthur, Tex., 787 miles, and in 1897 was made general manager of the system, including the Omaha, Kansas City & Eastern, Omaha & St. Louis, Kansas City & Northern Connecting, Kansas City Suburban Belt and Kansas City & Independence Air Line. He was also chief engineer of all these roads. He constructed the Port Arthur ship canal and had charge of all the terminal and harbor improvements at Port Arthur.

When the Gulf road got into trouble, some time ago, Mr. Gillham stood by it and in April, 1899, was appointed receiver. He resigned this position, however, but still, at the request of the new receiver, retained the office of general manager.

Robert Gillham's has been a very active life. He became much interested in compressed air and at one time he was sent to Europe to make some extensive technical tests, one result of which has been a valuable addition to the literature on this interesting subject.

The funeral was held on Sunday, May 21st, and was observed in an unusual manner. When the casket was carried from Mr. Gillham's late residence an operator stationed there notified the chief dispatcher's office and orders were given to hold every train on the entire system from Illinois to the Gulf until the late general manager should have been laid in his grave. For an hour not a wheel turned on the Kansas City, Pittsburg & Gulf road. No greater mark of respect was ever paid to one of its officers by the owners of a railroad.

IMPROVEMENTS IN DAVENPORT.

General Manager Lardner, of the Tri-City Railway Co., Davenport, Ia., has been authorized to make some extensive improvements. He will make an addition to the present shop and car storage facilities in Davenport at a cost of $15,000. The new building will be two stories high and 65 x 150 ft. in area, and will give the company a frontage on Rock Island St. of 320 ft. with a depth of 150 ft.; this will afford ample room for all probable developments of the road for several years. New machinery will be put in the new shop.

The recent purchase of the rolling stock of the Moline Central lines made this addition imperative. Mr. Lardner will also buy a new engine and dynamo, so that the capacity of the power-house will be greatly increased. It is the purpose of the company to equip all its cars with electric heaters.

CHICAGO LAND DAMAGE CASE.

Judge Bishop, of the Cook County Circuit Court, Chicago, on May 8th rendered a decision in favor of the Lake Street "L" road and against the Chicago Office Building Co. which may prove to be of great importance. The Office Building Co. brought suit for damages it claimed resulted from the construction of the road alongside its building. The road demurred on the ground that where the fee to a street is in the city which permits a railway company to use that street and the use is not inconsistent with the purposes of such a street, an abutting property owner cannot recover damages. Judge Bishop sustained the demurrer, and if the decision is upheld by the Supreme Court it will defeat all pending suits for damages on account of the erection of elevated roads and all which are in contemplation.

NEW ROAD IN NEW JERSEY.

The Trenton, Lawrenceville & Princeton (N. J.) Railroad Co., J. L. Branson, of Langhorne, Pa., president, will, it is expected, be in running order by July 1st. Work has already commenced and will be pushed forward as rapidly as possible.

This new road bids fair to become very popular. It is ten miles from Trenton to Princeton and Lawrenceville lies half way between these towns. The company is incorporated under the general railroad laws of New Jersey, and not as a traction or street railway company. It owns its own right of way and can use either steam or electricity as its motive power. The tracks are to be the standard gage and if desirable, freight cars can be transferred from steam roads.

The population of Trenton is 70,000; of Lawrenceville 1,000, and of Princeton 6,000. Besides this there may be estimated as living along the line about 3,000 people. With Trenton as a great market and commercial point and Princeton, famous for its educational institutions, this road is much needed and cannot fail to receive paying patronage from the start.

A TROLLEY TRIP FROM BOSTON TO NEW YORK.

BY ROBERT H. DERRAH.

Not very long ago, stimulated by the rapid development of high power electric locomotives, some enthusiast predicted that the day would soon come when trains would run from Boston to New York, at high speed, over the hills and valleys, regardless of grades, carrying passengers between these points. That time has not yet come, but there are signs that the dream of the past may become a realization in the not remote future. The writer has proved that it is possible to go from Boston to New York, with the exception of a few gaps, all the way by electric car, and even now arrangements are under way for the filling of these gaps. The total distance is 261 miles, 209 of which are covered by trolley, and the time consumed in making the trip is less than twenty and one-half hours. In the trip I made, 9 miles were covered by carriage and 43 miles by steam train, and including $2 for the carriage and 91 cents for steam railroad fares, the total cost of transportation was $5.71.

CULVERT CROSSING, ST. CHARLES STREET R. R., NEW ORLEANS.

NOVEL CULVERT CROSSING.

The accompanying engraving from a photograph taken on the lines of the St. Charles Street Railroad Co., of New Orleans, is interesting as showing the wood paving used on all except the main streets, and also a novel culvert crossing. The drainage of New Orleans being on the surface the depth of crossings over the gutters has been limited to 5 in. in order not to interfere with the flow. The company is laying some 9-in. girder rails and at culverts it is necessary to cut away the lower flange and 4 in. of the web, and rivet angles to the web as shown in the illustration.

The United Railways & Electric Co., Baltimore, Md., has paid a dividend of one-half of one per cent on its income bonds and preferred stock for the three months ending May 31st. The amount paid out was $70,000.

Even to one familiar with the street railway developments in New England, the trip to New York by trolley was something of a revelation. Bearing in mind that of the 209 miles covered by trolley fully 180 miles are in the country, and less than 30 miles in city streets, the reader will come to a realization of how important a factor the electric railway has come to be in our New England country life. It has wrought a great change in the habits and life of the people. The country farms have been robbed of their isolation, the trip to the nearest large town is no longer a matter of taking a "day off" because of train connections, and the "pleasure traffic" of the people of the cities has been infinitely extended, making possible excursions into the country for people to whom such excursions had previously been a luxury.

There are only five breaks in the continuous trolley line to New York from Boston, and some of these are short.

The first is between West Warren and Indian Orchard, Mass., a distance of some 18 miles. Yet here the Palmer & Munson Street Railway Co. has obtained a franchise from its existing line at Forest Pond through to West Warren, via Ware. This company now operates a line through from Palmer to Three Rivers and Forest Pond, and when this new link is connected, it will bring the traveller from Boston some 10 miles nearer Springfield. Between Warehouse Point and East Windsor Hills, in Connecticut, is another gap of five miles and this gap is to be closed by a line now under construction. When this is completed, one may ride from Indian Orchard, through Springfield, Hartford, and New Britain to Berlin, Conn. The third break comes between Berlin and Meriden, a distance of about eight miles. Although a street railway between these points is not projected, the New York, New Haven & Hartford Co. probably will have its third rail electric system in operation

between these two points in the near future, with sufficient service to accommodate the general riding public. Petitions are now pending before the Legislature of Connecticut asking for the right to operate a line of electric cars from New Haven parallel to the tracks of the New York, New Haven & Hartford, to Wallingford, Conn. Should these petitions be granted, and the line built, there will be a continuous electric line from Meriden to Stamford, a distance of 65 miles, all connected. From Wallingford to Mount Carmel, Conn., is a break of about four miles, and in spite of the fact that this is the shortest gap in the whole line, it will probably be the last one filled, as the country traversed is one which would afford almost nothing in the way of revenue from local traffic. The last of the missing links is that between Stamford and New Rochelle, Conn., but an electric railway covering the 17 miles of this distance is likely to be constructed in the near future.

So much for what may happen. To come to actual facts, I left Park Street Station in the Boston Subway at 8.30 one Monday morning, boarding a Newton Boulevard car. After a run of 34 minutes through Boston and its aristocratic suburb of Brookline, I arrived at the city line between Newton and Boston, where connection was made with the car of the Commonwealth Avenue Street Railway Co., near at hand. After a fast ride to West Newton, a change was made to the line of the Wellesley & Boston Street Ry., which crosses the Commonwealth Avenue line without switch connection. This took me in a few minutes to Newton Lower Falls, where, at the other end of the bridge crossing the Charles River, connection was made with the Natick & Cochituate car to Natick. Thence over the line of the South Middlesex Street Railway Co. I went on to South Framingham, crossing over the steam railroad track. Thus far most of the country traversed had been urban or suburban in character, but after leaving South Framingham the car of the Framingham Union Street Railway Co. carried me into a region distinctly rural—a country of farms and small rural villages, all the way from here to the central city of Massachusetts. The car of the Framingham Union Street Ry. runs to Framingham Center, where connections are made with the Marlboro Street Railway Co. to Marlboro. A through line will be run from South Framingham to Marlboro this summer, shortening the journey somewhat. Here a change is made to the cars of the Worcester & Marlboro Street Ry. to Worcester, which city I reached at 1 o'clock, arriving in time for luncheon.

Resuming the journey on the 1:45 p. m. car of the Worcester & Suburban Street Ry., a run was made to the town of Spencer, where connections were made with the Warren, Brookfield & Spencer Street Ry. for West Warren. Here came the first break in the journey by trolley, but the electric car arrived in time to allow me to take the 5:24 train on the steam railway for Indian Orchard, a distance of 18 miles. Here another electric car was boarded, and I arrived in Springfield at 6:35 p. m. over the line of

the Springfield Railway Co. The journey from here might have been continued that night, but as my desire was not especially to make record time, I remained in Springfield over night.

At 6:35 on the following morning (Tuesday), I boarded a trolley car passing through Longmeadow to the dividing line between Massachusetts and Connecticut. Here the state boundary enforced a change to the line of the Enfield & Longmeadow Street Railway Co. to Warehouse Point, Conn., a little town, where a carriage ride is forced upon the traveller. A dollar conveyed me in a carriage to Windsor Hill, although from Warehouse Point to East Windsor Hill, some four miles, the rails and ties of a street railway were scattered along the roadside and the line connecting these two points will be in operation this summer, thus saving the passenger 90 cents. At East Windsor Hill the Hartford Street Railway line is taken to Hartford, where a change is made to another line which is operated jointly by the Hartford Street Ry. and the Central Railway & Electric Cos. As for some seven miles these companies operate over a private roadway, swift time is made, giving a glimpse of the possibilities of the future electric railway between Boston and New York. The line operated runs to New Britain, 10½ miles, and here a change was made to the line of the New Britain Street Railway Co., running to Berlin, and arriving at the electric terminus there in time to take the 12:43 o'clock train for a run of eight miles. Fifteen minutes later I stopped in Meriden for luncheon, after which I took the car of the Meriden Street Railway Co. to Wallingford, about nine miles, coming to another gap in the journey. At this point, in order to make as much as possible of the journey by electric car, I took another carriage as far as Mount Carmel, some four miles, connections being made there with the electric cars of the Fair Haven & Westville Street Railway Co. for New Haven.

The New Haven & Milford electric cars run every two hours, and as, owing to an unforseen delay, I had missed the 4:15 p. m. car by about five minutes, I was obliged to remain over until the departure of the 6:15 electric car, which took me through to Bridgeport that evening. The run over this portion of the journey was one of the most delightful of the entire trip, there being occasional glimpses of Long Island Sound, while the scenery of the Connecticut Valley is of the most charming character. The country landscapes are refreshing to the city traveller, and the succession of pretty villages and old colonial houses would delight an artist.

Remaining in Bridgeport over night, on Wednesday morning I took an early car for Westport, still following the coast, where connections were made with the cars of the Norwalk Tramway Co. (The trip from Westport to Stamford was made in a special car of the Norwalk Tramway Co., which met Mr. Derrah and his companion, who represented the Boston Globe; a number of Norwalk men were guests on the special.—Ed.) taking me through to South Norwalk, and there connecting with the Stamford Street Railway line. Arriving at Stamford, I was obliged to take the steam cars again for the final break in the line, to New Rochelle, a run of 17 miles. At New Rochelle a line runs out of the town to Mount Vernon, where a change was made to the car for West Farms. At West Farms another change was made for 129th St., New York City, the distance from New Rochelle to this point being 15 miles. One cash fare was taken, and two transfers furnished. At 129th St. the Metropolitan line was taken, running to the City Hall in New York, completing the journey.

It should be borne in mind that when I took this long trip by trolley the cars were not running on the summer schedule. In the summer time many of these lines run a greater number of cars, so that it would be possible for one to make this journey in a somewhat shorter time than I consumed. In September or October, when the country is seen at its best, with the forests colored by the frosts, no more delightful trip could be imagined. It is well worth taking at any time, and one who has been unacquainted with the conditions of electric railroading in the country can have no idea of the broadening influence of such a journey. As a rule, the rolling stock of all the companies is of a high class, and the time made is generally good. On many of these roads will be found center-aisle, vestibuled cars, and the latest improved motors, while the rolling stock and roadbed are far superior to that of the average city railway of a decade ago. Ten years hence may see an equally great improvement. At least it is likely to see a continuous trolley line between Boston and New York.

The table and sketch show the mileage, rates of fare, time consumed, and the route of this trolley journey. In the table the figures give the distance, fare, and time between the station opposite the figures and the station just above it.

BOSTON TO NEW YORK BY TROLLEY.

Subway, Boston.	Miles.	Fare.	H. M.
Newton Line	6½	$ .05	34
West Newton	4	.05	18
Newton Lower Falls	2	.05	09
Natick	6	.10	30
South Framingham	4	.05	22
Marlboro.	11¾	.15	1 :
Worcester	16	.15	1 : 30
Spencer	12	.20	1 : 20
West Warren	15½	.25	1 : 20
Indian Orchard	**		
Warehouse Point, Conn.	22¼	.20	2 : 51
East Windsor Hill	*		
Hartford	8½	.15	45
New Britain	10½	.10	45
Berlin	2½	.05	15
Meriden	**		
Wallingford	9	.15	45
Mount Carmel	*		
New Haven	8½	.15	48
Milford	10	.25	1 : 00
Bridgeport	11	.15	50
Westport	11	.15	1 : 00
Norwalk	3	.05	20
Stamford	12½	.25	1 : 10
New Rochelle	**		
129th St.	15	.05	1 : 35
City Hall, N. Y.	7½	.05	50
Total by electric cars	209	$2.80	16 : 57
*Total by carriage	9	2.00	2 : 00
**Total by steam	43	.91	1 : 32
Total	261	$5.71	20 : 29

Average fare by electric cars, 1.34 cents per mile.
Average fare by steam cars, 2.12 cents per mile.

IN THE POWER HOUSE

This department is devoted to the construction and operation of electric railway power houses. Correspondence from practical men is specially invited. Both the users and makers of power house appliances are expected to give their views and experiences on subjects within the range of the department.

In the report of the committee on the revision of the American Society of Mechanical Engineers code of 1885, relative to a standard method of conducting steam boiler trials the method recommended for measuring tube heating surface was changed from that given in the committee's preliminary report. The report submitted at the Washington meeting in May, 1899, says:

"The area of heating surface is to be computed from the surface of shells, tubes, furnaces, and fireboxes in contact with the fire or hot gases. The outside diameter of water tubes and the inside diameter of fire-tubes are to be used in the computation."

The preliminary report recommended taking the outside diameter of the tubes in all cases. The rule adopted is to be commended because it is correct and accuracy is more important than uniformity.

CALCULATING HORSE-POWER FROM INDICATOR DIAGRAMS.

April 11th, Mr. Edward F. Miller presented a paper entitled "Some Uses of the Steam Engine Indicator" before the New England Railroad Club. An extract is as follows:

"Figure 2 represents what is called a stroke card. The indicator shows the pressure on one side of the piston for a revolution. (a) When we calculate the horse-power from a card, we are assuming that the back pressure and compression line on the other side of the piston are the same as shown on the card. This may, or may not, be the case. (b) In calculating the total horse-power for the two ends of the cylinder, any error from this cause affecting the calculation for one end of the cylinder will be nearly balanced by an opposite error in the calculations for the other end, so that the final result is practically right. (c) If it were not for the piston rod making the area of one side of the piston smaller than that on the other, there would be absolutely no error arising from this.

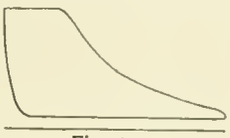


Fig. 1.

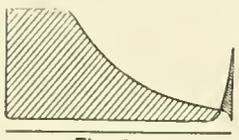


Fig. 2.

"(d) The stroke card shows the pressure on opposite sides of the piston at all points of the stroke. The difference between the lines at any point is the effective push per square inch. This card is constructed by using the steam and expansion lines of the card from one end, and the back pressure and compression lines for the same stroke from the card taken on the other end.

"In constructing this diagram for very accurate work, the ratio of the areas of the two sides of the piston have to be considered. The pressure above the atmosphere for one side being multiplied by this ratio. It will be seen that up to the point of cut-off, the difference of pressure or effective pressure is nearly constant; this difference grows less due to the drop along the expansion curve, till at the point where the two lines cross the pressure on the two sides balance. Beyond this point the pressure exerted to hold the piston back is greater than that exerted to push it ahead. The energy stored in the fly-wheel during the first part of the stroke is given out here near the end of the stroke to help the engine over the dead point."

Assuming the paper to have been correctly reported, it is surprising to find in a paper on this subject such erroneous ideas concerning one of the most common uses of the steam engine indicator. For convenience in discussion reference letters have been inserted in the extract quoted.

(a) The statement (a) is incorrect. The only assumption made when horse-power is calculated from an indicator diagram is that the diagram correctly represents the changes in pressure and volume which took place in the cylinder.

A few definitions may be of assistance here:

A horse-power is 33,000 ft. lb. of work done per minute.

Work when measured in foot-pounds is the product of force (pounds) and distance (feet), or it may be expressed as the product of the force per unit area and the volume displaced while that force is acting. From this latter conception of work we get the well-known expression: Work equals the integral (between the proper limits) of p.dv, where p is the force per unit of area acting during any short interval of time and dv the volume displaced while the force p is acting.

If the indicator diagram shows the changes in pressure and volume on one side of the piston during a revolution, then the area between the line traced during the working stroke, a line of zero pressure and two parallel straight lines joining these two, is proportional to the work done BY the steam during its working stroke, because it is proportional to the integral of p.dv. Similarly the area between the lower line traced by the indicator pencil, a line of zero pressure and two parallel end lines in proportional to the work done ON the steam during the exhaust stroke. The difference between these two areas is area of the diagram and is proportional to the net work done in that end of the cylinder during that revolution. When the area of the diagram is multiplied by the proper constants and by the number of revolutions per minute and the product divided by 33,000 ft. lb. the result is the horse-power developed in that end of the cylinder.

This result is exact, and the fact that the steam pressure on the opposite side of the piston is one of the opposing forces against which the work was done does not make the case different in principle from one where a friction brake furnishes all the resistance.

(b) Since the horse-power computed for each end is exact the statement (b) concerning compensation of errors is incorrect.

(c) For the same reasons the fact that the effective piston area is usually less on the crank end than on the head end does not introduce any error and the statement (c) is incorrect.

(d) The "stroke card," if properly drawn, shows the net force per unit area acting on the piston due to steam pressure. It gives no idea, however, of the net force or effective push on the cross-head or crank pin, because the "effective push" due to the steam together with the fly-wheel have in the early part of the stroke to accelerate, and in the latter part of the stroke to retard the reciprocating parts. While the "stroke card" is undoubtedly useful for some purposes, the calculation of horse-power is not one of them.

"KALOR."

Prof. R. C. Carpenter, of Cornell University, writes us concerning what purports to be a letter from him recommending a fuel saving compound known as "Kalor" and made by the National Fuel Compound Co., of Boston. Professor Carpenter writes in substance as follows:

"I find on referring to the testimonials that a letter of mine is published which has no reference to 'Kalor,' but did have reference to another compound, which at the time was called 'S. C. (394) Compound.' I was engaged by a disinterested third person to make a series of boiler tests in 1892 with and without the latter compound in such a manner as to determine its value, and was requested to write to a third person the results of the tests as made from time to time. The letter published is a copy of one written during the progress of the trials for information of said third person, and the tests to which it refers were those in progress at the time. It will be noted by referring to the letter that the trials quoted did show an apparent, although slight, advantage

COST OF POWER FOR ELECTRIC RAILWAYS.

Output Measured by Wattmeter in Each Case.

STATION.	MONTH, 1899.	Monthly Output, Kilowatt-Hours.	Cost of Electrical Output per Kilowatt-Hour Cents.						Gals. Cylinder Oil per 10,000 k. w. h.	Gals. Lubric'ting Oil per 10,000 k. w. h.	Lbs. Water per Lb. Coal.	Lbs. Fuel per k.w.h.	Price of Fuel per Ton of 2,000 Lbs.	Kind of Fuel
			Fuel.	Labor	Supplies, Oil, Waste, etc.	Water.	Repairs.	Total.						
1	Feb.	1,532,640	.242	.142	.037	.032	.044	.497	3.63	.679	11.18	2.62	1.85	Bituminous
3	"	214,880	.512	.295	.052	.018	.002	.879	3.7	2.8	.....	4.81	2.12	"
4	"	434,950	.375	.149	.022	.006	.062	614	2.0	2.5	.....	3.48	2 16	"
5. Metropolitan Elevated, Chicago.	"	.....	....	....	....	....	....	....	...	...	...	...	...	"
6	"	485,284	.833	.281	.052	...	.157	1.323	...	...	.....	2.70	.959**	Oil.
8	"	763,400	.612	.302	.022	.047	.047	1.029	...	...	.....	...	...	Bituminous
9	"	400,870	.489	.257	.017	.043	.024	.830	...	...	.....	...	...	"
10Central Av., Metropolitan, Kansas City, Mo.	Jan.	471,394	.309	.103	.012	.005	.006	.437*	2.2	3.4	.....	4.89	1.27	"
"	Feb.	433,291	.323	.120	.014	.006	.004	.449*	2.5	2.4	....	4.971	1.30	"

*Miscellaneous .003. **Price of Oil per Barrel.

due to using the compound. The compound was applied by putting it in solution and applying it to the coal. Mr. Wm. Kent suggested that the apparent gain might be due entirely to the dampening of the coal when applying the compound. Subsequently other trials were made, and it was found that equally as good results could be obtained by slightly dampening the coal without the use of 'S. C. (394) Compound' as with it. The final conclusions of our entire series of trials was that the compound S. C. (394) was absolutely worthless as a fuel; further, that all the gain which was caused by its use in some cases was due to the applied water or to the method of handling the fire. This final conclusion I see is not given in the testimonial.

"I know nothing in regard to 'Kalor,' nor know anything in relation to the National Fuel Compound Co., but do know that the letter in question was never written for the purpose for which it was used, and consequently that its use in such a manner must tend to deceive the public. If the compound is the same as the compound investigated in 1892 I do not hesitate to say that I believe it entirely worthless as a means of improving the calorific value of fuel."

SAFETY VALVES.

From a paper on "Steam Engineering" read before the Maritime Electrical Association by P. A. Freeman:

"Safety valves are the most delicate part of a boiler and demand constant care and watching if we wish them to work fairly accurately. My experience with spring safety valves has led me to adopt the rule that all our safety valves shall be lifted from off their seats once every 24 hours. If this is not done I find that a so-called skin forms on spring and seat, and if the valve is not lifted oftener than once a week it will take considerable more pressure to lift it than for which it was originally set. Another very serious trouble with safety valves which often occurs is the loosening of the check nut, and if this is not attended to immediately upon the indication of such troubles the steam pressure will drop and all steam escape into atmosphere, shutting down the plant. Although it at first appears difficult to the engineer or fireman to tighten the nut and set the valve properly, nevertheless if he understands his type of valve thoroughly he can accomplish it with his monkey wrench, hammer and chisel in very short space of time with perfect safety to himself and plant. If the valve should commence to blow off and steam pressure drop more than 5 lb., or if the steam pressure should at any time drop more than proper on account of the safety valve blowing off, the engineer or fireman should at once assume that the valve is out of order and must be attended to immediately. If the check nut is loose it can be remedied by turning the valve spindle to the right until the steam stops escaping, then the cap may be removed and the check nut tightened without further difficulty. The boiler pressure should be increased to the same point at which the valve blew off, and beyond, in order to make certain that the valve will blow off at the proper pressure. This point can be easily obtained by slightly turning the valve in the proper direction.

The above method of handling the safety valve is that commonly used in ordinary practice, but for close regulation the cushion seat should also be raised or lowered according to the range within which it is desired to have the safety valve act. Under no conditions should the safety valve spindle, or any of its parts be struck or hammered in order to make it close, as this is a very dangerous practice and is liable to cause more or less serious explosions. This latter precaution of mine may seem to be hardly necessary, yet in my own experience I have seen an engineer strike down on the spindle with a piece of wood 6 x 6 with the idea of causing the valve to close. Although at this time of which I speak no serious results occured, it might cause great danger the very next time it was tried.

CORNELIUS SMOKELESS FURNACE.

Mr. Frank H. Mason, U. S. consul-general at Berlin, has sent to the State Department an account of the operation of a process of burning low grade fuels without smoke patented by Mr. Paul Cornelius. Tests have been made in various plants which, it is stated, resulted in a great saving in fuel bills and the complete abatement of the smoke nuisance.

The plant at Berlin, which Mr. Mason inspected, is thus described:

The two boilers are of the ordinary flue pattern, placed side by side and their furnaces separated by a dividing wall, so that one can be thrown out of use or turned on, as occasion may require. The furnaces are about 10 by 4 ft. in area and the smoke passes by subterranean flues to a stack chimney standing in a central court and rising above the roof of the building. Near the furnaces is located an ordinary fan blower, driven by an electrical motor of ½ h. p., the speed of which is easily controlled and which drives the air through a 6-in. pipe into a hollow iron chamber about 10 in. deep, which forms the front section of the hearth of the furnaces. Into this air chamber is fitted one end of the hollow grate bars, which are about 2½ in. in diameter, extend backward the length of the furnace, and are supported by ordinary bearings at the farther end. These hollow grate bars are round on the bottom, but at the top are hexagonal, presenting three faces, each pierced with holes about 2 in. apart and beginning with a caliber of ⅛ in., which increases slightly throughout the length of the bar, to equalize the discharge of air from the gradually decreasing pressure within. The hollow grate bars are laid about 6 in. apart, and there is placed between each pair three solid triangular bars, which assist in sustaining the weight of the burning fuel. The air being forced by the fan blower into the hollow chamber, is there heated from the fire on its upper surface, then passes into the hollow grate bars and is injected upward in three rows of jets, one vertical and two inclined to right and left, so that the entire under surface of the burning mass resting on the grate is fed constantly by jets of fresh-heated air, which generate from the most ordinary grades of fuel an intense white heat, which can be perfectly controlled by regulating the speed of the fan blower and produce a combustion so natural and perfect that the smoke is entirely consumed.

PIPE FLANGES AND BOLTS.

Abstract of a paper presented before the American Society of Mechanical Engineers by A. F. Nagle, of Chicago.

There is probably no part of a steam plant which presents so untidy, so incongruous, an appearance as the exposed pipe flange joint. The engine itself is handsomely finished, and all its steam joints are steamtight and covered in a substantial manner with nonconducting material and sheet steel. But we do not get away from this finished and polished machine before we are offended by the sight of the rough, uncovered, and hot pipe flanges. Why is this unsightly practice continued? Why should not a simple little round pipe joint be made as steamtight as any part of the engine?

The pracical engineman will tell you that all these steam pipe

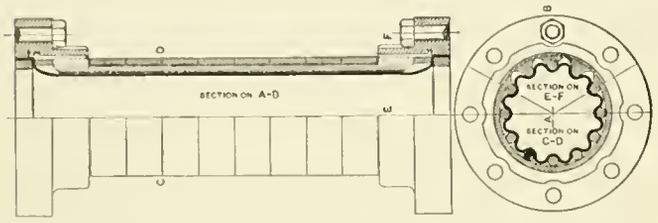


FIG. 1.

joints are liable to leak or blow out at any time, and hence he wants to have easy and quick access to them, which he would not have if they were covered. Here is a confession of a weak point in our steam engineering practice that should not be allowed to go on forever. I have given this subject considerable study of late years, and some of my conclusions I shall be glad to lay before this society.

It can scarcely be imagined that it is difficult to make a single flange joint steamtight when undisturbed by an extraneous force. The fact, however, is that in a modern large steam plant the elongations due to heat are irresistible, and provision must be made to take care of them. This is not always easy to do within the limted space at command, but it may be set down as a guiding principle that wherever possible it is better to let these expanding forces come upon torsional resistance rather than in the form of transverse stress upon the pipe and its flanges. Flexure produces a strain upon the bolted joint which it is not able to stand to any appreciable degree without opening up the joint, but torsion is easily resisted by a bolted joint to any degree even to the point of twisting the pipe to destruction, should it not possess sufficient flexibility to give the required amount of angular motion.

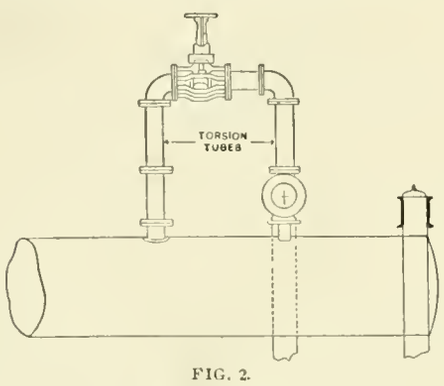


FIG. 2.

Assuming a permissible fiber stress of 10,000 lb. per sq. in. in the bolts and basing computations on the dimensions of standard Chapman fittings for steam pressures of 250 lb. it is found that the pressure which can be put on the gasket is from 168 lb. per sq. in. on a 16-in. pipe to 347 lb. per sq. in. on a 3½-in. pipe; these pressures are very small and it is quite apparent why a slight transverse stress on the piping causes plane faced flange joints to open. The pressure per square inch on the gasket is found by subtracting the steam pressure on the area of the pipe from the total permissible stress on the bolts and then dividing by the net bearing area of the full flange.

To get an increased unit pressure on the gasket the national recourse is to a tongue and groove. Similar calculations were made for the gasket pressures obtained with the dimensions of tongues and grooves now largely used which are ½ in. for 3-in. to 7-in. pipes; ⅝ in. for 8-in. and 9-in.; ¾ in. for 10-in. to 14-in.; ⅞ in. for 15-in. and 16-in.; 1 in. for 18-in. to 24-in. The gasket pressures vary from 600 lb. per sq. in. of tongue for 22-in. pipe to 2,500 lb. per sq. in. for 7-in. pipe.

The author shows that if the tongue is made 1 in. wide for all sizes of piping, the gasket pressure will vary from 755 lb. per sq. in. of tongue for 16-in. pipes to 1,360 lb. for 6-in. and 7-in. For other sizes between 3-in. and 24-in. the gasket pressure varies but little from 1,000 lb. per sq. in.

In order to carry out more completely the author's idea of relieving flange joints of all transverse stress, or flexure, and substituting, so far as possible, torsional strains therefor, he has designed a pipe construction which admits of torsional movement to a large degree without straining either the material of the tube or the flange joint to any appreciable extent. It is shown in Fig. 1 and consists of what might be termed stave construction instead of solid pipe. These staves are steel rods securely fastened to the flanges. Exterior to these staves are strong iron or steel enveloping rings. Interiorly is a thin, longitudinally corrugated copper tube also securely fastened to the end flanges. This makes a pipe which is strong in every direction but one, namely, that to resist torsion. With these flexible tubes put in in the proper manner all elongations of steam pipes should be easily taken care of and without straining any joint to a dangerous degree. See Fig. 2.

It is not intended to patent this form of pipe, and hence it can be made by any one who chooses to do so.

COST OF OPERATING ELEVATED ROADS.

Mr. B. H. Thwaite, writing on "The Influence of Electricity upon Railway Locomotion" in the current number of the Engineering Magazine, gives the following figures on the cost of operating the Liverpool Overhead Ry., the Manhattan Elevated, New York, and the Brooklyn Elevated. Though not stated, we presume the tons are long tons.

	Liverpool.	Manhattan.	Brooklyn.
Cost of coal per ton-mile.....	.020d.	.029d.	.038d
Cost of supervision per ton-mile	.014d.	.036d.	.021d.
Total operating expenses per ton-mile	.1245d.	.190d.	.152d.

UNION BOILER TUBE CLEANER.

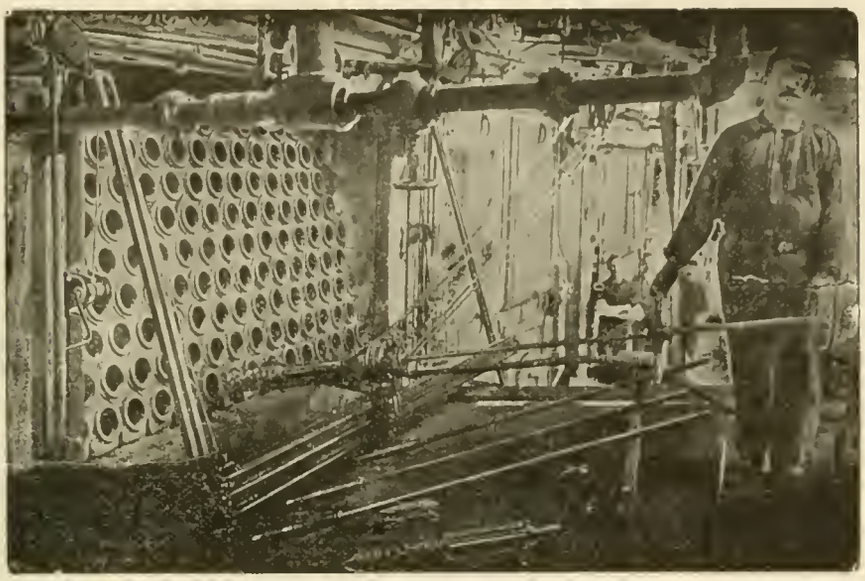
The accompanying illustration is from a photograph showing the method used by the Union Boiler Tube Cleaner Co., of Pittsburg, Pa., for cleaning horizontal straight tube boilers. A substantial platform is first erected in front of the tubes; this platform should be the full width of the boiler front and about 10 ft. long. The boiler tubes are uncapped at both ends and the doors removed; brackets are then bolted to the hinge lugs and to these is secured the cross bar that carries the driving head of the cleaning device. The power for driving is transmitted through ropes, suitable pulleys and counter weights being arranged to take up the slack. The cleaning head is rotated at from 1,200 to 2,000 r. p. m. depending on the diameter of the tube, and is kept cool by a stream of water under ordinary hydrant pressure.

The cleaning head, which is seen in the foreground, is formed of a series of discs, nine in number, one in front of another, five of which are in a progressively graduated series. One of these discs has a left-hand thread and forms a nut or binder, which, with the aid of the cone-shaped head, holds the other eight discs in place; to each of these eight discs are loosely pivoted, but restricted in motion, three arms; to each of these arms is loosely pivoted a wheel having 18 sharp points—both arms and wheels, 24 of each, are made of the best tool steel, finely tempered; the rapid rotary motion causes the arms to fly out, and consequently each successive set of cutters up to the sixth set operates in a path of larger diameter than the preceding set; the last three sets of cutters do the final cleaning out and polishing of the tube. There should be but one going through.

The feed rod is in sections fastened together with snap couplings; after each of the rods passes the driving head a movable bearing is fastened around the coupling, there being three of these bearings necessary with tubes of ordinary length.

For boilers having curved tubes a flexible shaft is used in conjunction with suitable straight shafts and gearing, the details of which depend on the design of the boiler to be cleaned. The company states that its device is applicable for cleaning all straight or curved metal tubes used in water tube boilers, economizers, condensers, etc., regardless of the nature of the incrustation.

It gives returns from horizontal straight tube boilers aggregating nearly 25,000 h. p. showing that from 5 to 61 tubes can be



UNION BOILER TUBE CLEANER.

cleaned per day of 10 hours, the average being 30 per day. The cost per tube, including repairs, labor and interest for one year on the cost of the device, was 26.3 cents; per horse-power it was 13.1 cents. These data are for the first cleaning of the boilers.

The extra fuel consumption because of the decreased conductivity of incrusted tubes is usually placed at 13 per cent for scale 1-16 in. thick, 38 per cent for ¼ in., and 60 per cent for ½-in. scale. The importance of keeping the tubes clean and the value of apparatus for doing so at small cost are therefore apparent.

THIRD AVENUE-MANHATTAN INTERCHANGE OF PASSENGERS.

The transfer ticket arrangement entered into not long ago between the Manhattan Elevated and the Third Avenue lines in New York City, has grown very popular, and as a natural consequence is a financial benefit to both roads. The officers of the Third Avenue line say that since the plan went into effect there has been an increase in the patronage of 25,000 passengers, and they figure that at the very least calculation 20,000 of that is new business. So popular has the plan become and so certain are the officials of its lasting benefits that the company intends buying 25 more cars for the route.

The officials of the elevated road are equally pleased at the result and can see an increase in business all over the city. Neither company has as yet had any official report, but it is a certainty that both roads are profiting by the arrangement.

The severe storms occurring in the vicinity of Chicago about the end of May caused much damage. The heavy rain of Sunday night, May 28th, washed out the roadbed on the Chicago & Milwaukee Electric Ry. in Wilmette, near Chicago.

The Pueblo (Col.) Electric Street Car Co. on June 1st made an advance in the wages of its employes, which means to most of them about $18 per month. This is the second increase since the consolidation of the Pueblo lines.

EVAPORATIVE CONDENSERS.

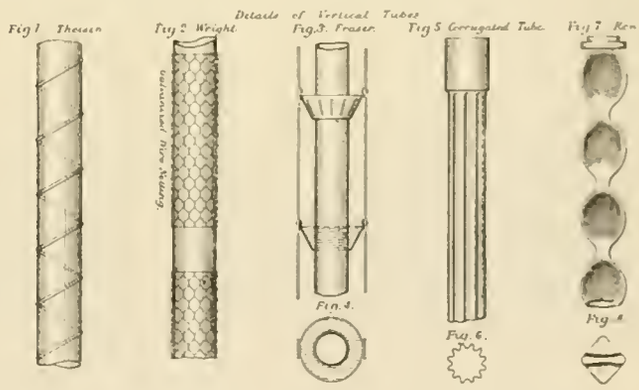
Abstract of a paper read before the Institution of Mechanical Engineers, England, by Harry G. V. Oldham.

The evaporative condenser, which is now being rapidly developed, has forced itself upon the users of large quantities of steam, and of necessity finds a place in the equipment of large generating stations for supplying light and power by electricity.

Jet and surface condensers are in many cases prohibited by reason of the large quantities of cooling water consumed, and the waste of the latter unless some method of cooling is adopted. This again, entails the apportioning of large ground space for the necessary cooling ponds and apparatus, and large steam installations have thus been compelled to work without a condenser. Inability to reduce the back pressure on the piston is also a drawback. Again, the actual amount of condensing water used when an evaporative condenser is employed may be from 25 to 30 per cent less than the amount of feed water used when the engines are non-condensing, and about one-fortieth the water supply when surface condensing.

The general principle of the condenser is simple; it consists of a large number of copper, brass, wrought or cast-iron tubes, arranged horizontally or vertically according to the type of condenser employed. The tubes are connected with chambers at each end. Through these tubes the exhaust steam is passed, and water is allowed to flow over the external surfaces. Part of the water on the external surface is being evaporated, and carried away with the heat taken from the steam. A more rapid and better result is obtained if a fan is used to remove the hot damp air.

It is well known that at such pressures as we have to deal with in the condenser the thermal units in 1 lb. of steam are about 1,000 more than in 1 lb. of water at the same temperature. Before any condensation takes place, therefore, it is necessary to withdraw this number of thermal units from the steam. The latter not only heats the circulating water as in a surface condenser, but evaporates a considerable portion of it. Each 1 lb. evaporated from the surface of the tubes takes with it about 1,000 thermal



units; and thus for each 1 lb. of steam condensed, only 1 lb. of cooling water should be required. It has, in fact, been shown by experiment that only two-thirds of this is required, a large amount of heat being dissipated by radiation, conduction, etc.

There is a tendency, when the tubes are of a large diameter and the steam passes through without taking a circuitous course, for a central core to pass through without being condensed. It is therefore desirable to stir up the steam, so that the condensation may be more rapid and effective. Internal steam distribution has been provided for by Mr. Row, who uses a design with interesting results in exhaust steam heaters, etc. The principle will be seen from the diagram in Figs. 7 and 8. The exhaust steam on its passage through the tube impinges against one indented surface and

is thrown off on to another, being thus split up so as to bring all parts of the steam in contact with the tubes. In providing for internal steam distribution, Mr. Wright places a tube of small diameter inside the one upon which the film of water flows. This does not break up the steam, but eliminates the uncondensed core and utilizes the largest surface of the tube area. Messrs. John Fraser & Son have devised a series of internal spiral distributors,

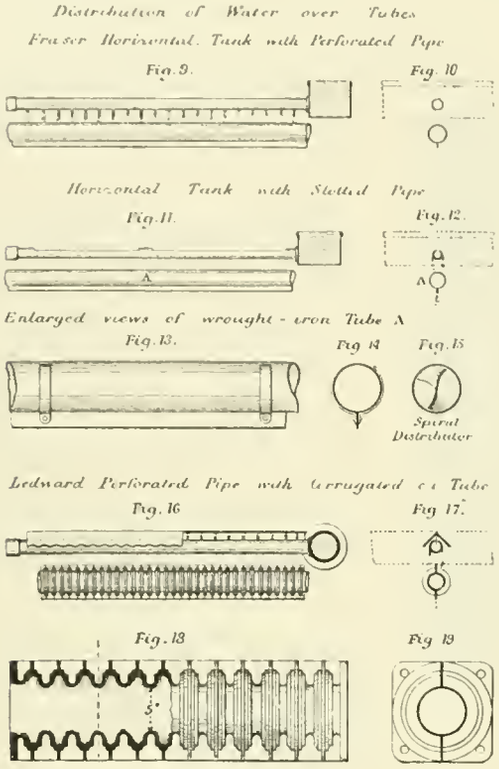
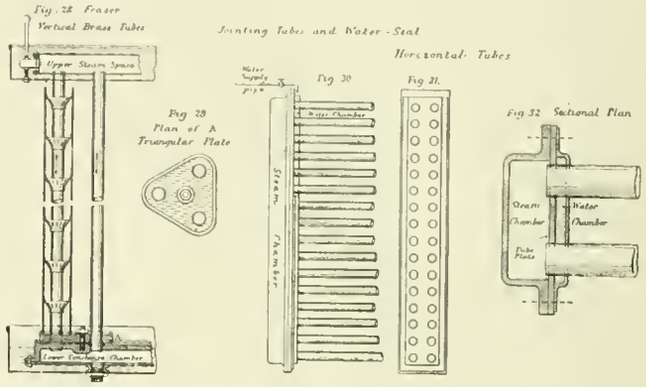


Fig. 15, which they place inside the tubes. These distributors, being very thin, do not in any way contract the area through the tubes or impede the flow of exhaust steam. The vapor on entering the tubes is split in two portions by the action of the spiral-shaped division, which gives the steam a spin as it passes through. The internal distribution in the Ledward tube is shown in Fig. 18 and 19. The exhaust steam follows the corrugations and is drawn to the surface where they are largest. Though space for a central core exists, it is maintained that the steam is sufficiently disturbed in this tube, from the fact of its having to pass in and out of the corrugations. These latter act as a trap to any solid matter, and particularly to oil, which may be carried over with the exhaust steam.

DISTRIBUTION OF WATER OVER TUBES.

In a great measure the success of the condenser is due to a proper distribution of the cooling water over the external surface of the tubes. In the case of a vertical tube condenser the water is delivered into a top receiving tank through which the tubes pass, the holes in these tanks having a larger diameter than the tubes. This leaves an annular space through which the circulating water passes on is way down each tube into a lower receiving tank.

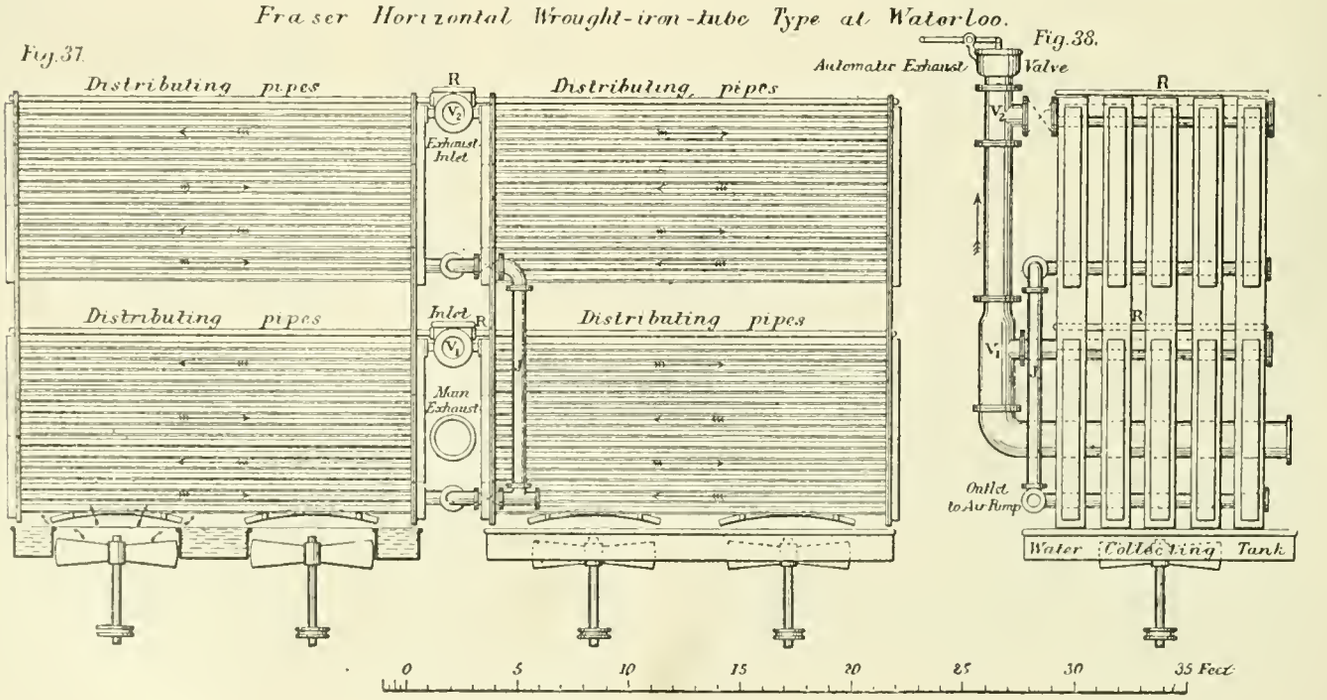


On the horizontal tube type the distribution is somewhat different. At the extremities of the rows of tubes, and at right angles to them, is placed a rectangular tank into which the circulating water is pumped. Into this tank galvanized iron pipes are led and carried vertically above each top tube in the condenser. Each pipe is perforated so as to allow the water to fall upon the whole length of each uppermost tube. The water passes round the circumference of the first tube, is collected underneath and distributed over the second, and so on until it has passed round each one and is finally collected in a receiving tank below.

The most important methods employed are those of Theisen, Wright, Fraser and Ledward.

Theisen uses vertical brass tubes of about 2 in. diameter, shown in Fig. 1. On each of these is wound in the form of a helix or

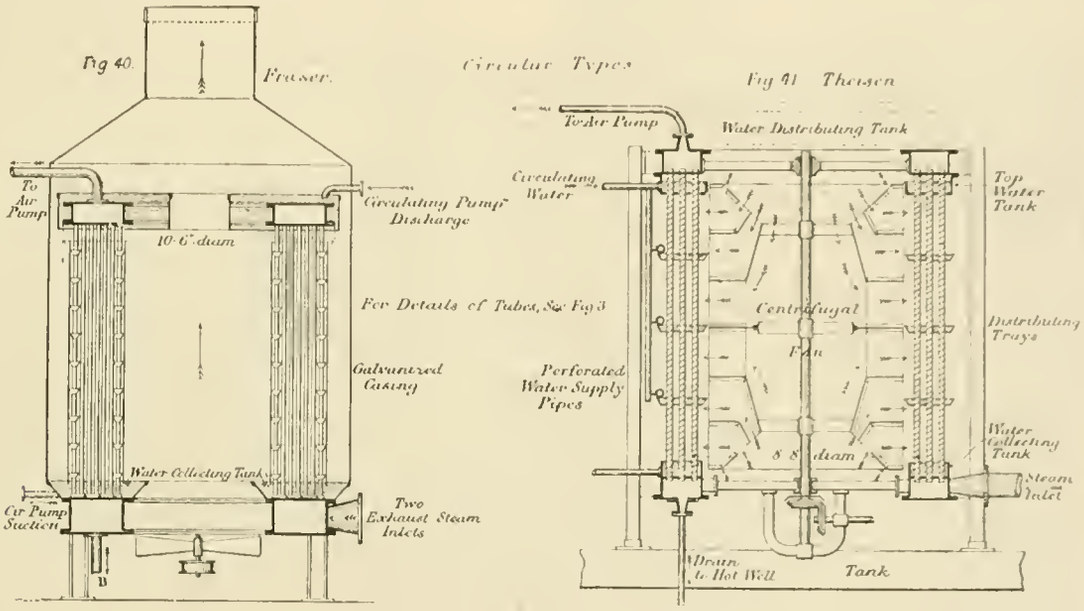
Fraser Horizontal Wrought-iron-tube Type at Waterloo.



screw thread a No. 9 galvanized steel wire, causing the water to follow this course round and round the tube until it reaches the bottom.

Wright places round the vertical brass tube brass plated wire in the form of ordinary galvanized wire netting. This appears to give a satisfactory distribution of the water. Later designs have spaces between the lengths of netting which allow of these being moved up and down for cleaning the tubes and removing scale, Fig. 2.

Fraser, in his vertical type, places round the brass tube perforated conical brass cups as shown in Figs. 3 and 4, about 12 in. apart, connected by a light rod on each side. It was found by experiment that the rupture of the film of water took place after falling about 12 in., and the action of these cups is to collect the water at distances of about 12 in., so that there is a steady film of water continually passing down the tubes. A small annular space is left between the lower edge of the cup and the tube to allow the water to pass through. Several slots are made in the side of the cups through which the water can still flow, even should the annular space become obstructed by sediment or dirt. The cups also act as tube scrapers by being moved up and down by hand. Figs. 5 and 6 show a brass tube which is now being



introduced for evaporative condensers of the vertical type. The tube has corrugations drawn into it for the greater part of its length, giving 25 to 30 per cent more surface than the plain tube. The ends are left plain for about 3 in. to allow for jointing and expansion. Fig. 7 shows an elevation and Fig. 8 a section of the Row tube as applied to evaporative condensers.

With the Fraser horizontal tube, Figs. 9 and 10, water is taken from a rectangular tank and passed along a perforated galvanized iron pipe immediately above the condenser tube. For further distribution on each of the lower tubes, strips of galvanized iron extending the whole length are fixed on the underside of each tube by means of iron straps or brass spring clips. Fig. 14. When fans are used with this type of condenser a curved trough is fixed under each tube on the lowest tube of each row, turning the water off into the side tanks. This prevents it from dropping on to the fan blades, and the disturbance of the water on the face of the tube.

The water distribution in the Ledward condenser is carried out as shown in Figs. 16 and 17.

Other arrangements for distributing the water over the tubes consist of open troughs perforated at the bottom, or with notches along the top edges. One form of wood trough that is used has a flat bottom and inwardly inclined sides; the water flows over the tops of the sides and drips from the two bottom edges into two condenser tubes.

It is very important that all joints be air tight, and in addition to rubber packed or expanded joints a water seal is generally provided. Figs. 28 to 32 show method of joining the tubes to the headers in vertical and in horizontal types.

The Kensington & Knightsbridge Electric Light Co. has an installation of the Ledward type at one of its stations which condenses the exhaust from engines using 20,000 lbs. of steam per hour and maintains a vacuum of 23 to 27 in., depending on the temperature of the circulating water. From 20,000 to 30,000 gallons of water is circulated per hour. The tubes are of the design shown in Fig. 18, and are in sections 5 ft. long. The amount of radiating surface is about 8 sq. ft. per 1 lb of steam per hour, and the condensation is about 8 lb. of steam per running foot of pipe. The maximum ground space is placed at .9 sq. ft. per h. p.

Condensers with cast iron tubes, plain, save for a fin on the lower side to collect the water for distribution on the next lower tube, have been used with success.

A Fraser condenser with horizontal wrought iron tubes for dealing with 40,000 lb. of steam per hour has been erected at the station of the Waterloo & City Electric Ry. This is arranged in two bays, Figs. 37 and 38. The tubes are 3 in. in diameter and 18 ft. long, made of galvanized iron. There are 640 tubes, giving a total tube surface of about 9,000 sq. ft. Figs. 30 to 32 show the arrangement of the tubes; steam passes first through the 10 upper tubes, returns through eight, goes back through the next eight and then passes through the bottom six. Four fans 5 ft. 6 in. in diameter, driven at 300 r. p. m. by an electric motor through a continuous rope, are used for circulating air. The ground space occupied is 1 sq. ft. per 5 h. p.

Condensers of the circular type are shown in Figs 40 and 41. In connection with these a supplementary condenser is sometimes used; this consists of a cast iron or steel vessel with brass tubes. The cold water necessary to replace the loss by evaporation in the main condenser is passed around the tubes and the discharge from the main condenser passes through them on its way to the air pump.

In condensers with Thiesen tubes a minimum of 1 sq. ft. of tube surface per 8 lb. of steam condensed per hour is usual; in the supplementary condenser it is 1 sq. ft. for 80 lb. of steam per hour. A Thiesen condensing plant at present working in connection with 11 separate engines, aggregating 3,000 h. p., requires 31 h. p. to operate circulating pump, fans and air pump.

The Wright evaporative condenser has vertical tubes and differs principally in the method of distributing water over the surface of the tubes.

To be continued.

Street car men in St. Louis estimate that last year the number of transfer tickets issued by the various lines amounted to 20,000,000. On this basis the consolidation of the roads will necessitate the granting of at least 40,000,000 transfers per annum.

NEW INDEMNITY COMPANY.

The Pennsylvania Mutual Indemnity Co., Drexel Building, Philadelphia, is the latest organization for undertaking an indemnity insurance, but has already written a promising line of policies and has every reason to expect a large business before the end of its first year. The lines carried are confined exclusively to electrical concerns,—railway and lighting, and the insurance is made to cover both employes, and passengers on the cars, as desired.

Among the members of the board of directors will be recognized some well known names in the street railway field: J. F. Porter, president, Alton Railway & Illuminating Co., Alton, Ill.; A. Demange, president Blomington (Ill.) Street Railway Co.; Cyrus See, president, Meadville (Pa.) Traction Co.; A. E. Maher, treasurer North River Electric Light Co., New York; E. C. Clay, president Jenkintown Electric Light Co., Philadelphia; A. C. Brister, claim agent Philadelphia & Reading R. R. The officers are W. W. Paterson, president; H. W. Rogers, secretary, and Newton Jackson, general manager. Mr. Jackson has had much experience in indemnity insurance and will undoubtedly secure for the company a large amount of desirable business. He will be glad to correspond with any manager and describe in detail the plan and evident advantages under which his company is working. A large guarantee fund for payment of leases has already been paid in.

the exhibit of goods made in this country for export, and that one very strong feature will be the showing of all kinds of foreign makes alongside of the American, in order that the manufacturer here can see just what he must compete with.

REORGANIZATION OF NEW ORLEANS CO.

The reorganization of the New Orleans Traction Co. which has been contemplated for some time was effected last month and the New Orleans City & Lake Railroad Co., the Crescent City Railroad Co. and the New Orleans Traction Co. are now combined in one company known as the New Orleans City Railroad Co. The officers of the new company are: President, R. M. Walmsley; vice-president, A. Baldwin; secretary and treasurer, A. H. Ford; general manager, C. D. Wyman.

The prospects of the company are quite good; there was an increase in receipts last year and a decrease in expenses, and at the present time the receipts are increasing as compared with last year. Payments of dividends on preferred stock will begin July 1st; the company's preferred stock is now selling at about par, while the common stock is quoted at between 21 and 22 and is rapidly appreciating.

The company has recently completed changing the last of its horse lines for electrical operation, and has recently received some new suburban cars and ordered 20 new urban cars for fall delivery. About 10 miles of new track will be laid during the year and much of the special work renewed; the building of new shops and a power station and other improvements are also contemplated.

AUTOMOBILE EMERGENCY WAGON, PITTSBURG.

PHILADELPHIA EXPOSITION.

Mr. P. A. B. Widener is the president of the National Export Exposition, to be held in the city of Philadelphia from September 14th to November 30th, and no stronger guarantee could be given of its success. Mr. Widener is an active man in many fields, but in nothing of late years has he taken a more assertive interest than in making this exposition a crowning glory, not only of Philadelphia, but of the whole nation.

The work of preparation is progressing rapidly and satisfactorily. The buildings will all be ready for the installation of the exhibits by August 15th, giving a full month for their proper arrangement before the exposition opens.

The value of this exposition to the small manufacturers of the country can hardly be estimated. Expositions as a general thing are dominated by the large concerns, but the management has in this case established such broad principles and propose to conduct the affair on such liberal lines that the small manufacturer will be put on an equal footing with the large one.

It should be borne in mind that this exposition is especially for

CHANGES IN ATLANTA, GA.

Now that the financial combination of the street railway lines of Atlanta, Ga., has been concluded, the management is busy arranging for a physical consolidation. Petitions are going into the council asking permission to connect the tracks in order to have it one system in fact as well as name. The Atlanta company has made the first move and when the permission asked for has been granted work will be at once begun. In this work of connection there will be an opportunity to correct many evils and make changes long recognized as desirable. When all is completed Atlanta will have a most satisfactory system of street railway.

AUTOMOBILE EMERGENCY WAGON.

The accompanying illustrations show an automobile emergency wagon built for the Consolidated Traction Co., of Pittsburg, Pa., by the Columbia Automobile Co., successor to the Pope Manufacturing Co., of Hartford, Conn. It was a part of the maker's display at the electrical exhibition in New York last month, and attracted a great deal of attention as the pioneer in this field. It was shipped to Pittsburg June 3d.

The wagon is equipped with all appliances and tools carried on wagons of this type, fire extinguishers, extension ladder, stretcher, lanterns and a complete kit of lineman's tools and apparatus. It is built to carry a crew of four or five men at a speed of 10 miles per hour for 18 miles, this distance being much in excess of the requirements in this class of work. The batteries, weighing 1,400 lb., are carried beneath the main body and are removable at the side. The total weight is 4,500 lb. Wooden wheels with solid

WAGON WITH LADDER RAISED.

rubber tires, 42 in. in diameter at the rear and 36 in. in the front, are used.

We are indebted to Mr. Fitzgerald, general superintendent of the Consolidated Traction Co., and to the maker of the wagon for the photographs and data.

COLLECTION OF PORTRAITS OF ELECTRICIANS.

L'Elettricita, published at Milan, Italy, will exhibit a collection of portraits of men connected with electricity at the International Exposition commemorating the centennial of the Voltaic cell, to be held at Como within a few weeks, and requests that everyone who has been identified with electricity as an author, professor or inventor will forward a photograph with autograph signature to the editor of l'Elettricita, Via Cusani 11, Milan.

The wages of the employes of the Indianapolis (Ind.) Street Ry. have been increased 10 cents a day.

VALENTINE SIGNAL STSTEM.

Mr. H. B. Rogers, general manager of the Brockton (Mass.) Street Railway Co., sends us a description of a signal system patented by Mr. Daniel Valentine, the company's chief engineer. Some time since the company installed a signal system which did not give satisfaction and the question was given to Mr. Valentine to investigate; he devised the system described here and Mr. Rogers states that he has found it simple and reliable.

The system comprises rail contacts and signal boxes with lamps and semaphores. There is a signal box for each direction of traffic and the two boxes are arranged as shown in Fig. 1. Fig. 2 is a diagram of the wiring and the apparatus for moving the semaphores. D is a solenoid and G a solenoid bar having at one end a contact piece H, and at the other the tell-tale or semaphore F. In the body of the solenoid bar is a helical or inclined groove which receives a stationary projecting tooth, so that as G

FIG. 1.

moves in or out of the solenoid it rotates and changes the position of F. T is a feeder supplying current to the apparatus. P is a cluster of lamps and Q the rail contact; L is a solenoid, the bar of which forms a catch to lock the bar G in "danger" position, and is released when a current passes through the coils of L. The meaning of the other letters and figures in Fig. 2 will appear from the detailed description of the method of action.

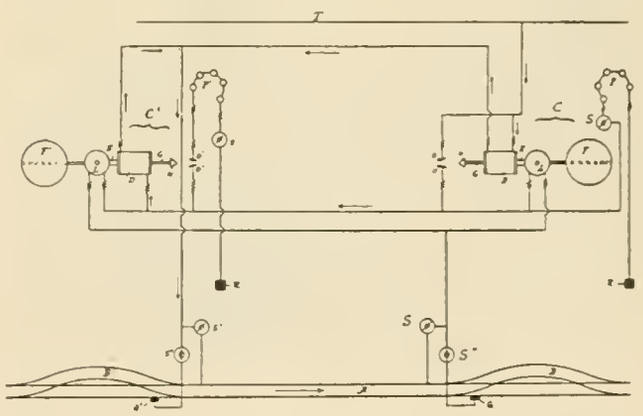


FIG. 2.

If a train or car should proceed on the track A in the direction of the arrow in Fig. 2, on passing the contact-plate Q', the circuit from the line T will be closed through the solenoid D, causing its solenoid-bar E to be moved forward and causing the semaphore F to be set for "danger" and locked in that position. During the forward motion of the solenoid-bar E, its contact-piece H is caused

to close the circuit through the circuit-closers O O, by which the circuit is closed through the lamps P as well as through the solenoid D', causing its solenoid-bar E', to be moved forward and causing its semaphore F' to be set accordingly and locked. During the forward motion of the solenoid-bar E' its contact-piece H' is caused to close the circuit through the lamp or lamps P', thus causing the semaphore F, either alone or in connection with the lighted lamp or lamps P, to indicate to a train approaching the turnout B in an

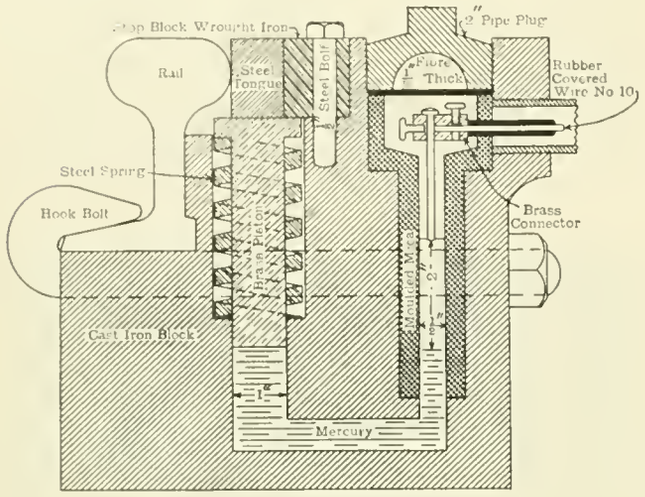


FIG. 3—CONTACT BLOCK.

opposite direction that the track in not clear. The position of the semaphore or telltale F', either alone or in connection with the lighted lamp or lamps P', will indicate to a train following the first train in the same direction that the track between the turnouts B' B is obstructed by a train or car. On passing Q' the moving of F' to "danger" shows that F has already been set to danger. As the train or car going in the direction of the arrow reaches the turnout B it causes the contact-plate Q to close the circuit through the solenoids L L', causing the locking levers on the solenoid-bars E E' to be released and the latter to be automatically returned to their normal positions by gravity, the solenoids D and D' being placed

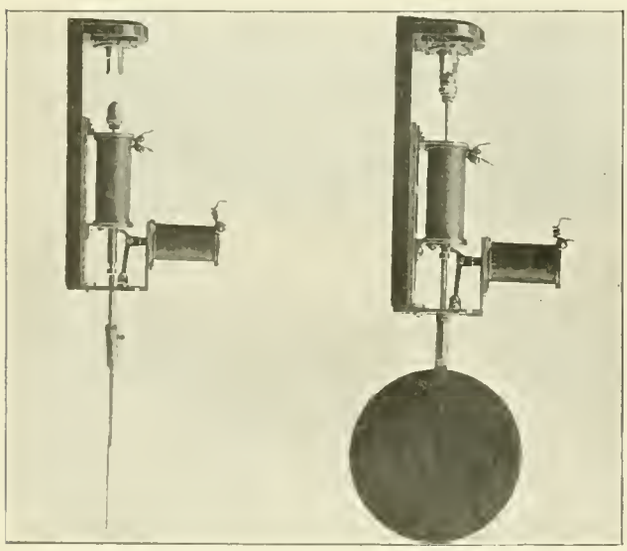


FIG. 4 -THE SOLENOIDS AND SEMAPHORE.

vertically, and the lamps are cut out and the semaphores turned to safety position.

In fig. 2, s, s', s", S, S', S" are switches for cutting out the rail contacts and lamps and operating the signals non-automatically.

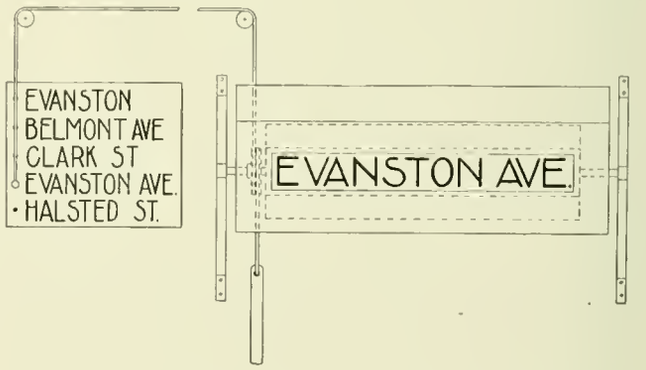
The rail contact box is shown in section in Fig. 3 and its construction will be readily understood. The tongue which is pressed down by the car wheel is 18 in. long by 1½ deep by 1 in. wide, and at one end is pivoted to the web of the rail. Mr. Valentine says concerning the contact: "The weight or pressure required to force down this spring sufficient to close the circuit is 1,500 lb. No road wheel, except that of a car, can get on the contact tongue and press it down, as it is too narrow for a heavy team. In fact, there is no wheel only 1 in. wide made for road work that will carry 1,500 lb., and we have had no trouble from that cause. The tongue is so arranged that the trackman can raise it up to clean underneath after a storm of rain, if needed, but up to the present this has not been necessary. The contacts alone were in operation all through the past winter, and were never once found to be frozen, after being filled with mercury. During heavy rain storms the rail contact boxes are covered with water, but as the water cannot get to the contact point without displacing the mercury, trouble from water is out of the question. It is advisable to fill the space under the steel tongue with salt during the winter months, or during those days when it is necessary to salt the frogs and switches."

INDICATING SIGN ON NORTH CHICAGO.

A simple but ingenious device to indicate the "next car" on the North Chicago Electric Ry. has been placed in the Arcade at the north side "Limits" barns, from which the cars start.

The device is simply an iron case about 3 ft. long, 18 in. high and 12 in. deep fastened to the wall with a pair of brackets. The lower portion of this case is rounded, and inside is a hexagonal prism constructed of a metal frame with glass sides. This prism is mounted on an axle having a grooved wheel on one end.

On five of the glass sides there are painted in bright colors



(corresponding with the color of the line) the names of the different lines of cars which pass through the arcade. A window is cut in the iron case and by means of five incandescent lamps inside the name of an approaching car shows clearly through the window.

At the rear of the arcade is a board with the names of the different car lines upon it, a hole is bored opposite each name. From a pin stuck in one of these holes a rope leads over pulleys to the sign cylinder, passes around the wheel on the cylinder axis, and is fastened to a weight moving vertically in a suitable box. An operator at the board moves the pin to the proper hole as he sees the car approaching and the cylinder size in front is set accordingly. When no car is on the track the blank space is exposed.

The arcade is rather dark and until the car has almost reached the front end it is difficult to distinguish the line, hence the advantage of this sign. The device is only used during the evening and on Sundays when the traffic is heavy.

The New York City street car companies are considering the idea of adopting the Baltimore system of watering the streets from tanks on trolley flat cars.

The Central Railway Co., Peoria, Ill., is making extensive improvements in its lines. New steel rails are being laid and the cars given a general overhauling. The Peoria & Pekin Railroad Co. is rebuilding its depot and when the work is completed it is expected the street cars will enter the depot to let off and take on passengers. The handsome fountain in Prospect Park is now finished.

MECHANICAL DEPARTMENT

SOME NEW CARS.

The Atlanta Consolidated Street Railway Co., of Atlanta, Ga., has recently completed eight cars, which are very elaborate, and at the same time, very serviceable for street railway purposes. These cars were built at the company's shops, where 12 more are now under construction. They were designed by Mr. Thomas Elliott, chief engineer of the company.

It was not with an idea that cars from the factory were not good enough that this company began building its own cars, but with the three-fold purpose of constructing a car to meet the special requirements, of saving the item of freight, and of spending the money at home.

The idea of durability seemed to be uppermost in the mind of the designer of these cars. The sills are made of the best heart pine 3 x 8 in. and steel angles are bolted in every corner of the framing. The sides of the cars are perfectly straight, making the sills wider than the trucks, and for this reason it is necessary to put in a sub-

NEW CAR, ATLANTA, GA.

sill to carry the trucks. The inside measurements are: Length, 20 ft.; width, 87 in. The platforms are 5 ft. long and 8 in. lower than the floor in the car. One side of the platform is completely closed up by extending the dasher around until it joins the car proper. The diagonally opposite side of the other platform is similarly closed, so that passengers alighting from the rear platform will step away from any paralleling track. The doors are not placed in the center of the car, but about 12 in. nearer the side where the step is. This makes it very much more convenient both for the alighting passenger and any who may be standing on the platform.

Beginning at the side of one door and extending around the car to the corresponding side of the opposite door is a sheet of No. 10 steel. This sheet is set flush with the bottom edge of the main sill, and extends upward 36 in. This presents an even surface, easy to screw to the window posts. On the inside of the car and separated from this steel by the window post, is a solid piece of ash and cherry panel-work extending from the floor up to the window, and from one end of the car to the other. The space between this panel-work and the outside steel sheet is just large enough to allow the window sash and blinds to drop. And this space being straight admits of much better workmanship than is ordinarily found.

All of the carlines are lined on each side with a piece of 3-16-in. steel, bolted through, thus adding great strength to the deck. There are no wooden look-outs under these cars, but instead a 4 x 6-in. steel angle is used, (See the illustration) and to this angle is bolted the floor, which is 1⅛ in. thick.

The doors are hung on ball bearings and a slight depression at each end of the bearing track keeps them in position when open or closed. These ball bearings have completely eliminated the constant trouble of hard running doors, so annoying to passengers. The bearing is entirely new, and a conception of the company's chief engineer.

These cars were built with a view of operating them both in winter and summer. To this end the doors and windows are very large, and when these are opened the cars are thoroughly comfortable on the warmest day. Should a sudden shower come up they can quickly be made rain tight in a jiffy.

Cross seats of the Hale & Kilburn walk-over pattern, finished in red plush, are used. Seven of these are placed on either side of a 19 in. aisle; thus giving the car a seating capacity of 28. Some objection was made to using red plush seats in a summer car. To meet this objection the seats were covered with linen, which gives them a very cool appearance.

The advisability of building cars with straight sides was questioned from a standpoint of appearance. To begin with, this question of appearance is a mere matter of opinion. And furthermore, with the width of car used, cross seats could never have been put in if the sides of the car had been curved. Then, too, the straight sided car is much more easily and durably constructed, and makes a better pocket for the window sash and blinds. The only real objection to the car with straight sides is that, with a standard gage truck, the side sills are wider than the truck; this is easily obviated by using a sub-sill, as has been done here.

The decks are 12 in. high, which adds materially to the comfort of the car during the summer season.

The cars are finished inside with ash and cherry, except the head lining, which is of quartered oak. The blinds are made with cherry stiles and white pine slats.

These are already the most popular cars on the company's lines; and the riding public has been loud in praising them, stating that it is easy to get one's "money's worth" in a ride on such comfortable cars.

DATA ON AXLES.

In the "Review" for April were published some notes concerning the experience of different street railway companies with axles. Herewith is additional information on the same subject furnished by other companies.

Road K operates 300 miles of track and has a total of nearly 6,000 cars in service. The rolling stock equipped with motors comprises that shown in the table.

EQUIPPED WITH MOTORS.

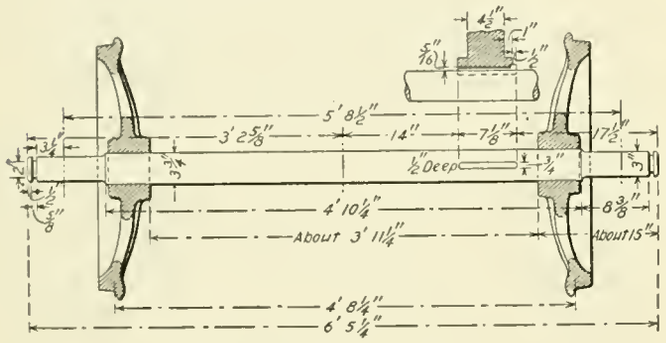
Type	16-ft. Box	20-ft. Box	25-ft. Box	7 & 8-B Open	9-B Open	14-B Open	Plows, Etc.
No.	60	330	884	568	667	47	171
Length	24 ft. 4 in.	28 ft. 7 in.	33 ft. 11 in.	27 ft.	29 ft. 4 in.	31 ft.	
Seating capacity	22	26	34	35 40	45	50	
Wt. with max. load	22,500	27,500	34,000	22,500 25,500	27,333	34,667	24,000
Wt. car body	6,158	7,120	7,820 8,320	5,504 6,104	6,754	7,332	
Wt. trucks, wheels, axles	4,530	4,530	6,740 8,240	3,370 4,530	4,530	7,200	
Wt. motors	About 2,300 lbs., varying somewhat with make						
No. of motors per car Summer	1	1	2	1	1	2	
Winter	2	2	2				2

The motors used are W. P. 50, G. E. 800, G. E. 58 and Westinghouse No. 12. Both sidebar and nose suspensions are used, one-half, or less, of the weight of the motor being carried directly on the driver axle.

For the last four years cold rolled steel axles of the dimensions shown in the accompanying drawing have been used. There are no specifications or tests for the axles. The keyway is cut on a milling machine and is ½ in. deep by ¾ in. wide by 7⅛ in. long. The same axle is used for non-driven as for motor-driven wheels.

The company has had no cold rolled steel axles break in service; in 1898 16 axles broke in service but they were either hammered iron or old style axles. The axles which have failed for the most part broke just outside the wheel; a few just inside the wheel. The fracture generally shows indication of an old crack which gradually increased until the section became too weak and failed.

There are no data at hand to show the relative number of broken motor axles and broken non-driven axles, nor whether rear axles break oftener than forward axles. Low temperature in winter has not noticeably increased the number of failures except with steel axles several winters ago; these were not of the material at present standard. The track is in good condition, but a larger amount of special work makes it severe on axles.



STANDARD AXLE, ROAD K.

The company finds that it never has to throw out axles because of journal wear, except when the journal has been cut, which is unusual.

Formerly 3⅜-in. axles were used on this road but the present standard is 3¾-in.; larger axles could not be used without making costly changes in the equipment.

The opinion is expressed that the method of suspending the motor affects the life of the axle, the life being longer with side bar suspension.

Road L operates about 150 miles of track and has 250 motor cars. The cars are 34 ft. long and mounted on double trucks. The car body weighs 8,000 lb., the trucks 1,000 lb. each without wheels or axles, and the motors (two per car) 3,200 lb. each; the total weight including maximum load is about 20,000 lb. The gage is 3 ft. 6 in.

The motor-driven axles are hammered iron, 3¾ in. in diameter with 3¼-in. journals; non-driven axles are hammered iron 3⅜ in. in diameter with 3-in. journals. The only specifications are that the material shall be first class and the axle free from seams and dirt. Hammered iron is used because flaws and cracks do not travel so rapidly as in steel.

The key-seat is made by drilling holes at the ends and planing out the center, and is ¾ in. wide by ½ in. deep.

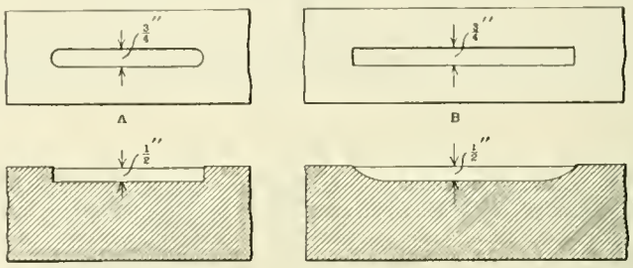
Quite a number of axles are said to break in service but the figures are not given. More axles fail in winter, and 99 per cent of the broken axles are motor-driven.

It is stated that the axles have been enlarged at the key-seat from 3¾ in. to 4⅛ in. with good results. Shallow keyways, ⅜ in., have been tried, but were not satisfactory, as the keys quickly become loose; for keys ¾ in. wide the seat should be at least ½ in. deep.

A yoke suspension is perferred as conducive to longer life of axles.

Road M has now in service about 940 axles under motor cars. Of these 800 are 3⅝-in. axles with 3¼-in. journals, which size has been standard for several years. Recently it was decided to make all renewals with 4-in. axles and about 140 of these are now in service. The 4-in. axles will be used with all motors having an axle bearing large enough. For the last three years this road has been buying wrought iron axles instead of steel which had been used previously.

During 1898 the number of steel axles which broke in service was 242, and the number of wrought iron axles 13. In drawing conclusions from these figures it must not be forgotten that the steel



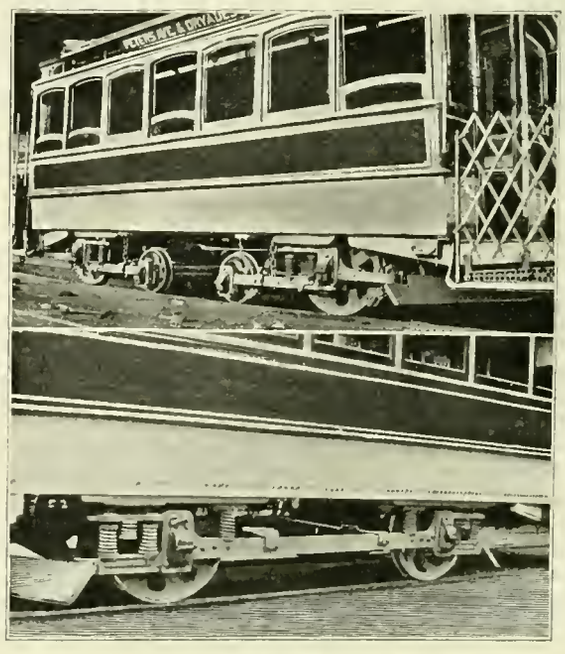
axles must have been in service at least three years longer than the others. Of the steel axles breaking in 1898 about half broke in the keyseat and half at the inner edge of the wheel seat.

The keyseats in all the axles which broke at that point were cut by boring and planing and had square bottom corners at the ends, as shown at A in the figure. Those that failed elsewhere had keyseats cut on a milling machine and were of the section shown at B. That this latter form of keyseat is greatly to be preferred is corroborated by a report made to a committee of the Railway Master Mechanics' Association in 1891; this was that steel locomotive driving axles having keyseats with a square bottom end corner broke, those having keyseats with end like that in B did not break.

REBUIDLING CARS AND TRUCKS.

The New Orleans Traction Co. has recently been rebuilding some of its cars and trucks and some of the details will doubtless prove of interest. The 28-ft. cars on the New Orleans City & Lake road were originally equipped with two "Eureka" maximum traction trucks each, which gave excellent service, but as they grew old the cost of maintenance increased and Mr. Rojo, the master mechanic, determined to make one single truck out of the two double ones, discarding the trailer wheels.

The only new material required was the steel for making connecting bars 3¼ x 4½ in. and 7 ft. 3¾ in. long. This made a single truck



OLD AND NEW TRUCK.

with a wheel base of 8 ft. From the illustration it will be noted that the old trucks, deprived of their pony wheels, are reversed so as to extend the spring base, making it about 11 ft. A slight alteration in the cross timbers of the car is necessary, but the total cost

of the change is not more than $50 per car. The results with the rebuilt truck are said to be very satisfactory.

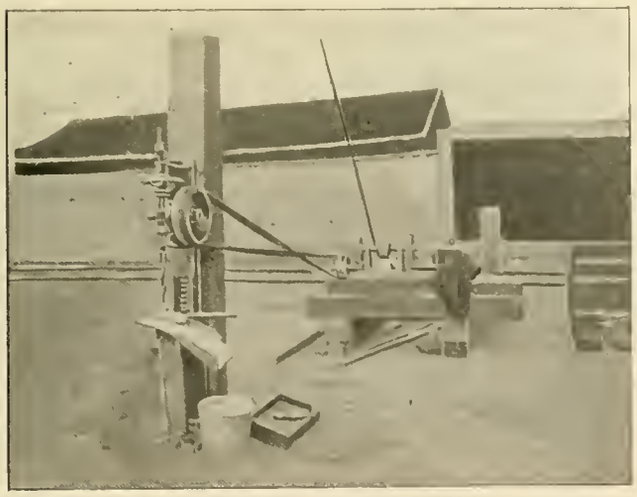
Side entrance summer cars have lost favor with General Manager Wyman, and he is transforming the equipment by placing wire screens at the sides of the open cars and cutting an aisle through the center. The smaller open cars formerly used as trailers in summer are being spliced to make large trailers for through traffic on

RECONSTRUCTED OPEN CAR.

the Lake line. Two 8-bench side entrance cars are spliced to make a car 45 ft. 4 in. over all. The joint is reinforced by a steel plate ½ x 6 in., and truss rods are used underneath; the remodeled car will seat 64 people. It will be noted that there are no side entrances on these cars.

DRILLING CONDUCTOR RAILS.

The Brooklyn Rapid Transit Co. is changing the Brooklyn & Brighton Beach R. R., recently acquired by it, for electric traction and is replacing the light T-rails with 9-in. girders. The T-rails taken up will be used for conductor rails on the elevated lines and in consequence have to be drilled for rail bonds. Near the elevated junction two posts have been set and drills mounted on



TEMPORARY PLANT FOR DRILLING RAILS.

them; the posts are set the proper distance apart so that both ends of the rails may be drilled at once.

Two motors taking current from the Bergen St. line drive the drills through jack-shafts; mounted on the jack-shafts are emery wheels for grinding the drills. A platform is arranged at the proper height with oiled rails for the rails to slide upon, so that they can be handled without difficulty.

SHOP FLOORS.

At the December, 1898, meeting of the American Society of Mechanical Engineers one of the topics discussed was that of machine-shop floors.

Mr. Charles T. Newcomb stated that for ground floors his practice for the last 17 years had been to use for joist floor timbers, 6 x 6 in. kyanized timbers placed 4 ft. on center, well bedded and laid crosswise of the shop, so as to put the plank lengthwise of the shop. On top of the timbers are placed 3 in. matched spruce planks, planed on one side. Before the planks are laid the earth fillings under plank are well puddled for about 2 ft. and left higher than floor timber, and struck off to light of floor timbers, leaving a solid surface under plank onto which machinery can be set without other foundations. This kind of floor will wear out on top in about five years, when it will be found to be rotted on bottom so as to need replacing, the kyanized timber lasting indefinitely.

Kyanized timber or treated lumber can now be obtained very readily on the market. This kind of floor costs laid 11 cents per square foot, and is easily replaced, and in view of the fact that the top of floors wear out, it is better to use this or similar cheap construction and have a new floor when needed.

For second-story floors for such work as is usually put on such floors, he used 3-in. matched spruce plank with paper laid over it to keep the dust and dirt from passing th[illegible]n, the top flooring being 1⅛ in. thick matched hard maple, bored and blind nailed, not wider than 3½ in. This kind of floor will last many years, wearing out in spots only. The spots can be easily and quickly patched.

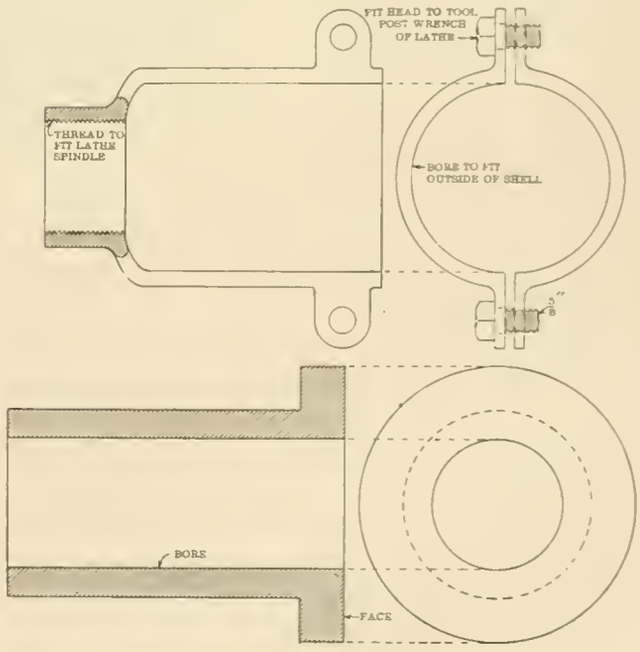
Mr. Albert A. Cary stated that the result of experiments he had made with different woods for top flooring in factories has led him to adopted maple as preferable to all others.

Mr. Durfee described the floor of a shop erected by him. After the ground was excavated to the proper depth it was covered with 10 in. of broken stone; on the stone were bedded chestnut sills and the space between sills filled with broken stone. On the sills were laid 4-in. planks and 5 in. wide. The planks were placed slightly open joints (not to exceed ⅛ in. wide) and were laid at an angle of 45° with the traffic. The galleries in the shop were laid with 4-in. spruce planks not over 8 in. wide with a top flooring of 1⅛-in. hard pine.

CHUCK FOR BORING ARMATURE BEARING SHELLS.

Council Bluffs, Ia., May 22, 1899.

Editor "Review": We have devised and are using in our shop a special chuck which makes possible a great saving of time in fitting up the heavy 25-lb. armature bearing shells for G. E. 57 motors; it can, of course, be used for any similar shell and may prove of interest to your readers.



CHUCK FOR ARMATURE SHELLS.

The shell for our motors is shown in Fig. 1. To bore these shells in the ordinary lathe chuck consumes too much time, as

every shell must be turned up when it is chucked. With our special chuck the shells are bored perfectly true and no time is required to center them in the chuck; the work can be accurately done by cheap labor.

The chuck is merely a casting, weighing about 50 lb., with two slots cored back to the thread which screws onto the lathe spindle, See Fig. 2. The top bolts are to tighten the two halves of the chuck on the shell, and the heads of these bolts should be fitted to the tool post wrench of the lathe on which the chuck is used. Our practice is to pour the shells on a plug smaller than the bearing, slip them into the chuck, bore and face them, and then spin the metal out as tightly as possible in the shell.

In fitting up the chuck the thread should be cut first and the casting screwed on the lathe spindle, after which it should be bored; this method insures a perfectly true bore. The dimensions of chuck to take a shell 4¾ in. diameter by 8½ long, are 6 in. diameter and 11 in. long.

We have just finished fitting 75 shells and found the chuck effected a great saving of time; also it was accurately done with labor costing 13 cents per hour. W. B. TARKINGTON,
Master Mechanic.

Omaha & Council Bluffs Railway & Bridge Co.

NEW YORK AIR BRAKE TESTS.

New York, May 29, 1899.

Editor "Review": Referring to your discussion in the May "Review," p. 336, of the formula chosen by the New York Railroad Commissioners for comparing the efficiency of different braking systems, it is evident that the Commissioners use the term "efficiency of braking system" in a broad practical sense, i. e., points 1, 2 and 3, will be judged upon the distance travelled beyond the point at which signal to stop is given. This signal should be given by a person on the car, as making a stop from a fixed point gives the motorman a chance to get ready, which would not be proper for an emergency test, and largely eliminates the factor which you call D_1 (the distance run between the time that the signal is given and the time when the brakes are applied,) a most important point in considering the practical efficiency. The coefficient of friction of brake shoes varies for different speeds, and evidently recognizing this fact the Commissioners propose to test the various brakes under the same conditions as to weight and type of car and speed, therefore the formula $W S \div D = E$ is as good as a more complicated one.

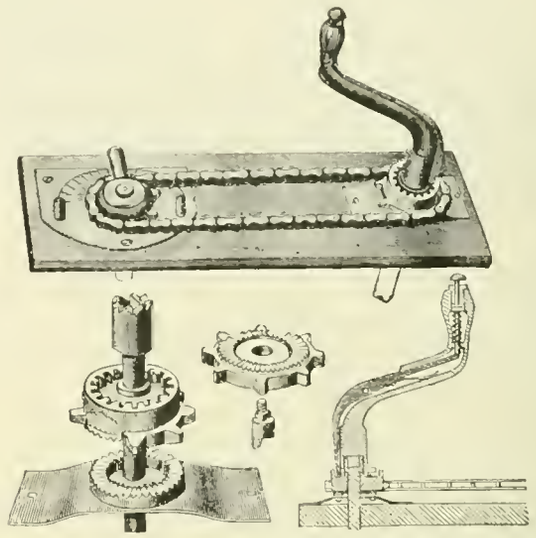
It is far simpler and more just to the contestants to eliminate the variables from the test, than to attempt to provide a complicated formula that will give each variable its due weight with respect to the value of the others.

Yours very truly,
STANDARD AIR BRAKE CO.,
Jas. R. Ellicott, Gen. Mgr.

GROSSMAN CONTROLLER ATTACHMENT.

Mr. Adolph Grossman, of New Orleans, has recently patented an ingenious device for use on electric cars for turning off the controller and applying the brakes by one operation. The accompanying drawings show the details of the brake handle and gears on the brake staff and the method of connecting the brake and controller shafts.

The upper end of the brake staff is provided with beveled teeth and the staff can be operated in the usual manner. To the brake staff a sprocket wheel is secured, provided at its under side with a clutch face engaging a corresponding face mounted on a spring plate. The sprocket wheel has an interiorly toothed flange, adapted to be engaged by a detent lever fulcrumbed on the crank and held out of engagement with the flange by a spring. In order to enable the motorman to place the detent lever in engagement with the flange, and thereby lock the sprocket wheel to the crank, a pusher pin is provided, normally held in the position shown by means of a coiled spring. When the pin is depressed the detent lever will be placed in engagement with the toothed flange; when the pin is released the lever is disengaged by its own spring. Loosely mounted on the rheostat shaft is a sprocket wheel connected by means of a chain with the brake staff sprocket wheel. The rheostat sprocket wheel has a clutch face designed to engage a similar face on the under side of a plate fixed to the shaft. The plate has an arm by means of which the current is turned on and off. When the motorman desires to stop his car he depresses the pin, in order to lock the brake staff sprocket to the crank and turn the crank to the right. By reason of the chain connection with the rheostat sprocket the motorman, in turning the brake staff, also causes the switch arm to rotate and shut off the current. When the current is cut off, the motorman releases the pin in order to disengage the sprocket wheel from the brake crank and continues to turn the crank until the car is stopped. By turning the crank to the left the brakes are released; by depressing the



GROSSMAN CONTROLLER ATTACHMENT.

pin, the two sprocket wheels will operate to cause the switch arm to turn on the current in order to start the car.

Should the motorman forget to release the plunger when the switch arm has turned the current on or off, the continued rotation of the crank can do no harm, because the clutch teeth of the rheostat sprocket will ride over those of the switch arm plate.

A trial of the device was recently made on cars of the New Orleans Traction Co., and it is reported to have worked very satisfactorily.

CHICAGO TO MILWAUKEE BY ELECTRICITY.

When two small gaps have been closed up, from Evanston to Highland Park and from Waukegan to Kenosha, Wis., it will be possible for a person to ride in electric cars all the way from Hammond, Ind., to Waukesha, Wis., and to go it quickly and cheaply.

The tendency of these electric roads to absorb local passenger traffic is not more clearly illustrated than round about Chicago. The electric line from the city to Hammond has been in operation for a long time. The North Side cable line and the North Shore electric to Evanston, with which it connects, have been carrying passengers for several years. The lines between Highland Park and Waukegan and between Kenosha and Milwaukee and from Milwaukee to Waukesha are now all old stories. Men are at work constructing the road from Evanston to Highland Park, and the right of way for a road between Waukegan and Kenosha has all been secured and the present summer will see these two gaps closed and a practically continuous line of about two hundred miles will be open. Besides this there is some strong talk of connecting Milwaukee and Green Bay.

In regard to time required, a passenger can start from Chicago now at 6 a. m. and reach Milwaukee at 12:30 and Waukesha at 2:30 p. m., the cost of the trip, including the two jumps on the steam cars, being only $2.45. This trip was taken recently by the representative of a Milwaukee newspaper.

A car on the line of the Suburban Traction Co., Pittsburg, Pa., jumped the track on the morning of May 30th and came near precipitating 12 people down a 60-ft. embankment. Everybody but the motorman left the car.

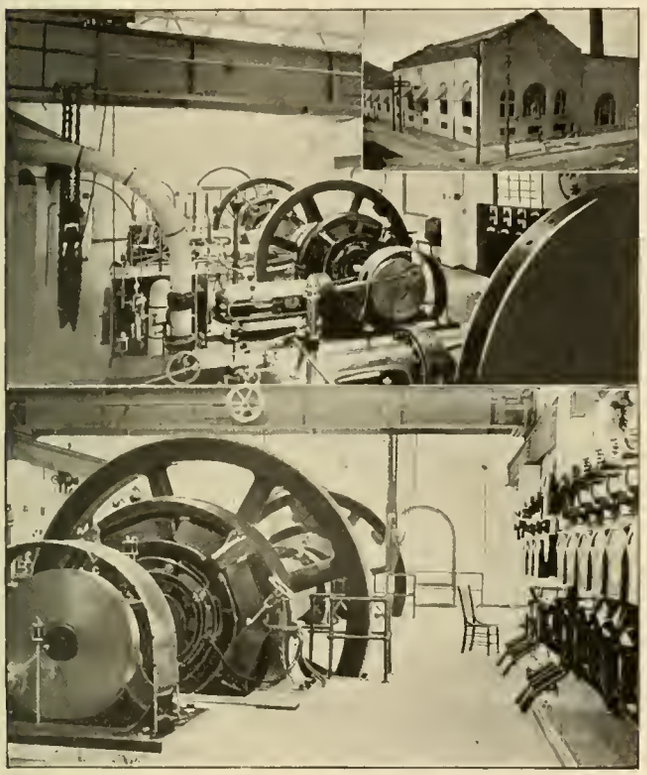
D. G. HAMILTON.

POWER STATION OF THE ST. CHARLES STREET R. R., NEW ORLEANS.

The power plant of the St. Charles Street Railroad Co., of New Orleans, has been in operation for several years, and has proved to be economical and durable. When built the general opinion was that the foundations for heavy engines must, in New Orleans, be built upon piling, but this plant has demonstrated that such is not the case.

The power plant occupies a portion of a building at Marigny and Peters Sts., within 100 ft. of the Mississippi River. The whole building is 190 x 127 ft. and includes the shops of the company. The portion containing the power plant is 88 x 109 ft.; the walls are of brick supported on piling. The roof is a steel frame with fire-tile filling and covered with galvanized iron. The engine room floor is 8 ft. above that of the boiler room and is made of brick arches, and covered with pine flooring.

The boiler room is 69 x 88 ft. and 28 ft. high to the cornice; it is lighted by skylights. There are three 250-h. p. Heine boilers



POWER HOUSE—ST. CHARLES STREET R. R.

equipped with Murphy furnaces; Alabama run of mine is used for fuel. The feed water is taken from artesian wells; condensing water for the engines from the river. The feed water comes from the wells at about 78° F., and is first heated at 200° in a 500-h. p. heater made by Warren, Webster & Co., and then taken to a Green economizer with 216 tubes, where the temperature is raised to 265°.

There are two Worthington pressure feed pumps, one pump used to lift water to a house tank mounted on a 20-ft. tower, and one small pump for returning all sewage to the river, besides two condenser pumps which draw from the river.

The stack is 6 ft. 6 in. in diameter and 125 ft. high, lined with fire brick for 85 ft. It rests on a foundation of 40 ft. piling capped with timber on which is 7 ft. of concrete.

The engine room is 40 x 88 ft. The entire area to be occupied by engines and generators was excavated to a depth of 3 ft below the street grade and the bottom covered with two layers of 6 x 6 in. cypress timbers; on the timber was laid 18 in. of concrete; then a layer of old 45-lb. steel rails placed 12 in. c. to c., and above these 18 in. of concrete, the top of this forming the basement floor. On the foundation so prepared were built the engine and generator foundations, which are of brick. These have proved to be perfectly satisfactory and the cost was very much less than if piling had been used.

There are three cross-compound Hamilton-Corliss engines built by the Hooven, Owens & Rentschler Co. These engines have cylinders 14 and 26 by 36 in. and run at 100 r. p. m.; the fly wheels are 14 ft. in diameter with 12-in. face, and weigh 25,000 lb. Jet condensers are used.

The steam piping is of an extra heavy wrought steel and is not in duplicate. The exhaust main is 12 in. in diameter and extends along the entire length of the engine room; it is connected to the three engines and the two condensers and in case of emergency connection to the atmosphere is made through an automatic valve. The station piping to the river includes one 12-in. flanged cast iron pipe for the condenser intake, one 5-in. main for feeding the boilers in case of emergency and one 6-in. discharge for the boiler blow-off.

There are three 8-pole 200-kw. Walker generators directly connected to the respective engines.

The switchboard is of enameled slate with nine panels; it is equipped with Weston ammeters and voltmeters and a Thomson recording wattmeter.

There is a 20-ton Morris crane traveling the ...e length of the engine room.

We are indebted to Mr. Alexander L. Black, electrical engineer of the company, for the photographs and data.

CHICAGO ELECTRICAL ASSOCIATION BANQUET.

The Chicago Electrical Assoeation held its annual banquet at the Technical Club on Friday evening, May 19th. Plates were laid for 47 and that number of members and their friends feasted and made merry.

This was 110th meeting of the Association and much credit is due Mr. J. M. Hollister, chairman of the banquet committee for the pleasant evening and the general success of the event.

Mr. E. E. Jewell acted as toast-master and suggested many interesting topics which were discussed in an informal manner. But the real enjoyment of the evening was that offered by the responses to the set toasts. Among the principal ones was "Electricity of Long Ago," responded to by Mr. C. J. Warner, the patriarch in electrical work. Mr. Warner's pratical experience in the field dates back to 1831. Prof. Carhart, of the Michigan University, responded to the topic "Education," Lieut. F. B. Badt to "Mathematics," and Mr. E. P. Warner to "The Construction of Electrical Generating Apparatus."

Altogether the banquet was a most happy event, proving both enjoyable and profitable to those present.

IMPROVEMENTS AT KNOXVILLE.

The Knoxville (Tenn.) Traction Co. is making extensive improvements in its roadbed and rolling stock. The track to Chilowie Park is double; in the business district 100-lb. 7-in. Lorain Sec. 338 rails are laid and elsewhere 55-lb. T-rails in 60-ft. lengths. Hewn white oak ties 6 x 8 in. x 7 ft. are spaced 2 ft. c. to c. In paved streets the ties are laid on a 6-in. macadam foundation and the spaces between the ties filled with concrete; the paving material is vitrified brick, 3 in. of sand being placed between the cement and brick. In unpaved roads the ballast is Tennessee marble.

The overhead work is the center pole construction with flexible bracket suspension; the material was furnished by the Creaghead Engineering Co.

The new cars were ordered from the Brownell Car Co., of St. Louis; they are 8-bench open cars, vestibuled; there is a box for the motorman at each end of the car and on either side of the box is a short seat for two persons. The cars are equipped with G. E. 1,000 motors and K-10 controllers and Van Dorn couplers; they are mounted on du Pont trucks.

At the power house a new boiler and a 200-kw. generator have been installed.

Mr. C. C. Howell, vice-president and manager of the Knoxville Traction Co., and also of the Knoxville Electric Light & Power Co., is exerting every effort to make his road second to none in the country.

The Southwestern Gas, Electric & Street Railway Association.

First Annual Convention of the Association at Austin, Tex., May 17 19, 1899—Officers' Reports—Papers Read by Street Railway Men.

The annual convention of the Southwestern Gas, Electric & Street Railway Association was held in Austin, Tex., May 17th to 19th. This association was organized at Laredo, Tex., in March, 1898, its membership comprising gas, electric and street railway men of Texas, Mexico, Louisiana, Arkansas and New Mexico.

The recent convention at Austin was to have been held one month earlier, but was postponed on account of the small-pox epidemic then raging at Laredo and other points in Texas and Mexico. This postponement was no doubt one of the main causes for a decreased attendance. The uncertainty as to whether the municipal power plant of Austin could furnish power was the cause of many manufacturers and supply houses failing to set up any exhibition of their machinery.

The convention convened at 10 a. m. on May 17th, being called to order by President Carl F. Drake, of Austin. Secretary E. L. Wells, of Marshall, Tex., recorded the proceedings. Mr. Drake made a few remarks welcoming the visitors to the city and expressing the hope that the session might be of pleasure and profit to all concerned. He then introduced Mayor John D. McCall, of Austin, who delivered the formal welcoming address. Mr. T. D. Miller, of Dallas, responded to Mayor McCall's address of welcome, on behalf of the association. This ended the proceedings of the first day's session. The visitors were then taken in charge by the local reception committee and shown about the city. They were escorted to Hyde Park and other suburban resorts and spent a very enjoyable afternoon. They also paid their respects to Governor Sayers, who made a brief address, in which he paid the members of the association high compliments. Major Ira H. Evans, of Austin, responded to the Governor in a brief but appropriate speech.

PRESIDENT'S REPORT.

The second day's session was devoted to the reading of the officers' reports. President Drake's annual report was as follows:

Gentlemen of the Convention:—It is my pleasant duty to make to you the first annual report of the President of the Southwestern Gas, Electric and Street Railway Association. A large number of our members were, previous to the joint meeting held at Larado in 1898, members of either the Texas Gas & Electric Association or the Texas Street Railway Association, but for the benefit of those who are not familiar with the reasons for the amalgamation of these two bodies it is perhaps wise that we make some slight explanation.

Those interested in the ownership and operation of gas, electric and street railway plants in Texas, some years ago realized the necessity of a concert of action. In its inception the Gas & Electric Association conceived that their interests were in a measure identical. The street railway people, not having been invited into the fold, and realizing the necessity of organized action, formed the Texas Street Railway Association. Owing to the large investment necessary to carry on the business of any one of these branches, the number of firms interested within the border lines of our state were necessarily small, and many of our best educators among the manufacturers and representatives of the great supply concerns were obliged to attend two meetings, both of which were limited in their scope and membership, but held for the same general interest. It was thought, therefore, that a combination of the two associations would be wise. Upon investigation we found that our sister republic of Mexico and the states and territories surrounding Texas were entirely without organizations of this nature. It therefore seemed that great benefits might be derived from the organization of an association whose interests were so thoroughly identical and whose territory embraced the southwestern portions of North America.

To this end your committee, appointed at Laredo, organized the present association, and it is proper that we should hold our first annual meeting in the capitol of the state whose organizations were the foundation and the corner stone of what we hope to see in the near future, a thoroughly international and so far as the southwest is concerned, interstate association, the value of whose work and the limit of whose membership shall only be exceeded by those great national meetings which are annually held in this country.

Of the work of the past year, in detail, your secretary and treasurer will doubtless advise you at length, they being more familiar with the routine affairs of the association. These will be supplemented by the reports of the various committees, and I shall therefore, after touching lightly upon those items with which I am familiar, deal more with generalities and confine my report to making such suggestions as I believe will be of benefit to us in enlarging our membership and widening our field of development. In accordance with your instructions at Laredo, the committee on permanent organization, to which was given the power to prepare a constitution and by-laws, prescribe such rules and appoint such committees as were necessary to the conducting of our business and including this meeting, met at the office of the president in this city, and formulated such rules as experience had taught us were necessary for our guidance, making them as brief, concise and clear as was possible. These have been submitted to you, and we trust that you have studied them carefully and come here prepared to so alter and amend that when a permanent organization is effected its laws shall be as nearly perfect as possible. We shall call upon some of the members of the committee to give their ideas and would suggest that before adjournment a committee on constitution and by-laws shall be appointed and that it, in conjunction with our past committee, submit for your consideration a permanent and lasting constitution and by-laws.

Your committee, appointed to select a silver cup, to be presented to President Diaz, owing to unforseen circumstances, met with some delay, but the plate has now, however, been properly engraved and is now with us and will be forwarded at once, together with a proper communication. We shall ask Mr. Miller, of Dallas, who is chairman of this committee, to report to you at length.

Such other committees as were appointed will be called upon to make reports. The associations that were the parents of the present association were organized, and very properly so, for a purely educational purpose. Their organizers did not at that time realize the limits to which we were likely to grow, and I concur with them in the belief that the chief aim of this association should be the distribution of knowledge among its members, and exchanging of experience and information. The rapid advancement and development is such that no one man engaged in active business can keep up with the new thoughts, the new ideas and the new facts that were heretofore only theories; therefore the necessity of our getting together to learn from each other that which is taught by experience.

There is also another field for us who are actively engaged in business and whose time is so occupied that we are unable to enter into the smaller details, which is of particular interest to us; this field embraces economy in construction, economy in maintainance, economy in operation, and under the latter head a thousand questions arise in every business man's daily experience. The assignment of papers and your question box furnished a solution of the problem of education; but the application of the knowledge so acquired, it seems to me, should be through permanent committees to be appointed at such meeting, to hold their offices for one year and to be at all times subject to the call of the chairman or the officers of the association, and ready at all times to take up any work that may be suggested by the members.

As an illustration, there is scarcely a doubt but that the rates of insurance, as they heretofore have been fixed by the state board of underwriters, have in many cases been exorbitant and in some cases almost prohibitive. This, we believe, with proper attention could be satisfactorily adjusted.

The members of various legislative committees, whose duty it is to investigate and pass upon many bills which are of direct in-

terest to us, doubtless use their best judgment, but they are neither practical electricians, manufacturers of gas, nor managers of street railway plants. In order to arrive at an honest and just verdict they must be educated. As a rule you will find that the instigator of the bill if aggressive and strongly in opposition to any of our interests is only too often a man who is governed by some personal or local following. He may have had cause on account of unfair treatment, or it may be an imaginary wrong that he strives to remedy. Had you a legislative committee, whose duty it was to get before these bodies and explain to them the conditions and the facts as they exist it would be the source of much benefit to us, and would in a great many cases prevent unwise legislation, which is passed often with no evil intent, but purely from lack of information. There is probably no one here who is more bitterly opposed to what is known as "lobbying" than I, but in the many years that I have lived in the capital I have seen many cases where the legislative body was as anxious to secure information as were the interested parties to give it. We therefore think that a committee on legislation would be wise. And so on a great many committees might be appointed on other lines which would be of great importance to us. We cannot come together daily or weekly, as the exigencies of the occasion may demand. We are all active business men and if we could be represented during the year by strong committees, having separate and individual work to perform, and which should meet with us once every year and give us an account of the stewardship, I believe that great practical benefit would result. There have been one or two questioning voices during the year; but only few have seemed to fear as to the result of our amalgamation. The past year, of course, has been no criterion as to what might be done. At Laredo we joined issues without any laws or any definite plan of action. We thought that as with other bodies of a similar nature it would take time necessarily and I sincerely believe that the basis we have adopted, together with the suggestions that will be offered at this meeting, will soon put us in a place where we will not only demand, but have a right to expect both national and international recognition. To my brother officers and to the standing committees, I wish to extend my sincere thanks for their untiring efforts.

Secretary Wells presented his report, as follows:

SECRETARY'S REPORT.

Gentlemen: The formation of the present Association from the Texas Gas & Electric Light and the Texas Street Railway Associations in Laredo, Texas, in March of last year was accomplished during the latter part of the joint session of the two associations, and a new Southwestern Gas, Electric & Street Railway Association was launched on its career with practically no rules and no precedent for the guidance of its officers. The committee appointed at Laredo to draft a constitution and by-laws for the new Association met in this city in May of last year and the result of their labors is herewith presented to you in their report.

The committee appointed to arrange for the 1899 convention selected Austin as the place and April 19th as the time of the meeting, owing, however, to the prevalence of small-pox in Southwest Texas and Mexico and to the inadequate and unprecedented condition of the water power of the city of Austin from which current for the purposes of exhibition and entertainment were to be drawn, it was deemed advisable to postpone the date of the meeting to May 17th. That this postponement has influenced the attendance unfavorably is probable, but it was considered that no other course was open under the circumstances. On May 21st, the following board of directors was appointed by the president to serve until their successors are elected at this meeting, or for such time as may seem proper to the association: J. F. Strickland, Waxahachie; E. Dysterud, Monterey, Mexico; W. E. Hamilton, Shreveport, La.; L. T. Fuller, Calvert, Tex.; W. E. Holmes, Austin; J. H. Fitzgerald, Houston; Thos. D. Miller, Dallas; W. H. Weiss, San Antonio; H. M. McGregor, Houston, and Harry L. Monroe, Dallas. On the same day the following finance committee was appointed: Messrs. Scovill, Lord and Yaeger.

On June 23, 1898, Messrs. Drake, Monroe, Miller and Wells met in Dallas and took steps looking to the reduction of insurance rates on gas and electric risks. As an outcome of this meeting the secretary issued a circular letter during July on this subject, attaching copy of a letter from President Drake, which read as follows:

Austin, Tex., June 27, 1898.

Mr. E. L. Wells, jr.,
Secretary, Marshall, Tex.

Dear Sir: The Lumbermen's Association of Texas, of which I am an officer, has made arrangements with insurance companies whereby our rates have been largely reduced in consideration of our giving them a large amount of insurance in bulk. You will please take up the matter at once with the members of the Southwestern Gas, Electric & Street Railway Association and ascertain how much insurance they will be willing to place through the Association, provided we can give them equally good insurance, with as good or better adjusters, at a considerably less price than what they are now paying. I am not prepared now to state just what this reduction will be or through whom we shall write our policies, but can assure you that if sufficient risks can be obtained considerable benefit can be derived.

Our Association heretofore has been of much benefit from an educational standpoint; but we believe that a practicable financial benefit will greatly strengthen us. We therefore hope that you will without delay communicate with our members and obtain from them a definite proposition as to the amount of insurance they would be willing to place through us, assuring you, however, that there will be no pecuniary remuneration to any officer of the Association, and the benefits, whatever they may be, will be equally divided amongst our members.

Trusting that you will give this your immediate consideration awaiting your commands, I am,

Yours truly,
(Signed) C. F. Drake,
President.

As a result of this circular a considerable amount of insurance was pledged, but not enough to justify the Association in taking the final steps necessary to secure the desired reduction. The good accruing to the Association and to its individual members through the accomplishment of such a plan is obvious and need not be enlarged upon. It is therefore hoped that steps will be taken at this meeting to bring the matter to a successful issue. During the past few weeks the committee has deemed it best to defer further action until pending legislation affecting insurance has taken definite shape. On Sept. 5, 1898, a meeting of the directors of the Association was held at the Minger Hotel, San Antonio. The program for the 1899 convention was arranged and subjects were assigned with the view of presenting to this body a series of papers that would be a credit to the Association. In these assignments, I am sure, you will find that the directory has been most fortunate. The constitution and by-laws as prepared by the committee were passed upon subject to the action of this convention. The following committee on insurance was appointed with authority to enter into negotiations with both the old line and mutual companies, looking to a reduction of the present rates: Messrs. Weiss, Holmes, Drake and Wells. Messrs. Scovill, Weiss and Drake were appointed a committee to meet with the representatives of the Street Railway Association at Austin on Sept. 20, 1898, to arrange for one or more summer amusement circuits for the season of 1899. On Oct. 17, 1898, President Drake appointed the following committee on membership. Messrs. Monroe, Johnston, Dutton, Dysterud, Brook and Hamilton. The secretary respectfully suggests that a more general interest in the acquisition of new members would be most proper. The life and growth of the Association depend on the constant infusion of new blood and too much attention cannot be paid to this feature. He would also be glad to see some plan adopted looking to an organized effort on the part of the Association as a whole and of the traveling members in particular whereby large and constant additions to our membership roll can be made. The Association has maintained during the year an electrical department in the Southwestern Industrial and Lumber Review, which has done much to keep the members in touch with one another as well as generally informed as to the light and railway news of this section. Mr. Chas. A. Newning, editor of the Review, has exerted every effort to make his journal useful to the association and that he has been eminently successful cannot be questioned. It is hoped that this unique feature of association work will receive much encouragement from members during the coming year, not only in a financial sense, but in the way of contributions, and open discussion between members that will be of interest and of benefit to the Association as a whole. In addition to the matter appearing in the Review the Association has

issued through its secretary several circular letters during the year to the entire territory embraced in its scope, calling attention to the advantages of associate work and soliciting applications for memberships. It is hoped that these efforts will redound to the benefit of the Association and that with others which will follow they will succeed in building up an organization that will be of credit to the section, and a source of much good to the profession. In conclusion the secretary begs to thank the officers of this Association, and all members who have helped him with their assistance and advice.

Summer Attractions for Street Railways.

BY T. H. STEWART, SECRETARY CITIZENS' RAILWAY CO., WACO, TEX.

Under ordinary conditions the way of the manager of a street railway system does not lead through shady avenues, lined with fragrant flowers, with downy couches here and there in pleasant nooks, on which he may at will recline and take his ease. But rather it is filled with stones and boulders, hedged in by jagged rows of thorns and thistles and yawning chasms ever threatening to engulf him.

But there came a time when the public would not ride and empty cars rattled back and forth and brought no fruit. Stockholders grew restless and fretful. Out of every 5 cents passenger receipts, there was required 7½ cents expenditure for maintenance, damage suits and franchise taxes. Expense accounts grew and kept growing and took the shape of spectres and goblins and haunted the manager at night, and in his waking hours were ever present.

But the street car man did not despair. He was made of different material. He set his mind to work to devise ways and means to coax the people to board his cars and contribute of their hoarded wealth to fill his coffers. He called to mind how in his younger days he had coaxed a stubborn calf to go by simply twisting its tail. He also remembered that he had once induced a terrapin to come out of his shell by the application of a red hot coal. But neither of these methods seemed practicable in the case of the public. Then he remembered how eagerly and with what untiring zeal he had pursued the elusive end of the rainbow for its traditional bag of gold. "Eureka, eureka," he said,—or words to that effect—"I will put a bag of gold at the end of my line in the shape of summer amusements, and the public will go after it."

I have given the subject of "Summer Amusements for Street Railways" some thought and consideration, and will very briefly present to you the result.

The first question to be considered will be the particular style of entertainment to be offered. This will depend entirely upon circumstances and conditions surrounding the street car system and the facilities at its command. If it has the use of a good-sized park, such amusements as base ball, picnic parties, bicycle races, balloon ascensions, fire works, trapeze performances, etc., can be made good drawing cards. But if the entertainment must be confined to an auditorium, it must take the form of theatrical performances, musicals, balls, etc. In any event, it is of the first importance that the opening attraction be well attended and a success. It is a singular fact that the people like to go wherever the crowd goes, and if the season can be opened with a large crowd in attendance the battle is more than half won. To this end great care should be exercised in selection a first-class attraction for the opening and getting it properly advertised. Newspaper advertising in the way of reading notices is one of the best methods of reaching the public, and such advertisements should be plain simple statements of facts in a dignified and straightforward manner. Remember that you are building a structure to last through a season, and your foundation must be solid, else your building will likely topple over before it is finished. It is well to begin, at least, by telling the truth, however awkward it may come. Later on, if the strain becomes too great we might depart therefrom, and give free reign to lurid imagination, but it ought to be done by degrees. When anything happens to mar your entertainment, or if the play has been tiresome, if you will admit its shortcomings in your newspaper notices and promise to do better the next time, it will go a long way toward securing the public confidence. It is not a good idea to try to fool the people.

After starting with a good entertainment and a good attendance, the street railway man must be ever watchful to keep his performances strictly respectable. Under no circumstances should he permit anything either in word or act bordering on the vulgar, for his success will depend entirely on the attendance of ladies and children, especially the ladies. Get the feminine approval of your entertainment, then you may rest satisfied.

The street railway man who undertakes to furnish an entertainment daily for an entire season, of such character as to please his audiences so that they will come again and again to see them, and outside of this give proper attention to his other duties, has taken upon his shoulders a task that is herculean, and he needs the brains of a Solomon to be forever planning, the eyes of Argus, that he may never sleep, and the legs of a centipede, that he may never tire. His ears should be large and commodious, that into them may be poured complaints innumerable and criticisms galore. In patience he must surpass the Job; his temper must never become ruffled; his smile under all circumstances must be childlike and bland. But above all and over all, his tongue should be well oiled.

And right here is a good place for me to air a pet scheme which has been nursed for some time by street railway managers in Texas, and which I hope to see in operation at least by the beginning of next season. It is to establish a circuit embracing a number of cities. We will say a half dozen cities combine together, those of us who depend upon theatrical companies for summer attractions, and before the opening of the season select and employ for the entire season a high-class entertainment company for each city in the circuit, these companies to play alternately for a week or longer in each city of the circuit, the object being to furnish as often as necessary in each place new faces and new attractions, and at the same time relieve the management of a great deal of worry and annoyance. I only touch upon this subject in a general way, as it will not admit of discussion in so short a paper. The luxuries of today are the necessities of tomorrow. The summer attraction started as a luxury to the people; it has developed into a necessity with them, and our patrons meet us early in the spring with clamors for our opening bill at the end of the line. We must be prepared to meet their tastes and wishes, and a summer theatrical circuit is now almost a necessity to fill this need. I hope this important question will be thoroughly discussed at this meeting.

There is a question about the entrance fee, as to whether a fee should be charged. There are two classes of people. One class are always looking for bargains. The things they get free, or at a great bargain are the things they prize most highly. The other class do not consider a thing of value unless they pay a high price for it. Inasmuch as you cannot charge a high entrance fee to your entertainments, I think it best to make the entrance entirely free, and charge a small sum for desirable seats. In this way you can catch both classes of people. The bargain hunter will have secured his bargain, for he can see the entertainment free, while the moneyed man will have been satisfied, at least in a measure, for he can pay his money and get the best there is to be had.

Then there is some revenue to be derived from letting of special privileges such as lemonade stands, candy stands, etc., and it is desirable on this account to have a large attendance—another reason for making the entrance free. While on this subject, the street car company should see to it that the venders of these refreshments should be gentlemanly in their behavior and always attired in neat and clean uniforms befitting their business.

The price to be paid by the street car company for any special entertainment will be governed, of course, by the benefits derived from the entertainments, and is a matter for the judgment of the person in charge.

The character of the entertainment should be changed as often as possible to keep up interest, and great care must be taken not to keep the audiences too long or they will become tired and bored. It is much better to send them away a little hungry than to send them away gorged.

In case you should make the entrance entirely free there will be a question about what to do with those who visit your place in other conveyances than your cars. In my opinion such visitors should be charged the same amount paid by those who use your cars. My experience is they will not object to this.

Speaking for the company with which I am connected as to its experiences with summer entertainments, I can say unreservedly that they have been a source of profit and success.

Means of Encouraging Diversified Use of Electric Current.

BY C. L. WAKEFIELD, DALLAS.

Several things are necessary in order to encourage a diversified use of electric current. In the first place, you must be able to furnish power at a figure less than the cost of equipping and operating a small steam plant. This is not so difficult a part of the problem as it might appear, as you must always take into consideration the employment of considerable labor in operating a small plant, and the further fact that an ordinary high speed engine takes much more steam per horse power than the cross-compound condensing engine, such as are now being installed in our newer plants.

In Texas few manufactures can be carried on successfully except those in which labor is the principal item of the cost of production; freight rates are so high both on the finished product and the raw material, that success cannot be reached unless the freight is but a small part of the total cost. There are a great many things that can be manufactured in this country from cotton and the by-products of cotton mills, but the necessary expert labor does not live in Texas, it must be imported or induced to locate here. It strikes me, therefore, that the first step necessary towards the encouragement of a diversified use of the electric current, is to thoroughly advertise the resources of your town with regard to raw material and power, and I know of no better way than through a commercial body or club, and if there is no such organization in your town, one should be organized, and by you if necessary.

The perfection of the alternating current motor has eliminated many disagreeable features in the use of the electric current, in that these small machines are not likely to get out of repair and need no expert to put them in shape, should they by chance get out of order. The time when electricity will be generally used for cooking and heating purposes is probably very far distant; the difference in the cost of gas or fuel for this purpose and electricity to get the same results cannot be bridged except by convincing the users of the current of the extreme nicety and cleanliness of this mode of cooking, and until our people are so far advanced financially that they can afford luxuries of this sort, very little can be hoped for in this line.

I suggest, therefore, that the first thing to do is to get our people or outsiders to install factories in the lofts and other unused portions of buildings in our cities for the purpose of making brooms, blank books, baskets, belts, paper boxes, etc.—or any small articles for which much power is not required. A cheap motor adapted for ready attachment to ordinary sewing machines would greatly increase the use of electricity.

One difficulty is that the work in a kilowatt-hour is so little known that people are not willing to be charged for just what they use. The flat rate is the most popular and the most iniquitous thing in the business. It is simply one of the plans by which the good citizen is made to pay the dead beat's bill. Time and experience will probably cure this evil and greatly alleviate the distress that the station man suffers by reason of it. Any one with a small manufacturing business in Texas can afford to pay from 2 cents to 3½ cents per kilowatt-hour for current, and whether or not, you can furnish the current at this price depends upon your equipment and somewhat upon your geographical position, as the latter influences the price of coal, although the cost of fuel is now being ruled more by the labor trust than any other thing that I know of.

There is a field already before you that has only been partly worked and is capable of much larger results than are now being obtained. I refer to fan motors for residences. In many smaller towns a day circuit is not operated and inasmuch as such a circuit will only cost you coal and a small outlay for day attendance, I would advise all station managers in towns of 5,000 or over to try the experiment, and at the same time not to try to get too much from the consumer for this kind of service.

A Model Plant Under Model Management: What Both Should be Like.

BY J. F. STRICKLAND, WAXAHACHIE.

This plant is located in a live and progressive city of eight to ten thousand inhabitants. The generating station is centrally located and 50 per cent of its business is within one-fourth mile of the station, 75 per cent within one mile, and at no point has this plant a customer more than one and one-half miles out. Hence, according to my views, the management wisely adopted the 220-volt direct current system. Some of my friends no doubt will take issue with me on this point, but as we are dealing with a plant where the conditions are as stated above, I will say that all they would need to reconcile them with this system would be practical experience in its operation.

STATION EQUIPMENT.

Buildings: The building is one story brick or stone with fireproof walls between boiler and engine rooms with two heavy metal covered doors within this wall, one each towards either end of the engine room. This building is divided up as follows: Engine and dynamo room 30 x 42 ft. Boiler and pump room 40 x 42 ft. Office, including hallway to storeroom, 20 x 20 ft. Storeroom 20 x 20 ft., and directly in the rear of the storeroom and across an open hallway or alley, we find a repair shop 20 x 22 ft well equipped for all repairing necessary around this plant. This building also has concrete floors throughout, except in the office and storeroom, and is supplied with all necessary openings for ventilation, ingress and egress, and the reception of machinery. It will be noticed that there is a minimum risk of fire about this building, hence a low rate for insurance.

Fuel: There is space inside of the boiler room on side next to the railroad track to store about fifty tons of coal.

Boilers: There are two in number, of the return tubular type made of the best material, with double strap, butt joints, treble riveted and well stayed for safety at a working pressure of 125 lb. They are set in masonry in the best workmanlike manner. They are 60 or 66 in. in diameter and are of the proper length and number of flues to make them 100 h. p., nominal. These boilers are connected to one common flue running above uptakes to a steel stack resting upon its own foundation and of proper area and heighth to carry away the gases for a battery of three boilers of 100 h. p. each. They are so spaced in the building as to allow for the setting of the third, and they are equipped with one steam and one electrically driven pump, each being of a capacity to supply a battery of three boilers. There is connected between the engine exhaust and the water supply system, a heater for the utilization of the exhaust steam in heating and extracting as near as practicable all impurities of the feed water. These boilers are also equipped with first-class mechanical surface skimmers and all steam connections are made in a practical workmanlike manner, and as flexible as conditions will allow; each has an independent safety valve. Each connection from boiler to steam main has places therein and near to the boiler a gate valve which enables the engineer to cut in or out either boiler as the load varies.

Engines and generators: There are two four valved, high grade, medium speed engines of 100 h. p. each, with gridiron admission valves and exhaust valves of the well known cylindrical, oscilating type. To each of these engines is direct coupled one 65-kw. 220-volt direct current generator capable of carrying 25 per cent overload from three to four hours. One of these units carries the load except on special occasions. At the peak of the load the other one is started up and both units are run in multiple over the peak. While the rated capacity of these two units is only 2,500 lights, they easily take care of 5,000 lights wired in, which are almost exclusively on meter basis. As stated, this plant is located in a live and progressive city, hence I will endeavor to show what provisions have been made to take care of the increased business. The demand is so great now that something must be done, and the matured plan is (presuming that the territory has increased with the business of this plant) to install the three wire system, work the two units now in the station in multiple series, which means 220 and 440 volts. At this time there is to be installed a unit of about 300 h. p. of the corliss compound type with a 200-kw. generator direct connected. This generator will deliver current at 220 and 440 volts. This type of generator is being discussed pro and con at present by able engineers, but my belief is that it will be practicable by the time the business of this plant demands it. If not, however, the next thing to it will be adopted.

Motors: From the date of the above mentioned addition all motors, say from 3 h. p. up, are to be 440 volts, and those already on the service should be changed as soon as convenient. This would simply balance the load.

Switchboards and interior wiring of station: Beginning at each generator there is a double line of conduit or 3-in. vitrified clay pipe leading to the switchboard; it is laid in cement and lined with paper saturated with good insulating paint. For these leads a good rubber covered cable is in use, and on each generator panel there is a main switch, ammeter, voltmeter, rheostat and a recording wattmeter, with capacity equal to its respective generator, besides the necessary equalizers, terminals and switches; connected across the buss bars there is a recording voltmeter. The instruments on the second board are one switch, an automatic current breaker, ammeter, and magnetic blow-out lightning arrestor on each circuit. Other instruments on this board are ground detectors, clock and some minor station instruments. The board is located in the center and near the front of the engine room. All circuits go out through a tower directly over the board and from there to the pole lines.

Meters: As stated, the business of this plant is largely done through meters. A feature that is growing in favor because an accurate meter is just to both the producer and the consumer. The management is also introducing the two rate meter as rapidly as possible, which will certainly be a winner.

MANAGEMENT.

The owners of this plant have in their wisdom employed a conservative, yet progressive man, and dividends or no dividends, for the time have been left entirely with him. He immediately employed an up-to-date electrician who is good in practice as well as in theory, as both are essential to success in our line. Certain authority was given the electrician and from this time he acted as both the superintendent and electrician. A first class mechanical engineer for a city of the size of this is in charge of the station, and given the day run. He is furnished such help as is necessary to enable him to keep everything in first class mechanical shape. All the other employes are a sober, reliable type of men and are educated to let the patrons of the plant do all the kicking (if any is to be done), and they to report the same to their superiors. The manager of this plant will not tolerate in any of his employes any discourtesy to his customers. The manager of this company looks after the supply business, wires, building, etc., which according to my views is proper as he is to be held responsible for the good or the bad lighting and all other complaints known to the business. It is necessary for the manager to know as nearly as possible all about the class and condition of the wiring through which he is to supply current. The manager is also of the type that believes first in good service, but especially in maintaining rates on a legitimate basis, which is easily done where the service is kept up. He is a progressive fellow, always looking out for business and encouraging every probable consumer of current; the day load is especially looked after, and reduced rates are made for this service. He stays as clear of politics as possible yet he maintains a fair contract with the city. He furnishes nothing free, neither does he rent anything to his customers, except in special cases. It is the opinion of the manager of this plant, as well as the writer, that it is a mistaken idea to rent fans, motors or meters as a rule; but the central station should supply them to its customers at just profit enough to make that branch of the business self sustaining.

Rates: The greater part of the business of this plant is done through meters and the established price is 20 cents per kilowatt, but at this point the two-rate meter does good work on long hour service, or day business. Meter bills are payable at the end of each month and all flat rate customers are required to pay their bills 30 days in advance. The point here is that a customer who invests his money in meters, fixtures, etc., is a safer risk than those who run on the flat rate business with less money invested in fixtures.

Quarterly dividends are the result of the operation and management of this plant.

A number of papers of interest only to gas men were read at the third day's session. The following officers were elected: President, Thomas D. Miller, of Dallas, Tex.; first vice-president, J. F. Strickland, Waxahachie, Tex.; second vice-president, C. A. Yeager, Laredo, Tex.; third vice-president, W. E. Hamilton, Shreveport, La.; directors, Carl F. Drake and F. E. Scovill, of Austin; E. Dysterud, Monterey, Mex.; Fred Fries, San Antonio; E. L. Wells, Marshall; J. C. Cullinane, Denison; secretary, T. H. Stuart, Waco; treasurer, Fred Fries, San Antonio.

It was voted to hold the next convention at Waco, Tex.

INTERURBANS HELP SMALL TOWNS.

One of the hardest things to combat in securing franchises for an interurban road through small towns, is the fear on the part of the local merchants that the building of their road will take their business away and send it to the larger places. Of course experienced railway men know the history of events to absolutely disprove the assertion. An interurban road helps all along the line. The following is good campaign literature and is a copy of a letter written by the editor of the Pontiac (Mich.) Gazette, to an old friend of his in Indiana, in a town "threatened" with the advent of a trolley line, which was expected to close up every store in the place. The Pontiac road is about 27 miles long, has been in operation several years, and connects that town with Detroit, to which everybody was expected to go for their trading. What did result is told as follows:

"Our people are now delighted with the road and so are the villages of Birmingham and Royal Oaks, between here and Detroit. It was naturally thought the big city of Detroit, only 27 miles away, would be largely benefited by the road to the detriment of the trade of smaller places, but this preliminary scare has entirely disappeared. Before the road was built our merchants were apprehensive that trade would go to Detroit more largely, but they are all pleased now as business has improved greatly and the road has been a blessing. The little towns along the route which were supposed to be doomed by the road, are now more prosperous than ever, so that all the arguments we at first advanced against the electric road were largely visionary, the phantoms of fright. Not only are the towns benefited, but every farm along the line has largely increased in value, and there are no happier people than the farmers over electric roads. We are building another line to Detroit by another route, so you see our people are not alarmed over having close connection with a city of 250,000 people. The talk that trade would all go to Detroit has proved to be moonshine."

COPPER IN 1898.

Commercial Agent Atwell, of Roubaix, transmits to the State Department a table of the copper production of the world for the last four years, which is from the Revue da la Semaine:

Country.	1898.	1897.	1896.	1895.
	Tons.	*Tons.*	*Tons.*	*Tons.*
Algeria	50	.....	.....	35
Argentine Republic	125	200	100	150
Australia	18,000	17,000	11,000	10,000
Austria	1,100	1,210	1,075	1,110
Bolivia	2,050	2,200	2,000	2,250
Canada	8,040	5,905	4,000	4,000
Chile	24,850	21,900	23,500	22,075
Cape of Good Hope	7,060	7,440	7,450	7,080
England	550	555	555	580
Germany	20,085	20,145	20,065	16,555
Hungary	430	445	210	200
Italy	3,435	3,480	3,400	2,500
Japan	25,175	23,000	21,000	18,430
Mexico	10,435	11,370	11,250	11,620
Newfoundland	2,100	1,800	1,800	1,800
Norway	3,615	3,450	2,500	2,685
Peru	3,040	1,000	740	450
Russia	6,000	6,025	5,100	5,280
Sweden	480	545	500	515
Spain and Portugal	53,225	54,060	53,325	54,950
United States	234,261	215,460	203,893	172,297
Total	424,126	397,190	373,363	334,562
Average price January 1 of each year	$250.08	$238.97	$229.85	$208.40

Consul Stearn, writing from Bamberg, gives the estimated copper consumption of various countries in 1898 as follows: Germany, 101,518 tons, an increase of 81 per cent since 1892; England, 106,000 tons, a decrease of 4,500 compared with 1897; France, 55,000 tons, 4,000 less than in 1897; East Asia, 20,000 tons; Russia, 6,600 tons.

Street car mail service is fast growing in popularity in Hartford, Conn. The cars were put on April 1st and on that day collected 399 letters. The increase was rapid, doubling in a few days. The service is being used for special delivery letters much to the satisfaction of the business men.

DETROIT, LAKE SHORE & MT. CLEMENS.

The Detroit, Lake Shore & Mt. Clemens Ry. has now been in operation for about eight months and has demonstrated the advantage of using cars which are not only handsome in appearance but in which the perfect comfort and convenience of passengers is made a first consideration. By the adoption of sleeping, parlor and buffet cars, which for the most part are simply luxurious palaces on wheels the steam railroads of the country have robbed traveling of nearly all its inconveniences and made it a pleasure instead of a trial. The Detroit, Lake Shore & Mt. Clemens Ry. seems to be the pioneer in regularly running palace cars on electric roads.

This road, which has proved very popular, now runs from Detroit to Mt. Clemens. The route lies along the beautiful Detroit River and along the shores of Lake St. Clair. It is 26 miles long, every foot of the way being through an attractive country, starting from one of the loveliest cities in the world and ending where are located some of the most famous mineral springs yet discovered.

The president of the road is Mr. M. B. Mills, a very wealthy Detroit capitalist. He is commonly called the "Commodore," being the owner of the "Cynthia," one of the finest appointed yachts in this country. Thos. N. Fordyce is the secretary; F. T. Ranney, treasurer, and W. J. Hart, general manager. Mr. Hart was interested in the Interurban road of Saginaw, Mich., but sold out there to become manager of this line. He had general charge of its entire construction and equipment.

The track is of 70-lb. T-rail laid on oak ties 6 x 8 in. x 8 ft.; the ballast is gravel. The cars were built by the Barney & Smith Co. and are particularly fine ones. They are 51 ft. long and are without any doubt the most comfortable, complete and handsome ever regularly used on an electric line. Each car contains a baggage and smoking room, the latter fitted with folding seats. There is a luxurious stateroom with four seats in which it costs 10 cents per passenger additional to ride. This stateroom is much used by parties desiring to play cards on the trip. There is also a complete toilet apartment and a water cooler.

The regular passenger compartment has a seating capacity of 50. The cars are each lighted with 25 16-c. p. lamps and have Wagenhals electric headlights. The cars all through are very handsomely fitted up.

The power house is located at Lakeside. It is built of brick and is 100 x 40 ft.; the roof is metal. The equipment comprises two Russell compound four-valve engines guaranteed to develop 450 h. p. with 125 lb. steam pressure. Each engine is direct connected to a 300-kw. Siemens & Halske generator. There is also a 200-h. p. Russell four-valve engine direct connected with a 100-kw. Siemens & Halske booster. The switchboard is of the ordinary type. There are two Stirling water tube boilers, each provided with the Jones' machanical stoker. There is also a Laidlaw-Dunn-Gordon single jet condenser for each engine, a Wainwright closed feed water heater and all the other usual appliances.

The cars on this line are fitted with two trolleys, one immediately behind the other, and both are used when the car is heavily loaded. The diameter of the trolley wheel is 6 in. and it has a groove 2 in. in width and flange 1¼ in. in height. The Wilson-Thompson trolley pole catchers have been adopted.

All the cars are provided with telephones and connections can be made with telephone wires at the turnouts by using junction boxes. If necessary, messages can be sent between turnouts by means of a flexible connection and jointed poles furnished with hooks which are thrown over the telephone wire. While this telephone service is especially provided for the use of the conductors and the train dispatchers the public can have the benefit of it in case of emergency.

The Detroit, Lake Shore & Mt. Clemens Ry. is an admirable road and its success from the start will doubtless give the palace street car a strong impetus.

DETROIT, LAKE SHORE & MT. CLEMENS RY.

COMMERCIAL ASPECT OF TRAMWAYS IN GREAT BRITAIN.

The commercial aspect of electric traction in Great Britian was discussed in the Engineering Magazine for April by Mr. Emile Garcke, who after an extensive experience with electrical enterprises in England is now managing director of the British Electric Traction Co. The difficulties of promoting an electric tramway in Great Britian are classified and their causes analyzed by Mr. Garcke. He states that the great developement of various industries by means of private enterprise in the early part of the century resulted in a reaction which for the last twenty or thirty years has greatly discouraged private undertakings in the nature of monopolies. One of the tentative and mischievous measures which has proved prejudicial to the public and to investors was the Tramways Act of 1870. Unfortunately capitalists did not at first fully appreciate what they were doing and the tramways after a pitiful existence of 21 years are being purchased by local authorities at the price of old rails and machinery.

When in 1882 an electric lighting act was passed, capitalists had learned their lesson and none of 62 provisional orders granted to companies in 1883 was carried out; very little was done until 1888 when the act of 1882 was amended making the period of purchase 42 instead of 21 years.

The limited tenure permitted by the Tramway Act of 1870 is not the only cause of the failure of many tramway companies in Great Britian. The capital expenditure per mile of track is much greater than in America and this Mr. Gracke states is due largely to the difficulties placed in the way of the company by municipalities.

"The whole tendency of late has been to regard commercial promotors of public works not as benefactors, or as people rendering a public service and therfore entitled to a fair reward for their labors and risks, but rather as people who have no interests in common with the public they serve. In theory and in law, the right of a tramway company to use the street is granted on the sole ground that it is for the interest of the public that they be allowed to do so. The grant of the powers is an accommodation to the public and not a privilege or gift to the company, and, therefore, the company should be fairly remunerated for rendering a public service; and the better the company does the service, the better it should be rewarded; but local authorities now generally take the view that the promotor of public works is an usurper who should be mulcted and discouraged rather than assisted.

"This view is not held by responsible legislators nor by representative institutions, but is forced upon them by the organizations

and influence which municipal corporations are able to bring to bear."

Typical cases showing the difficulties that private companies have to meet are as follows:

"(a) A tramway company sanctioned by Act of Parliament obtained statutory power to adopt electric traction. For the purpose of carrying this out, the angles of the loops or passing places on single lines had to be slightly eased so as to enable the electric car, which cannot—like the horse car—be pulled to one side to pass over them. The corporation objected to these alterations being made, unless the company agreed to widen the streets in other parts of the town. The result was that the introduction of electric traction was delayed until this legal point was settled, and the company has nothing to show for the unnecessary law costs it had to incur.

"(b) Upon the invitation of a corporation, a tramway was promoted. The corporation insisted upon the scheme being enlarged by lines being added which were not needed, except, perhaps, to increase the value of some building plots, and which lines, in the opinion of the company, would not pay to work for very many years. Many other serious conditions were imposed, and as the company declined to accede to these conditions the corporation opposed the confirmation of the order at every stage of its process; as there was no longer any prospect of the undertaking becoming remunerative, the order was withdrawn, and there is no electric traction in that town.

"(c) In the case of a tramway worked by steam without any profit, application was made for necessary powers to work the line by electricity. The corporation approved of the proposal, but made it a condition of their assent that the electrical energy should be purchased from an electric-light station which the corporation proposed to establish. The electric-light station by itself would probably not pay, as the town is a very small one; but the corporation hoped that, by obtaining the tramway as a customer, they would be able to make their proposed electricity-supply works remunerative; but so doubtful was this that they would not undertake to supply the electrical energy except at a price which would be higher than the cost of working the tramway by steam power."

In one instance, two cities no more than eight miles apart, each having municipal tramways, cannot agree on a common gage and therefore an interurban line is out of the question.

PROMPTNESS OF AMERICAN ENGINEERING.

Nothing daunts the American engineer, and the following story from The Tradesman partly accounts for the rapid progress being made in the introduction of American steel railway materials in Europe.

The British Government needed an iron bridge over Atbara River, near Phartown, and submitted tenders to several of the leading engineering works of England. Time was the essential consideration, rather than cost. The best any British firm would say was "seven months." The Pencoyd Iron Works, of Pittsburg, have completed the spans—seven of them, 1,029 ft. long in all—and loaded them for shipment, in six weeks. This reminds an eastern daily of a story:

Some years ago a landslide in Switzerland destroyed a section of railroad. It was rebuilt carefully and solidly, to last till the crack of doom. It had taken several years to complete. An American engineer was present at the ceremonies. "Could you beat that?" the Swiss engineer said to him, with pride. "No, we couldn't," the American replied, "but—" "But what?" the Swiss asked, as he hesitated. "Well," the American went on, "I doubt if we should have made as good a job of it as you; but instead of wating three years to finish it in this style, we'd have put up a temporary trestlework around the landslide and been running trains again in six weeks." The Swiss shook his head. "We never thought of that," he said. "P. D. Q." is an American expression which means, as Kipling says, "with speed." The British Government wanted that bridge over the Atbara River, and wanter it quickly for Kitchener's use. The Americans said they would have it done P. D. Q., and—to use another American expression—they got a hump on themselves and did.

There is some excuse for the English taking seven months to do a six weeks' job, in the fact that the great strike of 1898 resulted in overloading their capacity with home orders, so when a new order of magnitude comes in it is set down to be done when every one booked ahead of it is out of the way. But that isn't all, it doesn't account for all of the difference. An American house, the pay being enough to justify it, will run "double turn" twenty hours each twenty-four. Or it will temporarily extend the works. They will meet the demand if it be possible; and they are more fertile in expedients for the purpose, than any other people in the world. By virtue of this peculiarity our iron works, in various lines, are getting a good many large and—we hope—profitable orders, from Europe. Locomotives, electrical appliances, heavy enginery of the stationary kinds, are ordered on this side, because neither the German nor the British firms can do the work in the time limit allowed.

U. S. MAIL SIGNS ON STREET CARS.

May 13th Postmaster-General Smith promulgated an order regarding the use of "U. S. Mail" signs on street cars, which is as follows:

"Hereafter no street car company having a contract for transportation of United States mails shall display the words 'United States Mail' or their equivalent upon any cars except those in which the mail is actually carried. Such companies must provide portable signs bearing the words 'United States Mail,' which shall be displayed on cars only when the United States mail is being transported therein. The sign 'United States Mail' must not be painted on or displayed from cars having street letter boxes attached thereto, the boxes themselves being a sufficient indication that United States mail is being carried on the cars. This order does not in any way affect street cars used exclusively for the transportation of United States mail."

MILEAGE REPORTS AT TERRE HAUTE.

The accompanying diagrams show the two sides of the conductors' collection report recently designed and adopted by M. F.

Form D. 10M 12-98.

READ AND REFER TO INSTRUCTIONS ON OTHER SIDE

TERRE HAUTE ELECTRIC RAILWAY CO.

CONDUCTOR'S COLLECTION REPORT

..... 18

Route ..... *Badge* .....

CAR NO.	CASH	TICKETS	TRANSFERS
Reg. In			
Reg. Out			
NO. PASSENGERS			

Trip	Time a.m. p.m.	Price of start and Arr	TICKETS: Cash Fares	No. 1 6 for 25	No. 2 Blues	No. 3 Pink	Special or Half Fare	D. H.	Transfers Received	Transfers Issued
1 O										
1 I										
2 O										
15 I										
15 O										
15 I										
TOTAL										

..... *Conductor*

Burke, general manager of the Terre Haute (Ind.) Electric Railway. As shown on the back the routes are divided into short sections and the stations designated by letters. This arrangement enables the company to keep a record of its mileage with but little labor for the conductor. The blanks are 11 in. long by 3⅛ in. wide.

TERRE HAUTE ELECTRIC RAILWAY CO.

MILEAGE

North Sixth Street Line

	Miles
From A—Union Depot, to B—Power House	.52
B—Power House to C—9th and Wab. Ave.	.06
C—9th and Wab Ave. to D—7th and Wab. Ave	.11
D—7th and Wab. Ave. to E—6th and Wab. Ave	.15
E—6th and Wab. Ave. to F—End Double track	.33
F—End of Double track to G—Big Four R.R.	.23
G—Big Four R.R. to H—Lafayette and Locust sts	.19
H—Lafayette and Locust sts. to I—8th and 6th Ave	.57
I—8th st. and 6th Ave to J—8th and Buckeye	.42
J—8th and Buckeye to K—8th and Collett Park	.21
	2.87

Main Line

From A—3rd and Osborn to B—3rd and Crawford	.72
B—3rd and Crawford to C—3rd between Wabash & Ohio	.43
C—3rd between Wabash and Ohio to D—6th & Wab. Ave	.24
D—6th and Wab. Ave to E—7th and Wab. Ave	.16
E—7th and Wab. Ave to F—9th and Wab. Ave	.14
F—9th and Wab. Ave to G—13th and Wab. Ave	.37
G—13th and Wab. Ave to H—18th and Wab. Ave.	.48
H—18th and Wab Ave to I—Wab. and Home Ave's	.78
I—Wab. and Home Ave's to J—Edgewood	.46
J—Edgewood to K—Fruit Ridge Ave.	.23
K—Fruit Ridge Ave to L—Blake's Gate	.43
	4.44

South Seventh Street Line

From A—3d and Wab. Ave to B—6th and Wabash Ave	.24
B—6th and Wab. Ave to C—7th and Wab. Ave	.16
C—7th and Wab. Ave to D—7th and Oak St	.34
D—7th and Oak to E—7th and Washington Ave	.62
E—7th and Washington Ave to F—7th and Voorhees	.79
	2.15

South Thirteenth Street Line

From A—3d and Wab. Ave to B—6th and Wab. Ave	.21
B—6th and Wab. Ave to C—7th and Wab. Ave	16
C—7th and Wab. Ave to D—9th and Wabash Ave	.14
D—9th and Wab. Ave to E—13th and Orchard	.42
E—13th and Orchard to F—13th and Crawford	.52
	1.48

North Thirteenth Street Line

From A—3d and Wab Ave to B—6th and Wab. Ave	.24
B—6th and Wab. Ave to C—7th and Wab. Ave	.16
C—7th and Wab. Ave to D—9th and Wabash Ave	.14
D—9th and Wab. Ave to E—13th and Mulberry	.41
E—13th and Mulberry to F—13th and Van R. R.	.33
F—13th and Van R. R. to G—13th and Tippecanoe	.09
G—13th and Tippecanoe to H—13th and 2d Ave	.25
H—13th and 2d Ave to I—13th and C. & E. I. R. R	.30
I—13th and C. & E. I. R. R. to J—13th and Beech.	.32
J—13th and Beech to K—13th North side Maple Ave	.37
K—13th N. side Maple Av to L—13th & Collett Park Ave	.22
L—13th and Collett Park Ave to M—End Double Track	.37
M—End Double Track to N—7th and Collett Park Ave	.19
	3.29

NOTICE

Conductors MUST POSITIVELY use station letters in making out these reports and familiarize themselves with the letter of station their car starts from and runs to. Negligence and Indifference on the part of conductors will be treated as it will merit.

M. F. Burke

General Manager.

SALE OF LEXINGTON (KY.) ROAD.

Mr. R. Lancaster Williams representing capitalists in Baltimore and Richmond, Va., last month purchased the property of the Lexington (Ky.) Railway Co.; the purchase price has not been made public, but parties who are well acquainted with the affairs of the company estimate it at $750,000. The property sold includes that of the Belt Electric Line Co., which operates the electric railway; the Central Electric Co., operating the lighting plant; the Hercules Ice Co. and the Passenger & Belt Co.

May 13th the board of directors, which consists of J. Williams Mittendrof, S. Davies Warfield, W. J. Loughridge, Geo. W. Doonall, J. R. Morton, R. P. Stoll and R. Lancaster Williams, chose officers as follows: President, R. Lancaster Williams; vice-president, Geo. W. Darnell; treasurer, R. P. Stoll; secretary, T. D Murray. R. T. Gunn, who was superintendent of Belt Electric Line, will continue to have the management of the concern under its new owners.

The company intends to at once begin an extension of the lines within the city and there is a strong probability that a belt around the city will be constructed. There is considerable talk looking toward the purchase of land in London for a park and if that is done a large summer hotel and places of amusement will be certain to follow. In the event of such a plan being carried out it goes without saying that the lines will be extended to the park and that will be but the opening wedge of a plan to extend the lines to connect with all surrounding towns.

SOUTHERN CALIFORNIA ELECTRIC POWER CO.

In the "Review" for April, 1897, we noted the plans of the Southern California Electric Power Co. to develop the water power of the Santa Ana River; this plant was completed about Jan. 1, 1899, and has been sufficiently tested to determine that it is fully equal to the work for which it was designed. This is the longest line for the commercial transmission of power that has ever been successfully operated; water is taken from streams in the San Bernardino Mountains and transmitted 2½ miles to the generating station, where it flows to the water wheels under a head of 700 ft., generating electrical energy which is transmitted to Los Angeles, 81 miles distant, at a pressure of 33,000 volts. The drop in this line is less than 3,000 volts.

H. H. Sinclair, Henry Fisher and other members of the Redlands Electric Light & Power Co., one of the pioneer companies in the development of power from the streams of Southern California, who formed a corporation known as the Southern California Power Co., for the purpose of developing the power of the Santa Ana River, secured O. H. Ensign as electrical engineer, and L. S. Boggs as civil and hydraulic engineer. Before the plant was completed it was sold to the Edison Electric Co., of Los Angeles, and the current is now being used in Los Angeles and Pasadena for lighting and power purposes, and will soon be utilized in propelling the street cars of Pasadena.

The Santa Ana River is comparatively a small river during the summer months and a very ugly stream after a heavy rain. The minimum flow of the river at the mouth of the canon, in an ordinary summer, is 4,500 in., but during the past summer it fell as low as 1,250 in. During winters of heavy rain it is a stream which runs high into the hundreds of thousands of inches, and as the canon has a grade of about 300 ft. to the mile, the water comes down with a force almost irresistible.

The point of the diversion of water from the river is at the junction of that stream with Bear Creek, where there is a natural reservoir site. The two streams come down from mountain heights through picturesque narrow canons, but just above the junction of the two streams the canons broaden out considerably, and then the united canon leads between two massive walls of rock 200 ft. high and but little more than that distance apart. Here there will be built, in the course of time, a dam, which will serve the purpose of a settling basin, a reservoir for increasing the minimum flow of the stream and adding to the irrigation system in the valley below, and as a means of diverting the water. This is not yet undertaken, the water at present being diverted by means of a temporary structure.

At this point the water is taken into a series of flumes and tunnels having a capacity of 15,000 miners' in. of water. The flumes in this system have an aggregate length of 4,150 ft., while the tunnels, which are arched and lined with Colton Portland cement, have an aggregate length of 11,850 ft. At the terminus of this system there is a pressure pipe, of which a twin will be built in the course of a few months, which leads down a precipitous hill side to the power house. This pipe is an important feature of the plant, being 2,210 ft. long and delivering the water at the Pelton wheels under a head

of 728 ft. The steel of which this pipe is made, at the top, is No. 10 gage, from which it increases to a thickness of 3-16 in., and then by sixteenths of an inch, until at the bottom it is 9-16 in. The twin of this pipe is designed to double the capacity of the plan and give it a dual character, an idea which is carried out throughout the whole design, making it possible to operate either half of the plant alone, or the two together.

This pressure pipe is joined to a steel, lap-welded 30-in. receiver, flanged and bolted and divided by a 30-in. gate valve. Where the pipe taps the receiver there is a 30-in. gate valve and by-pass.

The power house is 126.6 ft. by 36.6 ft., inside measurement, and is constructed of Portland cement concrete. The machines are arranged along one wall, with the shafts parallel to the long dimension of the building. The water wheels are mounted directly on the shafts of the revolving fields of the three-phase generators, each unit being independent of the other, the machine being combined as a water wheel and generator upon one base.

The outlets from the receiver to supply water to the wheels are tapered from 10 in. down to 6 in., where the nozzle connects. The largest nozzle is 3¾ in. in diameter. The wheels are of the well-known Pelton impulse type, and are 82 in. in diameter. Each wheel weighs 12,500 lb. The center of the wheel is made of cast steel, turned all over to give accurate balancing, the buckets or cups being held on by 1-in. bolts, driven into body-bound, reamed holes, the buckets themselves being of soft cast steel. The generators are of the revolving field type, with armature so mounted that they can be moved off the field for repairs without dismounting. The water wheels are governed with a special Lombard governor designed for impulse work, and the working of this appliance is one of the novel and most successful features of the power plant. The revolving portion of the combined water wheel and generator weighs 36,000 lb., and is driven at the rate of 300 r. p. m. The generators are of 750 kw. capacity, being operated at 750 volts. There are three General Electric exciters of 30 kw. capacity each, each driven by a separate Pelton water wheel and governed by a Replogle mechanical governor.

Each of the main Pelton wheels discharges its water through a separate tunnel under the floor into a separate tail-race and each tail-race discharges into a common reservoir 8 ft. wide, which in turn empties into the river through a sluice gate.

At a point farther down the stream, the water is again withdrawn from the river and used for irrigating purposes. It is claimed that the amount available is much greater than in the case of ordinary river flow, or an irrigating canal, as the careful construction of the power canal prevents the great loss from seepage or evaporation, incident to an ordinary open canal, and also the loss from underground flow, which happens when the water is carried in a mountain stream.

The current generated at 750 volts is transformed to 33,000 volts for the line. There are now installed four banks of three transformers each, wound for from 750 to 19,000 volts. Three of the transformers are grouped in Y to give the required 33,000 volts on a three-phase circuit. The transformers are of the General Electric air cooled type and mounted on a foundation of iron girders and concrete, which is 30 in. above the floor.

The low tension switchboard is composed of marble panels 90 in. high, 36 in. wide and 2 in. thick. There are six such panels for the generators, one for the three exciters and one for the total output, on the latter are mounted a recording voltmeter, a recording ammeter, and a recording wattmeter on each bus-bar. On each of the three transformer panels there are two sets of transformer switches, so arranged that the transformers can be connected to either set of bus-bars. The double set of bus-bars are arranged to run two complete and separate plants, or with all machines on one bus-bar, this arrangement being carried through the exciter bus-bars as well.

The high tension switch board stands on a gallery above the low tension, and consists of two line panels, a panel for each bank of transformers, there being arrangements for six banks of transformers. These panels are also equipped with double bus-bars. The line panels have an ammeter in each leg of the circuit.

All the panels in the building are composed of Tennessee marble, the currents being somewhat insulated from the marble by thick, hard rubber bushings, which extend five inches through on each side. The marble is all polished on both sides.

The transmission line from the power house is 81 miles long, and is composed of two circuits of three wires each, No. 1 B. & S. gage. In the canon the poles are 30 ft. high, 8 in. on top, 110 ft. apart, the canon being 5½ miles long from the power house. From the mouth of the canon to Los Angeles the poles are 120 ft. apart, 35 ft. high, 8 in. on top, except through cities and towns, where 50-ft. poles are used. The wires form triangles, are spaced from 17 to 28 in. apart, and are spiraled every 88 poles on the south side and every 41 poles on the north side. The two spiralings are so arranged that tney never come on the same poles. This method is reported to have successfully prevented any interference with the telephone circuit on the same poles.

As a whole, the system seems to meet every expectation of the company, and it is believed that it will be no great time until the additional pressure pipe is put in and the power generated thereby doubled. This is the worst time in the history of the state for the generation of electricity by water power, the rainfall having been so light as to reduce the flow of the river to the lowest point ever known. The water of the Santa Ana last summer touched the low point of 1,250 in., whereas the normal summer flow as stated is about 4,500 in. There is probably more snow on the mountains this year than there was last, though the continued comparative drought would seem to hold out little hope for a great increase, if any, over the flow of last summer. Thus the achievements of the present can be taken to be about the minimum expectations of the plant, while in a normal year the supply of water would certainly be many times that required by the plant.

In other respects, the conditions have been such as to thoroughly test the efficiency of the new plant, the canon having been the scene of a heavy fall of snow, which is by no means infrequent at that altitude, while on many nights the most dense fogs ever experienced in this section have prevailed, the fogs being considered the worst obstacles to the heavy-current transmission of electricity.

The plant to date has cost about $600,000, a large part of which has been expended in labor, especially in the long series of tunnels.

The current is received at Los Angeles at the main power station where it is transformed by three 250-kw. air-cooled transformers to 2,200 vols and sent to the switchboard, from which it is distributed for three distinct purposes.

A part of the current is put direct on the mains and feeders which supply the residence portion of the city, under a voltage of 2,200, small transformers being placed on the poles in front of the individual houses where used, to reduce the voltage for the houses to 100. Another portion of the current at the same voltage is taken to the sub-station, by means of a line part aerial and part underground. At this sub-station it is converted into a direct current at 110 volts, by means of two motor generator sets, each consisting of a 300-kw. three-phase synchronous motor, direct connected to two multipolar 110-volt generators of the same capacity. From these the current is distributed through a network of underground mains and feeders which supply the customers in the conduit district of the city. For the distribution of this current, the Edison three-wire system is used.

The Edison Co. is at present installing at the main station a 525-kw. synchronous motor direct connected to a 550-volt direct current generator. The current furnished by this will be used for supplying power at 500 volts in the conduit district and for railway purposes.

The Edison Co. is now utilizing this power in the operation of 49,000 incandescent lights, 300 arc lights and small motors aggregating about 700 h. p. in this city, besides owning and operating the Pasadena Electric Light & Power Co. plant, with 15,000 incandescent lights and 105 arc lights. The officers of the company are George H. Barker, president; Henry Fisher, vice-president; William R. Staats, secretary, and John B. Miller, treasurer.

CABLE STRAND CAUSES WRECK.

About 7 a. m. on May 22d an exciting street car wreck ocurred at the corner of Adams and Clark Sts., Chicago. A west-bound cable train, consisting of the grip car and two trailers, had been halted to permit a Wentworth Ave. electric car and trailer to pass, when it was struck from behind by a second cable train. A broken strand of the cable had caught in the grip of the rear train and it was beyond control. The eight cars were all more or less injured and also an express wagon; the only person hurt was the driver of the express wagon.

RECENT STREET RAILWAY DECISIONS.

EDITED BY J. L. ROSENBERGER, ATTORNEY AT LAW, CHICAGO.

CAR SHIFTER NOT A SUPERINTENDENT.

Whelton v. West End Street Railway Co. (Mass.), 52 N. E. Rep. 1072. Mar. 1, 1899.

A car shifter, whose sole duty it is to get cars ready for conductors and motormen, the supreme judicial court of Massachusetts holds, is not a superintendent, and neither is his starting of the transfer table, nor his failure to stop it when it has caught the foot of a conductor, an act of superintendency, within the purview of a statute making an employer liable for injuries caused by the negligence of a superintendent.

ALWAYS TO USE ORDINARY CARE IN ALIGHTING.

North Chicago Street Railroad Co. v. Brown (Ill.), 52 N. E. Rep. 864. Feb. 17, 1899.

If an instruction, which requires of the plaintiff reasonable care, is not technically accurate because it does not instruct the jury as to what is reasonable care, the supreme court of Illinois holds that the objection is obviated in another instruction that a person attempting to alight from a street car is bound, under any and all circumstances, to use ordinary care and caution to avoid injury to herself, and if she fails to use such care, and is injured by reason thereof, the owner of the car cannot be held liable for such injury.

KENTUCKY STATUTE AS TO VALUATION OF FRANCHISES CONSTITUTIONAL.

Paducah Street Railway Co. v. McCracken County (Ky.), 49 S. W. Rep. 178. Jan. 27, 1899.

The court of appeals of Kentucky holds constitutional sections 4077-4079 of the Kentucky Statutes, notwithstanding that the state board of valuation and assessment, created and provided for by the statute for the purpose of valuing of franchises, was claimed to be unconstitutional. Moreover, as to the contention that the board should have deducted the indebtedness of the company, and the cost of operating its business, from the value of its franchise, the court answers that no such rule of valuation is applied to any other property, and that the claim of double taxation is not tenable.

RIGHT TO MAKE A TEST CASE.

Adams v. Union Railroad Co. (R. I.), 42 Atl. Rep. 515. Jan. 9, 1899.

The point was taken by the defendant in this case, reported at some length under another heading, in this department, that, because the plaintiff boarded the cars for the purpose of making a test case, this was a moot case, which the court would not entertain. But the supreme court of Rhode Island answers that a moot case is one which seeks to determine an abstract question, which does not rest upon existing facts or rights. Where a concrete case of fact or right is shown, it says that it knows of no principle or policy of law which will deprive a party of a determination, simply because his motive in the assertion of such right is to secure such determination. It is a matter of common practice. Most of the cases of trespass to try title are of this sort. For which reasons it is of the opinion that the case was not objectionable on this ground.

NOT NEGLIGENCE TO RING GONG A DOZEN TIMES.

Henderson v. Greenfield & Turners Falls Street Railway Co. (Mass.), 52 N. E. Rep. 1080. Feb. 28, 1899.

This was an action to recover damages for personal injuries received by being thrown from a wagon on account of a horse being frightened by the noise and sparks from an electric car. The supreme judicial court of Massachusetts holds that a verdict was properly directed for the defendant. It says that up to the moment of the accident there was nothing in the behavior of the horse which rendered it negligent on the part of the motorman to ring the gong, and it declares that it cannot be said that to ring the gong on an electric car in a public street half a dozen or a dozen times, which it was charged was done, is of itself, without anything more, evidence of negligence. Beyond this, it contents itself with merely remarking that there was nothing to show that the noise and sparks were due to any defect in construction or negligence in operation.

CARE REQUIRED OF EMPLOYES WHILE PASSENGER IS ALIGHTING.

Lutz v. Louisville Railway Co. (Ky.), 48 S. W. Rep. 1080. Jan. 11, 1899.

In this case, wherein a judgment for the defendant is reversed, and which is "not to be officially reported," the court of appeals of Kentucky holds that this instruction, which was asked for, but not given, is a correct statement of the law, to wit: "The court instructs the jury that the law made it the duty of the defendant's agents and servants operating the cars upon which it is alleged plaintiff was a passenger to observe the utmost care and skill which a prudent man would exercise, under like circumstances, in the management and control thereof, while she was alighting therefrom, and to afford her reasonable opportunity to alight in safety; and if the jury shall believe from the evidence that the defendant's said agents or any of them, failed to observe such care, and that by reason of such failure plaintiff received the injuries by her alleged, then the law is for the plaintiff, and the jury should so find."

MOTORMAN NOT NEGLIGENT IN NOT SEEING BICYCLER.

Gould v. Union Traction Co. (Pa.), 42 Atl. Rep. 477. Feb. 27, 1899.

During the moment when a certain motorman's eyes were turned from one side of the street, a boy, 12 years old, riding a bicycle came rapidly and noiselessly upon that side of the street from behind a wagon, which was close to the track, with his bicycle turned so that he was facing the car, and then suddenly changed his direction, and struck the car, because he could neither go forward nor stop. The motorman was not, under the circumstances, the supreme court of Pennsylvania holds, negligent in not seeing the boy, he having just then turned his eyes momentarily towards the other side of the street in the performance of his duty to watch both sides of the street. And so it reverses a judgment obtained by the plaintiff. If the motorman had seen, or by the exercise of reasonable care could have seen, the boy in time to stop the car, the court says that it would of course have been his duty to do so.

CROSSING IN FRONT OF APPROACHING CARS.

Clark v. Bennett, Receiver of the San Francisco & San Mateo Railway Co. (Cal.), 55 Pac. Rep. 908. Jan. 13, 1899.

The supreme court of California holds that it cannot be said that a person is guilty of contributory negligence merely because he attempts to cross a street railway when a car is approaching. If that were so, it continues, he could never attempt to cross such a track in the crowded parts of a city, where there is practically always an approaching car; and in such case, as street cars go at a comparatively slow rate of speed, and are quickly stopped, it insists, the question of negligence would depend upon the proximity or remoteness of the car, and upon all the other circumstances surrounding the occurrence. In such a situation, it declares, the traveler cannot be held to exercise the very highest prudence and judgment; it is sufficient if he exercises that degree of care and prudence and good sense which men who possess those qualities in an ordinary or average degree exercise.

INDEPENDENT LINE CANNOT BE BUILT UNDER EXTENSION PROCEEDINGS.

McClean v. Westchester Electric Railway Co. (N. Y.), 55 N. Y. Supp. 556. December, 1898.

A separate and apparently independent line of street railway, a special term of the supreme court of New York holds, cannot be constructed under extension proceedings, the articles of association of the company and the provisions of law contemplating but a single line of road, carrying from end to end for a single fare.

Nor, while second extension proceedings had might cure defects in the first, does the court consider that they can relate back so as to make valid resolutions of the municipal authorities which were before inoperative and ineffectual.

And the court does not think that an owner of land, offering to prove that a street railway is unauthorized, and so is a nuisance, is called upon to prove that the probable, speculative, or actual benefits of the unauthorized structure will not offset the apparent disadvantage or injury, however small.

NOT REQUIRED TO INSTRUCT CONDUCTOR OF NINE YEARS' EXPERIENCE.

Fletcher v. Philadelphia Traction Co. (Pa.), 42 Atl. Rep. 527. Feb. 27, 1899

This was an action brought to recover for the death of a conductor of nine years' experience. He had run only closed cars. About 5 o'clock in the afternoon of the day of his death, he was instructed to take out an open summer car. He assumed charge of the car, and started on his trip. Soon after, a violent thunderstorm arose. He went out on the running board, and commenced pulling down the curtains at the sides. Just at that moment a closed car passed him on the other track, striking and killing him. Negligence on the part of the company was charged in its not warning him of the danger incident to the passage of an open and closed car on tracks only 37½ inches apart.

The court below submitted the question of the company's negligence to the jury; instructing them that if they found that there was special danger from the nearness of the tracks at that point, which was increased by the greater width and arrangement of the open car, and that this danger, because of the conductor's inexperience was unknown to him, then it was for them to say whether the company was negligent in not warning the conductor of the danger incident to his employment on an open instead of a closed car. The result was a verdict against the company.

The supreme court of Pennsylvania, however, thinks that no authority of the state sustains the ruling of the court below, and reverses its judgment, holding that it erred in not directing a verdict for the company. Many of the cases of the state hold that it is the duty of employers to warn young or inexperienced employes of dangers not obvious, but incident to their employment, and that a failure to do so is negligence for which the employer is answerable. But the supreme court declares that this conductor was neither young nor inexperienced. Concede that he had never conducted an open car that necessitated walking on the running board along the outside; yet, from his long experience, the court considers that he must have known the danger in passing another car on a wider one. The inexperienced conductor, it says, is one new to the business, and unaware of a danger not plainly noticeable.

CASE WHERE OPERATION OF PORTION OF LINE COULD BE ABANDONED.

State v. Helena Power & Light Co. (Mon.), 56 Pac. Rep. 685. Mar. 31, 1899.

Here a writ of mandamus was applied for to compel the above company to operate a portion of its system of street railway which it was alleged that it had abandoned.

A writ of mandamus may be issued, says the supreme court of Montana, to compel the performance of an act which the law specially enjoins as a duty resulting from an office, trust or station. But it holds that the operation of the line of street railway which had been here abandoned was not an act specially enjoined as a legal duty, and that the writ of mandamus could not be issued.

In explanation of this, the court says that it did not appear that the charter of the company, or the statute under which it was organized, required it to maintain or operate a line of railway; nor was it claimed that the state had delegated to it the power of eminent domain. Indeed, the court says that it did not appear whether the company owed its existence to a special act of the legislature, or to a compliance with the terms of some general act authorizing the formation of corporations thereunder. At the argument, it was stated that it was organized and exists under chapter 25, division 5, Compiled Statutes of 1887, entitled "Corporations for Industrial or Productive Purposes;" but nothing contained in that chapter, the court holds, may be so interpreted as to impose upon the company the obligation to continue the operation of any portion of its system of railways.

Moreover, the court pronounces the ordinances of the city barren of any language expressing or implying the intention of the council to impose such duty, the ordinances merely granting the right and privilege of constructing, operating, and maintaining railways in particular streets. That the ordinances provided that unless a designated portion of the line of railway should within a certain period of time be constructed and operated or the right and privilege granted would be forfeited as to the parts of the line where the failure occurred, and provided for the running of cars at such intervals as might from time to time be directed, the court apparently does not consider altered the case.

EVEN COURT KNOWS JERKS ARE UNAVOIDABLE ON CABLE LINES.

Bartley v. Metropolitan Street Railway Co. (Mo.), 49 S. W. Rep. 840. Feb. 15, 1899.

It is a matter of common knowledge, of which even a court is not ignorant, as well as a matter of physics, says the supreme court of Missouri, Division No. 1, that the rope of a cable railroad cannot be kept taut, and that the jerks which are common and unavoidable to such roads are caused by the slack in the rope being taken up.

In order to recover from a cable railroad, continues the court, it is not enough to show that there was a jerk, but it must affirmatively appear that the jerk was an extraordinary or unusual one, or attributable to a defect in the track, an imperfection in the car or apparatus, or to a dangerous rate of speed, or to unskilled handling of the car by the gripman.

This was an an action to recover $25,000 for personal injuries. The court says that the testimony did not show anything extraordinary or unusual in the jerk complained of. No defect in the track or car or apparatus was shown, and no negligence of the gripman was made to appear. Under such circumstances, the court holds, it was the duty of the trial judge to declare these facts, and to sustain a demurrer to the evidence at the close of the plaintiff's case, and it was error on the lower court's part not to do so.

Moreover, the court will not agree with the contention that negligence should have been imputed to the defendant, entitling the plaintiff to go to the jury, although his testimony fell short of making out a prima facie case. It says that the contention is not tenable, because it is not true that jerks do not usually occur in the running of cable cars, but, on the contrary, it is a fact that they are unavoidable. It is only in cases where the injury would not occur in the ordinary conduct of such affairs that negligence is imputed to the defendant. Where, as here, it affirmatively appears, and is proved by common experience, as well as by the laws of physics, that the particular thing complained of is unavoidable, it holds, there can be no negligence.

ASSESSABLE FOR LOCAL IMPROVEMENTS.

Cicero & Proviso Street Railway Co. v. City of Chicago (Ill.), 52 N. E. Rep. 866. Oct. 24, 1898. Rehearing denied Dec. 13, 1898.

Under its previous decisions, the supreme court of Illinois says that it regards the question settled that a street railway occupying a public street is liable to be assessed for a local improvement in the same manner as other property owners.

But reliance was placed, in this case, by the company, on the provision of the revenue law that "the personal property of street railroad, plank road, turnpike or bridge companies shall be listed and assessed in the country, town, district, village or city where the

principal place of business is located. The track, road or bridge shall be held to be personal property, and listed and assessed as such in the town, district, village or city where the same is located or laid."

The fact that the track of a street railroad company may be required to be assessed as personal property for general taxation, the court however holds, has no bearing on the question of taxation for local improvements. No question in regard to the assessement and collection of general taxes under the revenue law of the state, it maintains, is involved in a case of a special assessment for a local improvement.

The legislature, no doubt, had the right to provide, in the assessment of property for state, county, and city purposes, that the track of a street railroad company might be assessed as personal property, without changing the nature or character of the property when a proceeding might be instituted to make an assessment on contiguous property to pay for a local improvement, says the court. It perceives no reason why for one purpose it might not be treated as personal, and for the other as real, property. But, however, that may be, it adds that it is satisfied that the property of this company was within the meaning of the law, contiguous property, and, as such, was properly assessed for the construction of a vitrified tile-pipe sewer.

MOTORMAN SHOULD HAVE FULL USE OF BOTH EYES.

Rice v. Crescent City Railroad Co. (La.), 24 So. Rep. 791. Jan. 9, 1899.

No man should be in charge of an electric car as motoneer, running along populous thoroughfares of a city, the supreme court of Louisiana holds, who has not the full and complete use and sight of both eyes.

In this case, a motor inspector and repairer of cars, whose right eye had been injured in an accident, so that he was almost blind in that eye, who had boarded the car in question, had been asked by the regular motorman to take charge of the car, because the motorman felt sick from a blow he had received in the stomach by reason of the brake handle slipping from his hand.

A child was run over, and killed. If the temporarily acting motorman saw her, and failed to govern his car accordingly—running at such slow speed as to be able to check it immediately should the imminence of danger appear—the court says he was guilty of the grossest, if not criminal neglect. If he did not see her, it says that it was due to the fact that he was not performing his duty by keeping a sharp outlook, or to the fact of his blindness. In either event, it holds, the company would be liable.

The fact that the car ran 150 feet after the child and its nurse were struck, the court pronounces eloquent in refutation of the contention of the defense that there was neither negligence in the effort to stop the car nor want of skill on the part of motorman in diong so.

A child 3½ years of age is, of itself, the court holds, incapable of contributory negligence. But if its nurse, after reaching it on the street, started back with it across the track, and in consequence of this was run over, the court says that it would relieve the company of liability.

No doctrine or rule exists in Louisiana, the court says, that the negligence or imprudence of a plaintiff, while not of the proximate character to defeat his recovery, may yet be looked to by the jury or court in mitigation of damages.

Nevertheless, the supreme court goes on to say that it has constantly exercised its reasonable discretion of increasing or diminishing the sums awarded for damages, according as its judgment, operating on the facts, prompted in given cases.

But it denies that it has ever been the intention to fix by rule specific sums for different classes of injuries, or for varying grades and duration of anguish and suffering. In this respect, each case, it says, considered independently, on its merits, and on the state of facts peculiar to it, a due regard, however, being always had to the proper observance of a reasonable uniformity of jurisprudence on general lines.

Finally, the facts and circumstances of this case, it thinks justify the reduction of the verdict of the jury from $12,500 to $4,000, for the killing of the child mentioned.

RULES AS EVIDENCE IN PERSONAL INJURY CASES.

Cincinnati Street Railway Co. v. Altemeier (O.), 53 N. E. Rep. 300. Mar. 14, 1899.

Rules adopted by a street railway company for the government of its employes in operating such railway, the supreme court of Ohio holds, are competent evidence, when relevant, in the trial of a cause for damages for personal injury caused by the negligence of the servants of such company.

In discussing this subject, the court says that the rules by which a street railway company runs its cars are a part of what are termed the resgestae, or things inseparably connected with the accident as one of the circumstances surrounding the case, and which are often necessary to a proper understanding of the same. They are not so much in the nature of admission as a part of the transaction. The rules by which a railway is operated are as much a part of the transaction as the construction, and appliances of the cars, motors, machinery, and tracks.

If the rules require more care of the employes for the safety of the passengers than the law requires, the court goes on to say that it is easy for the court to say so to the jury, and point out what the law requires, and wherein the rules require more than the law, and that to the extent of the excess the company is more careful than is required by law. Such a showing, it thinks, would be an advantage to the company instead of a detriment.

If the rules require only what the law requires, the court maintains that no harm can come to the company from their introduction in evidence.

But if the rules require less than the law, or if there are no rules at all, then, the court says, the company might well be held to be negligent for such a state of affairs.

It seems, therefore, reasons the court, that the introduction of the rules of the company is not only proper, but would lead to the working out of just results in all cases, sometimes against the company and sometimes in its favor. The fear that the introduction of the rules of the company would discourage such companies from making strict rules for the safety of passengers, the court thinks, is more fanciful than real. The reason it gives, is that the company would suffer much more loss from absence of strict rules than from having the rules introduced in evidence, and self-preservation would induce such companies to adopt such rules as will reduce accidents to a minimum, whether such rules are received in evidence or not.

RIGHTS WHERE TELEPHONE AND ELECTRIC RAILWAY COMPANIES USE SAME STREETS.

Birmingham Traction Co. v. Southern Bell Telephone & Telegraph Co. (Ala.), 24 So. Rep. 731. Oct. 29, 1898.

In this case a bill was filed by the last named company praying that an injunction be issued restraining and enjoining the traction company, its officers and agents, from so constructing its line of poles and wires on and along certain streets as to interfere with, hurt, harm or injure the complainant's telephone property, service wires and poles; and an injunction was granted.

To begin with, in considering the case, the supreme court of Alabama says that it does not understand that it was insisted that the telephone company had the exclusive right to the city streets for the purpose of operating its telephone system. No company under ordinary circumstances, can assert and maintain a right to the exclusive enjoyment of a public street. Such a monopoly the law does not favor.

In the same vein, the court goes on to say, that, while it is probably true that two electric systems of the kind under consideration cannot be constructed in and operated along the same street—unless it be of uncommon width—without inflicting some incidental injury or damage, the one to the other, it may be safely stated as applicable to all conditions, that no one public corporation of the kind should be given a monopoly to the exclusion of the others in the use of the streets of a city. Ordinarily, it holds, such privileges should be granted, equal with and not superior to other like enterprises established for the use of the public; and when two are authorized by law to use the same street, it should be with the express or implied condition, that each shall respect the rights and

interests of the other, and occasion, no unnecessary harm the one to the other.

At the same time, while the court does not decide that prior occupancy of a street by a telephone company confers any superior privileges, it does insist that it may certainly be considered in denial of a street railway company's usurpation of superior rights in the street.

It also holds that where the unwarranted usurpation of a railway company amounts to a trespass upon a telephone company's rights, which is recurrent and continuous, a court of equity will interfere by injunction.

Besides this, it says that the authority of a court of equity to grant and maintain an injunction in such a case may be rested on that other ground of chancery jurisdiction, that such courts will interfere to control such corporations as these, to keep them within the line of their authority and subject to law, in order to prevent such usurpations as were here complained of.

EXEMPTION FROM OBLIGATION TO PAVE BETWEEN TRACKS.

Wood v. Common Council of City of Binghamton (N. Y.), 56 N. Y. Supp. 105. Feb. 4, 1899.

This was an action brought by certain taxpayers to restrain the collection of taxes for the expense of paving a street, between the rails of the track of the Binghamton Railroad Company and two feet in width outside such tracks, and to compel said company to pay such expense, less the cost of paying one foot in width between the rails, which it had already paid.

Now, while it concedes it to be true that this company became vested with all the rights of certain other companies at the time of their consolidation, and that the statutes under which the several companies were organized did not impose an obligation to pave streets, yet the trial term of the supreme court of New York holds that the omission in such statutes to require the companies to pave did not vest in them or their successor, the Binghamton Railroad Company, any right to be perpetually exempted from such obligation, if the legislature should impose it, the power to impose such obligation at any time being given the legislature by the state constitution.

The term "vested rights," the court holds further, relates to property rights, and does not embrace within its meaning the immunity or exemption created by an omission in the statute under which the incorporation was effected, to impose a liability for the paving of streets used and occupied by a street surface railroad.

And, if nothing further appeared in the case, the court says that the plaintiffs would be entitled to the relief sought, for the reason that, under the general railroad law as amended, it would be the duty of the defendant railroad company to pay the expense of paving between the rails and two feet in width outside thereof, and the city of Binghamton would have no power to assess such expense upon the abutting owners or the city at large.

But one of the defenses of the company was that it was exempt from the duty to pave required by section 98 of the provisions of the general railroad law by virtue of a contract or contracts made with the common council of the city, in 1892, which the legislature confirmed, ratified, or legalized in 1893, which contract required the company to pay one-fifth of the expense of paving and repairing between the rails of its tracks and to erect poles of a certain description which might be used by the city for the purpose of stringing electric light and fire-alarm wires, etc., and this legalizing act the court holds valid and of the effect contended for by the company, so that it was entitled to judgment dismissing the complaint on the merits, though the action of the common council alone would have no such effect, being unauthorized.

CONSTRUCTION OF CONTRACT WITH TOWN LIMITING FARE.

Adams v. Union Railroad Co. (R. I.), 42 Atl. Rep. 515. Jan. 9, 1899.

Under a statute giving authority to towns to pass ordinances or make contracts granting franchises to corporations for operating street railways, etc., the town of East Providence made such a contract with the defendant, in which it was agreed that, "during the continuance of said exclusive franchise, the fare from one point to any other point on the lines of the party of the second part in said town shall not exceed five cents." By entering into this contract, the supreme court of Rhode Island holds that the defendant waived its previous rights in respect to fare, including the rights it had as one of the successors of another company authorized by its charter to fix rates of fare not exceeding ten cents between any two points on said road. Under this view of the contract, the court pronounces the defendant's plea of justification for refusing to transfer and carry the plaintiff for one fare of five cents from a point on its main road to a point on the connecting road above mentioned of no avail, so far as it rested upon rights previously held.

There still remained the question, which was the one chiefly pressed in argument, whether the plaintiff could avail himself, as an individual, of the right to claim the benefit of the provisions of the contract in an action of trespass for assault and battery on account of being ejected from the car for refusal to pay an additional fare on the connecting line. This, the court answers in the affirmative.

The terms of the contract, that "the fare from one point to any other point on the lines of said party of the second part shall not exceed five cents," the court declares that it cannot vary by reason of the fact that, when the contract was made, two rides for five cents was not the established rate of fare.

The contract in question, the court goes on to say, was made for the benefit of passengers using the defendant's cars. The town could hardly show damages for its breach, and therefore, if the people for whose benefit it was made could not recover for its breach, no one could. True, the town might take steps to avoid the contract and stop the road for failure to perform conditions; but, in so doing, it would cut off the privileges of many to redress the wrong of one. This would neither be a reasonable nor an adequate remedy. It must have been intended to be a contract for the benefit of the public, made through the town as their corporate representative, upon which passengers could rely, and for breach of which they could seek redress; otherwise, it would be a contract of little obligation and force. Along this line of reasoning does the court reach the conclusion that the plaintiff, having paid the fare of five cents, had paid all that he could be required to pay under the contract, which, being for the benefit of passengers, a class of which he was one, was for his benefit, and of which he could take advantage.

The statute giving authority to a town to act by ordinance or contract, the court says that if it acted by contract, as in this case, the necessary implication was that it might stipulate for terms other than those expressed in the statute. Thus, the statute providing that the charge for service should not be greater than the price actually charged by the corporation at the time of granting the franchise, the court holds, would clearly imply that it might be less.

NO PRESCRIBED RATE OF SPEED.

Fullerton v. Metropolitan Street Railway Co. (N. Y.), 55 N. Y. Supp. 1068. Feb. 10, 1899.

There is no statute, says the first appellate division of the supreme court of New York, which prescribes the rate of speed at which one may run a car through the streets of the city of New York, and, therefore, except in extreme cases, it cannot be laid down that to run a car at any given rate of speed in any place constitutes negligence, as matter of law. It is not intended to say, it continues, that a rate of speed cannot be so great that, taken in connection with all the circumstances, the court would not be required to hold that it constituted negligence of itself; but circumstances which would warrant such a holding would be extreme. Ordinarily, the question whether the speed constituted negligence is a question of fact, to be determined by the jury in view of the surrounding conditions at the time. All these things are to be taken into consideration.

The duty of the driver of the car is to manage it in a reasonably prudent and careful manner, having in view all the conditions which surround him at the particular place where he is; and whether in this case he did so manage his car the court holds was to be determined by the situation as it was then exposed by the evidence presented in the case. More particularly, it hold that when it is made to appear that a heavy car, operated by machinery, running upon a steep down grade in a populous street of a city, is permitted to acquire such a rate of speed that it cannot be stopped in a distance of 40 feet, if necessity requires, the question of negligence is for the

jury, and should not be determined as a legal proposition by the court.

While there happened to be no one on the street at the time in question, yet, the court says, it was clearly the duty of the motorman to keep his car under reasonable control, so that he could manage it with sufficient promptness to stop it promptly, if occasion arose to do so.

While there must be conceded to vehicles of this kind a right to run at a considerable rate of speed, yet, continues the court, that rate of speed must in all cases be such as is reasonable and safe, in view of the correlative rights of other persons upon the streets. Those living upon the streets have the right to be upon them, not only to go backward and forward, but to cross them, as their necessities, business, and even pleasure, may require; and the cars running along the street must be managed so as to give such persons a reasonable opportunity to exercise their rights in the streets, if they use ordinary care in doing so. To that end, it is clearly the duty of the persons controlling the movements of such a vehicle to keep the car under such control as to be able to check its speed, or bring it to a standstill, in time to avoid injury to those persons who have occasion to be upon the street. To do this involves, not only the duty of regulating the speed of the car so that it may be stopped within a reasonable time, but of giving such a strict attention to the situation as to be able to use the appliances for bringing the car to a stop without unnecessary delay. What conditions must exist, to establish proper care, in view of those duties, in any given case, cannot be laid down as a matter of law. They must be questions of fact, to be determined by the jury.

It is safe to say, however, adds the court, that if the jury should find that a motorman permitted the speed of his car to be so accelerated upon a down grade, where it would be naturally difficult to control it, that he was not able to bring it to a stop in the time usually taken for that purpose, when the car was running at the ordinary rate of speed, he would be guilty of negligence, for which his employer would be responsible.

RISKS ASSUMED BY CONDUCTOR.

Pikesville, Reistertown & Emory Grove Railroad of Baltimore County v. State, to Use of Russell (Md.), 42 Atl. Rep. 214. Dec. 20, 1898.

In accepting the employment of an electric railway company as conductor, the court of appeals of Maryland holds, a person takes upon himself all such risks as are usually incident to the service, and also such other risks as are known to him or are discernible by ordinary care on his part. He is obliged to observe and guard himself against danger from the poles as properly or apparently located. On the other hand, where a pole has been negligently and improperly placed, so that thereby the usual risks of the service are increased, and if such misplacement is not apparent to the conductor with the exercise of reasonable care, and is not in fact known to him, the court holds, he is under no obligation to protect himself against such increased risk. In such case, the increased danger being hidden and secret, no rule of law demands that he shall look out for it.

Applying these principles to this case, where the poles along the road were apparently placed in line, as is usual with such poles, and at the apparent distance of about two feet, eight inches from the track, but one of the poles was seven inches closer, the court holds that for the increased risk consequent therefrom the conductor was not bound to look out, unless he knew of the location of the pole, or ought reasonably to have known it, or unless it was obvious.

Taking up next the contention that the conductor in question, as matter of law, was guilty of contributory negligence in attempting to collect fares on the side next to the poles, the court says that he was a new man, and knew of no rules on the subject, and was not informed there were any. His duty was to collect fares, and he was not directed on which side of the car he was to do it. If, therefore, he chose to collect the fares on the pole side, for any reason, the court continues, his obligations as to taking care of himself were not thereby enhanced. He was bound in any case to look out for the poles as they ought to have been and apparently were located but the use of the pole side of the car did not impose upon him the duty of knowing what he did not and could not reasonably know. If he did not know of the misplaced pole, and the increased risk growing out of its misplacement, there was no reason why he should not collect fares on the pole side, so long as he was careful to protect himself from all the apparent danger he incurred in so doing.

In all such cases, adds the court, the question of the negligence of the parties should be submitted to the jury, for them to determine from all the facts offered in evidence whether either or both of the parties had been guilty of negligence, in consequence of which the accident happened.

A PECULIAR ACCIDENT.

The accompanying cut is taken from a photograph of an accident that occurred at Watertown, N. Y., during the March blizzard, and accentuates the pretty well established fact that the street railway manager's couch is not necessarily a bed of roses. It might not be amiss at this juncture to invite the ardent advocates of municipal ownership to contemplate the above picture. They might possibly hesitate before thrusting their sickle with too prodigal a hand into the golden harvest the grasping monopolies are supposed to be reaping.

There were some peculiar features surrounding this accident that make it of interest. In the first place, it is a striking illustration of the old adage that it is the unexpected that happens, and that accidents do not as a rule occur at the so-called danger points, for the

WRECK AT WATERTOWN, N. Y.

car left the rails on a straight and level piece of track which was in perfect order, the car running at a moderate rate of speed. But it chanced to be raining and freezing hard at the same time, and the girder rail filled up rapidly with ice, causing the flanges of the forward wheels to mount the rail. The car ran some 13 ft. on the frozen ground and went over the abutment of the bridge, falling a distance of 30 ft., the forward part of the car being submerged in the water of the Black River. Nothing was saved of the wreck except the trucks and motors, there not being enough left of the wood-work "to make tooth-picks," as Superintendent Smith graphically expressed it.

Fortunately only three passengers were in the car when it took its fearful plunge; two of them saved themselves by jumping. The only person injured was a young man named Zimmerman, who was carried down with the wreck and pinioned under the front platform —all of his body being submerged in the water except his head, which he managed to hold up until he was rescued from his perilous position by neighbors, who were obliged to chop away a portion of the wreck before he could be extricated. He was taken to the hospital, where it was found that in addition to severe bruises he had sustained an injury to the spinal cord, causing partial paralysis, this company happily disappearing after a few weeks.

The company was insured with the American Mutual Indemnity Co., of Scranton, Pa., which sent its adjuster, Dr. H. B. Rockwell, to the scene, and succeeded in obtaining Mr. Zimmerman's release for $150. An enterprising attorney, even before the adjuster had left town, succeeded in persuading the man that he was "incompetent to sign a release," and instituted a suit against the company, which was afterwards withdrawn, however, when it was found that he could not enlist the co-operation of the doctors and nurses.

WISCONSIN ANTI-PASS LAW.

At the last session of the Wisconsin Legislature an anti-pass law was passed and it received the approval of the governor. It is as follows:

"Section 1. No person, association, co-partnership, or corporation shall offer, or give, for any purpose, to any political committee, or any member or employe thereof, to any candidate for, or incumbent of any office or position under the constitution or laws, or under any ordinance of any town or municipality, of this state, or to any person at the request or for the advantage of all or any of them, any free pass or frank, or any privilege withheld from any person, for the traveling accommodation or transportation of any person or property, or the transmission of any message or communication.

"Sec. 2. No political committee, and no member or employe thereof, no candidate for and no incumbent of any office or position under the constitution or laws, or under any ordinance of any town or municipality, of this state, shall ask for, or accept, from any person, association, co-partnership, or corporation or use in any manner or for any purpose, any free pass or frank, or any privilege withheld from any person, for the traveling accommodation or transportation, of any person or property, or the transmission of any message or communication.

"Sec. 3. Any violation of any of the above provisions shall be punished by imprisonment in the state prison not more than five years nor less than one year, or by fine not exceeding one thousand dollars, nor less than two hundred dollars.

"Sec. 4. No person, and no agent or officer of any corporation within the purview of this act shall be privileged from testifying in relation to anything therein prohibited; and no person having so testified shall be liable to any prosecution or punishment for any offense concerning which he was required to give his testimony or produce any documentary evidence.

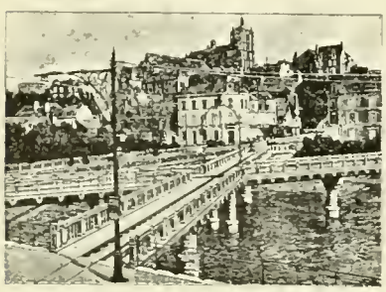
"Sec. 5. This act shall take effect and be in force from and after its passage and publication."

In compliance with this act a number of street railway companies have issued orders that henceforth policemen and firemen will not be carried free.

THE X BRIDGE AT LE MANS.

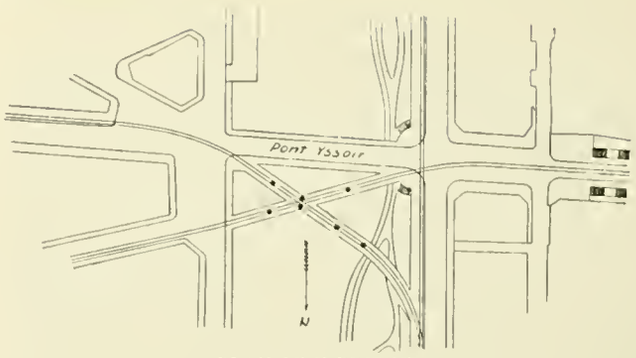
A bridge built not long since at Le Mans, France, has attracted a great deal of popular attention because of its peculiar form, which is that of an X, and is of interest to engineers because of the low cost. This bridge was destroyed by M. de la Noe, a chief engineer of bridges and roads, and has been described in recent issues of French technical papers, notably La Revue Technique.

It was desired to build a bridge across the Sarthe for the department railroad (steam) and at the same time provide another route for an electric tramway system which had previously crossed the river on a wagon bridge and made use of the department tracks in the neighboring streets. The existing bridge, built in 1888, was beginning to show signs of weakness under the electric tramway traffic and it was desirable to stop this, and quite out of the question to run the steam trains over this bridge. At the same time it was found that the single tracks were insufficient for the use of the two roads and the narrow streets did not admit of a second track. As a solution of all the problems it was proposed to build a new bridge adjacent to the existing Pont Yssoir. The city and the electric tramway together raised $7,000 for the purpose and the department $2,000 more, which was fixed as the maximum. The routes of the two roads decided the peculiar X-shape of the bridge.



THE X BRIDGE.

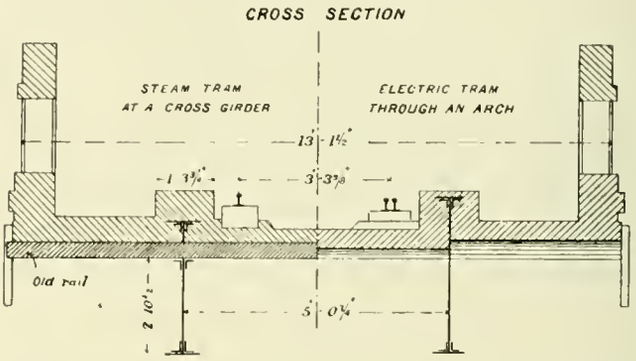
The necessary area was 5,382 sq. ft. As the old Pont Yssoir had cost $7.07 per sq. ft. with foundations and $5.18 per sq. ft. without foundations, the funds at hand seemed entirely inadequate, but the



PLAN OF X BRIDGE.

X bridge was built for $1.21 per sq. ft. including foundations, a total of $6,408.

The X bridge is supported on one double and five single piers; the piers are of concrete, 1 m. in diameter, and rest on wooden piles, the cost for the six being $858. Old rails are used in the piers to strengthen them. The main girders are continuous and placed 1.8



m. apart. The cross girders are old rails stuck through the webs of the main girders and resting on angles riveted to the latter. The arches between the cross girders are of hollow brick, and concrete is placed above so that it forms a part of the upper flange of the main girders.

The line drawings are from Indian Engineering and the general view from La Nature.

REPORT OF RECEIVER OF TERRE HAUTE ROAD.

Joshua Jump, receiver of the Terre Haute (Ind.) Electric Railway Co. retired from his office after a most excellent stewardship. Mr. Jump was appointed receiver in October 1897.

His first annual report to the court showed total receipts of $154,804.15 and disbursements $140,619.26, leaving a balance on hand of $14,184.89.

He has recently filed his last report which is from Oct. 18, 1898, to Apr. 17, 1899, inclusive and is as follows:

Cash on hand	$14,184.89
From passengers	47,816.05
From sundries	538.75
From light installations	479.48
From city lighting	12,916.21
From commercial arc lighting	2,721.81
From incandescent lighting	9,404.60
From power	2,416.91
From steam heat	2,125.59
From steam heat installations	75.55
Total	$92,679.84
Disbursements	88,934.01
Balance	$3,745.83

STREET RAILWAY TRACK CONSTRUCTION.

BY M. D. BURKE.

Read before the Engineers' Club of Cincinnati and published in the Journal of the Association of Engineering Societies.

In treating the subject, it appears to be desirable to describe briefly what was done in the days of the horse car, the transition to that which is now being done to provide tracks for the motors at present in use, and, finally, to suggest such forms of construction as would appear appropriate for the conditions which exist, or are likely to prevail in the near future.

More than 27 years ago the writer was employed to reconstruct certain portions of track in Cincinnati, and to replace some curves that were in unsatisfactory condition. He found that the curved rails were iron castings, and that the curved tracks had been constructed as shown by Fig. 1. Only the inside rail was provided with a guard, which was unnecessarily high, the groove was excessively wide, while the outer rail was merely a flat casting upon which the wheel was carried upon its flange. It was thought possible to better some of these conditions, so new patterns were made, and the curved tracks were built as shown by Fig. 2. It will be observed that the "knees," or castings which were intended to hold the timbers to gage were omitted, and the tie rod introduced, and that both rails were grooved. Prior to that time, these little cast brackets, fastened to the ties with 3-in. spikes, had been the sole dependence for holding the track to gage, and, since the loads were always carried upon the upper outer corners of the timbers, there was always a tendency to widen the gage. The tie rod was introduced to resist this pressure, and "knees" were afterwards used only where required for straightening crooked stringers, or where joints needed a special support.

This was the first track which the writer ever saw made of grooved rails. This form of rail, somewhat lighter in section, was, at about that time, or soon after, patented, made of rolled steel, bent to the desired radius, and, for many years, was manufactured and sold by the William Wharton jr., Co., Limited, of Philadelphia, as the Wharton patent curve. The form of rail head has not been essentially changed in the standard grooved rails of today, but the support is different.

In those days street railroad rails were essentially "strap rails," varying in weight from about 18 lb. to 50 lb. per yard. They were spiked to the tops of wooden stringers, which were in turn, fastened to cross-ties, generally with boat spikes, but sometimes with treenails or wooden pins. The earth or gravel was tamped under both the longitudinal stringers and the ties, which were placed four or five feet apart, so that the loads carried, at the speeds then attained, were fairly well supported, while the track was in good condition. But there was an abundance of elasticity, and the "wave motion" that theoretically precedes the locomotive, was generally visible to the naked eye. Each car was usually provided with a "frog," by the use of which the driver was expected to be able to pull his car onto the track, if it got off, or to pull it off and on again, if it became necessary to pass around some immovable obstacle on the track.

The municipal statesmen of those days, in protecting the rights of their constituents, found it necessary to provide a broad inside tram, so that the street car track became a tramway for the use of all vehicles that could travel upon it. The width of the express wagon, to the outside of wheel treads, was found to be about 5 ft. 2 in., so the gage of street car tracks was generally fixed at 5 ft. 2½ in. and ordinances provided that the rails should have an inside tram of 3 in. As a natural result, vehicular traffic was concentrated along the lines of street railroad tracks, and where double tracks existed was systematized by them to some extent, but vehicles going in the same direction did not travel at the same speed, and the pulling into and out from the tramways was destructive to pavements and tracks as well as to vehicles.

The rails were secured to the stringers by spikes having countersunk heads, driven through the tram of the rails into the wooden stringers, but the expansion and contraction of the rails, due to changes in temperature, either sheared the spike heads, enlarged the spike holes, or bruised away the wood, and the fastening became defective, but the rails were provided with lips coming down over the corners of the stringers which aided greatly in keeping them in place.

Pavements were generally of cobblestone, or the roads were made of broken stone or gravel. Between rails, where the car horses or mules traveled, the most satisfactory roadway was the cobblestone pavement. An eminent engineer of this city invented, and, I think, patented, the pavement made of round locust blocks paved on end. One of our prominent street railroad officials declared that the said engineer made that pavement all out of his own head, and had blocks left. In the tracks it was an utter abomination, as the heart of the locust block polished and became worn to a rounded point, while the residue of the stick disappeared, and animals' feet were destroyed in traveling on the slippery pegs. Where the wooden block is of about uniform density, as cedar, oak, or pine, it does for street car horses, it soon becomes worn and does not furnish as reliable and durable footing as the much-abused cobblestone.

A few forms of rails that were used are shown in Fig. 3. A shows the "crescent rail," which was laid on Elm St. It weighed about 18 lb. per yard, was spiked, or rather nailed to 3 x 6-in. stringers, had no inside tram, and was rather just criticised. B shows the Route 9 rail, which was laid on Vine St., it weighed about 30 lb. per yard, the rail head being rolled thin to fit over an oak strip, nailed to the top of the stringer. It had the required inside tram, and, if it did not fill all of the requirements, it rattled around in them effectually. C was the Mount Auburn, or Route 8 rail, laid on Main St. It was laid on 6 x 8-in. timbers placed flat. It made a very good tramway,

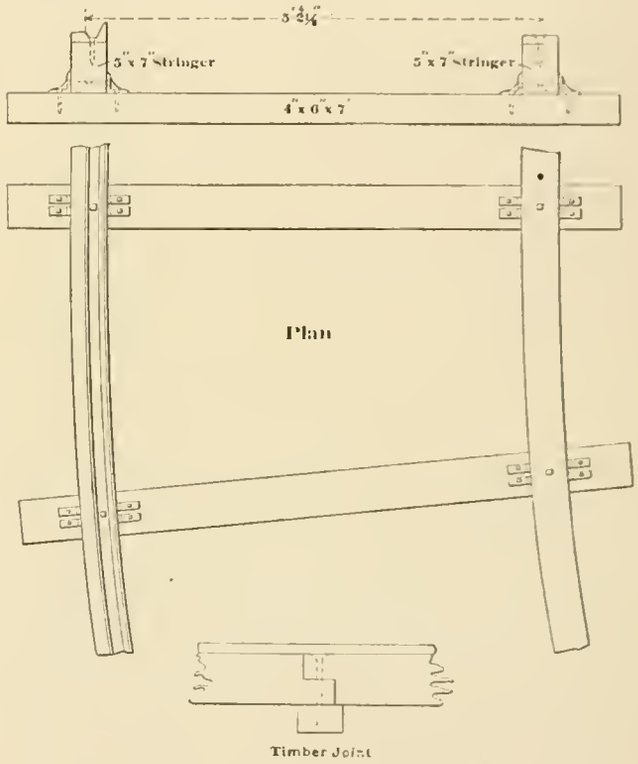


FIG. 1.—CURVED TRACK PRIOR TO 1871.

but a rather indifferent car track. There was but little rail head, and what there was rested upon the extreme outside of a broad timber, and was so soon pressed out of gage that the cars traveled upon the wheel flanges. D was used upon the same route, on the upper end of Main St. It was laid on 4 x 6-in. timbers, set on edge. There was much criticism because of the narrow inside tram, but the track, being held to gage by tie rods, was a fairly good one for street cars.

E is the center bearing or "saddlebags" rail, laid on the eastern part of Route 5, and on Route 7. It was the best of the strap rails, because it had sufficient weight to make it tolerably rigid, and, as it brought the weight upon the center of the timber, it avoided the tendency to tilt the stick over, and thus widen the gage, as did all of the forms having the inside tram. The lack of the tram brought upon it much censure from teamsters, but it was retained until the advent of the electric motor.

F is the standard T-rail of about 35 to 40 lb. per yard, always preferred by railroad companies, and very much used, but objected to

in pavements, because it provided no tram, but did provide a groove alongside of it in the road. Its defects, from the side of the railroad company, were lack of depth, lack of protection to wheel flanges, and weak joints; while, on the side of the public, it was claimed that no street surface could be maintained adjacent to it.

G is the standard tram rail, weighing from 42 to 50 lb. per yard, used upon what was regarded as first-class lines in cities requiring good service and well-maintained streets.

Where the rails met upon the timbers, the wood soon yielded, and the maintenance of the joints became troublesome. In original construction an iron plate about 4 x 6 x ¼ in. was used, but it was soon shown that something more rigid was necessary. The cast iron joint plate, shown in plan and section at H, Fig. 3, was devised by the writer, and was the most satisfactory that he has

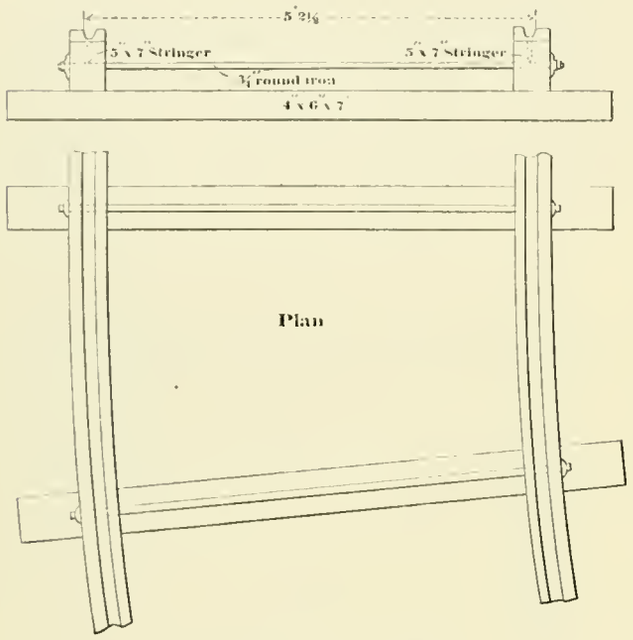


FIG. 2.—TRACK BUILT IN 1873.

seen, excepting a plate slightly lighter, but very similar in section, made of rolled iron.

The gage having been arbitrarily fixed at a width that suited street traffic, it became necessary to construct cars having a short wheel base in order to operate them on the curves necessary to turn the corners in city streets. A rigid wheel base of about 6 ft. was commonly adopted, and we could swing around a circle having a radius of 33 ft. to the center of the track. As might be expected, there was some friction connected with such proceedings, but these short curves never occurred upon heavy gradients, and the resistance due to curvature was not the most serious obstacle to be surmounted.

For the empty horse car, the load upon each wheel was about half a ton, seldom exceeding 1,200 lb. The live load was exceedingly variable, and generally, good-natured and accommodating. If it found itself off the track, and stuck in a chuck hole, it would often get off and assist in putting the dead load back upon the track. Of average passengers, it takes between 50 and 60 to make a load of four tons, but that load was often exceeded on crowded cars, making the weight on each wheel frequently greater than 3,000 lb. These heavy loads, on the yielding timbers, disturbed the pavements, and made street and track repairs continuously expensive. City officers learned that the maintenance of streets carrying car tracks was more expensive than that of other streets, and they began to lay additional burdens on the street car companies. Promoters, failing to realize the great expense incident to street maintenance, frequently accepted grants which involved such great expense for paving and maintenance, that the conditions of the grants could hardly be complied with. The stringers required such frequent renewals, and the rails were so constantly loose and out of gage, that some remedy must be devised.

Mr. Johnson had invented an automatic switch, so planned that the mule should turn it by stepping on the proper side of a tilting plate, and thus avoid interrupting the driver when engaged in his legitimate occupation of beating his team. In the few nights that the writer spent with the inventor in this city, setting two or three of those contrivances, Mr. Johnson saw the decayed timbers, and, bringing his inventive mind to bear, he produced the "girder rail." The iron or steel web and base of the T rail were placed beneath the head and tram of the strap rail, the base and stem taking the place of the wooden stringer. Being about right, it soon became popular, and the worst evil now connected with it arises from the fact that there are too many forms of it. If standard weights and heights were rolled, the cost of manufacture could be reduced, and better results would follow.

Street railroad companies had become accustomed to the use of light rail sections, the price per ton for iron rails was then about

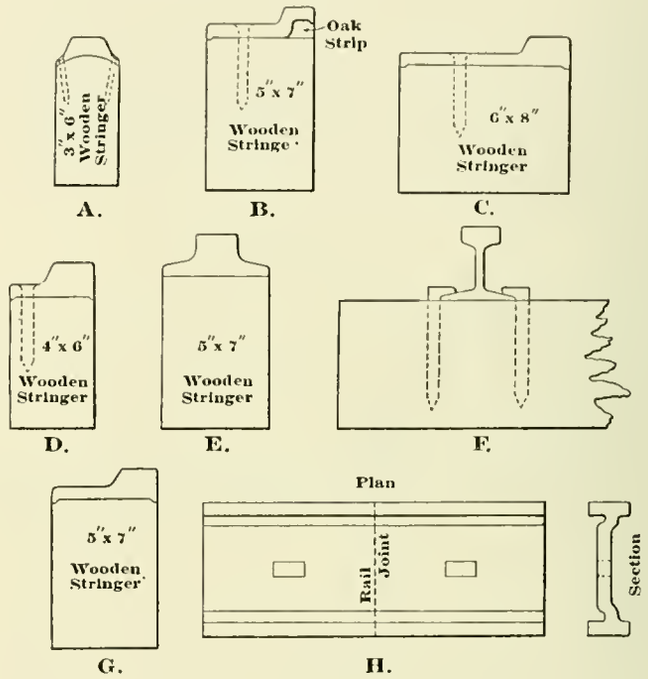


FIG. 3.

three times the present price for steel rails, the requirement for the inside tram was being rigidly enforced, and the sections produced were influenced by these conditions, so that all defects were not eliminated. In Fig. 4, A is a typical section of light girder rail, weighing about 32 lb. per yard, while B, would then, (say 15 years ago), have been regarded as a standard heavy section.

In these sections the lack of strength in the joints is at once apparent, and lack of depth became troublesome so soon as any proper form of street pavement was to be placed along the tracks. They have still another defect which people were slow to learn, and which, in fact, is still a mystery to some people who are struggling

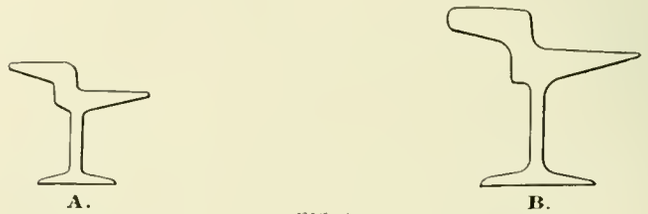


FIG. 4.

with low joints. In the girder, the rail head and tram constitute the upper chord, the base of the rail the lower chord, while the stem makes the connecting web. The distribution of the material is approximately as follows: 66 per cent in the upper chord, 21 per cent in the lower chord, and 13 per cent in the web. This is a bad disposition for a beam or girder, especially when the material in the upper chord is subject to much wider and more sudden variations in temperature, than that in the lower chord. The rail head and tram, being exposed to the direct rays of the sun, become much warmer than the base of the rail, and consequently longer;

there is sufficient material in the base to cause the rail to curve vertically, loosening it from the ties, and no fish plate or other fastening, and no trackmen, however skillful, can keep up the joints. This condition, with its consequent troubles, still exists with the forms of rails having the inside tram.

When cities began laying stone block pavements, and it became apparent that neither broken stone, gravel, nor asphalt, could be maintained where the top of the tie came within three or four inches of the surface, various devices were brought out for lowering the ties. The clamp chair, which was especially adapted to what is known as the bulb rail, in which the lower chord of the girder is given a rounded form, the box joint chair, the brace joint chair, and numerous rail clips and tie plates have been devised, and many are still in use; but those girder rails still keep on bowing up in the middle and down at the ends, and they still continue to loosen any and all of those fastenings, and they are not likely to stop, so long as metals continue to expand when heated.

To obviate these difficulties, and to provide for the greater weights and higher speeds of electric motors, deeper girders are being generally adopted, carrying the rail down on a broader base to a heavier tie, placed at a greater depth. Sixty-five and 70 lb. per yard, are now regarded as light rail sections, while 80, 90, 95, and even 100 lb. per yard, are now common weights of rails used in the tracks of electric roads in the streets of our larger cities. But nearly all of them are laid on wooden ties. It is true that the tie is generally imbedded in concrete, or placed upon a foundation of crushed stone compacted by rolling, but the fastening of the rail is to this perishable tie, and it is inaccessible, except by the digging up of costly pavements, and the interruption of congested traffic. The stringer has gone, now why not eliminate the perishable tie. Leave off that silly inside tram, and omit the wooden tie, and you may be able to make your track for electric roads reasonably permanent.

The maintenance of the street railroad track is essentially different from that of the steam railroad track; and in its construction this difference should be fully considered.

The steam railroad track is placed upon a right of way owned and controlled by the company which owns the track. Its construction, its drainage and its maintenance, are all in the hands of its owners, who supply the requisite material, and direct the workmen under skilled supervision. The joints, the drains, the ties, are visible, and are subject to daily inspection. When the requisitions have been made, and the materials and funds supplied, (it may be that these are sometimes administered in homeopathic doses), there is nobody to consult, no traffic to interrupt but that controlled by the company itself, and repairs are systematically made, without interference or delay.

With the street car track, these conditions are all reversed. The roads are built in public streets or highways, where everybody has a right of way, and each individual assumes and asserts that he has a little better right than any street car company, when he wants to drive on the street, and an absolute right to be carried on time, when he wants to ride on the cars, he preparing his own schedule.

The track construction is entirely buried from sight, excepting the tops of the rails, and frequently they are covered with mud. The drainage, when there is any, is under the control of municipal authority, and, unless provided when the tracks were laid, it cannot be either supplied or maintained by the street railroad company, unless it be under conditions which the municipality shall dictate. If bolts or spikes become loosened, or a tie requires better support, such facts cannot be known until a depression is visible in the track, and the adjacent pavement shows the effect of the movement that has been imparted to the rails. Then a permit must be obtained from the authority having control of street repairs, often involving the rights of contractors who have agreed to maintain the pavements, and in due time the street pavement can be taken up, the defect remedied, and the pavement replaced. The delays are so vexatious, and the conditions imposed are so onerous, that what might have been prevented at trifling cost by the tamping of a single tie, or the adjustment of a single joint, has involved numerous delays, and the expenditure of many dollars.

Because these conditions do exist, and for the further reason that street railroad companies should, as a matter of right, use every proper means to render their service as prompt and reliable as it can practically be made, and because the use and occupancy of streets and highways by the street car companies should be attended by the least disturbance of such roadways, and the least amount of interference with their use by the general public, it follows that the construction of street railroad tracks should be of the most durable materials, and the most permanent workmanship that is attainable at reasonable cost. Since the electric motor has taken the place of animal power in propelling cars, and since those cars have been given such weights and speeds that colliding with them is accompanied with great danger, it follows that no tramway should be provided to allure vehicles to their tracks, but that street surfaces should be so formed that wagons will pass over or along the rails without being impeded by the broad groove or rut that invariably accompanies the inside tram. That feature should, therefore, be eliminated from the rail. Where street surfaces are properly paved and maintained, the full grooved rail should be laid. Where they are composed of broken stone or gravel, the deep T-rail should be laid, having a low inside guard that will provide a space for wheel flanges, and a shoulder against which the road metal can be packed.

Possibly a digression may be permitted for a brief discussion of rail sections. It may be true that some of the sections of girder rails now in the market, have been designed by the men who make and sell steel by the ton, so that weight is fully as desirable as length of service. Then it may be true that electrical engineers have designed some sections, without having made a careful study of the matter of so disposing the material as to secure the greatest life of rail at the least cost. And then again it is possible that a few city engineers have interjected certain requirements and conditions, just because they could. At any rate, there is great variety, and many of the sections are not such as can be commended on the

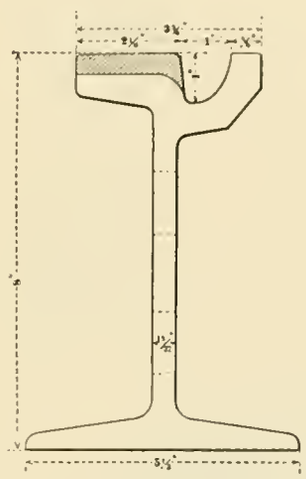


FIG. 5.

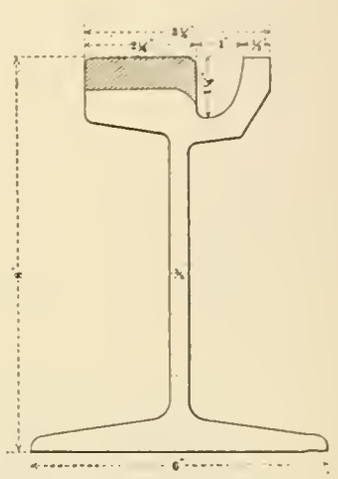


FIG. 6.

score of economy. It is not the purpose of the writer to design a rail, but he is willing to state a few of the principles that, in his judgment, should be considered in making such a design, and he desires to urge the advisability of adopting standard sections for certain heights and weights, so that the cost of manufacture can be reduced.

In track construction, it may be assumed that the rail is the essential feature, and that it should be so designed that it can be rigidly held in place, that it will resist, without deflecting perceptibly in any direction, the stresses to which it is subjected, and that it will continue to do so until it shall have lost, by actual wear in service, the greatest allowable percentage from that portion with which the wheels come in contact, before it shall be unfitted for service. The rail head upon which the wheels bear is the only portion subjected to actual wear, and when that shall have lost so much material in service as to cause it to fail to properly support the car wheels, the whole of the residue of the rail becomes scrap. The web and the base serve only to maintain the rail head in proper position. Width of base renders the rail laterally stiff and easy to support. Depth of rail makes it vertically rigid, and carries the rail fastenings down beneath the paving blocks. It also provides space for rigid joint fastenings.

When the rail acts as a girder, the material in the base is subjected to tensile stress, and that in the rail head to compression. To allow for reasonable wear, there should be at least one-third more material in the upper chord, or rail head, than there is in the lower chord or base. In the web there should be sufficient material to transmit the loads to the base. Inasmuch as the web must resist

lateral as well as vertical stresses, it is usual to make rather liberal allowances for that purpose, and also to give ample bearing surface for the bolts, but web material, beyond that which is required for these purposes, is wasted, and, adding to the thickness of the web, in high rails, increases the weight more rapidly than increasing any other dimension. It is here that waste occurs. Granite blocks constitute our heaviest pavements. They are 6 in. in depth. There cannot, therefore, be any valid reason for giving rails a greater depth than 8 in. In a rail having a depth of 8 in., there can be no possible use for a greater thickness of web than $\frac{3}{8}$ in. By no calculation or practical experiment can it be shown that a web of that thickness could be deformed by any force, or combination of forces, acting upon it in the track.

As an example, take Section 95, No. 216, as rolled by the Johnson Co., and very extensively used in this city. Fig. 5 shows the rail as used, the shaded portion of the head being that part subject to wear, and Fig. 6 shows a rail of the same weight and height, just as rigid and strong, the shaded portion of the head again representing the part subject to wear. When that part shall have been

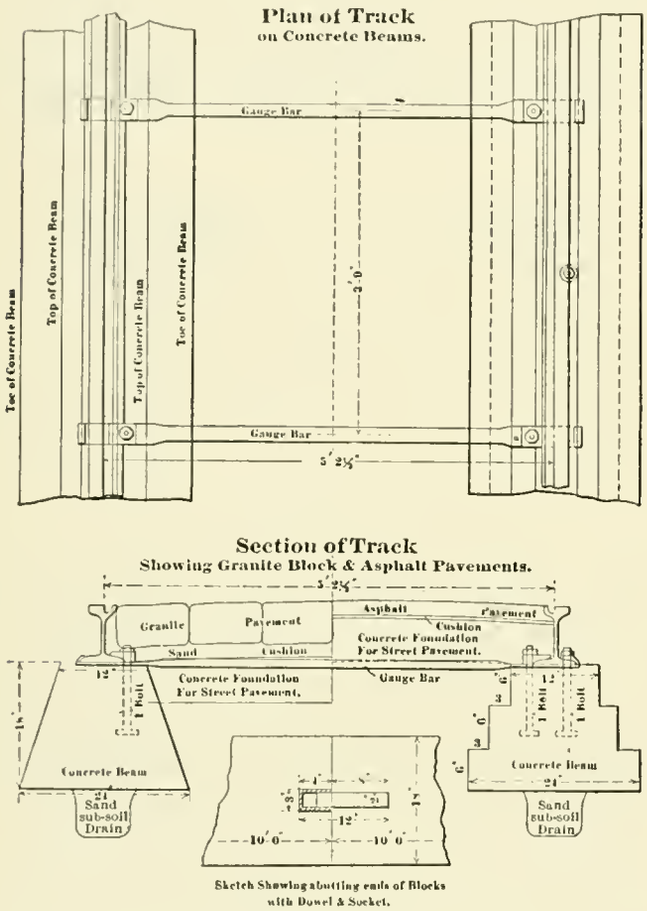


FIG. 7.

worn from either rail, as it will be by continued use, the residue will be scrap. A comparison of the areas of the shaded portions of the sections shows that, if the wear be uniform, the changes suggested would increase the life of the rail about 60 per cent. That is to say, if the rail shown in Fig. 5 has a life of 15 years, that shown in Fig. 6 will wear, under the same traffic, 24 years or more.

The essential differences consist in widening the base, deepening the groove by lowering the guard, squaring up the side of the rail head to lessen the flange friction, and taking material from the web and placing it where it will be subject to wear. But this is only a criticism, not a design. It is made upon a rail section which is very familiar to all of us, and is in fact on a section that is very much superior to many that are in use. The tonnage carried by some of the tracks where this rail is in use closely approximates, if indeed it does not exceed, that upon the main tracks of some first-class steam railroads. That use will wear down those rails, and, unless the joints fail, the wear will be quite uniform, and nearly as indicated upon the sections. It is certainly desirable to defer the day of renewal as long as possible. It is no more difficult to roll one of these forms than the other, and that form should be used which, at equal cost, has the longest life. But it is time to speak of the real subject of the paper, that is, how to lay the rails.

In Engineering News for Jan. 5, 1899, are two articles and two designs for "permanent ways" for steam railroads. The one written by a member of the editorial staff of that journal is so readily adaptable to the construction of electric street railway tracks that its author should have full credit for the invention, if there be one. With the modifications which the writer would suggest, to adapt it to street railroad tracks, it is shown in Fig. 7.

The plan consists essentially in placing the rails directly upon continuous concrete beams, placed centrally under each rail, fastening the rails to the concrete by holding-down bolts and rail clips, and holding the rails to gage by gage bars. There is nothing perishable in the construction, and, when properly built, there should be no expense for track repairs until the rails wear out. The dimensions of the beams that are necessary will depend upon the nature of the soil and upon the climate in which the tracks are laid. In the average clay or gravel soils of this vicinity, the dimensions shown on the drawing will be found ample to sustain the heaviest traffic, where the subsoil is properly drained. This form of construction should not be used upon newly constructed embankments subject to any considerable settlement.

The concrete can be made in its proper position in the street, or the blocks can be made at a factory, hauled to the work and placed in the tracks, being connected by iron dowels, as shown in the sketch. If made in position, the concrete would be placed in three layers, and the sides, instead of being sloping as shown on the left in the drawing, would exhibit offsets, as on the right. The sectional area and the bearing surfaces are the same in either case. The writer, having much more faith in the continuous beam than in either the tamping of the foundation or the dowel joint, would, wherever possible, build the beams in position; but where that process would be impracticable, the other method could be successfully used, and it would have some advantages. For instance, there could be no question about the quality of the concrete, and it could not be used until it had acquired sufficient strength to insure its preservation.

The base of the rail should be about 6 in. in width, and its depth should be sufficient to give to the rail joints as nearly the sustaining power of the body of the rail as is practicable. If made in position, a bearing plate should be placed under rail joints; if made at the factory, that would not be found practicable. By the plan shown in Engineering News, the holding-down bolts are all shown on the inside of the rails, but, for a street car track, the writer would place two bolts in each rail upon the outside, and bring those bolts through the base of the rail, for the reason that the paving may be all taken from one side of a rail, while it remains upon the opposite side, and the pressure might then be so great as to spring the rail inwards, unless the rail clips had very efficient bearings. While such motion would not be likely to be imparted to the rail, the method suggested would certainly prevent it. But there is still another reason,—viz, these two bolts, passing through the base of the rail, would prevent any creeping of the rails; and, as the holes need not be slotted, the expansion and contraction of each rail, whatever that might be, would be confined to that rail length, and its effects could not become cumulative. About one-half the usual allowance for expansion and contraction should be made in track laying, as that would prevent any objectionable openings at the joints, and at the same time avoid subjecting the track fastenings to the extreme stresses brought upon them by attempts to wholly resist such motion.

The quality of the concrete, used in these beams, is an essential feature. Its cost will vary, in different localities, with the cost of the materials which compose it. In this climate it is not essential that it be made with portland cement, because it will not be exposed to the direct action of the weather; but, if natural cement be used, it must be of good quality, and the ingredients must be so proportioned and manipulated that the resulting mass will be a dense artificial stone. In this locality, or wherever clean sand, crushed stone or clean gravel is obtainable at the prices prevailing here, it can be made, at a reasonable profit, at $5 per cubic yard. Upon this assumption, let us see what a mile of this kind of construction will cost, omitting the rails and street paving, as those items are common to each kind of track.

Estimated cost of one mile of permanent way for electric street railroad:

1,300 cu. yd. of excavation at $0.20 per yd.	$ 260.00
120 cu. yd. of sand for subsoil drain at $1.00 per yd.	120.00
880 cu. yd. of concrete at $5.00 per yd.	4,400.00
9,665 lb. of holding-down bolts, with heads and nuts, at $0.01½ per lb.	144.98
32,553 lb. of gage bars (6'-1" x 3" x ⅜") at $0.012 per lb.	390.64
2,816 rail clips at $0.04 each	112.64
7,089 lb. of joint plates at $0.012 per lb.	85.07
Total	$5,513.33

or $1.04 per lineal foot. If the blocks be made in 10-ft. sections and connected by dowels, the joint plates should be deducted, and $253 added for the cost of dowels and sockets, making the total cost per mile $5,681.26, or nearly $1.08 per lineal foot. The cost of the track laying may be assumed to be the same as that for the present form of construction. Since it would necessarily be done simultaneously with the placing of the concrete, the actual expense would probably be somewhat less.

Estimated cost of one mile of street railroad track on ties in concrete:

1,400 cu. yd. of excavation at $0.20 per yd.	$ 280.00
1,175 cu. yd. of concrete at $3.00 per yd.	3,525.00
2,640 ties at $0.45 each	1,188.00
7,920 lb. of spikes at $0.0125 per lb.	99.00
4,693 square yards of rolling at $0.03 per sq. yd.	130.79
Total	$5,222.79

or, about $0.99 per lineal foot. If the ties be laid on broken stone, the cost per mile will be about $3,850.00, or about $0.73 per lineal foot.

From these figures it will be seen that, if this form of track construction be desirable, its cost is not prohibitive, for in one case the saving, by methods now in common use, is but 5 cents per foot, or $264.00 per mile, and, in the other the saving is but 31 cents per foot, or $1,636.80 per mile. Now, is it desirable? If it be really permanent, there can be but one answer to the question, and it appears to be perfectly self-evident that a track, properly constructed upon the plan suggested, would cost practically nothing for repairs until the rails should fail from actual wear. Being continuously supported, the rails would not act as girders, but, if the foundation should yield, or be dug from under them, those concrete beams and the rails would carry any electric car now in use over spans of ten or twelve feet without perceptible deflection. The construction does not extend into the ground a sufficient depth to interfere with pipes or other conduits, and at the same time it does rest upon a part of the street that is not likely to be seriously disturbed by the plumber or the street repairer.

The question may be asked, why make the beams so heavy, when the loads upon them are so light? The answer is, that in view of the great amount and unknown position of the excavations that are almost constantly being made in the public streets, it is cheaper to provide a wide margin of safety than to repair the defects that might result from such causes. Then, as we know by recent experience, the frost penetrates to considerable depths in this climate, and would be likely to reach the bases of these beams, but not so as to affect their stability. Were they lighter and shallower, however, its effects might be seriously detrimental to the stability of the track.

The holding-down bolts are spaced 3 ft. 9 in. apart, making eight on the inside of each 30-ft. rail, and there are two upon the outside of each rail, making 10 1-in. bolts by which each 30-ft. rail is secured to its foundation. It is at once evident that this affords far greater security than is now obtained by about three times the number of spikes. The gage rods are made from flat steel bars 6 ft. 1 in. long for our Cincinnati gage, with rail bases 6 in. wide and ⅜ in. thick. "The ends are turned up to form claws, which engage the outer edge of the rail flange, and the central part is stamped into a semicircular trough shape, to stiffen it to resist compression. These bars are also punched to slip over the holding-down bolts. It will be seen at once that these gage bars would offer vastly more resistance to the spreading of the rails than the present spikes in wooden ties. The rails would, in fact, be solidly held to perfect gage. The security of this, as compared with the rail braces, tie plates and spikes which are now used, will be apparent." (From Engineering News.)

Regarding the subsoil drain, which is here shown as filled with coarse sand, the writer believes that to be the most effective material for the purpose, except in rare cases where the inflow of water would be quite considerable, when a tile should be bedded in the sand. It should be connected, by tile drains properly screened, with the sewers or other outlets for the water, at frequent intervals. In placing it in trenches, it should be well compacted, so as to aid in supporting the concrete beams. These trenches should not be filled with broken stone, especially in clay soils, as the clay will fill the interstices between the fragments of stone, and the drains will thus become entirely clogged. For the same reason gravel is inferior to sand. Where the subsoil is sand or gravel, the drains will not be required. The quantity of water to be carried by these drains is so small that it will seldom produce a running stream, but it is of the utmost importance that it be cared for, or its effects may be highly detrimental.

For suburban or interurban roads, a lighter form of construction may be used; but, even in such work, the form of track construction herein described would be found economical because of its permanency and the saving that would be effected in track repairs.

As heretofore stated, the writer does not claim much originality for the ideas of track construction advanced in this paper, but he does believe them to be in the nature of real betterments in the work, and therefore worthy of careful study, of elaboration, and, where found to be betterments over present practices, of adoption. The foundation should have the same ownership as the rail which it supports. As little reliance as possible should be placed upon street pavements for the stability of the tracks, and the latest possible quantity of detriment to street pavements caused by the presence of the tracks. It is believed that the plan here presented will be conducive to those ends.

LONDON AUTOCAR.

In a paper before the Liverpool Self-Propelled Traffic Association Mr. Thomas H. Parker treats of new features in the design of motor-vehicles, and among other cars describes the one designed by him for the London Electric Omnibus Co., which is shown in the accompanying illustration.

It is constructed on the double-bogie principle having the batteries under the seats. It has two motors, one on each bogie, driving all four wheels. To each of the four wheels has been attached a powerful hydraulic brake, working by means of a force pump near the driver's seat. It has only two handles to manipulate it. The vehicle has three speeds forward and one backward, it will turn in its own length, and will run over ordinary roads 25 miles with one charge at a mean speed of 10 miles an hour. The weight with 14 passengers, driver and conductor is about 7,800 lb.

LONDON AUTOCAR.

A car of the United Traction Co., Allegheny, Pa., suddenly started from the barns at 5 o'clock on May 20th and ran away. It dashed down the steep grade on Charles St., and on a curve below jumped the track and crashed into the front of the Valley House. There was no one on board. The car was wrecked and the damage to the bulding was about $800.

OMAHA EXPOSITION.

An organization has been perfected in Omaha, Neb., called the "Greater America Exposition," and the intention is to hold an exposition in which exhibits from the newly acquired possessions of the United States will be the main features. The buildings of the Omaha Exposition of 1898 have been purchased by the new company, and the work of publicity and promotion has begun. The show is to open July 1st and to continue for four months. The managers claim that already commissioners have been sent to the different islands to secure attractions and they promise to have native Cuban and Filipino villages, showing the people exactly as they are in their own homes.

But these colonial exhibits will form only one feature of the exposition. Space will be given free for American manufactures, and it is to be hoped there will be a good showing made. The grounds are now being handsomely laid out and a veritable tropical garden may be expected.

COLLAPSE OF CAR BARN AT CINCINNATI.

The framing of new car barn of the Cincinnati, Newport & Covington Railway Co., in process of construction at the corner of 11th and Brighton Sts., Newport, was blown down in the severe storm of Sunday, May 21st. The collapse occurred about noon. The damage is estimated at $5,000.

This car shed is 280 x 100 ft. and was being constructed of steel. About half of the trusses were in position upon the columns. Neither the trusses nor the uprights had been properly braced and the wind threw the entire roof frame to the ground.

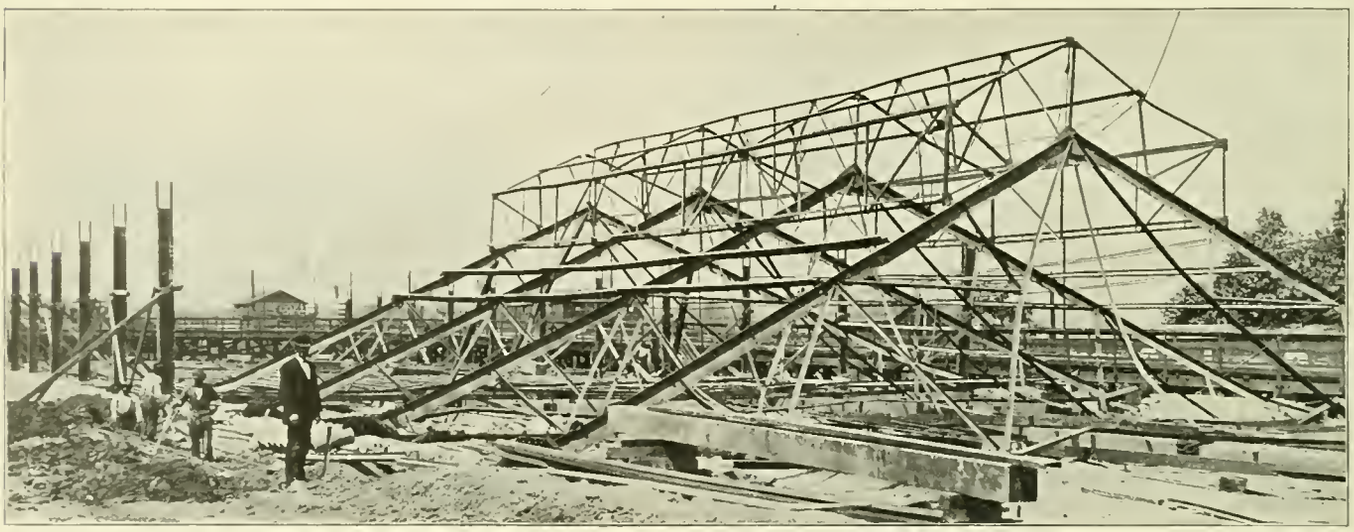
There will now be considerable delay in the erection of this barn, as it will take some time before material to replace badly twisted members can be obtained. The order for new material has been placed and as soon as possible the building will be erected.

NOTES FROM NIAGARA FALLS.

The Niagara Falls & Lewiston Electric Railroad Co., which built and for four years operated the electric railroad through the Niagara gorge along the New York bank, will pass out of existence and be succeeded in business by the Niagara Gorge Railroad Co. This change is the result of a sale of the road by the sheriff of Niagara County in Lockport on May 23d. The purchaser was Herbert P. Bissell, of Buffalo, who is the chief promoter of the new company, and who is the only one of the old company remaining in the new one. The capital of the new company will be $1,000,000, whereas the old company was capitalized at $1,400,000. During the month of May large forces of men were employed in the reconstruction of the roadbed, removing fallen rock, and putting in new trestles and bridges. New retaining walls were built at several points. The roadbed was reballasted and the overhead construction repaired. It is stated that steel bridges will replace all wooden structures.

The incorporators of the new company are: Gen. Francis V. Greene and Avery D. Andrews, of New York; Herbert P. Bissell, J. Henry Metcalf, Joseph T. Jones, William C. Cornwell, Clarence M. Bushnell, Edward W. Eames, John A. Kennedy, George A. Ricker, Arthur C. Coffey, Herbert H. Hewitt, George C. Riley, George V. Turner and Bert L. Jones, of Buffalo. The board of directors includes all of the incorporators mentioned excepting Messrs. Kennedy, Ricker, Coffey and Riley. The officers of the company are: President, Gen. Francis V. Greene; vice-president, Herbert P. Bissell; secretary, Herbert H. Hewitt; treasurer, Bert L. Jones; general manager, Godfrey Morgan; chief engineer, George A. Ricker.

Governor Roosevelt has signed the bill which will allow the commissioners of the New York state reservation at Niagara to construct, without expense to the state, street railroad tracks upon and along that part of the Riverway, so called, between Falls and Niagara Sts., Niagara Falls. The commissioners in their discretion may grant revocable licenses to street surface railroad companies to use such tracks upon such terms as the commissioners may prescribe. The Riverway is the street running along Prospect Park, and the new law makes it possible for the International Traction Co. to make connection between the Falls St. tracks and the tracks of the Niagara Falls Park & River Ry. on the upper steel arch bridge. The construction of this loop will thus make connection between the tracks used by the Buffalo & Niagara Falls cars and the tracks that run along the Canadian bank of the river to Queenstown, and in the future electric cars may be run from Buffalo, N. Y., to Queenstown, Ont., the steamer landing, direct.



WRECK OF CINCINNATI, NEWPORT & COVINGTON CAR SHED.

FIRE IN NEW JERSEY.

On May 24, 1899, about 3 a. m. the car house of the Atlantic Highlands, Red Bank & Long Branch Electric Railway Co., at Shrewsbury, N. J., and almost all the rolling stock were destroyed by fire. The origin of the fire is still in doubt, but the evidence thus far seems to stamp it as the work of an incendiary. The car house was large enough to hold 20 cars, and included work shops and a large supply of stores. It was built of brick, with an iron roof. Today only the two side walls are standing. There were 16 cars in the shed at the time, and these were totally destroyed. The loss is estimated to be about $35,000, and is fully covered by insurance.

A PROMINENT VIRGINIA MANAGER.

Mr. R. D. Apperson, general manager of the City Street Car Co., of Staunton, Va., and president of the Virginia Street Railway & Electric Association, has been practically identified with electric and railway work all his life. His career began at 11 years of age, when he was employed in the cashier's office of the Pullman Palace Car Co.

President Apperson was born at Mt. Sterling, Ky., on Aug. 16, 1863. When he was a year old his parents moved to New Orleans. He was with the Pullman company for about 18 months, when he went to Kansas City, Mo., and secured a place with the

R. D. APPERSON.

Bell Telephone Co., as switch boy. In a week he was promoted to the position of operator, and in course of time became the manager of the office. Resigning, he went to Little Rock, Ark., and was appointed assistant superintendent of the Little Rock Cotton Seed Oil Mills. He held that position for five years, when the same company made him superintendent of the cotton compress.

But street railway business began to attract Mr. Apperson and he left the Cotton Seed Oil Co., to become cashier of the Little Rock & Citizens Street Railway Co. In four months he was made superintendent, as well as cashier, holding both offices until the road was sold in April, 1890. Staunton, Va., was Mr. Apperson's next field of action. He went there to construct and equip the City Street Car line, and when that work was finished he was asked to take the full management, which he did. For six years the road was operated by horse power. He then changed the entire plant to electric traction, personally superintending the installation. At this time also he installed the electric lighting and gas plant for the street railway company and now holds the position of general manager of all three concerns.

Mr. Apperson has always been thoroughly practical, and in all his street railway and electric work has drawn his own plans and done his own engineering.

IMPROVEMENTS OF SOUTH CHICAGO CITY LINES.

There is great activity along all the lines of the South Chicago City and the Hammond, Whiting & East Chicago Electric roads. Improvements of all kinds are under way, all tending to put the roads in first-class condition. Grades are being raised, streets paved, sewers built and grade crossings placed.

Near the north end of the South Chicago City line the grade is being raised 3½ ft. on Buffalo Ave. and the street paved with granite blocks. The grading begins at about 87th St. and extends south to 92d and around the curve to where Indianapolis Ave. branches.

Another important piece of work is the putting in of 54 heavy solid grade crossings to replace "jump" crossings. The new crossings are the steam road standard, built of 80 and 85-lb. rails. The crossings are spiked to hardwood tie bedded in cement. As fast as may be necessary all the remaining crossings will be improved in the same way.

On the Hammond, Whiting & East Chicago line Indianapolis Ave. is being filled from where it begins at Buffalo Ave. to Hammond, Ind. This line passes down between Wolf Lake and Lake George, crosses the Calumet River and runs on to Homan Ave. The Lake County Commissioners are doing the filling and are macadamizing 13 ft. on each side of the street railway tracks. There are on this line four miles of double track and the company is paving its own right of way.

A similar improvement is being made on the other branch, the Whiting & East Chicago line. The grade will be raised and the road macadamized from the junction at Forsythe across the state line to Whiting and from Whiting to East Chicago.

A large sewer is being constructed in Homan St. and the grade is being raised about 20 in. from the Calumet River south. In the case of simply grading and paving the streets, Mr. Walmsley does not allow traffic to be interfered with but in this work on Homan St. the sewer building obliged the company to remove its tracks.

The company has plenty of cars of all kinds, but just now the great problem is to secure safety in operation. The long footboard for open cars has been abandoned. The open cars are being reconstructed so that it is possible to enter and leave them from the rear platform only, that in front always being guarded with gates. Wooden guards cover all the wheels and with the fenders it seems an impossibility for any one to fall or be dragged underneath the car. For a long time the general manager, Mr. Walmsley, recognized a danger in passengers putting their heads and arms out of the cars when crossing the bridge over the Calumet River. To avoid accidents he had rods fastened to the sides of all the cars, even the winter ones. He has adopted the same plan for the open cars and has three ½-in. round iron rods placed on each side of the cars. To prevent small children from falling out between the seats a strip of 1½-in. band iron is carried from the floor up to the lower rod.

In the matter of fenders, Mr. Walmsley has inaugurated a change which pleases him very much. He sees no use for such a contrivance on the rear of a car, which is both useless and unsightly. He has therefore devised a detachable fender which can be shifted very quickly. Each fender is numbered and belongs to a certain car.

CARS LEAVE MADISON AVE. AND 63RD ST FOR SO. CHICAGO AND ROBY

A M									
5	45	55							
6	00	05	15	25	30	35	45	50	55
7	00	05	13	15	25	35	40	45	55
8	00	05	15	25	28	35	45	55	
9	05	15	20	25	35	43	45	55	
10	05	10	15	25	35	45	55	58	
11	05	15	25	35	45	50	55		
P M									
12	05	15	25	35	40	45	55		
1	15	25	28	35	45	55			
2	05	15	25	35	43	45	55		
3	05	10	15	25	35	45	55	58	
4	05	15	25	35	45	50	55		
5	05	13	15	25	35	40	45	55	
6	05	15	25	28	35	45	55		
7	05	15	20	25	35	45	55		
8	05	10	15	25	35	45	55	58	
9	05	15	25	35	45	50	55		
10	05	25	40	45					
11	05	30	35	45					
A M									
12	05	20							

3

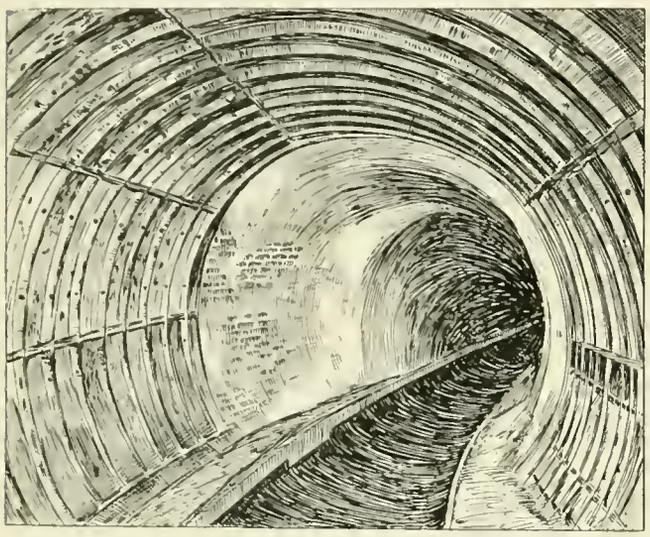
SECTION OF TIME TABLE.

Mr. Walmsley has also devised something unique in the way of a time card. Besides having a convenient map showing clearly the routes of the different lines and in foot notes affording all possible information regarding the time used in running from the north end starting point, Madison Ave. and 63d St., to any other main terminal and also noting the color of the signs in the daytime and the lights at night, the card gives the leaving time in minutes between each hour.

Inventors are busying themselves at present over the problem of wireless telegraphy. Reports come from the patent office that no less than ten applications a day are filed for patents in this field. The applications are mainly from experts engaged in the manufacture of electrical machinery and from scientists. Regular telegraph operators do not seem to interest themselves much in the new discovery, at least not to the extent of trying their hands at invention.

THE OLD NEW YORK TUNNEL ROAD.

If, while the New York Board of Rapid Transit Commissioners is discussing the question of tunnels as a means of rapid transit, they would stamp their feet on the Broadway pavement, they might hear a sound—a sort of hollow mocking sound—a ghostly sound—which might be the death knell of any such hopes or expectations. For underneath that great thoroughfare is a tunnel, or what was a tunnel, dug out nearly thirty years ago. The idea of the promoters of the scheme was to have rapid transit from the Battery all the way to the Park with air for the motive power. But that tunnel is now the grave of buried hopes and of over a quarter million of dollars in money, all wasted in a futile attempt to build a passenger railway on which danger or delays from obstructions would be entirely eliminated. It is true the conditions are different now. New tunneling appliances have been invented; pneumatic systems have been perfected, electricity has been made subservient as a motive power and an underground road could undoubtedly be constructed much cheaper than was possible 30 years ago. But with all these improvements and all these great advantages over the past, the fact remains that it is still easier to bore a hole through the yielding



INTERIOR OF OLD NEW YORK TUNNEL.

atmosphere, and to construct a railway upon a steel structure, than to tunnel through the ground.

The Beach Rapid Transit Ry. originated in the brain of one Alfred E. Beach, a newspaper man, with scientific inclinations. He was interested in the transmission of letters and packages through tubes by means of compressed air, a system of transit now in use in some of the large cities. Mr. Beach conceived the idea of constructing tubular street cars and shooting them through the tunnel on this principle. He raised some money and went secretly to work. The entrance to his tunnel was at 260 Broadway, where a building was rented. The earth and stones dug out during the day were carted off at night. For four months gangs of men were kept busy, and but few people knew that such work was going on. Several hundred feet of excavation had been made when the workmen ran against the walls of an old building. In removing this obstruction the pavement above settled and this gave the secret away. Protests were entered against the further prosecution of the work. Beach fought the opposition hard and to popularize his enterprise and prove the absence of any danger and the great benefits the system would provide, he inaugurated a reception to the great men of New York to be held in the tunnel itself. A car had been constructed and it was contemplated giving the guests a trip over the line as far as constructed, but unfortunately the power would not work and the reception was to a certain extent a failure. A successful trip was, however, made a few days later. This was in February, 1870. The car made regular trips and the people of the city were wild with enthusiasm.

Mr. Beach met with much opposition, but finally, after many failures, he secured a charter. Then came the railway panic and before the money could be raised the "L" system had grown in favor and for that time solved the rapid transit problem. The last effort made to do anything with the tunnel was in 1876. It died a natural death, but the yawning grave, empty but for the wreck of the pneumatic car, is still there.

THIRTY-THREE ROADS COMBINE.

A syndicate has effected the consolidation of 33 street railways in eastern Massachusetts and Rhode Island. The negotiations have been in progress for several months and were only concluded on May 9th, the Newport & Fall River being the last to come in. The new association known as the Massachusetts Electric Companies, will control the system of street railways from Nashua, N. H., through eastern Massachusetts and in Rhode Island to Newport, excepting the Boston Elevated; the consolidated mileage is about 625 miles.

The capital is $22,000,000. This is based on the actual cost of the properties, with enough added to provide for the payment of all the floating debts and for such improvements as expert reports may show to be advisable. One half of the capital stock will be common and the other half preferred 4 per cent cumulative. No bonds will be issued.

It is intended to reduce expenses wherever practicable without impairing the system. It is thought that a number of the now operating power houses can be dispensed with by enlarging those located so as to furnish the requisite power for all the sections.

The syndicate is composed of American capitalists, and will operate in the counties of Essex, Middlesex, Plymouth and Bristol. As showing the prices paid for the various properties the following may be interesting. The Lynn & Boston was secured for $2,600,000, the Lowell, Lawrence & Haverhill for $1,500,000 and the Brockton system for about $1,000,000.

The following is a list of the street railway and electric light companies concerned: Lowell, Lawrence & Haverhill; Reading & Lowell; Lowell & Suburban; Rockport; Nashua; Gloucester; Gloucester & Rockport; Gloucester, Essex & Beverly; Lynn & Boston; Beverly & Danvers; Salem & Wakefield; Wakefield & Stonham; Woburn & Reading; Mystic Valley; North Woburn; West Roxbury & Roslindale; Needham & Boston; Norfolk Central; Norfolk Suburban; Boston, Milton & Brockton; Braintree; Brockton; Brockton & East Bridgewater; Brockton, Bridgewater & Taunton; Quincy & Boston; Taunton; Dighton, Somerset & Swansea; Providence & Taunton; Globe St. (Fall River); Newport & Fall River, and Newport street railways, Newport Illuminating Co., and Hyde Park Electric Light Co.

Mr. P. F. Sullivan has been appointed manager of the consolidated system, and a better man could hardly have been chosen. He is well known among street railway men as one of the most efficient managers in the country, and is an accepted authority on street railway economics.

Mr. Sullivan began his street railway career in 1888 in the capacity of secretary of the Lowell & Dracut and the Lowell Horse Railway Cos. When these roads were consolidated in 1891 he was made the general manager and has held that position until now when he assumes charge of the Massachusetts Electric Cos.

Mr. Sullivan is president of the Massachusetts Street Railway Association and has ever been much interested in its growth and advancement. In 1896 the Association sent him to Europe to investigate the systems abroad and he gave particular attention to the laws governing street railways in Great Britain, France, Germany and Ireland and familiarized himself with the methods of legislation regarding them. On his return he made an exhaustive report of the information he had obtained which was submitted to the Association and has proved of much value.

Mr. Sullivan has been a resident of Lowell for over a quarter of a century and no one man has more friends. His nature is genial and he has the happy knack of making people like him even before they know him. In business he is always prudent, just and firm. He studies every matter thoroughly and when once he has taken a stand he is convinced is right he is immovable. And those with whom he comes in contact invariably find him correct in his judgment.

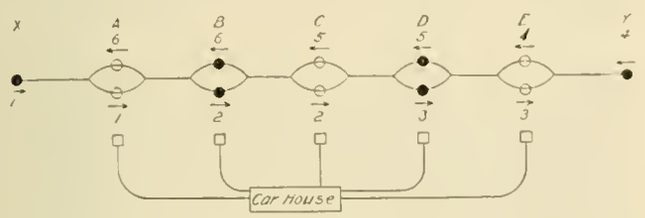
A man in Duluth, Minn., was recently arrested and given 60 days imprisonment for throwing stones at street cars.

SIX-MINUTE HEADWAY ON SINGLE TRACK.

Oakland, Cal., May 27, 1899.

Editor "Review": In regard to the inquiry concerning the operation of cars with a 6-minute on single track, appearing in the "Review" for May, I would say that I have had several years' experience in operating cars on $7\frac{1}{2}$, 8, 9, 10 and 15-minute headway and a plan for preventing unnecessary delays at turn-outs, which is used on my division, may be of interest.

With a single track and the headway fixed, it is first necessary to find the time required for a round trip of the car, and then the number of turn-outs, and the time between them may be determined. Thus if a round trip requires 30 minutes and the headway is 6 minutes, six cars and five turn-outs three minutes apart are necessary. Thirty-six minutes after the first car has started from one terminus the six cars are located on the line as shown by the solid circles in the diagram; three minutes later they are located as shown by the open circles. Time tables should then be prepared which give the time at which each one of the six cars should be at each of the turn-outs and termini.



Now if signal lamps be placed at each of the passing points and wired so that they can be manipulated from the car house or office, delays may be avoided. When a car is off time or turned into the car house for repairs, the signal lamp at each passing point is turned on at the time the disabled car is due there, and the conductor of the other car, seeing the light burning, proceeds to the next turn-out without delay.

My first suggestion is to avoid a single track if possible, because it is difficult to operate it successfully. But if the road can only build a single track the system of signal lamps described will prove convenient, and it is believed that it has one advantage not found in some more elaborate systems. That is, a failure of the signal light to operate holds the car on the turn-out.

We use this flash light system on our division and it has given satisfaction in avoiding delays at switches. Yours truly.

G. ROBERTSON.
Supt. Berkeley Division, Oakland Transit Co.

A CORRECTION.

Boston, June 3, 1899.

Editor "Review": Our attention has been called to an error on page 344 of your May issue wherein you refer to the storage battery in use at the power plant of the Laconia (N. H.) Street Railway Co. as being of the "Stetson" type. We beg to state that this is incorrect; it should have read "Chloride" type. Yours truly.

THE ELECTRIC STORAGE BATTERY CO.,
Frank J. Stone, New England Manager.

STRIKE AT CLEVELAND.

The employes of the Cleveland Electric Railway Co., known locally as the Big Consolidated, struck at 4 o'clock on the morning of Saturday, June 10th. The men demanded the recognition of the union and a board of arbitration to pass upon alleged violations of the company's rules; there were some minor questions concerning hours and schedules but the men and the company could easily agree concerning them.

No serious attempts were made to run cars until Monday morning when non-union men took out a number of cars. Strikers at first contented themselves with attempting to persuade the new crews to abandon their cars; later the cars were stopped by backing heavy drays and other vehicles onto the track and stones and eggs were thrown at the men, and the trolley ropes cut. The mobs were dispersed by the police and a number of persons slightly injured.

The company's board of directors adopted the following resolution at its meeting on May 12th:

"Resolved, That the differences between the Cleveland Electric Railway Co. and its former employes have substantially narrowed down to the proposition, upon which the company must stand that it must hire and discharge men without the dictation of anybody. As already stated, it does not attempt, nor will it attempt, to dictate to its employes whether they shall belong to a union or not. It will not require them to joint, nor will it discharge them for joining or refusing to join, at their pleasure. The company must reserve to itself the right to treat directly with its own men, to hire new ones as the needs of its service require, and to discharge inefficient men without accounting to anybody except to its director. Entertaining these views, it must respectfully decline to submit these questions to arbitration."

ELECTRIC LIGHT CONVENTION.

The annual convention of the National Electric Light Association began its sessions at Madison Square Garden, New York City, on May 23d. This was the 22d meeting of the association. The attendance was large and the sessions were interesting. President Alden M. Young, of Waterbury, Conn., was in the chair. President Young made a brief address of welcome, in which he called attention to the great number of electric light stations now within the limits of New York City and as illustrating the rapid advancement made in electrical science and its growing importance as a commercial factor he said that in Brooklyn the 10 street railway companies, in 1897, represented an investment of $55,000,000, and were operated as separate companies. They owned 678 miles of track and had carried 223,180,504 passengers during that year. In 1898 the entire system had been changed to electricity, the capitalization had been increased to $150,000,000, and the passengers carried had been 236,680,010.

A number of interesting papers were read. Mr. W. S. Barstow, of Brooklyn, followed the president with an article on "A Local Transmission System—Development and Operation." Mr. William Lispenard Robb, of Hartford, Conn., presented a paper on "Rotary Transformers and Storage Batteries as Related to Long Distance Transmission." The other papers read at the various sessions were: "Single Phase Distribution," by Mr. Herbert A. Wagner, of St. Louis; "Underground Electrical Construction," by Mr. Louis A. Ferguson, of Chicago; "Some Notes on Underground Distribution of Two-Phase Current in New York City," by E. A. Leslie, New York City; "Means of Affording Safety in Electrical Distribution," by W. L. R. Emmet, of Schenectady, N. Y.; "Alternating Current Generation and Distribution—Changes Contemplated in Atlanta, Ga.," by Mr. H. M. Atkinson, of that city, and "Transformers, Iron Loss—Its Increase—the Remedy," by Mr. G. Wilbur Hubley, of Louisville, Ky. All the papers elicited more or less discussion.

After other routine business had been transacted the association went into executive session and elected the following officers: President, W. W. Carns, Memphis, Tenn.; first vice-president, O. T. Crosby, Washington, D. C.; second vice-president, J. B. Cahoon, Elmira, N. Y.; secretary and treasurer, George F. Porter, New York City; master of transportation, C. O. Baker, Jr., executive committee, F. A. Copeland, W. W. Bean, W. McLea Walbank, Samuel Insull, Samuel Scovil, H. M. Atkinson, E. T. Peck, W. M. Brock and C. S. Scott.

During the convention the delegates were treated to an automobile ride, a sail around Manhattan Island and a trip to the works of the General Electric Co., at Schenectady, N. Y., the company providing a special train for that purpose.

PROPOSED IMPROVEMENT AT BAY CITY.

Mr. M. P. Heraty, president, and Mr. Lawrence Johnston, director, of the Bay City Consolidated Railway Co., of Bay City, Mich., were in that city recently looking over the property. They both expressed themselves as pleased with the prospects, and will advise the expenditure of at least $100,000 to put the road in first-class condition. It is Mr. Heraty's intention to call a meeting in Philadelphia of the Board of Directors and make an effort to have that sum appropriated. If it is done the work will be pushed through within a year; if not the road may pass into other hands.

THE DULUTH STRIKE.

The street railway employes union at Duluth, Minn., has ordered a boycott. The resolution is as follows:

"Whereas, we, the organized street railway employes of the city of Duluth have, through the obstinacy of the officials of the Duluth Street Railway Co., become involved in a controversy which we have so far been unable to settle, and

"Whereas, our city officials have so conducted themselves as to manage to keep astraddle of the fence in that they refused to take a decided stand in regard to this controversy, and

"Whereas, the agreement entered into between the two delegations that went to St. Paul has been broken by the representatives of the business element of our city, therefore, be it

"Resolved, that we, in defense of our rights as American citizens, having exhausted all other legitimate means to obtain an honorable settlement of our differences,

"We now declare a boycott upon the Pavilion at Seventh Ave. West and upon the Duluth-Superior Bridge, and that we also boycott any and all business men who patronize the same."

The history of this strike is quite interesting. Early in March the receiver and the manager of the Duluth (Minn.) Street Railway Co., found it desirable to reorganize the service and the employes were divided into three classes; the men in the first were those whose services had been satisfactory in every respect and an increase in wages was announced to take effect April 1st; the second class were kept on probation; the third class were dismissed. The men alleged that the discharge of 17 men during the first week in March was an attempt to break up their union and considerable talk of a strike was heard.

The executive committee of the union issued an address on March 9th in which Mr. Mendenhall, the receiver, and Mr. Warren, the general manager, each received his full share of abuse. A few days later other men were discharged and on March 21st, several of the ex employes petitioned the court having charge of the company to order their reinstatement.

When the petition came up for a final hearing on April 8th, affidavits were presented by General Manager Warren, containing definite charges against the men seeking reinstatement. These charges were for violating rules, and in one case dishonesty was alleged.

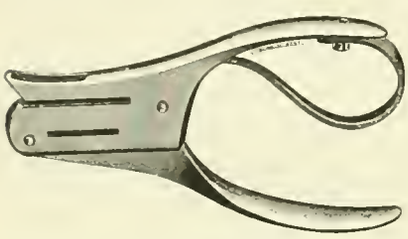
The court being called upon to decide between what it called two classes of the company's employes expressed a belief in the good faith of the management, and refused to order the reinstatement of the discharged men, but did not determine the truth of the charges.

In the "Review" for May we noted that a strike was ordered on May 2d, after the arrest of 10 men charged with cutting feeder wires. Attempts to assault non-union men who had been employed and to damage cars were made by the strikers, and also attempts to blow up cars by dynamite placed on the track.

Later announcements are to the effect that the strikers are applying for their old positions. The company states it will keep the non-union men, but will fill vacancies with the old employes if they so desire.

WOODMAN TICKET PUNCH.

The R. Woodman Manufacturing & Supply Co., of Boston, Mass., has achieved a big reputation on many special features among its railway supplies, but with no one article has it met with more success than its new transfer ticket punch. This punch has become vastly popular all over the country with street railway men. It is fitted with an elliptical spring which has been found to be a great improvement over any other kind used. The best of Jessop's tool steel is used in making the cutting dies and this gives the punch great durability.

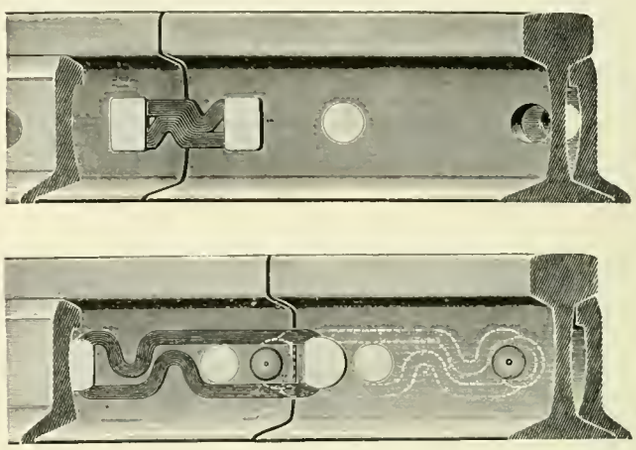


Air power cars began running regularly on the 23d St. cross-town line in New York on May 13th. The route is from North River to East River and the headway 16 minutes.

PROTECTED RAIL BONDS.

The Protected Rail Bond Co., located at 10 S. 10th St., Philadelphia, is the new company controlling the rail bond patents formerly owned by J. M. Atkinson & Co., and the Forest City Electric Co. The new company has just printed and is sending out its first catalog of the rail bonds and rail bonding tools. This catalog is a very handsome one and is perhaps the most complete ever issued on rail bonds. It contains 32 pages besides the cover which is embossed in gold and silver and has 30 illustrations. The company will be pleased to send one to any person interested in the subject.

The accompanying illustrations show types of the "Protected"



"PROTECTED" RAIL BONDS.

bond, which are so well known as to need no description. The company has excellent facilities for making its bonds and has made adequate provision for taking care of the business; the factory at Cleveland is working night and day, though the season has barely opened. Mayer & Englund, of Philadelphia, Pa., will have full charge of the company's business in the East and of the export trade. J. M. Atkinson & Co., of Chicago, will have full charge of all business in the West.

For the past year the company has been experimenting with hydraulic tools for bonding and punching; a number of orders have been placed for installation of "Protected" bonds with these tools and the company will shortly place complete outfits on the market.

NEW PENNSYLVANIA LINE.

Senator Gibson is the chief promoter of the Edinboro & Erie Electric Ry., the new trolley line between those two Pennsylvania towns, and he states the road is to be pushed rapidly through to completion. The financial arrangements have all been settled and no difficulty was experienced in disposing of the bonds. The company is capitalized at $500,000, but at the present time only $425,000 will be issued, the balance to be held in case improvements and extensions are needed to a greater extent than the earnings of the road will warrant.

The contract for 55,000 ties, 380,000,000 ft. of lumber and 200,000,000 ft. of planking has been let to R. B. Willis, of Erie. C. M. Stephens, the construction engineer, has already opened his office in Erie and has secured as his assistant W. H. Baxter, of that city. Senator Gibson says the law under which the charter was granted does not prohibit the carrying of express packages and baggage and in all probability this road will do that kind of business.

ANOTHER STREET RAILWAY BAND.

A brass band of 20 pieces has been organized by the employes of the Hartford (Conn.) Street Railway Co. Fred Phoenix, leader of the East Hartford band, and a member of the Colt's band, is directing the practice of the members of the new organization at every opportunity, in the Vernon street barns. The band is made up of conductors, motormen, car painters, electricians and utility men.

WORK ON THE A., B. & C.

The Akron, Bedford & Cleveland Electric Railway Co. has nearly completed the laying of 15 miles of double track between Akron and Bedford. The company has had a force of men at work since early in the spring. It is the intention to lay double track the entire length of the line, 23 miles, but the work on the remaining 10 miles will rest until next spring.

There are rumors to the effect that this company contemplates the purchase of the Canton and Massillon city railway, but President Everett of the A. B. & C., declares there is no foundation for the talk, so far as his company is concerned. Nor, according to President Everett, is there any plan on foot to build a connecting line between Akron and Massillon.

PROGRESS ON THIRD AVENUE, NEW YORK.

The main line of the Third Avenue Railroad Co., New York, is now nearly ready for the conduit cars and will be completed by the latter part of July. The electrical conductors have been placed in the conduit but are for the present set back so as to permit the temporary operation of the cable. The plan for making the change in operation is to shut down the line some Saturday night, withdraw the cable, and put a force of men at work to set out and adjust the electrical conductors. It is estimated that the necessary work can be done in 24 hours so that electric cars can be run the following Monday.

The old cable cars will be equipped with motors and used on the Third Avenue's cross-town lines. The new cars are to be 41 ft. over all, with 32-ft. body and will be mounted on double trucks.

MEETING OF OHIO STATE ASSOCIATION.

The annual meeting of the Ohio Street Railway Association was held at Springfield on June 14th, at the Lagonda Club. Among those present from out of town were: B. W. Peterson, Wheeling; C. Currie, Lima; H. C. Fogle, Canton; F. E. Grimm, Lancaster; C. E. Harrison, Steubenville; John Harris, Cincinnati; W. R. Morrison, Bay City, Mich; Reid Carpenter, Mansfield; C. R. King and A. L. Wilkinson, of the Ohio Brass Co.; Chas. Hodge, of the Westinghouse Co.; George A. Schroder, of the Multiplex Reflector Co., Cleveland; O. C. Evans, of the Johnson Co.; G. R. Scrugham, of the Creaghead Engineering Co.; C. S. Nolloth, of the Standard Electric Co.; and E. J. Wehrly, of Arbuckle Ryan Co., of Toledo.

The vistors were elegantly entertained by Gen. Mgr. S. L. Nelson, of the Springfield Railway Co., who placed a private car at the disposal of his guests.

All of the old officers were re-elected to serve during the coming year; no place for the next meeting was decided upon.

MR. H. C. BENAGH has tendered his resignation as superintendent of the Savannah (Ga.), Thunderbolt & Isle of Hope Ry. to take effect July 1st.

MR. SULLIVAN T. HOPKINS, superintendent of the Columbus (O.) Street Ry. was on June 7th married to Miss Mattie Lockett, daughter of Hon. John W. Lockett, of Henderson, Ky.

MR. FRANK WOODMAN, of Haverhill, Mass., has been appointed superintendent of the Merrimac Valley Division of the Massachusetts Electrical Companies which includes the roads at Nashua, Lawrence, Lowell and Haverhill.

MR. NELSON GRAHAM, assistant superintendent of the Montreal Street Ry., will shortly go to Glasgow to become superintendent of the Corporation Tramways.

MR. F. H. C. BOUTELLE, resident manager for an English railway syndicate in Buenos Ayres, was in Chicago recently inspecting car shops and electric railways.

JUDGE EGBERT JAMISON, who recently resigned as general counsel for the North and West Chicago Street Railroad Cos., has declined the presidency of the Chicago Union Traction Co.

FALK PLANT BURNED.

Just as we go to press we learn that the entire plant of the Falk Co., of Milwaukee, was destroyed by fire on the morning of June 13th; the loss included the office and all its contents were destroyed. The Falk Co. is building a new plant as noted on page 425 of this issue and while the fire at this time causes a very heavy loss indeed, the company will soon be in command of greater resources than before. Work on the new plant will be pushed as rapidly as possible and the company bespeaks the forbearance of customers until its completion.

MULTIPLEX REFLECTORS.

We illustrate herewith a new headlight that is now being placed on the market by the Multiplex Reflector Co., Cuyahoga Bldg., Cleveland, O. This reflector is claimed to be superior to any others on the market; they are corrugated and a single incandescent lamp makes a brilliant light. Fig. 1 shows a standard size headlight with

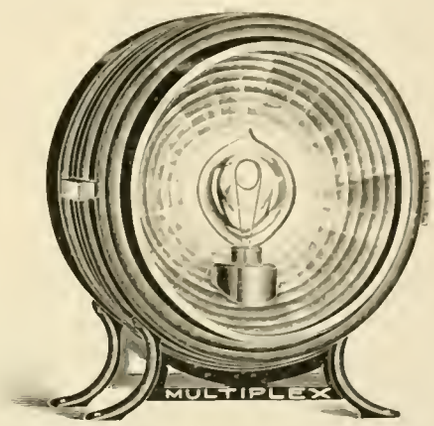


FIG. 1.

corrugated reflectors. The case is of polished steel with solid steel back which has four legs so that it can be fastened to the car hood very securely. The wires enter at the back of the bottom of the case and the connections are thoroughly insulated; the case itself is waterproof. It is reported that a 16-c. p. lamp throws a beam of

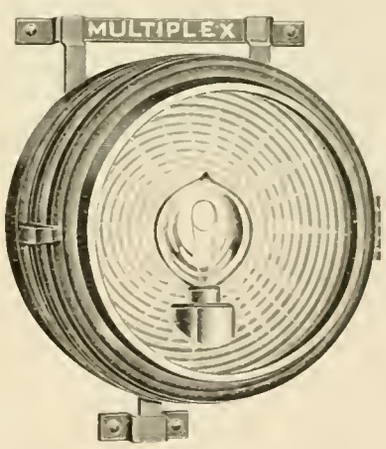


FIG. 2.

clear light 300 ft. Fig. 2 is the reflector as made for dash lamps; this lamp has direct connections.

These lamps are being adopted by both the Big and Little Consolidated roads of Cleveland, and by the Cleveland & Chagrin Falls road.

The International Register Co., Chicago, has just shipped 50 registers to the Twin City Rapid Transit Co., of Minneapolis, for immediate use.

The Marinette (Wis.) Electric Street Railway Co. proposes erecting a water toboggan at Lakeside. Manager H. C. Higgins thinks "shooting the chutes" will be a popular amusement.

HALF FARES.

The women of Sioux City, Ia., played street car conductors on May 13th and collected a neat sum for the benefit of Morning Side college.

The directors of the Brooklyn (N. Y.) Rapid Transit Co. held a meeting May 18th and passed resolutions on the death of Roswell P. Flower.

Burglars got into the safe of the Missouri Electric Railway Co. at Webb City on the night of May 4th and secured $605, the receipts for the day.

The North Jersey Street Railway Co., of Jersey City, has voluntarily increased the wages of its men. The advance ranges from 15 cents to 25 cents per day.

A company with a capital of $500,000 has been organized in Lima, O., for the purpose of building an electric railway from Toledo, O., to Dayton, a distance of 153 miles.

The Wisconsin Legislature adjourned without passing the bill to limit street railway fares; it passed an act, however, providing that street railways shall make reports to the state railroad commissioner.

The officials of the Atlanta (Ga.) Consolidated Street Railway Co. entertained visitors on May 16th. After a trolley ride there was a barbecue at the power house in the afternoon; about ninety guests were present.

An electric car containing 25 passengers was run into by a Northern Pacific train at Seattle, Wash., on May 20th. One man was killed and seven others were severely injured. The motorman saved his life by jumping into the bay.

The town board of West Seneca has granted the Hamburg Railway Co. a franchise to lay tracks and operate an electric road over the Ridge road and Hamburg turnpike, to connect with the Limestone Hill line, Erie County, N. Y.

An accident occurred on the River View branch of the Union Railway Co., of Baltimore, Md., on May 30th. A trolley slipped the wire and as the car stopped suddenly, a train following crashed into the rear end and injured several people.

Something like $70,000,000, which has been tied up pending the consolidation of the Baltimore, Md., street railways, is now released, the financial arrangements having been completed. The Consolidated company retains $21,000,000 in its treasury.

The Pittsburg, Pa., traction companies have invested very largely in new summer cars in anticipation of a heavy suburban traffic. It is stated that the total amount of money expended in improvements and for new cars will reach nearly half a million dollars.

The Alliance (O.) Street Ry. has been sold by order of court. Dudley B. Wick, of Cleveland, bought it for $15,334. The road consists of three miles of track running from the Union depot to a point near Mt. Union College. It is believed the line will be extended to connect with Canton.

It is announced that in all probability the Manhattan Elevated, of New York, will install inclined elevators at its stations when the change to electricity is completed. The Reno system, which is the only one in practical operation at this time, was illustrated and described in the "Review" for December, 1896, p. 750.

May 23d the breaking of a piston rod on a locomotive on the Brooklyn Elevated R. R. caused a blockade from 7 to 11 a. m. The rod broke just as the train was leaving a station, or the accident might have been more serious. The rod fell across the track and one car was derailed, one end being pushed off the structure, so that the truck fell into the street.

The Atlanta (Ga.) Consolidated Street Railway Co. has just issued a new transfer ticket which will cover about all the lines in the city. There is also a prospect that the line out to the barrack will be extended to College Park, a distance of about four miles.

The Nassau (N. Y.) Electric Railroad Co. has filed a report with the State Railroad Commissioners showing business for the quarter ending May 31st to have been: Gross earnings, $401,720; operating expenses, $390,101. Net earnings, $11,619. The same quarter of last year showed a deficit of $50,144.

The Market Street Railway Co. of San Francisco, Cal., went before the Board of Supervisors and declared its willingness to surrender its right in Geary St. if the Board would advertise for bids for its sale according to law. This surrender was offered for the purpose of securing new and more favorable franchises for a longer term. The Board referred the matter to a special committee.

It appears that the Indianapolis 3-cent fare litigation is not at an end, notwithstanding the new law and that the new company has made a contract with the city and purchased all the interest of the two old companies. One C. F. Smith has commenced suit for $5,000 damages because a tender of 3 cents was refused and he was ejected from the car.

The stockholders of the Brooklyn (N. Y.) Union Elevated Railroad Co. on May 3d elected the following directors: Frederic P. Olcott, Wm. Hours, jr., Frederick Uhlman, Wm. F. Sheehan, Nicholas F. Brady, Frederick S. Flower, John S. George, Ira A. Kipp, jr., John B. Taylor, John V. Clark, Henry Folger, Clinton Rossiter and T. S. Williams.

The Canton-Massilon Electric Railway Co. has increased the wages of its employes. Conductors and motormen who have been one full year in the service will receive $1.75 per day and 16½ cents an hour for extra time. Men who have been in the company's service for less than one year will receive $1.60 per day and 15 cents per hour for extra work.

The Eighth St. power house of the Cincinnati Street Railway Co. was recently damaged by fire to the extent of $5,000. A carriage factory across the way took fire and severely scorched the power house. The building was saved by the flood of water poured upon it by the firemen and the main damage was to the two dynamos and two engines from the effects of the drenching.

The order of the Postmaster General requiring street railways to paint out the letters "U. S. Mail" on their cars and provide portable signs to be displayed when the cars have mail on board, will be complied with by the Omaha Street Railway Co. so far as it relates to removing the permanent signs. Concerning the portable signs Gen. Mgr. W. A. Smith is reported to have said that his company is in the position of a man who is paying his own board and working for nothing, which he regards as an almighty independent position.

The Chattanooga (Tenn.) Rapid Transit Co. is pushing its lines to all the interesting points outside of the town. The Chickamauga Park extension is being rapidly constructed, and the line from the present terminus at Rossville will be extended to McFarland's Lake at once. The cut-off from Anderson Ave. to Orchard Knob has been entirely graded and some steel rail has been laid. The road to Orchard Knob will be in operation in a few days. A little later the road will be still farther extended from the Knob to Sherman Heights.

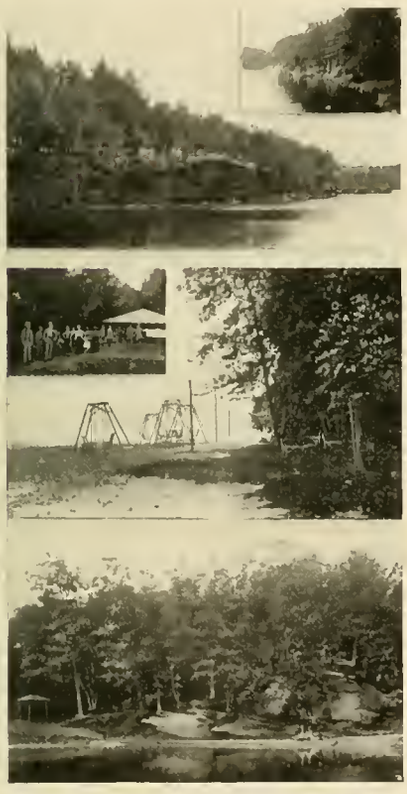
The U. S. Consular Reports advance sheet for June 3d states that the Wellington mines at Oyster Harbor, British Columbia, will be equipped for electric working, and the coal will be hauled from the mine to the depot by electric locomotives. The contract for this plant has already been let to a local firm. The electric tram line will be nearly five miles in length and operated by two 150 h. p. generators directly connected to automatic, high-speed, horizontal engines. This plant also includes two standard mining locomotives of 100 tons capacity.

Pleasure Resorts in 1899.

MIDDLETOWN, CONN.

The Lakeview Park, three and one half miles from Middletown, is easily reached by the South Main St. line of the Middletown Street Railway Co. This park comprises 20 acres, and is owned and controlled by the street car company. It has been fitted up as an attractive resort. The natural advantages are many. There is a large lake and on it the company has put steam launches, sailing yachts and a plentiful supply of small boats. A beautiful hardwood grove has been converted into a magnificent park and around it and through it are winding, shady walks encircling numerous grass plots, especially adapted for lunching and picnic parties. The natural beauties of the place are greatly enhanced by the presence of a deep ravine across which has been built a bridge 132 ft. long. The ravine is fully 50 ft. deep.

In one of the groves there has been constructed a large pavilion with a stage and seats for the accommodation of several hundred people. Entertainments of the high vaudeville class are given here



LAKE VIEW PARK, MIDDLETOWN, CONN.

daily. There is an excellent restaurant and all through the grounds are attractions of a varied order including shooting galleries, ball throwing, merry-go-rounds, and for the especial delight of the children a set of "flying horses" has been secured. There is always good music provided by the company. No intoxicating liquors are permitted on the grounds nor are teams or bicycles allowed inside. The latter can, however, be checked at the entrance.

Mr. E. W. Goss writes us as follows concerning the experience of his company last season:

"About May 15th last year we made up our minds to fix up a pleasure ground, and found this site about two miles from the end of one of our lines. We had to purchase land from some five or six different people, and build two miles of track, and put up such buildings as we wanted. At that time we had purchased no material such as rails, ties, etc., but succeeded in opening on the 1st of July, so that we got the best part of last year's business. We have located in the park an outdoor theatre, with a stage 30 x 50 ft., with dressing rooms on the sides. Fronting the stage is an incline on which we placed about 600 seats, which we sell at 5 and 10 cents. The theater and seats are in a hemlock grove, making it shady and comfortable there. There is a deep ravine running across the park which we found necessary to bridge. We also built a small restaurant building which we are enlarging this season. One section of our park runs along the side of a fair-sized lake, and there are several small groves running along side of it. We also have a large hardwood grove in another section of the grounds in which we placed tables and seats for picnic parties. I think the cuts show it up so that you can get a fair idea of the place. We run our main light wires from the station to a small building near the theater, and run out different lighting circuits from this house. In the house is a combined stereopticon and moving-picture machine. For lighting the grounds we did not think that taking lights from the regular railway feeder would be satisfactory, so we decided to run a No. 0 wire from the station direct to the park. This gives a very satisfactory service, and the lights are as steady as those in the city, although they are taken from the railway generator, using incandescent lamps in groups of five. Last season we ran shows on the stage from the week after we opened until the middle of September, and found that the better shows drew more patronage than when we happened to get an inferior one. We intend to commence booking earlier this season and expect to do more business than last season. We do not charge any admission to the park, but do not allow any bicycles

STREET RAILWAY PARK TERMINAL, MIDDLETOWN, CONN.

or teams to come on the grounds. Bicycles can be checked at the entrance, and owners of teams are provided with a place to hitch their horses outside. It would cost more to collect entrance fees than they would come to, as we are located some three miles from the center of the city. Charges of 10 cents and 5 cents are made for the seats fronting the stage; outside the railing people can look on if they wish. We have rented all the privileges this season to one party, giving him the privilege to sublet such as he does not care to run himself, and holding him responsible for everything in that line."

BIRMINGHAM, ALA.

In the "Review" for July, 1898, we published a number of views of East Lake Park, the attractive pleasure resort of the Birmingham (Ala.) Railway & Electric Co. This season colored electric incandescent lamps are to be placed in the trees for illumination at night. A large dancing pavilion is a feature of this park and music for dancing is provided every evening. This resort, like many others in the South is now under the control of the Southern Amusement Syndicate. This must not be construed to mean that the railway company has no right in the matter whatever. It purposes to see that nothing at all of an objectionable character will be permitted on the grounds, but so far as details are concerned, the syndicate has the management in its hands.

East Lake is a popular resort and the people are looking to the theatre there for that class of amusement. The Syndicate is in a position to furnish the best attractions and it has booked many first class shows for the season.

General Manager McClary of the Birmingham Railway & Electric Co. takes especial interest in this resort and is running special through trains for the benefit of his patrons.

PITTSBURG, PA.

Calhoun Park, on the Dravosburg division of the United Traction Co.'s line is a delightful resort of 51 acres. It is midway between Pittsburg and McKeesport in a bend in the Monongahela River and is about a 30-minute ride from each city. The ground is largely covered with forest trees and there are many fine springs. The park is lighted by electricity and a long distance telephone is at the service of pleasure seekers. A large pavilion has been built and furnished for dancing and dining purposes. There is a restaurant for serving meals and lunches at all hours, refreshments of all kinds

LAKE VIEW PARK, MIDDLETOWN, CONN.

to picnic parties and coffee and ice cream by the quart or gallon. In the kitchen, patrons of the park are furnished with fuel and cooking utensils free. A merry-go-round, roller coaster, bowling alleys, shooting gallery, race track and base ball fields afford athletic amusements. The booths and shelters of all kinds will accommodate 10,000 persons. Admission to the park is free and no concessions are let.

NEW ORLEANS, LA.

The New Orleans Traction Co. proposes to make its West End Park, on Lake Pontchartrain, the great resort, the Coney Island in fact, of the South. The company, under the management of C. D. Wyman, has already done much to make West End attractive, but the present season will effectually eclipse all its past glory. All the buildings, pavilions and band stands have been freshly painted and the park has been opened with the most flattering evidences of success. The best of music has been provided, the vaudeville shows will be exceptionally good; there are moving pictures, chutes and besides the botanical gardens, which have been added to extensively since last season, there is a perfect working scenic railway, such as they have at Coney Island, Boston, Philadelphia and Chicago.

General Manager Wyman has provided some magnificent electrical displays, which will be novelties to the Southern people and will be a delight to all visitors. But the scenic railway is the grand feature of all. This contrivance beats all the roller-coasters in the world. The capacity of the car is for eight persons. The highest point of rise is 80 ft., but at that elevation, in the evening, a magnificent scene is offered the passengers in the view of the thousands of electric lights scattered all over West End.

And the side of this resort is no small part of the pleasure to be obtained. They are handsome and comfortable and safe. In anticipation of very large patronage the rolling stock has been increased so that no one need fear crowding or delay in either going or returning home. Everything has been done to make West End a delightful spot, and the public which goes there and finds enjoyment can thank the New Orleans Traction Co. for the pleasure.

KNOXVILLE, TENN.

The Knoxville Traction Co. has greatly improved its park, known as Chilowie Park, for the present season. It has naturally a number of attractive features, among which may be numbered a lake covering five acres, half a dozen flowing springs and a prominent hill, Chestnut Hill, from which a good panoramic view of the city and surrounding country may be obtained. Last year this resort proved to be very popular.

A pavilion is located on Chestnut Hill and comprises a large dancing floor, a dining room and a well equipped kitchen. This building, together with four acres of ground, is fenced off from the rest of the park and is frequently rented for private parties; when not so rented it is open to the public and an orchestra furnishes music every afternoon and evening.

A theater with seating capacity for 1,500 has been recently completed; 800 of these seats are reserved, and a charge of 10 cents made for them. Among the other attractions are a Griffith gravity railway, an electrically operated merry-go-round, a large bowling alley, billiard and pool rooms, a shooting gallery, a cycle skating track and over 200 swings.

Water for the pavilion is pumped from the springs by windmills.

The park and all its buildings are brilliantly illuminated with arc and incandescent lamps.

SANS SOUCI PARK, CHICAGO.

Sans Souci Park, which was illustrated and described in our issue for March, last, was opened for the season on May 27th, and the patronage which it has drawn since that date corroborates the belief under which the park was built, that the South Side would appreciate a high-class pleasure resort fully as much as the other divisions of the city. Early in the evening of the opening the weather was very threatening and later it rained heavily; notwithstanding these unfavorable conditions there were over 18,000 people present and the management was obliged to close the gates at 8:35 p. m.

This park is a private enterprise under the management of Mr. W. H. Carter, but, to use the language of one of our Texas friends in a paper on summer resorts, the bag of gold has been so hung that the Chicago City Ry. will carry nearly all the people who wish to chase it.

The grounds and buildings are most brilliantly lighted; music by an excellent band, a temple of palmistry, booths of various kinds, vaudeville performances in the pavilion theater and the largest electric fountain ever built are among the attractions.

The accompanying engraving gives a view of the park from a point in the northwest corner. The building in the foreground at the right of the picture is the Japanese tea house, that at the left is the power house for the fountain, while directly in the center is the electric fountain. Immediately to the left of the tea house in the engraving is the theater and restaurant pavilion and in the background are seen the various smaller pavilions and booths visible from this point. The fountain has a capacity of 160,000 gallons of water per hour and the lamps have an aggregate candle power of 19,000; this is 50 per cent more water and 100 per cent more light than the rating of the fountain in Willow Grove Park, Philadelphia, which is the next in size to the Sans Souci fountain.

The fountain was designed by C. E. Moore, master mechanic, and C. J. Reilly, superintendent of motive power, of the Chicago City Ry., and they have substituted hydraulic and electrical control-

ling devices wherever practicable so that one man operates the pumps and controls both the water and light effects.

In the northeast corner of the park, near the bicycle sheds, is a large switchback merry-go-round, built by the American Merry-Go-Round & Novelty Co., of Lockport, N. Y.; it was designed by Mr. Wm. R. Inshaw, who has built two others of this type, one in Schenley Park, Pittsburg, and one at New Bedford, Mass.

Mr. Sturtevant is giving the theater much attention. Two performances are given each day, afternoon and evening. Some excellent attractions are engaged, and he intends, during the summer, to give all the popular comic operas, beginning June 25. A change of bill is made every week. Sans Souci Park affords every variety of amusement. Every taste and disposition can be suited, but it is safe to say that in the evening the electric fountain receives the most attention.

Last week the program was as follows: Band concert beginning at 1:30 p. m.; fountain at 3:00; vaudeville at 3:30; trained horses at 5:00; conclusion of band concert. In the evenings are the concert and theater performance and two exhibitions of the fountain, at 8:40 and 10:40.

SANS SOUCI PARK, CHICAGO.

THE NEW YORK FRANCHISE TAX.

The New York franchise tax law published in the "Review" for May, 1899, page 333, was amended at the special session of the Legislature called for that purpose last month. The changes made were substantially as follows: Authority to assess franchises is given to the State Board of Tax Commissioners, thus taking it out of the hands of the local assessors; but the State Board reports its valuations to the local boards, and the taxes are collected by each city or town for itself. The State Board, in making up the valuation is to include both the tangible property and the franchise connected with it, so that in the case, for instance, of a street railroad, local assessors will have nothing to say concerning the valuation either of the track or of the right to use it. The State Board is to give hearings at Albany after making a valuation, but before finally reporting it to the local assessors. An assessment may be reviewed by the courts. From the franchise tax as based on the valuation made by the State Board are to be deducted any and all taxes paid by the corporation to the city or town in the preceding year, such as license fees, gross earnings, taxes, etc., but not including money paid for paving or repairing streets. No deduction or credit shall be given for a greater sum than the amount of the special franchise tax. Other taxes are not to be affected by the new tax, and the tangible property shall not be taxable except on the assessment based on the State Board's valuation.

The new law goes into effect October 1st next. It is quite generally assumed that in administering this law the assessors will be guided by the market value of the stocks and bonds of a corporation.

There is a wide difference in the opinions expressed as to how the street railway properties will be affected by the new law. The estimates as to the amount of the tax vary in amount from $14,000,000 for the whole state to $25,000,000 for New York City alone; the estimate of the state comptroller's office is $27,000,000 for the state. The assessment is real estate.

There can be no doubt that the law will bear very hard on the small street railway companies throughout the state. In an argument before Governor Roosevelt on May 11th, Mr. G. Tracy Rogers, president of the New York Street Railway Association, presented the following data on this point:

"One hundred and three street surface railroads submit annual reports to the state, 49 of which show a surplus amounting to $1,102,855, and 54 show a deficit amounting to $471,878. Of the $1,102,855 surplus, $805,288 is shown by 12 companies in Greater New York, leaving but $297,567 to be divided among the 37 companies outside of that city. Of the 103 companies reporting, but 18 declared dividends (five of these being in Greater New York), the total dividends amounting to $3,069,465, of which the five Greater New York roads paid $2,512,374, leaving a balance of only $557,091 to be divided among the remaining 13 dividend-paying roads. Six of the dividend-paying roads showed a deficit after so doing. Eight of the 103 street surface railroads mentioned have gone into the hands of receivers during the past four years. In addition to these, at least 12 or 15 companies have gone out of business entirely or saved themselves from going into receivers' hands by making some arrangements with the bondholders. Briefly, the above report shows that the small and medium sized roads in New York state, and in fact all the roads with the exception of those in the very largest cities are struggling along under the most discouraging conditions, and cannot stand any additional burdens of taxation."

The larger companies in the state will probably be less affected.

When the law goes into effect its constitutionality will be tested, and a hard fight will doubtless be made against it. Mr. John Sabine Smith, an eminent corporation lawyer of New York, says concerning the law:

"The power to tax may be used as an indirect means of levying a burden not contemplated by the originators of the enterprise, and one which will strangle the operation of the work. This undoubtedly is not true of rich corporations, as a general rule, but all corporations must be placed on the same basis of fundamental principle of taxation, namely, that it shall be equal."

PERSONAL.

MR. J. MARSHALL ATKINSON will be married to Miss Elizabeth Amolia Weiland, daughter of Mrs. Annie Marie Weiland, of Lynchburg, Va., on Wednesday, June 21st. We join the many friends of Mr. Atkinson in the electrical and street railway world in extending congratulations.

MR. CLARENCE P. KING, president of the Schuylkill Electric Co., Philadelphia, and Mr. Duncan, his superintendent, were callers at our office when in Chicago last month.

MR. ALFRED OSKAMP, representing the Kisinger-Ison Co., of Cincinnati, called on the "Review" when in this city recently.

MR. ALBERT STANLEY, lately assistant superintendent of the Citizens' road at Detroit, has been appointed superintendent to succeed Mr. John Grant.

MR. JOHN A. WILSON, who was formerly with the Trenton Light & Power Co., was, in March last, appointed chief engineer of the Traction Passenger Railway Co.

MESSRS. HENRY M. WILLIAMS AND FRANZ BURGER, of the Ft. Wayne (Ind.) Consolidated Railway Co., called on the "Review" when in Chicago recently.

MR. JOHN GRANT, superintendent of the Detroit Citizens' road, has resigned that position to become assistant general manager of the Indianapolis (Ind.) Street Ry.

MR. WILL J. BROWNE, of Dubuque, Ia., has made an arrangement with the General Electric Co. and assumed control of the Dubuque Light & Traction Co., which has been in the hands of a receiver.

MR. CONWAY F. HOLMES, superintendent of the Metropolitan Street Railway Co., Kansas City, has been very ill for some weeks with congestion of the brain. At last account he was improving.

GEN. W. A. BANCROFT, general manager of the Boston Elevated Railway Co., last month declined an offer of the position of general manager of the new Chicago company, which is to take over the Yerkes lines.

MR. J. C. ROTHERY, superintendent of the Niagara Falls Park & River Ry., has been appointed superintendent of the upper steel arch bridge. The International Traction Co. now owns and controls both the railway and the bridge.

MR. G. F. GREENWOOD, consulting engineer, will go to Cuba this fall to reconstruct the street railways in Havana. Mr. Greenwood has, until recently, been the general manager of the Consolidated Traction Co., of Pittsburg.

MR. J. A. VANDERGRIFT, of Philadelphia, consulting engineer of the Chattanooga (Tenn.) Rapid Transit R. R., is at Chattanooga looking after the improvements now under way. He will remain there until all the work is completed.

MR. SAMUEL INSULL, president of the Chicago Edison Co., was on May 23d married to Miss Margaret Anna Bird, at the residence of the bride's mother, in New York. Miss Bird was better known to the public by her stage name of Gladys Wallis.

MAJ. E. C. LEWIS, at a meeting of the board of directors of the Nashville Street Railway Co., held May 18th, was elected vice-president to succeed Mr. J. C. Bradford, who had resigned. Mr. Bradford will still represent the company as general counsel.

MR. G. J. SMITH who for several years has most acceptably filled the position of master mechanic of the South Covington & Cincinnati Street Railway Co., has accepted a similar office with the St. Louis & Suburban, of St. Louis, and entered upon his new work.

MR. SIDNEY H. SHORT, it is reported, has gone to England to stay. He has accepted the position of consulting engineer with a new concern to be started by Dick, Kerr & Co., at Preston, for the manufacture of electric railway motors, generators and controllers.

MR. C. F. MOORE, who was treasurer of the Interstate Telephone Co., of Cleveland, O., has recently been chosen secretary of the Akron Traction & Electric Co., and has removed to Akron. This company is to be consolidated with the Akron, Bedford & Cleveland, in July.

MR. F. E. WOODWARD, formerly engineer of the Suburban Light & Power Co., Boston, in April last, was appointed chief engineer of the power station of the New Brunswick Traction Co., at Milltown, N. J. Mr. E. G. Grant, formerly with the Block Plant Electric Light Co., is his first assistant.

MR. JULIUS A. LEMCKE, who was a short time ago elected a director and treasurer of the Indianapolis Street Railway Co., has been obliged, on account of the pressure of private business, to resign. He was then made first vice-president, and the offices of secretary and treasurer were consolidated. This change puts Secretary W. F. Mulholland in both positions.

MR. MATTHEW T. CRONIN, who has for several years been chief train dispatcher of the Kings County Elevated R. R., of Brooklyn, N. Y., recently resigned to engage in business for himself at Bayonne, N. J. As an evidence of the regard in which he is held by his late associates, Mr. Cronin was, on the evening of May 13th, presented with a handsome gold watch and chain, the employes of all departments participating. Supt. E. W. Hartough, in a few well chosen words, made the presentation.

COL. THOMAS M. JENKINS has resigned from the superintendency of the South Covington & Cincinnati Street Railway Co., and accepted a position with a St. Louis company. To show the appreciation in which he is held by his late employes, Col. Jenkins was tendered a banquet and presented with a handsome solid silver service set on the evening of May 12th. The happy event took place in Elk's Hall in Covington. The First Regiment band was secured and at the head of 500 of the employes marched to Col. Jenkins' house, where he joined the parade. A visit was then paid to Pres. James C. Ernst and to the treasurer, Geo. M. Abbott, both of them being serenaded. The hall was packed, and everybody enjoyed the feast which had been prepared. President Ernst made a witty speech and George Taft, one of the conductors, in a most graceful and happy manner, presented the silver set. Col. Jenkins made a feeling response.

OBITUARY.

MR. ALBERT PACK, the well known Detroit, Mich., capitalist, died on Monday, May 29th, from the effects of a surgical operation. He was 57 years of age and had been one of Michigan's most active and enterprising business men and politicians, being largely responsible for the election of Pingree for governor in 1896. Together with Henry Everett, of Cleveland, Mr. Pack built street railroads on about 50 miles of Detroit streets not occupied by Johnson's lines and established a three-cent fare. The lines were later consolidated with Johnson's lines.

PENNSYLVANIA CAR WHEEL CO.

The Pennsylvania Car Wheel Co. desires most emphatically to deny the rumor that it has sold out to other parties. The impression was evidently founded on the fact that its rapid and very large increase in business has made it necessary to increase the capital stock from $100,000 to $200,000 and to take in additional properties; but the management has not had, and does not now entertain any idea of disposing of the business or plant. The success of this concern has been highly satisfactory to all connected with it.

NIGHT PHOTOGRAPH BY ARC HEADLIGHT.

We are indebted to Mr. H. P. Wellman, superintendent of the Ashland & Cattletsburg (Ky.) Street Railway Co., for a photograph which graphically illustrates the power of the electric headlight, which is his own invention. A description appeared in the "Review" for April, page 276.

The photograph was taken on a dark night at a point midway on the line. The arc headlight had a 14-in. reflector, ½ in. "Electra" carbons, and current used was a little less than 6½ amperes. The time of exposure was five minutes.

While much detail of the picture has necessarily been lost in reproduction in engraving, the photograph from which the cut is made is sufficiently clear to enable the reading of signs pasted upon the first pole and to count the poles for a distance of fully 1,500 ft

NIGHT PHOTOGRAPH BY LIGHT OF WELLMAN ARC HEADLIGHT.

NEW PLANT OF FALK CO.

The Falk Co., of Milwaukee, is at present a very busy concern. The contracts for work have come in so rapidly of late that the increase in the size of the plant has become an absolute necessity. The company has purchased eight acres of ground close to the present shops and will there erect new buildings. A machine shop, 100 x 200 ft. in size will be built, and a foundry, equipped for casting steel, occupying the same amount of space, will be put up. There will be a power house 60 x 140 ft. and an office building 40 x 60 ft. The entire plant will have electric motors for driving the machinery. It is expected that even this large increase in space may, before long, prove insufficient and all the buildings are to be erected with a view to possible longitudinal expansion. The shipping facilities will also be made as perfect as possible. The Chicago, Milwaukee & St. Paul will run a spur directly to the plant and immense cranes are to be erected to transfer heavy work from foundry and machine shop to any place desired.

Besides the enormous business the Falk Co. is of itself acquiring, it has recently absorbed the Cloos Electrical Engineering Co., of Milwaukee. This company made devices for controlling high voltages, particularly oil switches in which an imported, acidless oil is used. These switches have made it possible to do away with arcing between high voltage terminals and take away a large percentage of the ordinary danger to the operator. The absorbing of this plant will greatly increase the importance and the output of the Falk Co.

Regarding the work under way and the contracts lately made there may be mentioned one for the change of a five mile cable line of the Metropolitan Street Ry., of Kansas City, Mo., to the electrical system. The company has also a contract for the complete construction of a 14-mile road between Oskosh and Neenah, Wis. In the gear departments the orders are extensive and there is much activity in cast welding. A contract has just been closed with the Chicago Union Traction Co., for three complete cast welding equipments and for a license to weld joints under the Falk patents. The same equipments have lately been furnished the Boston Elevated Railway Co., and a full equipment of welding machinery, described in our last issue, has been shipped to Buenos Ayres for the account of Kincaid Waller & Manville, the London tramway engineers.

STREET CAR BUILDERS' COMBINATION FAILS.

The plan to consolidate the leading street car building interests of the country which at one time had every indication of going through has fallen down. Whether another attempt will be made is at present uncertain but the probabilities are strongly unfavorable. The principal hitch in the program seems to have been the fact that while the various interests were willing to go into the deal, practically none of them was willing to do so on the usual combination basis, of a portion cash and the large part stock. The car builders all wanted all cash.

The scheme was to incorporate in New Jersey for $18,000,000 divided into $8,000,000, 7 per cent cumulative stock and $10,000,000 common. Economy of administration was figured to increase net earnings by reducing expenses in the sum of $1,250,000 per year.

The concerns contemplated in the plan were the Laconia Car Co., of Laconia, N. H.; the Watson Car Co., of Springfield, Mass.; the Newburyport Car Co., the Briggs Carriage Co., of Amesbury, and the J. M. Jones Co., of Troy, N. Y. These were regarded as the Eastern group, and options were secured upon all but one. Elsewhere were the American, St. Louis and Laclede Car Cos., of St. Louis; the J. G. Brill Co., of Philadelphia; the Jackson & Sharp Co., of Wilmington, Del. Barney & Smith Car Co., of Dayton, O., the street car department of the Pullman Car Co., the Stephenson Co., of Elizabethport, N. J., and the J. G. Kuhlman Car Co., of Cleveland, O.

Besides these there were the Peckham Motor Truck & Wheel Co., of Kingston, N. Y.; the McGuire Manufacturing Co., of Chicago, and the truck works of J. G. Brill, of Philadelphia. In some cases, where the making of street cars was only a part of the manufacturing business carried on, as with the Pullman and the Jackson & Sharp Cos., the consolidation would have meant only an agreement to make no more electric cars, for the physical work of manufacture would have been generally consolidated into large plants.

The Fond du Lac (Wis.) Street Ry. will be completed and in operation by July 1st.

FIRST FRANCHISE TAX IN MISSOURI.

On June 7th the first assessment of a street railway franchise tax was made by the State Board of Equalization under the new act recently passed. The road selected was the St. Louis & Suburban Railway, of St. Louis.

Before assessing the board listened to arguments from the officers and attorneys of the railway company, who protested against the assessment as unjust and unfair. Evidence was also offered as to the value of the property of the company, the market and par value of the stock and bonds, and statements as to the gross and net earnings of the road.

One member of the board offered the following resolution, which was voted down:

"The board, having under consideration the assessment and valuation of the property of the St. Louis & Suburban Railway Co., after being fully advised of all and singular the matters and things relating to the character, extent and value of the property owned, used or leased by said railway company on June 1, 1898, finds that the total value of all the property of said railway company, measured by the market value of its stocks and bonds on the date aforesaid, is $3,587,000. It is, therefore, ordered by the board that the whole property of said railway company, as aforesaid, be assessed and valued for taxes of 1899 at $1,783,500, of which $543,010 is to represent the assessable value of the tangible property and the remainder, $1,250,490, to represent the assessable franchise value of said railway company, which is by the board distributed and assessed against the several classes of property owned by said company, as follows:

29.16 miles track and trolley wire	$291,600
86 motor and passenger cars	72,240
13 other cars	2,080
2 sweepers	200
Lands, buildings and machinery	176,890
Franchise	1,250,490
Total	$1,793,500

The resolution which did pass by a vote of three to two was offered by Mr. Crow, and reads:

"The State Board of Equalization, having given the St. Louis & Suburban Railway Co. opportunity to be heard personally by the board, and having heard the said St. Louis & Suburban Railway Co., through its officers, agents and counsel, and having carefully considered the facts set out in the return, schedule and supplementary statements of the said company, all evidence of value and all matters bearing upon the question of the value of the property of the company, and considering the cost of construction and equipment of said railway line and the location thereof, and its traffic and the market and par value of the stocks and bonds, and the gross receipts and net earnings, and the franchise owned by said street railway and the value thereof on June 1, 1899, on motion, the State Board of Equalization assesses and values for taxes of 1899 the property of the said company as follows:

29.16 miles of track and trolley wires	$291,600
86 motor and passenger cars	72,240
13 all other cars	2,080
2 sweepers	200
Lands, buildings and machinery	176,890
All other property	1,250,490
Total	$1,793,500

The "all other property" represents the assessment against the franchise, but the wording was chosen as placing the case in more desirable condition to take into court, as the railway company will lose no time in taking an appeal, and the board is anxious for a decision before making any further assessments of street railways.

The company will go to the highest court in the state and expects to be able to reach the United States Supreme Court, if necessary, on a question of constitutionality. What the courts will decide is altogether an unknown quantity.

Attorneys of high standing having no connection with either side seem to be about equally divided in their opinions, some declaring it will hold while others are equally certain the law has not a peg to hang on.

One thing is sure, if the assessment stands the taxes of the Suburban will be raised from $11,000 in 1898 to $36,000 in 1899, and as the road has never been a dividend payer it will mean a practical confiscation of the property. The same result would follow in the case of many other roads in the state. A few of the best paying properties might be able to stagger under their burden, but the weaker ones certainly could not earn enough money to keep out of the hands of the sheriff. What the lawmakers expect to gain by thus throttling improvements and better service is impossible to comprehend.

VIRGINIA ASSOCIATION.

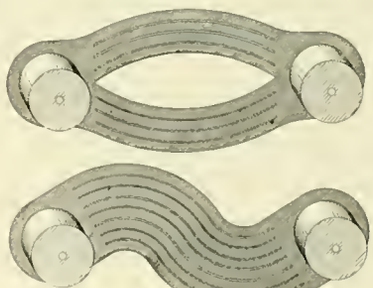
The first annual meeting of the Street Railway and Electrical Association, of Virginia, was held at the Hotel Jefferson, Richmond, on May 16th. The following representatives of the various companies forming the association were present: R. D. Appersen, Staunton Street Car Co.; Howard P. Page, Norfolk & Ocean View Railway Co.; Wm. Rexborough, Norfolk Railway Co.; J. R Curtis, General Electric Co.; C. W. Uthoff, Columbia Incandescent Lamp Co.; Julian Binford, Jr., Tower-Binford Electric & Manufacturing Co.; E. R. Williams, Richmond Traction Co.; R. A. Byrns, Ohio Brass Co., New York; William Todd, Virginia Electrical Railway & Developing Co., Richmond; E. W. Trafford, Richmond Railway & Electric Co.; C. T. Phillips, City Street Car Co., Staunton; R. D. McClure, City Street Car Co., Staunton; J. A. Cooke, Richmond Traction Co.; W. P. Woodson, Lynchburg & Rivermont Street Railway Co.; T. P. Cowardin, Richmond Traction Co.; R. L. Williams, Norfolk Street Railroad Co.

The following papers were read: "Track Bonding," by R. D. Apperson; "How to Increase Revenue of Electric Light Stations," by W. P. Woodson; "Park Amusements," by E. R. Williams; "The Use of the Wattmeter on Electric Cars to Check the Unnecessary Use of Current," by J. R. Curtis.

The association were the guests of the Richmond Traction Co. at a dinner given at the Jefferson Hotel.

MORRIS ONE-PIECE RAIL BOND.

Elmer P. Morris, 15 Cortlandt St., New York City, has placed on the market a new rail bond for which are claimed the advantages of larger contact surface and higher electric conductivity. This bond is made of either flat stripes or round wire and may be placed under the fish plate or around. The bond is also made to attach to the heel of the rail, and, in fact, can be substituted for any other make of bond now in use.



The terminals are made very large to insure a large contact surface between the bond and the rail, and the separation of the connecting portion into comparatively narrow strips or small wires gives the flexibility which is so necessary to a long life. The accompanying illustrations show two of the shapes into which the bond is usually bent.

The terminals are made solid and the ends are drop-forged to the exact sizes required. The bond has terminals from 5/8 in. to 1 in., and is made in sizes having the carrying capacity of from No. 0 to No. 0000, and of any length desired, when placed under the fish plate; it is larger than No. 0000 when placed around the fish plate or on the heel of the rail. Mr. Morris is ready to book orders for future delivery.

THE WHEELING STRIKE.

The employes of the Wheeling (W. Va.) Railway Co., who on April 8th struck for a 25 per cent increase in wages, have the sympathy of the public, and while the cars are all running on schedule time the traffic is very light. The sympathy is not manifested by obstructing the company's tracks since the fine and imprisonment of four men for this offense, but the public largely patronizes buses run by the strikers. There is no present indication of a settlement.

PORTABLE AIR COMPRESSING APPARATUS.

The Christensen Engineering Co., of Milwaukee, has recently placed on the market a very neat and compact air compressing plant, to be used wherever electric current is available, for such purposes as cleaning car cushions, operating pneumatic tools for clipping, caulking, riveting or drilling, and for general purposes. The apparatus herewith illustrated weighs about 1,400 lb. and is strictly portable and self-contained. The air compressor has a capacity of 50 cu. ft. of free air per minute, and is of the same pattern as the company is putting on the market for air brake purposes. It is prepared to furnish this style of portable apparatus in sizes ranging in capacity from 10 cu. ft. to 300 cu. ft. of free air per minute.

CHRISTENSEN PORTABLE COMPRESSOR.

The air compressor is self contained and all the working parts run in a bath of oil, the motor being arranged on the top of the compressor, and connected to the compressor crank shaft by means

WITH COVER REMOVED.

of a gear and pinion of a special pattern first introduced by the Christensen Engineering Co.; the teeth of the gear and pinion are sections of a true helix, which construction, it is claimed, makes their operation practically noiseless, and increases their durability fully 25 per cent over that of the ordinary straight faced spur gear and pinion.

The compressor delivers air into the reservoirs from which a hose connection carries the compressed air to the point where it is to do the work. The action of the compressor is controlled by means of an automatic governor, which operates by the air pressure accumulated in the reservoirs, in such a way that the motor stops whenever the pressure is at a maximum and stops when it is at minimum, with any desired variation between the two extremes.

The compressor is not provided with a water jacket, as experience has shown that in this form of construction, the compressor will run half the time without any undue heat. This makes the apparatus much more convenient than if it was necessary to have cooling water around the cylinders and the back heads, thereby introducing extra complications and need of care taking.

The box which encloses the motor compressor and also the electrical apparatus is water tight and it is so arranged that access is readily had to the various parts of the apparatus by simply opening doors arranged in the box for that purpose.

This apparatus is now being used in riveting the structural iron in course of erection on the new Post Office Building in Chicago.

On June 8th a foundry in Milwaukee, which made a large number of castings for the Christensen Engineering Co., was burned and many of the Christensen patterns were destroyed. The company has duplicates of all patterns, however, and this loss will not put it back in filling orders.

WILCOXON FOUND GUILTY.

In the United States Circuit Court at Springfield, Ill., on June 9th a jury returned a verdict of guilty in the case of C. N. Wilcoxon, for using the mails to defraud, and the court sentenced him to pay a fine of $500 and costs, amounting in all to about $1,200.

The swindle is as unique and interesting as it is unusual and reprehensible. Last June Mr. W. L. Ferguson, who was then manager of the lines at Decatur, Ill., received a proposition written on the letter head of the Richmond & Eaton Traction Co., Richmond, Ind., and signed by John M. Case, president of the company, to come to Richmond and take the management of the new road. The inducements were very liberal and by a strange accident the parties whom Mr. Ferguson wrote had in mind a project bearing a name very similar and which was being backed by responsible men. On the strength of the letters Mr. Ferguson resigned his position in Decatur and received his appointment as general manager of the Indiana road taking effect June 1, 1898. Just at this time C. N. Wilcoxon appeared in Decatur, applied for the position about to be vacated and was employed, which position he has since held.

Plausible letters from "John M. Case, President" accounting for delay in construction kept Mr. Ferguson in Decatur for several weeks. Whenever he tried to set a date to come to Richmond, a telegram from Detroit or some other point would state absence of Mr. Case on business and a request to postpone a few days or a week. In this way Mr. Ferguson was kept away for over a month, until one day he arrived in Richmond only to discover there was neither any Mr. Case, or railroad or position. The whole correspondence of two or three months was placed in the hands of the post office secret service, and in a short time the printer who printed the bogus letter heads was found in Muncie, where Wilcoxon had relatives, and who identified Wilcoxon as the party who had ordered and paid for them. Many other unmistakable proofs were discovered and in January a United States grand jury indicted Wilcoxon for using the mails to defraud. He was arrested and on January 6th was released on $1,500 bail, the bond being signed by Wm. L. Shellabarger, who was then secretary of the Decatur City Electric Ry., of which Wilcoxon was manager. The case came up for trial in February. Wilcoxon sprung a surprise by coming into court with a double, the two men being dressed exactly alike even to smallest detail of cuff buttons and necktie. Outside of Wilcoxon's own attorney few persons present could distinguish one from another. The case, however, did not get to trial, and was continued until June when the result was reached as above stated, after a trial lasting three days.

The United Traction & Electric Co., Providence, R. I., is being sued by David N. Smith of New York City for $500,000. Mr. Smith claims the company owes him this amount for failure to transfer stock.

ECHOES FROM THE TRADE

BOOTH & FLINN, of Pittsburg, Pa., have made contracts with the Consolidated Traction Co. of that city to the amount of from $600,000 to $700,000, for the reconstruction of its suburban rapid transit line.

THE GARTON-DANIELS ELECTRIC CO., of Keokuk, Ia., maker of the well-known Garton lightning arrester, advise us that it is busier now than at any previous times. The company's sales for May were equal to one-third of the total sales for 1898.

THE AMERICAN ELECTRICAL WORKS again takes advantage of Decoration Day to send to its many friends a delicate and extremely well executed steel engraving of General Grant. It belongs to the series which includes Washington and other great Americans.

THE PARTNERSHIP heretofore existing under the firm name of Wilson, Thomson & Co., Brooklyn, N. Y., manufacturers of the Wilson Patent Trolley-Pole Catcher, has been dissolved by mutual consent, Mr. Thomson retiring. The business will be continued under the name of Wilson & Co., and all obligations of the old firm have been assumed by Wilson & Co.

THE ELECTRICAL INSTALLATION CO., of Chicago, street railway contractor, believes in putting its advertisements in a permanent form and has sent to its friends handsome card cases of seal leather; the card of the company is in gilt letters on the inner side of one pocket and the name of the recipient also in gilt is on the other pocket. The editor is pleased to have received one.

THE UNIVERSITY OF TENNESSEE last year erected a new building for the department of mechanical engineering and mechanical arts. The need of such a building has been manifested for some time and the trustees decided to put up one fully adapted to the uses for which it was designed. It is named after Joseph Estabrook, in recognition of his valuable services as president from 1834 to 1850.

THE CLEVELAND FROG & CROSSING CO., Cleveland, O., has found expansion a necessary policy. The company's Eastern business has increased to such an extent that it has been deemed expedient to have permanent representation there. The firm of L. J. Buckery & Co., of 257 Broadway, N. Y., has therefore been appointed the Eastern agents and will henceforth control all the Eastern business.

THE JACKSON & SHARP CO., of Wilmington, Del., has just delivered to the Syracuse, Lakeside & Baldwinsville Railroad Co. a number of new double deck cars. The railroad company will put them in for summer use. They are quite a novelty in the vicinity of Syracuse and will without any doubt prove a great card for the company's summer suburban traffic. The cars will seat about seventy-five passengers.

THE G. P. MAGANN AIR BRAKE CO., of Detroit, has recently issued a pamphlet describing its storage air brake system which managers will read with interest. The advantages claimed for this system are: 1. Absence of complicated machinery on the car. 2. Constant air supply. 3. Positive and instantaneous release of brakes. 4. Noiseless operation. 5. No leakage. 6. Economy in use of air. 7. Economy in first cost of brakes.

THE PHILADELPHIA EXPOSITION management advises us that a special building for transportation exhibits is being constructed; it is 450 ft. long and has four tracks, giving a total length of trackage of about 800 ft. It has already received several applications for space in this structure, and is assured of a creditable exhibit of street railway cars and equipment of American manufacture, which are already exported in considerable numbers.

THE MICA INSULATOR CO., of New York City, is especially equipped for the manufacture of material used by the makers of electric vehicles. It is having great success with its "Micanite" insulation and is so certain of giving satisfaction that it offers to send free, for trial, a set of rings and segments for motors and samples of its "Micanite" and "Empire" insulating cloth and paper. The company has a branch office on Lake St., Chicago.

ADAM COOK'S SONS, 313 West St., New York, advise us that engineers who have used their "Original Albany Grease" report splendid results in lubrication with a saving in repairs impossible where mineral greases were formerly employed. Those in charge of fast running machinery recognize that the matter of expense for repairs is an important one and that a pure lubricant is essential to keep the machinery in order, and the "Albany" grease is continually growing in favor.

THE B. F. STURTEVANT CO., whose well-known "chimneyless" factory is situated at Jamaica Plain near Boston, is making an addition to its already large floor space for electrical work. Another story is being added to two of its shops, one 125 ft. by 50 ft. and the other 100 ft. square, both of which will be used for this purpose. The increase in this department has been enormous. The company is now making electric motors up to 125 h. p. and generators up to 100 kw.

THE NATIONAL SUPPLY CO., of New York, makes the claim that its "Standard Cold Water" paint for both interior and exterior use has features of excellence not to be found in any oil paint made. The three strongest talking points are that it resists fire and water and will not turn yellow with age. The company makes a great variety of colors adapted for use on cars, factories, bridges, warehouses, electric plants, barns, and in fact anywhere, indoors or out, that paint is used.

THE W. H. ELLIOTT ELECTRIC CO., of Cleveland, O., has been so favorably affected by the prosperous conditions of the country that it has found its present shops entirely inadequate to the increasing business. The company has moved into new quarters at 1076 Hamilton St., where it has double the room it had before and double the facilities for turning out its products. The company is a popular one and will need every facility the new and larger works afford, to supply the demands of its trade.

THE JEFFREY MANUFACTURING CO., of Columbus, O., maker of electric and compressed air coal mining machinery, has just issued its mining department catalog No. 16. The book is very complete and shows numerous illustrations of air drills, electric chain machines, self-propelling trucks, bits, electric motors, shearing machines, reels and cables, electric haulage machinery, and in fact every device to make the cutting out of coal possible and cheap. The catalog contains much valuable information and will be sent on application.

LEHIGH UNIVERSITY, Bethlehem, Pa., announces a summer course of study from July 5th to August 16th and applications should be made to "The Secretary of Lehigh University, South Bethlehem, Pa.," before July 1st. This summer school was organized in 1893 by the department of Civil Engineering. In 1898 was made a part of the regular program and in addition to the regular courses, ordinarily given to students of the University only, it has been decided to offer a number of courses in various departments which will be open to all applicants qualified to take them. The courses include electrical engineering.

THE CLAYTON AIR COMPRESSOR WORKS, of New York City, is just now sending out its catalog No. 10 which is one of the most complete books of the kind issued. It embodies the latest and highest types of air compressing machinery and contains illustrations and lists of sizes of standard patterns and descriptions of the Clayton type of compressor. The book will be found valuable for its data and tables relating to compressed air transmission, capacity lost by air compressors in operation of various altitudes, etc.

A. L. WHIPPLE has joined the ranks of the Chicago street railway supply men, and opened a pleasant office in the Chamber of Commerce Building, where he represents the Western interests of the E. T. Burrowes Co., of Portland, Me. He already enjoyed a wide acquaintance among the steam road people, and is rapidly getting to know the Western managers of street railways. He reports an excellent Western trade in the Burrowes car curtain, and that the factory is working up to full capacity. Mr. Whipple will make his home in Chicago.

THE UNIVERSITY OF WISCONSIN has issued a circular outlining courses of graduate study in electrical engineering to begin September 27th. The University of Wisconsin is essentially a college of mechanics and engineering. The laboratories are all well equipped for instruction and investigation and the most advanced students can find all their requirements fulfilled. There are separate laboratory equipments for the divisions of electromagnetism and dynamos, alternating currents and applied electro-chemistry. Catalogs and all information desired will be furnished upon application to the registrar, W. D. Hiestand, or to Prof. D. C. Jackson, Madison, Wis.

THE CHRISTENSEN ENGINEERING CO., of Milwaukee, Wis., will soon increase its facilities. The great popularity of the air brakes made by this company is responsible for this necessity. The orders are pouring in from all parts of the country and the shops are overrun with work. While it is true this air brake company is manufacturing brakes in large quantities for foreign car companies, the bulk of the orders is for this country. It is reported that there is hardly a street railway company of any size east or west which has not ordered brakes from this company, and the continued activity will oblige it to extend its plant in no small degree.

THE AMERICAN ELECTRICAL DIRECTORY AND BUYERS' MANUAL, published by the E. L. Powers Co., of New York, is out. This is a valuable work for all concerns having electric apparatus for sale, as it gives a complete list of all the electric lighting central stations in the United States, Canada and Mexico, and a great deal of information regarding the financial condition of the companies, the names of officials and the capacity of the stations. On the other hand, for the use of consumers there is a complete list of manufacturers and larger dealers in electrical supplies. The current issue is No. 1 of the seventh volume. It is published quarterly.

THE ELECTRICAL INSTALLATION CO., in the Monadnock Building, Chicago, puts forward its thirteen years' experience in the highest class of work as a guarantee for the future. The company is one of entire financial responsibility, thorough organization and equipment and is prepared to contract for the complete construction of electric railways and lighting plants. It names among its customers many of the best and most successful roads in the country, the range extending east and west, north and south. The company has recently taken the contract for completely rehabilitating the electric lighting system of Vicksburg, Miss. Work is to be started at once and completed within 90 days.

THE VAN DORN & DUTTON CO., of Cleveland, O., has decided to give special attention to its motor and armature department. The first move in this direction was the securing of the services of Mr. W. H. Elliott as manager. Mr. Elliott will unquestionably prove a valuable acquisition to the company. He has had more than 15 years' experience in connection with electrical matters and is fully and thoroughly qualified for the position he is filling. The Van Dorn & Dutton Co. is an extensive manufacturer of steel, malleable and cast iron gears and pinions and of rawhide combinations. It is also fully equipped for repairing armatures, generators, dynamos and motors and can promise quick delivery of all work put in its hands.

THE NEW PROCESS RAWHIDE CO., of Syracuse, N. Y., lately received a letter from Charles H. Mayer, treasurer of the York (Pa.) Street Railway Co., regarding a rawhide pinion which has been in use for 14 months. Mr. Mayer said the pinion had been in service on an average of 105 miles a day for all those months and that its wearing qualities had proved equal to any steel pinion he had ever seen. The teeth had been worn to a keen edge without a break and the gear had not been injured in the least. This pinion was one out of a lot and was simply a sample of all the rest. The New Process Rawhide Co. is in constant receipt of just such testimonials and they prove, as nothing else can, the excellence of the pinion the company makes.

THE FOREST CITY ELECTRIC CO., of Cleveland, O., is directly in line with all the large concerns of the country in feeling the boom in trade. It seems as if this company could not get room enough for its work. Not long ago the company moved into new shops, where it had about double the space of the old. It had just begun to feel comfortable in the new quarters when another boom came along, and, though the works are kept going night and day and a double force is employed, the demand still keeps ahead of the possible supply. The company was obliged to have more room, and it is now building an addition to the works which covers 30 x 120 ft. This addition will be finished in a few days, and then the company hopes to be able to catch up on orders and in the future meet every demand with promptness.

THE STEWART HARTSHORN CO., East Newark, N. J., manufacturer of the popular shade roller, publishes a humorous paper called "Hartshorn's Roller," which has reached Vol. XI., No. 4. It is a 16-page paper, well illustrated, and full of admirably selected jokes. One cannot help reading it through and enjoying it, and at the same time one cannot help seeing and being impressed with the excellent qualities of the Hartshorn roller. This shade roller has been on the market for years. Thousands of people have used it and are using it, but it is safe to say that but few out of the many have any conception of the number of excellent features it possesses. The publication will afford much interest to any reader and will give much information regarding a most valuable and necessary invention.

THE G. P. MAGANN AIR BRAKE CO., of Detroit, Mich., recently received a very strong testimonial from John Busby, superintendent of the Detroit & Pontiac Railway Co. Mr. Busby was emphatic in saying the Magann brake had proven superior to any he had ever used. The brake has been in use on this road for more than a year and the experience with it has led Mr. Busby to speak in the most flattering terms. He mentions a number of other air brakes he has tried, but says on one account alone, that no repairs have been required and no motors to keep in order, the Magann is by far the best of them all. The company has been operating 12 cars with this brake. They will make 400 stops without recharging and on two cars which lay over night at one end of the line there is only a loss of three or four pounds of air during the night.

THE CONSOLIDATED CAR FENDER CO., of Providence, R. I., is meeting with remarkable success with its fenders. The orders were never so large as during the past month. It is now supplying fenders to the Metropolitan Street Railway Co., New York; Omaha Street Railway Co., Omaha, Neb.; Ottawa Car Co., Ottawa, Ont.; Des Moines City Railway Co., Des Moines, Ia.; Paterson Railway Co., Paterson, N. J.; Troy City Railway Co., Troy, N. Y., and Union Depot Railroad Co., St. Louis, Mo. It has also shipped a large number of parts of equipments to City Electric Railway Co., Port Huron, Mich.; Hartford Street Railway Co., Hartford, Conn.; Staten Island Midland Railroad Co., Stapleton, N. Y.; Meriden Electric R. R., Meriden, Conn.; Fair Haven & Westville Railroad Co., New Haven, Conn.; Auburn City Railway Co., Auburn, N. Y.; North Hudson County County Railway Co., Hoboken, N. J.; North Jersey Street Railway Co., Jersey City, N. J.; Middletown-Goshen Traction Co., Middletown, N. Y., and Utica Belt Line Street Railway Co., Utica, N. Y.

THE FOSTER ENGINEERING CO., Newark, N. J., is advertising its Foster pressure regulator by distributing decks of playing cards, which ought to prove very useful during the summer season.

THE STREET RAILWAY DEPARTMENT of the Western Electrical Supply Co., of St. Louis, Mo., is still progressing rapidly and pushing to the front its street railway products, which have now a national reputation; this is due to pluck and push, backed by the excellent assortment of standard goods, and the reputation of the manufacturers whom it represents.

THE FILER & STOWELL CO., Milwaukee, reports that it is very busy. Within the past few days it has received a number of orders for engines, which include one simple engine 18 x 42 in. and one cross-compound 16 and 30 x 48 in., both direct connected, for the Woonsocket Street Ry., Attlesboro, R. I., two tandem compounds 18 and 36 x 48 in. for the Queen City Cotton Co., Burlington, Vt.; two cross-compounds, 28 and 56 x 60 in. and 18 and 36 x 48 in., for the Berkshire Cotton Manufacturing Co., Adams, Mass. The company has just shipped to the Chicago & Milwaukee Electric Ry. a center-crank corliss engine of 750 h. p.

GOULD & EBERHARDT, of Newark, N. J., designers and builders of machine tools, have just issued a booklet in which some pertinent questions are asked and some strong statements are made. All the latter the company is fully prepared to back up, and as for the former the contrasting illustrations make the most complete answers. The booklet is called "Like This," and the company asks if you had not better do "Like This," instead of "Like This." This particular booklet shows contrasts to prove that the Eberhardt sand sifter is the best on the market. The firm also deals in shapers, drill presses, cutters, grinders, lathes and hundreds of other machines and devices used in manufacturing plants.

THE H. W. JOHNS MANUFACTURING CO. had its new fuse on exhibition at the electrical exposition at the Madison Square Garden, New York City. This fuse is of the enclosed type and does not arc but indicates. It is known as the "Noarc" fuse and embodies features which cannot fail to secure the approval of all who use it. It is claimed to be sure, safe and accurate. The H. W. Johns Co. is very busy in all its lines but is particularly so in its electrical departments. The company has for some time past been employing a double force in the factory, working both night and day. It has orders ahead now for over 200 miles of overhead material, many of the orders being for export. The demand also for the "Vulcabeston" insulation, made by the concern, is constantly growing and is thoroughly liked by all manufacturers of electrical machinery.

THE EMERGENCY HOSE BRIDGE, made by the Ohio Brass Co., of Mansfield, O., was illustrated and described in the May issue of the "Review." This company has recently begun the exclusive manufacture of this device and is having great success with it, not only as regards sales but in the expressions of satisfaction received from all who have used it. The largest railway companies in the country have adopted this bridge. Among them may be mentioned the Syracuse (N. Y.) Rapid Transit Co., the Chicago City Street Railway Co., the Toledo (O.) Traction Co., the Nashville (Tenn.) Street Railway Co., the Knoxville (Tenn.) Traction Co. and the People's Railway Co., of Dayton, O.

This hose bridge is a thoroughly practical device and is reported to have never yet failed to meet any conditions or emergencies to which it has been applied.

THE WESTERN ELECTRIC CO. keeps the trade thoroughly posted on all the new devices and inventions it has ready for the market. The company has just distributed catalogs on the "Petite" arc lamp, a circular descriptive of the "Matchless" electric lighter, the "S. K. C." lightning arrester, the "S. K. C." single phase motors and type G transformers. The company has made a contract to furnish a Chicago building with one 40-k. w. Western Electric direct current generator and a switchboard for the same, and will install the apparatus and do the wiring for 500 16-c. p. lamps. It is also putting 10 motors in the Great Northern Hotel, Chicago, to operate the ventilating apparatus, laundry and other machinery. The United States Express Co. has a 30-k. w. Western Electric direct generator, to be used for running 400 16-c. p. incandescent lamps. These are but samples of the orders daily received by this company.

"WONDERLAND '99" is the title of a handsomely gotten up book published by the Northern Pacific Ry. It is a work of over a hundred pages, profusely illustrated and printed on the best of paper.

The book is written in an easy, entertaining style and affords graphic descriptions of what is indeed the "Wonderland" tributary to the railroad system which traverses it. The author takes his reader from what he very truthfully calls the "Lake Park Region" of Minnesota through Dakota, Montana and Washington, giving running descriptions and fine photographic views of the country. The route includes the canyons, the Yellowstone region and the Yellowstone National Park, the geysers, Mammoth Hot Springs, over Mount Ranier into Alaska and skirting Puget Sound and the Pacific Ocean leads the way into California, until the eye rests upon the snow capped peaks of Mt. Shasta.

Think of it! Mt. Shasta, Mt. Hood, Mt. Ranier, Mt. Adams—all on a trip to or from California by way of the Northern Pacific Ry.

THE B. F. STURTEVANT CO., of Boston, Mass., early recognized the demand for electrically driven fans, which was sure to follow the general distribution of electricity for power purposes. Its first fan motors were built about 10 years ago, since which time designs have been perfected, the number of types greatly increased, and a large electrical department established. Some of the recent products of this company in the way of special electric fans are presented to its Bulletins H. and M. The former relates to the enclosed fans, the latter to propeller ventilating wheels. The wonderful endurance of a well designed and thoroughly constructed fan blower is very emphatically evidenced by a recent statement of The William Kennedy & Sons, Ltd., Owen Sound, Can., to this effect: "We have two Sturtevant pressure blowers in use, one of which has run over 32 years steady, and often 24 hours per day, and is apparently as good as when installed, although no one has as yet seen the inside of it. The other has been used for foundry purposes, and has been in use for about 30 years or so."

THE WISCONSIN ENGINEER for May contains an interesting sketch of Prof. J. B. Johnson, the new dean of the College of Engineering, University of Wisconsin. This branch of the university has been growing constantly in importance, and a year ago it was deemed advisable to establish a deanship. Prof. Johnson was called to fill the chair, but does not take up his work at the university until next fall. In the meantime he is traveling in Europe making a study of the industrial systems of education in the old country.

The number contains many other interesting articles including one by Prof. Burgess, E. E., on "Electro Chemistry," and one by Prof. D. C. Jackson on "Electrolytic Corrosion of Water and Gas Pipes." Both of these authors are members of the university faculty.

Among other subjects discussed by various writers are the following: "Terrestrial Magnetism," "Photography of Sound Waves," "Photography in Colors," "Progress in the College of Mechanics and Engineering," "Outline of Trip made by Junior Civil Engineer."

GATES & RANDOLPH have taken the offices on the ground floor of the Monadnock Building, Chicago, formerly occupied by Sargent & Lundy; the suite is No. 13-15. They are handling the apparatus of the Triumph Electric Co., Cincinnati, for direct current work; of the Warren Electric Manufacturing Co., Sandusky, O., for alternating work; of the Empire Electrical Instrument Co., New York, for portable switchboard alternating and direct current instruments; of F. A. La Roche & Co., New York, for switchboards, circuit breakers and switches; of the Sterling Arc Lamp Co., New York, enclosed arc lamp for all circuits. It is the purpose of Gates & Randolph to operate a miniature electric lighting plant in their new warerooms, using a "Triumph" motor running a "Warren" alternator through a La Roche switchboard, with "Empire" instruments and transformers, etc., with arc and incandescent lamps and motors running through the same circuit. Gates & Randolph

are old timers in the electrical business and we predict for such a team a large volume of business. They will not only handle electrical apparatus, but they will undertake contracts for street railway and lighting plants. In addition to the companies mentioned the firm represents the Card Electric Co., of Mansfield, O., and the Sterling Arc Lamp Co., of New York.

THE E. P. ALLIS CO., of Milwaukee, finds it impossible to anywhere near keep up with the demand for heavy engines for electric railways. Orders are pouring in from both home and abroad. The company is now engaged on a very large contract for the Metropolitan Street Railway Co., of New York, for 11 of the largest engines of the kind ever built in this country, if not in the world. These engines will each be of 4,500 h. p., having a maximum capacity of 7,000. The cylinders are 46 and 86 x 60 in. and the distance from the foundation to the top of cylinders is about 38 ft. 3 in. There is a hollow shaft with a diameter of 37 in. at center and an opening 16 in. in diameter extending the entire length. The journals are 34 x 60 in. Three of these engines have been delivered and one more is in transit.

The company is also building two engines for the Boston Elevated Railway Co. of the same type as the above. Also two of 2,500 h. p. each for the South Side Elevated Railway Co., Chicago, two of 2,250 h. p. each for the Metropolitan West Side Elevated Railway Co., Chicago, and one of 1,000 h. p. for the Northwestern Elevated Railway Co., Chicago. It is building two engines, 2,500 h. p. and 1,200 h. p. for the Metropolitan Street Railway Co., Kansas City, Mo.; one of 2,000 h. p. for the North Jersey Street Railway Co., Jersey City, N. J., four engines, two 1,600 h. p. and two of 1,000 h. p. for the Milwaukee Electric Railway & Light Co.; one of 1,600 h. p. for the Toledo (O.) Traction Co.; one of 1,300 h. p. for the Consolidated Street Railway Co., Grand Rapids, Mich.; one of 1,300 h. p. for the New Orleans & Carrolton Railway Co., and three 1,000 h. p. engines for service in Richmond, Va. Besides these the company is at work on four 1,000 h. p. engines for Bristol, four of the same capacity for the London Tramways Co. and three 1,600 h. p. for the London Electric Lighting Co., all of England. There is also a great amount of smaller work goin on, both for this and foreign countries, all of which is causing the company to run full capacity and full time.

ROUTE TO THE CONVENTION.

The Boston & Albany R. R. is perfecting arrangements to take the Boston delegates and visitors to the annual street car convention to be held in Chicago next fall, in the most comfortable manner. It will run special cars through to Chicago, connecting at Albany with a special train on the New York Central. The Boston & Albany is a splendidly equipped road and affords its patrons excellent service. Its cleanliness is a marked feature. By sprinkling its road bed thoroughly with oil the dust is kept down, and passengers can travel comfortably in the dryest weather.

CHEAP EXCURSIONS.

For the meeting of the National Education Association, at Los Angeles, Cal., July 11th to 14th, cheap excursion rates have been made and delegates and others interested should bear in mind that the best route to each convention city is via the Chicago, Milwaukee & St. Paul Ry. and its connections. Choice of routes is offered those going to the meetings on the Pacific Coast of going via Omaha or Kansas City and returning by St. Paul and Minneapolis. The Chicago, Milwaukee & St. Paul Ry. has the short line between Chicago and Omaha, and the best line between Chicago, St. Paul and Minneapolis, the route of the Pioneer Limited, the only perfect train in the world.

All coupon ticket agents sell tickets via the Chicago, Milwaukee & St. Paul Ry. For time tables and information as to rates and routes address Geo. H. Heafford, general passenger agent, Chicago, Ill.

FOREIGN FACTS.

The Poole & District Light Ry., of Poole, England, has been authorized.

Extensions to the electric tramways in Bristol, England, are about completed and cars will be running by July 1st.

The overhead system will be in use this month on the Giant's Causeway, Portrush & Bush Valley Railway & Tramway Co., Ireland.

The tramways at Darwen, England, have been purchased by a new company, and they are to be converted from steam to electric traction.

The London United Tramway Co. has received permission from the London County Council to reconstruct the tramways in Hammersmith with the overhead trolley system.

The taxpayers of Lowestoft, England, object to a proposed electric tramway being constructed on the Marine Parade, and the petitioners have asked for a change of route.

Newcastle, England, is anxious for an electric railway, and is only waiting for Parliament to pass the tramway bill. The telephone company has withdrawn its opposition.

The Plymouth, England, tramways committee has recommended the adoption of electric traction on the Hyde Park and Compton routes. The estimated cost is £18,000, but the committee believes it will pay.

An electric road has been built between the towns of Ashton and Denton, England. A trial trip was made on April 3d from Denton to Gee Cross and on May 28th the first electric car was run the full length of the line.

The doctors in Hastings, England, have declared that the introduction of electricity into the city will injure it as a health resort, and this has caused a committee in the House of Lords to throw out a bill for an electric road.

Plans are reported for an immense water power plant in Italy, and the electric energy generated is to be used for traction purposes on the Bergamo-Lecco, the Bergamo-Seregno, the Bergamo-Milan and the Bergamo-Breslio railways.

The British Electric Traction Co., of Pontypridd, Wales, is applying to the Light Railway Commissioners for the privilege to extend its present tramway from Porth, from the terminus at Pontypridd, in the direction of Cilfynydd.

The Eastern Telegraph Co., of Cape Town, has brought a damage suit against the Cape Town Tramway Co. for £50,000. It is claimed that the leakage from the tramway company's electric wires interfere with the telegraph company's cable system.

The New General Traction Co. has been organized in England to build electric roads and lighting plants. The company is in an extremely prosperous condition financially and is now engaged in the construction of three tramways, Douglas Tramway on the Isle of Man, and one each in Coventry and Norwich.

H. Collbran, an American contractor for the Seoul-Chemulpo Ry., is just completing the construction of an overhead-trolley electric street railroad of some six miles in length in Seoul, for a Korean company. The materials for this road are from America and Japan, the car bodies having been neatly constructed by the Japanese.

Mr. F. Armstrong, British consul at Milan, Italy, is urging British manufacturers of electric appliances to keep their eyes on Italy as a field for trade. He speaks of the great exposition of electricity in all its applications now in progress at Como, and says the government is at present contemplating the construction of large water power plants for generating electricity, to be utilized for traction purposes. The railways in Italy are nearly all state property. The Mediterranean, one of the biggest companies, has experimented very successfully with electricity on its line between Milan and Monza. The Edison Co. supplies a current at 3,600 volts, which is transformed to 500 volts at the Milan station. For 60 k. w. the railway company pays £9.20 a year.

NEW PUBLICATIONS.

THE OTHER SIDE is the title of a 16-page weekly to be issued shortly with Allen R. Foote, editor, which will aim to fairly collate the current views and expressions of writers and thinkers on both sides of such questions as treat on the relations of the public to quasi-public institutions. The Other Side Publishing Co., Chicago; $1 per year.

MR. ALLEN RIPLEY FOOTE, author of the "Law of Incorporated Companies Operating Under Municipal Franchises," has in press a new book entitled "Municipal Public Service Industries," which is full of interest to railway managers and students of street railway problems. Mr. Foote proposes a system under which he believes the mooted questions of public and corporate rights can be justly and equitably settled "provided each party is willing to make a settlement that will conform with the requirements of correct economic principles uninfluenced by any other considerations." Cloth bound, 268 pages, price $1. The Other Side Publishing Co., Chicago.

THE MUNICIPALIZATION OF STREET RAILWAYS was the subject considered in the twenty-ninth annual joint debate of the University of Wisconsin, held in December last, and a full report has just been published by the university. The question as put by the president of the evening, Prof. D. B. Frankenburger, was: "Is the present system of private ownership and operation of the street railway line of the city of Chicago preferable to a system of municipal ownership and operation?"

The debaters for the affirmative were Benjamin Poss, Joseph Loeb and Wm. S. Kies. On the negative side were Wm. F. Adams, Warren M. Persons and Emerson Ela.

At the time of debate the question was one of especial interest, as it was then Mr. Yerkes was making his formidable fight for a renewal of long franchises. The question is at all times one of interest to any taxpayer of any city. The young men engaged in the debate were many months in preparing for the fray and thoroughly posted themselves on the subject. There was a genuine effort to bring out the strength and weakness of a system of municipal ownership of street railways and they handled the subject in a masterful manner, thoroughly interesting a large and a very critical audience.

The judges were Prof. Charles H. Haskins, Hon. Burr W. Jones and Prof. Chas. S. Slichter. They gave a unanimous decision for the affirmative.

THE Street Railway Review

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Even the most progressive and aggressive of the professional friends of labor are not exempt from some of the disagreeable results of unionism, as is witnessed by the fact that the firm of Pingree & Smith of Detroit, in which Governor Pingree is the senior partner, last month found it necessary to declare a lock-out and shut down its factory in order to vindicate its right to manage its own business.

How far a misplaced sympathy can lead men to their own disadvantage was shown in Cleveland during the Big Consolidated strike. A foreman employed by the Cleveland Foundry Co. had ridden to his work in a street car operated by non-union men, and the employes of the foundry demanded his discharge; to enforce the demand 400 quit work on June 20th. June 28th the greater number of these men returned to work; the offending foreman is not yet discharged and the net result to the men is the loss of a week's wages.

The action of the South Park Commissioners, the body having control of the parks and boulevards in the south division of the city of Chicago, in prohibiting the use of automobiles in the parks or on the boulevards, together with the arrest of officers of one of the automobile manufacturing companies on the charge of disturbing the peace when they violated the board's order, and their subsequent discharge when the case came to trial, all savor of an advertisement. If the order against automobiles was secured at the instance of the makers we congratulate them; if it was issued in good faith by the park board we feel that a "campaign of education" would not be amiss.

It is not improbable that the haulage of freight in large quantities may be diverted into other channels if not soon undertaken by the railway companies of some of our large cities. Already in New York City, where this subject has been considerably agitated, an automobile company has been organized for transporting merchandise about the city. A number of the most prominent merchants in the city are among the organizers of this company, which it is expected will do away with a large number of trucks and delivery wagons and their attendent expense, and will be able to handle the goods in larger quantities and much more expeditiously than with horses.

Within the last few years some steam railroad companies, notably the Boston & Albany and the Long Island, have sprinkled their roadbeds with crude petroleum in order to lay the dust and prevent the growth of vegetation. These experiments have been reported as quite successful in every instance where oil has been thus applied; the cost is stated to be about $150 per mile per year. It had occurred to us that sprinkling the roadbeds of electric interurban lines having a private right of way might be equally desirable, but we had no idea that oil could be thus used with advantage on roads subjected to wagon traffic.

It is now stated, however, that the experiment of treating country roads with oil is to be made near Des Moines, Ia., under the direction of the United States Department of Agriculture. The results will be awaited with great interest.

There was probably more rioting and ruffianism connected with the strike on the Big Consolidated system, of Cleveland, last month, than has attended a street railway strike since that at Milwaukee in 1896. The strikers and their "sympathizers" attacked the cars with bricks and stones, injuring in more than one instance women and children who were passengers, and beat into insensibility the non-union men who were trying to exercise one of their "unalienable rights"—that to earn an honest living. Great damage was done to the company's property, the cars being defaced and switch points broken or carried away—everything that was loose suffered. When the police forcibly dispersed mobs a loud protest went up against allowing the city thus to aid the company.

The question at issue was the vital one of whether the company should be permitted to hire and discharge its employes without the advice and consent—otherwise, dictation—of a labor union. The terms of the settlement finally reached show that the company was willing to accede to all reasonable demands.

The Supreme Court of Ohio has affirmed the verdict of a lower court, which awarded $10,000 damages to a woman for a permanently injured leg. The original claim was for $20,000. We do not know how severe or painful or disabling the injuries in question may be, but we cannot forget that it will take the fares from 200,000 passengers to pay it, and then the company has its expense to meet incurred in carrying all these people, which will bring the number up to fully 350,000. As the road is by no means a

large one, nor the city in which it operates a big city, the burden is sure to be a heavy one to bear. In this particular case the amount may have been deserved, though $10,000 looks large to us and is usually a balm the curative effects of which are surprising. It is easy to spend other people's money, and juries are no exception to the rule.

And now comes the vehicle with many names,—on no one of which any agreement has as yet been reached,—the horseless carriage to compete with the time-honored street car. To what extent its rivalry will mean competition and a dividing of the present business of hauling passengers, we will know more later. It would not appear, however, that it is likely to make any serious inroads upon street railway earnings as the bicycle has done. Its use for a long time will be confined to the class who can and now do patronize the horse and carriage or cab. In Chicago automobiles will take the place of a line of carettes, which are the embodiment of all that is terrible in appearance and use, and the fleshless horses which drag them can now seek some quiet spot to die. But when it comes to undertaking to handle large volumes of people with anything like regularity and expedition it will have to be done on rails and not on pavements.

The horseless carriage has, however, come to stay, and soon will displace horses in all our large cities for the general cab service. As they multiply they will become cheaper and already they have almost ceased to be a novelty or attract attention.

While the use of the three-wire system in street railway work has been tried and abandoned in several instances as unsuccessful, this method of electrical distribution presents many attractive features to street railway engineers, and it is an open question whether the system has been given a sufficiently exhaustive trial to definitely determine its value in traction work. It still remains to be seen whether the early failures in the application of this system were due to any inherent and insuperable difficulties or to such defects in the engineering details as will always occur in the introduction of entirely new methods. This system will again claim the attention of street railway men owing to its proposed introduction upon two large railway systems, those of the Consolidated Traction Co., of Pittsburg, Pa., and of the London United Tramways Co., of London, Eng., the latter being described elsewhere in this issue. Theoretically considered, the three-wire system offers a great advantage over the two-wire in the amount of copper required for transmitting a given amount of energy, as in the simplest case it requires but one-fourth the copper to transmit a given current at a given loss. This follows from the fact that by doubling the voltage only half the amount of current for the same energy is required. In practice, however, a neutral wire is used of the same size as the positive and negative wires and this brings the amount of copper up to three-eighths of what is required for the two-wire system in case the grounded circuit contains as much copper as the overhead lines. When the track alone is used to carry the return current, without being paralleled by any ground wire, the amount of copper in the two-wire system is halved, and the saving of copper in this case by the use of the three-wire system would amount to only one-eighth of that used in a complete two-wire circuit, or one-quarter of the overhead copper. It is obvious, therefore, that for a railway having a single overhead circuit with a grounded return the saving in copper, although considerable, is far less than is the case in a lighting system where there are no tracks to replace part of the copper in the circuit. The actual amount of copper saved may vary from one-eighth where no copper return is used, to five-eighths where the grounded copper is equal in amount to the overhead copper, and in practice it would fall somewhere between these limits. The necessity for using considerable grounded copper has become in recent years more and more apparent both on account of reducing the resistance on long lines of railways and preventing the electrolytic action on neighboring pipes by providing a path of greater conductivity, and the more thorough the construction of the return circuit the more nearly would the saving of the three-wire system approach the higher limit of five-eights.

The greatest difficulty in the application of the three-wire system to railway work, and this is the point on which its success or failure probably hangs, is the division of the road into two such sections that the loads on each shall be approximately equal throughout the entire day's run. If this condition is not fulfilled the three-wire system must assuredly prove a failure as the disadvantages of an unbalanced three-wire system are such as to prohibit its use. If a balance is not maintained the machines on the overloaded side will carry too much of the load, while those on the other side will be running comparatively light. The overloaded feeders will also have a drop in potential which tends to unbalance the system still further, and in this condition the maximum capacity of the machines can never be utilized. The question of balance is, therefore, of the utmost importance.

One of the earliest if not the first attempt to apply the three-wire system to street railway work was made in the city of Milwaukee upon a straight line of double track, one track using the positive trolley wire throughout its whole length and the other track using the negative wire, and all of the tracks being used as the neutral conductor. As the same number of cars operated on both tracks the system would probably have been successful if the roadway had been level, but as there was a decided grade all in one direction all of the current was consumed by the out-going cars, while those on the return track operated chiefly by gravity. The system here was abandoned because the whole load practically was carried by the machines on one side of the system.

In the case of the Lowell & Suburban road this system was adopted with considerable success. This road does a heavy business over a double track line to its park, about six miles from its power station. The track losses were very large and there was a good opportunity to obtain a balanced load, so the track feeders which were carried overhead on the two-wire system were changed over to feed one side of a three-wire system, using the rails as neutral conductors. The efficiency of the distributing system was thus found to be greatly improved.

It is to be doubted, however, whether the three-wire system will ever prove to be of much benefit to small roads, where the outlay for copper on the two-wire system does not involve excessive amounts. Unless the traffic is heavy and the road can be conveniently divided into two evenly balanced sections the three-wire system is hardly applicable, but in the case of a large system such as that of the Pittsburg Traction Co. the conditions seem to be very favorable to its use. This company's lines, as soon as the new power

house is completed, will be fed from a single generating station. The lines are divided into forty sections, each insulated from the others, and each section is supplied with a separate feeder running directly to the station switchboard. The feeder switches have a double throw with two sets of contacts, one contact throwing the feeder on the positive side and the other connecting it to the negative side of the system. The balance will thus be maintained between the forty different sections each of which can be thrown on either side of the system. Certain of the down-town sections will necessarily be run upon the positive side on account of their intersections with the overhead lines of other railways, at which points the insulation was only designed to take care of the fluctuations in pressure between two circuits of approximately the same potential and would be entirely inadequate for the protection of lines of 1,000 volts difference of potential, which would exist between the positive and negative lines. These down-town sections will be balanced by running the up-town sections on the negative side, still leaving a number of intermediate sections which may be thrown on either side of the system to regulate the balance.

The conditions in the case of the London United Tramways, described elsewhere, urge the use of the three-wire system still more strongly than on a single trolley road. The prohibition of a track circuit by the authorities compels the use of a double over-head trolley and a complete copper circuit, so in this case the use of the three-wire system permits nearly the maximum saving of copper over the two-wire system, which means a large reduction in the investment for this road.

The result of these departures from the ordinary practice by these two large systems of railways will be watched with the greatest interest by street railway men, and their success would undoubtedly establish a permanent place for the three-wire system in street railway practice.

For nearly 10 years there has been pending in Detroit a sharp controversy between the street railway companies and the city, and one of the contentions has been the rate of fare. The economically absurd experiment of seeking to improve and cheapen the service by building a competing line was tried in 1895. A company, the Detroit Ry., later the Electric Ry., was chartered solely for the purpose of giving 3-cent fares; the old company, the Detroit Citizen's Street Ry., met this rate for a year and then restored the old rate of six tickets for 25 cents. At about the same time the Detroit Citizen's Street Railway Co. purchased the stock of the Detroit Railway Co. and the management of the two roads was consolidated; on such of the lines of the Detroit Ry. as were yet operated tickets were sold at the rate of 3 cents each.

Mr. Pingree, through whose efforts, largely, the Detroit Ry. secured its franchises and was built, has never ceased to exert his influence in favor of a reduced street car fare and about a year ago opened negotiations with President Johnson, of the Citizens company, with a view to municipal ownership. The proposals and terms were secret and the public knows but little concerning the preliminaries.

January, 1899, the now celebrated McLeod bill was introduced in the Michigan Legislature. It aroused the opposition of the business men of Detroit, who asked that it be amended so that the question of purchase should be submitted to popular vote. However, the bill became a law on March 24th. April 1st Messrs. Pingree, Stevenson and Schmidt were chosen Detroit Street Railway Commissioners by the Common Council in accordance with the provisions of the McLeod act. The McLeod act and the history of the controversy up to the appointment of the commission were published in the "Review" for April.

Funds were raised by the Good Government League and quo warranto proceedings instituted against the commissioners shortly after their appointment. July 5th the Supreme Court of Michigan rendered an opinion, in which all the judges concurred, that the McLeod act is unconstitutional and void as being in conflict with that provision of the state constitution which says: "The state shall not be a party to or interested in any work of internal improvement, nor engaged in carrying on any such work, except in the expenditure of grants to the state of lands or other property."

The Commission and the owners of the railways reached an agreement as to the value of the property and franchises, $15,325,000 cash, or $16,800,000 in 4 per cent, 50 year bonds. As the Commission feared an adverse decision of the Supreme Court (which has since been rendered) a plan was devised for avoiding its consequences, and the scheme as submitted to the council was, briefly:

The Street Railway Commission to organize a new company to be called the Detroit Municipal Railway Co., which is to buy the street railway properties from the present owners, receive a 30-year franchise from the city and give 3-cent fares, i. e., five tickets for 15 cents, and also lower priced school and labor tickets.

This company is to join the old companies in mortgaging the property for $17,500,000, to secure an issue of 4 per cent. 50-year gold bonds. To further secure the bond holders in case of default, the city to grant a "security" franchise giving, in that event, the right to operate the lines for the remainder of the 30-year term and for 18 years longer, and to charge a 5-cent fare.

A sinking fund to pay the bonds to be provided.

The Commissioners to hold the stock of the new company in trust and transfer it to the city if the latter can legally take it; or, if not, the city to have the power to tax the company so as to prevent it from making any profit whatever.

A month ago it seemed quite probable that the council would accept this proposal and pass the necessary franchises, after perhaps first submitting the question to a popular vote. Consideration, however, failed to show any legal authority for such a referendum or that it would have any effect; the council was not willing to grant a "security franchise" providing for 5-cent fares in event that operation on a 3-cent basis proved a failure and the present owners would not accept a lower rate; also, the citizens opposed to the whole scheme announced that they would contest the validity of the council's action in the courts. In view of these facts the committee of the city council, on June 27th, unanimously reported as being adverse to any action looking to municipal ownership at present, and the whole matter was laid on the table.

This action followed by the decision of the Supreme Court leaves everything as it was at the beginning of the year

Those who have casually followed the trend of events cannot be blind to a strong personal interest at stake contingent on the successful culmination of the deal for both Governor Pingree and Mr. Johnson. The former cannot, it is thought, expect to receive any further distinguished political office at the hands of either his city or state, nor

certainly of the country at large. As chairman of the commission operating the street railways of Detroit under municipal ownership, he would have had for three years at least, an enormous political power to turn into whatever channel he desired, which would have put him in the position of being able to direct who should hold the offices he could not himself attain. As to the Johnson interests, they had everything to gain:—an extension franchise for 30 years on the property which if not paid for reverted with the franchise secured without any trouble. If the city could have been held to the proposed terms then they would have turned their bonds into cash or held them as good investment securities as long as the interest was kept up.

And now all these carefully laid plans which have attracted so much notice, and which must have cost somebody a pretty penny, have come to naught. A striking inconsistency on the part of Pingree was the attempt to restore 5-cent fares on the 3-cent lines, under the plea of temporary advisability of a uniform rate, with the promise to reduce on all lines on some rosy morning in the dim, undetermined future.

July 11th the city council of Detroit took the municipal ownership ordinance from the table, and after a prolonged struggle passed it by a vote of 19 to 14. The "security" franchise provides for 5-cent fares in the event of the 3-cent experiment failing. It is stated in the press reports that the mayor has announced his intention of vetoing this ordinance. This being the case, Governor Pingree has yet another victory to win before he can operate his road, that is, he must increase his majority in the council to two-thirds.

The street car mail service in Rochester, N. Y., is a great success. It has only recently been adopted, but is proving very satisfactory.

ELECTRIC LINE TO THE PYRAMIDS.

In the "Review" for May, 1897, page 317, we published a letter from a correspondent in Cairo, Egypt, who gave some interesting observations on the electric railway lines of that city, and the plans of the company for building an electric road to the Pyramids. At that time it was expected to have the road in operation before the close of the year, but delays of various kinds ensued and the line has but recently been opened for traffic.

The Societe Anonyme des Tramways du Caire commenced the operation of cars in 1896, having at that time about 18 miles of track, four separate branches diverging from the center of the city and going to Abbassiyeh, the English cavalry barracks; to Bulak, to old Cairo, and to the Citadel, familiar to our readers because of the massacre of the Mamelukes.

ON THE ROAD TO THE PYRAMIDS.

The extension to the Pyramids begins at the west end of Kasr-el-Nil bridge, one mile from the center of Cairo; the Government would not permit the tramway company to lay its track on this bridge, and the plan of building a new bridge was once considered, but later abandoned. From the starting point at the west end of the old bridge the tramway extends up the west bank of the Nile a distance of two miles to Gizeh, and thence in a westerly direction for 7½ miles to the foot of the Gizeh Pyramids and the Sphinx. The power house is on the east bank of the Nile, at the rear of the new Egyptian Museum, near the Kasr-el-Nil bridge.

The line to the Pyramids is single track with turnouts, but is soon to be made a double track road throughout. It is laid with 45-lb. T-rails, placed on cross ties; the track is bonded with "Chicago" bonds, two to each joint. The overhead construction is with bracket arms; two trolley wires are used. Mr. Giullaume Rizzo, engineer of the tramway company, supervised the construction.

The cars are of the enclosed type, seating 28 persons each, adapted to European requirements for first and second class passengers. They were supplied by "La Metallurgique," a Belgian manufacturing house. The trucks and bodies of the car are mostly of iron. The Westinghouse Electric & Manufacturing Co. supplied the motors and brake controllers for the cars. Two steel motors, wound for 500 volts, are mounted upon each car, each motor giving an output of 20 h. p. at 500 volts, turning at 375 r. p. m. These motors are wound for a revolving speed less than is customary in American practice. When testing the speed of the cars, it was found that one hauling two trailers filled with Arabs, a gross weight of 20 tons, obtained a speed of 45 kilometers (30 miles) per hour. The brake controllers are made according to a special Westinghouse device. When the lever is turned to the brake side of the controller, the circuit between the overhead trolley wire and the ground is broken, and the motor becomes a generator, the current acting as a brake by retarding the revolving armature. The motormen are all native Arabs; so are the conductors. Their uniform is of tight fitting yellow duck cloth, with a black belt.

The fare for the journey is five piastres out, and the same back, equal to about 50 cents, American money. The trip from the Bridge to the Pyramids can be made in 14 minutes, but it is usual to take one hour for the round trip. The trams are patronized almost entirely by the native Egyptians. The scarcity of European patrons is very marked, but is probably accounted for by the fact that the typical victorias of Cairo can be hired for almost the same price as the tramway fare.

Our illustrations show a number of scenes along the line; not the least interesting feature is that in two of these scenes there is nothing save the Turkish numerals on the dash board of the car to indicate that the picture may not have been taken on the Egypt Electric line of Cairo, Ill.

FREIGHT ON TROLLEY ROADS.

One of these days a very large proportion of many articles of merchandise such as ice, milk, meat, coal and other household necessities, which are now carted about our streets—and in many cases a long distance—will be handled in suitable cars on street railway tracks. We are so engaged with other

SCENES ON THE ELECTRIC ROAD TO THE PYRAMIDS—WESTINGHOUSE EQUIPMENT.

matters, and the difficulty of securing the necessary city and in some states, state legislation, that for the time being the subject is a dormant one; but in time it will force itself upon the public and there will be a positive demand which railway companies will be glad to supply, and city councils will not dare pass by unnoticed.

Take, for a simple instance the market supplies of Chicago. They center down along South Water St. and here from 4 o'clock in the morning until noon there is one continuous jam of vehicles. These, when loaded, separate in all directions, many of them hauling 10 miles to the north or south. The time consumed in making this distance under the most favorable circumstances is nearly two hours. The same service could be furnished on tracks to general distributing points in not to exceed 35 minutes, and then the wagon haul would not exceed 10 or 15 minutes at most—a direct saving of nearly one hour after allowing for the time

required for the one extra loading. This plan would, of course, necessitate tracks close to the curb in the street where the wholesale produce houses are located, but the removal of hundreds of wagons and horses, would give so much additional street room that, despite the space occupied by tracks, the street would be relieved.

Almost every large city has its great center where the produce is received in wholesale and distributed out to smaller dealers. The utilization of street cars appropriate to the transportation of such articles once tried, would be found so desirable no one would want to go back to the present ancient method. While it is not practicable to retail ice from car tracks, it can, however, be hauled in car loads at night to distributing stations from which the longest haul by wagon need not exceed one mile. The saving in loss by melting, which in extremely hot days frequently amounts to 10 per cent of the load per mile, would be no insignificant matter. Coal, also, while not to be delivered from cars to house, could be carried in original cars and set into distributing yards from which the wagon haul would be short.

Perhaps, however, no single item begins to approach in importance the handling of milk. Under present arrangements the milk leaves the farm in cans on wagons, and is hauled a distance often reaching four or five miles, over all kinds of roads and in all sorts of weather. It is then set out on a platform where it stands until the milk train comes. It finally reaches the city and the milk is unloaded onto platforms from which the wagons take it and go direct to customers, or haul it to their barns, where it remains until night or the next morning, as the case may be. There are immense milk routes in this city distributing several car loads daily where the milk is hauled from five to seven or eight miles to depots, and from there taken to customers. The saving which would be effected if this milk could be taken from the steam cars and loaded on an electric car and swiftly run out to the milk depot and there pushed into the building for unloading to the wagons, would amount to a thousand dollars a day on a very conservative estimate.

The foregoing are intended to be suggestive rather than exhaustive ideas on a subject which before a great while is bound to be a live question. It behooves managers to give the matter careful study and consideration and to post themselves fully as to the local conditions and requirements of their own cities.

It would hardly be expected that in England the subject would have already received attention, as electric cars are only now coming to be generally understood and appreciated; nevertheless, an English journal in commenting on the success of an electric freight line in this country, remarks:

> There is no reason why the tramways in England, now equipped or soon to be equipped with electricity, should not be similarly used, and connected wherever possible with the railways and the docks. It would be an easy matter for manufacturers, warehousemen, and large shopkeepers to connect their places with spur lines; to load their merchandise during the daytime, and have it transported over the electric street railways between midnight and 5 o'clock in the morning, when passenger traffic in most English cities is suspended. The municipalities could also use the street car lines at night for many of their services, such as the removal of street sweepings and snow, and the distribution of road making and road-repairing materials. It ought to be possible, too, for coal merchants to distribute their supplies at night by means of the trolley lines.

The Electrical Review, of London, in commenting on the same subject, says:

> In busy cities it would undoubtedly be an enormous gain to have effected silently and expeditiously during the night, a transfer of goods and merchandise, which at present occurs with excessive dirt, noise, obstruction, and discomfort during the day. But we cannot see that the idea is practicable, if it involves the laying of branch tracks and feeder systems all over our larger towns. The capital expenditure upon these extensions would make the cost of the new method of transit too high. We rather think that a solution will be found for the problem in the design of freight trailer cars which can be run either on the tramcar rails or on the ordinary roads. Such trailer cars would then be loaded as at present and taken by horse or manual traction to the nearest point of the electrical tramway system, where they would be picked up by the first train of freight cars going in the desired direction.
>
> We commend the idea to the attention of firms engaged in the manufacture of electric passenger cars in this country; as we feel convinced that were successful cars of this type designed and built they would be quickly adopted, and would be found of immense service in the distribution of raw materials and manufactured goods in many of our larger cities.

It is not by any means among the impossibilities that our English friends whom we are inclined to look upon as following our lead in nearly all matters street railway electrical, may surprise us by introducing a distribution system while we are yet commencing to study the problem.

BOLD ROBBERY IN PHILADELPHIA.

Early on the morning of June 19th a party of masked men entered the receiving office of the Fairmount Park Transportation Co., at Belmont, in Fairmount Park, Philadelphia, and after securing the receiver and five other employes, blew open the safe and took about $4,000, the receipts for Saturday and Sunday. Accomplices of the robbers cut the telegraph and telephone wires connecting with the company's main office, thus aiding them to escape.

A number of persons were arrested on suspicion, but up to the present writing nothing has been proved against them.

SALE OF CANCELED TICKETS AT BIRMINGHAM, ALA.

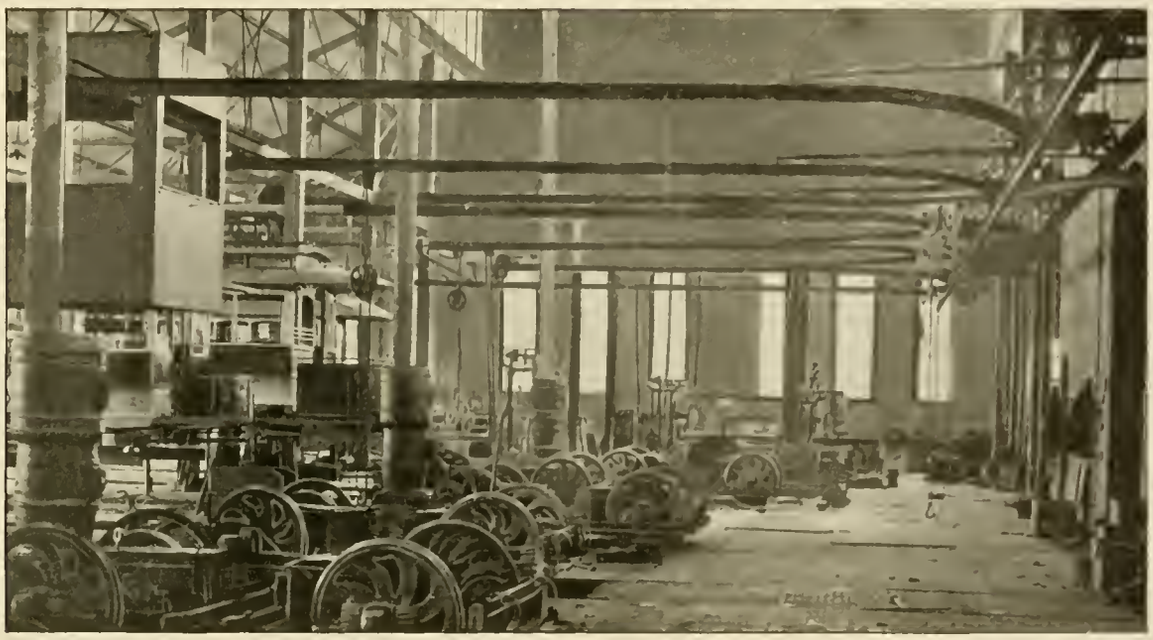
In the "Review" for June, mention was made, under the heading "Another Fraud," of the arrest of a boy who was selling canceled tickets of the Birmingham (Ala.) Railway & Electric Co. Inquiry develops the fact that the loss suffered by the company was greatly exaggerated in the reports, and was in fact only $1.30. Mr. J. B. McClary, general manager of the company, further advises us that our informant was wrong in stating that the method of destroying tickets practiced by the company was to merely tear them in two and throw into trash boxes. He states that the custom is, and always has been, to burn the canceled tickets each morning, in the office stove or under the boilers in the power house, according to the season. In last May the man having charge of this work was ill for a few days and his substitute inadvertently put a few of the canceled tickets into the trash box.

An injunction has been granted restraining the West Park Board from interfering with the West Chicago Street Railroad Co. in laying tracks across Washington and Humboldt boulevards. The court holds that the streets of the city extend across the boulevards and the Park Board cannot prohibit any use of the streets; it can only regulate the manner of crossing.

Power Station and Shops of the Louisville Railway Co.

The electrical repair shop of the Louisville Railway Co. was built in the summer and fall of 1898 after designs of W. T. Cook, chief engineer and master mechanic. It is a model of convenience in its general arrangement and the labor saving devices in handling cars and motors are particularly interesting. The building is of brick, 195 ft. long by 97 ft. wide, one story high, and is located at 18th and Walnut Sts.; it replaced a number of older buildings and is adjacent to the wood working and paint shops of the company. The roof is of slate supported on iron trusses.

The armature room, blacksmith shop and storeroom are separated from the main repair and machine shop by brick partitions as shown on the plan. The armature room is about 30 x 70 ft.; the store room, 25 x 80 ft., and the blacksmith shop, 25 x 50 ft. The equipment of these smaller shops is indicated on the plan. The equipment of the machine



INTERIOR OF SHOP—LOUISVILLE RAILWAY CO.

ENGINE ROOM—LOUISVILLE RAILWAY CO.

shop consists of 4 lathes, 3 drill presses, 1 planer, 1 shaper, 1 bolt machine, 1 boring machine and 1 wheel press.

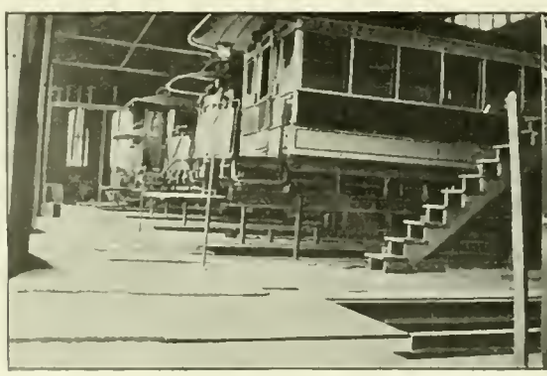
There are eight car pits, each provided with a car hoist of Mr. Cook's design. This hoist is shown in detail in one of the large drawings, and reproductions from photographs of one of the pits and of the cars when raised are given, and the method of operation will be apparent from an inspection of these illustrations. The car body is lifted by two I-beams, each of which is moved vertically by two square threaded screws; the screws are prevented from rotating by being rigidly fastened to the I-beams at their upper end. The nuts for these screws are bushings in the hubs of 30-in. sprocket wheels; they have their bearing on balls resting on a suitable base plate at the bottom of the pit. Pipes sunk in the ground provide pits for the lower ends of the screws.

The four screws are raised in unison by means of a chain passing around the four sprocket wheels and a driving wheel at the front end of the car pit. The driving pulley, marked "A" in the drawing is on a vertical shaft which has a beveled friction pulley at the top. The vertical shaft is driven from a shaft placed below the floor in a transverse pit extending the length of the building. The screws are driven either up or down by throwing in contact one or the other of two smaller beveled pulleys. The smaller beveled pulleys are mounted on a splined sleeve so that they may be moved lengthwise of main driving shaft, but turn with it; they are thrown in and out of contact by means of a lever connected to the hub.

REPAIR SHOP OF LOUISVILLE RAILWAY CO.

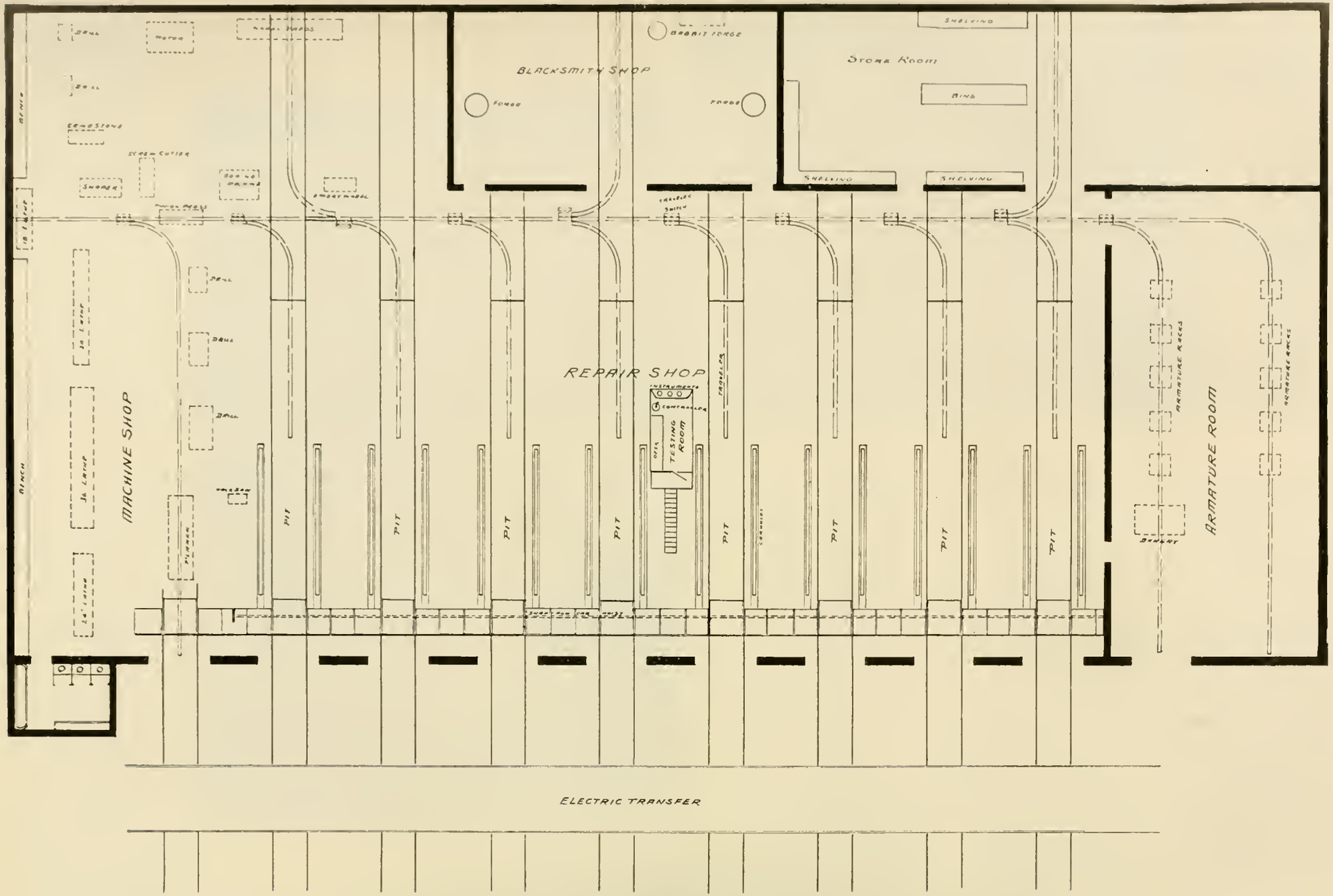
The main driving shaft extends along the eight pits, having a pair of pulleys for each of the hoists and at the end of the building is belted to a friction clutch driven from the line shafting. The pit containing this long shaft is covered with iron plates.

Another feature of particular interest here is the overhead traveler system for handling armatures and other



CAR LIFTING JACK.

VIEW OF PIT.

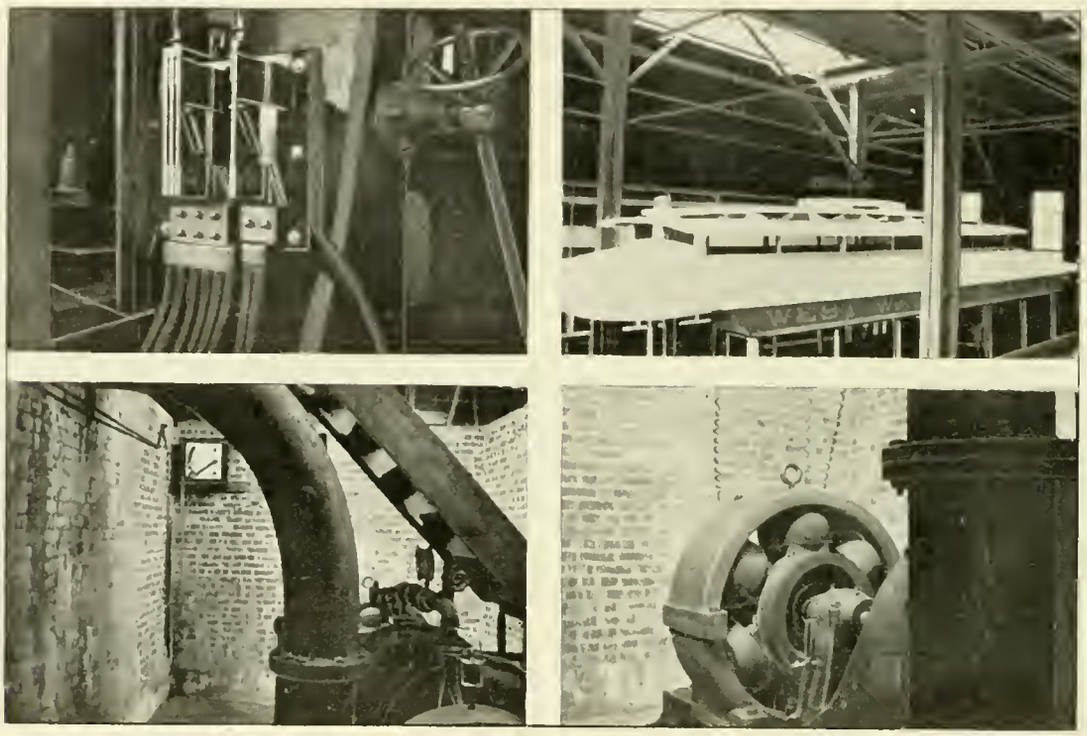


REPAIR SHOP OF LOUISVILLE RAILWAY CO.

heavy pieces. The tracks are I-beams supported as shown in the illustrations by rods from the roof trusses and brackets attached to the walls. The floor plan of the shops shows the location of the main and branch lines.

Instead of the ordinary tongue switches at the junction points of the traveler system there are trolleys moving on transverse ways. Suspended from the switch trolley are two or three sections of traveler rail onto one of which the carrying trolley is run; then the switch trolley is shifted transversely and the carrying trolley run on to the other track. The switch trolley is shifted by a gear worked from the floor by an endless chain. Stops are placed on the switch trolley on each side of the sections of traveler rail so that when the latter are shifted a carrying trolley on the branch line cannot run off its rail; the main line is always open, which is the great advantage of the device; also by no possibility can a carrying trolley run off at a switch. This switch is the invention of Mr. Snead, of the Snead-Van Alstine-Meldrum Co., of Louisville.

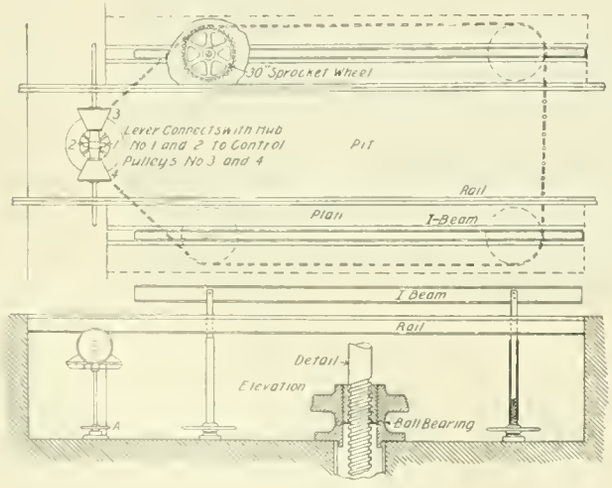
The power house is located at one side of the system, the supply of condensing water having been the controlling factor in choosing a site. The building is of brick; the roof is tin lined with sheet iron and asbestos. The power house is 235 ft. long by 112 ft. 6 in. wide; it is 19 ft. to the eaves and 43 ft. to the peak of the roof.



NEGATIVE LEADS ON LARGE GENERATOR. TRUSSED TROLLEY BOARD ON CARS.
PUMPING PLANT FOR CONDENSING WATER.

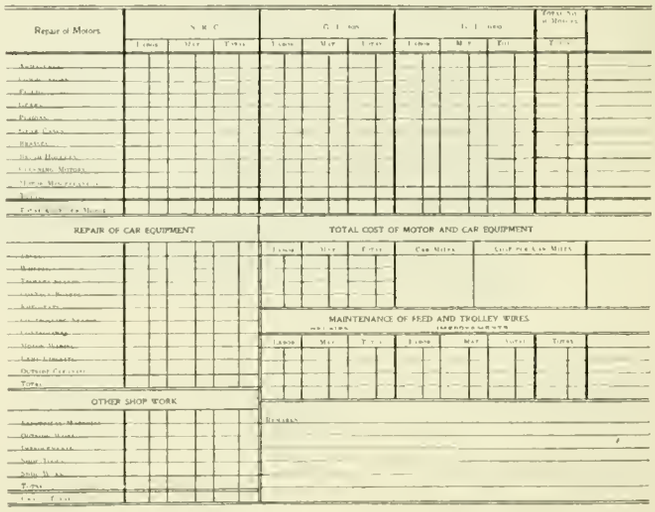
The boiler room is 235 ft. by 52 ft. 6 in. The boilers are 18 in number; 4 Babcock & Wilcox of 250 h. p. each with mechanical stokers made by the same company; 6 Heine of 200 h. p. each and 8 return tubular of 50 h. p. each. There are six Hoppes purifiers for the feed water. Six new Babcock & Wilcox boilers are now being installed.

There are two stacks, one 135 ft. high and 7½ ft. in di-



CAR LIFTING JACK.

REPAIR SHOP REPORT Louisville Railway Company



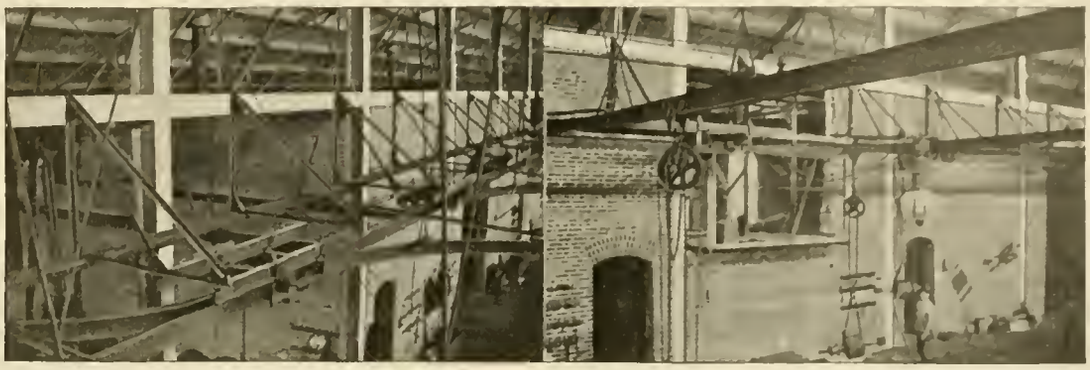
ameter and one 200 ft. high and 12 ft. in diameter; both are built of brick and lined with fire brick for half their height. No economizers are used.

The steam piping was made by the Crane Co. The flanges are all shrunk on and the pipe ends spread so that the gaskets come in contact with the pipe. The pipes from the boilers lead to a 20-in. header supported on rollers. There are no elbows used with pipes above 2½ in. in diameter, the necessary change in direction being effected by long bends. All the piping is covered with asbestos; the Holly drain system is used to return the condensation in the pipes.

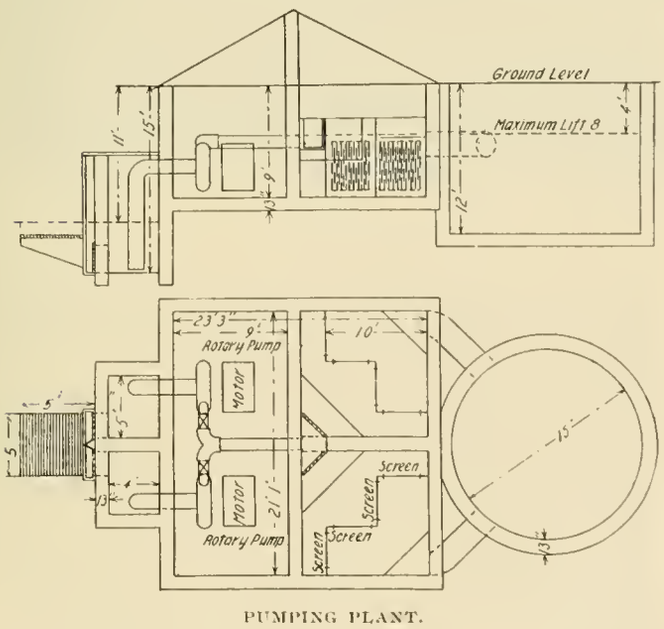
The engine room is 235 ft. long by 60 ft. wide. There are 7 engines, 1 vertical cross-compound, 4 horizontal cross-compound and 2 250-h. p. tanden compound. The large vertical engine was built by the E. P. Allis Co., and has cylinders 40 and 78 in. by 48 in. stroke. It operates at 75 r. p. m. The valve gear is of the Corliss type; an automatic safety device closes a butterfly valve in the main steam pipe if the speed becomes three revolutions above normal.

The fly-wheel is 25 ft. in diameter with a face of 24 in.; it weighs 160,000 lb. The main shaft is 27 in. in diameter with 24 x 48 in. journals. The engine is equipped with the Rochester lubricator and pressure oiling system.

The engine is designed to work most efficiently with a load of 3,000 h. p. It is direct connected to a 22-pole G. E. generator rated at 2,500 kw. The specifications were drawn by Mr. W. T. Cook, chief engineer of the power station, and called for an output of 3,000 amperes at 550 volts continuously, with a 50 per cent. overload, the rise in temperature above that of the room not to exceed 45° C., and the machine to be able to carry an overload of 100 per cent for short intervals without injury or serious sparking; the electrical efficiency specified was 95 per cent.

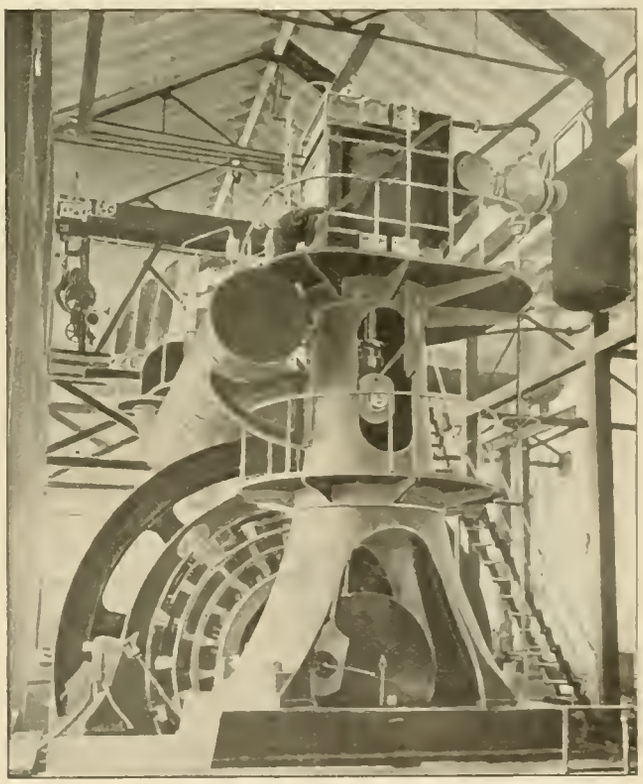


VIEWS OF TRAVELER SYSTEM IN SHOP.



PUMPING PLANT.

The foundations for the large engine are 19 ft. deep and 38 x 25 ft. at the base. First was put down a layer of concrete 2 ft. deep; this was covered with 70-lb. rails, next came 6 in. of concrete and a second layer of rails; next 6 in. of concrete and a third layer of rails; on this was 12 in. of concrete and 13 ft. 6 in. of brickwork; on top of the brickwork were placed stone caps, 18 in. thick, which are flush with the floor.



2,400-K. W. GENERATOR LOUISVILLE RAILWAY CO.

The other generators comprise four G. E. 500-kw. machines direct connected to the cross-compound engines and

four Edison 150-kw. machines belted to the two smaller engines.

The condensing apparatus consists of 4 1,000-h. p. Blake twin vertical condensers, 1 Worthington elevated cone condenser of 4,500 h. p. capacity, and 1 Reynolds vertical crank and fly-wheel jet condenser of 500 h. p. capacity.

The pumping station for handling condensing water is of particular interest. The condensing water is drawn from a small creek which is practically an open sewer and badly polluted by the refuse from woolen mills located above the power house; it is therefore necessary to strain this water before it can be used without danger of clogging the condensers.

This pumping plant is located at the bank of the creek and is all below the ground level except the roof. It is shown in plan and section in one of the line drawings. The water flows through a horizontal grating and is admitted through gates to one or both of two suction wells, which are 4 x 5 ft. and 15 ft. below the ground level. The pump chamber is 9 x 21 ft. inside and contains two Morris rotary pumps driven by direct connected 25-h. p. motors. The speed ranges from 200 to 300 r. p. m., the regulation being effected automatically by means of a float in the cistern or reservoir. The pumps deliver the water to the straining chambers through gate valves. The straining compartments are each 10 x 10 ft.

The reservoir is a circular cistern 15 ft. in diameter by 12 ft. deep. The maximum lift is 8 ft.

For cleaning the straining chambers a valve is placed in the bottom of each chamber and when this is opened the accumulated dirt is flushed out and carried to the creek through a drain which empties down stream from the intake.

The motors for this plant were built by Jas. Clark, jr., according to the specifications of Mr. Cook.

The switchboard has only positive leads, the only ground wire being a voltmeter connection. It is equipped with Weston ammeters and voltmeters and a Thomson-Houston wattmeter. The return wires from the line are carried directly to the machines.

The Louisville Railway Co. is a consolidation of all the street railway companies in Louisville, and was chartered in 1893. It operates 140 miles of track, 130 by electricity and 10 by horses, and has 500 cars and 650 horses. The company has, since the consolidation, been under the management of Mr. T. J. Minary, who, in 1897, was also chosen president and has since filled both offices. Mr. Minary was vice-president of the Central Passenger R. R., one of the consolidated roads, when the American Street Railway Association was organized, and has been active in that association. He has long been one of the representative street railway men of the country, and is one of the few horse car managers who has continued in the business.

T. J. MINARY.

The other officers of the company are: Vice-President, St. John Boyle; secretary and treasurer, S. G. Boyle; superintendent, T. J. Funk; chief engineer of power station, W. T. Cook.

SITUATION IN DETROIT.

(From our Special Correspondent.)

A very serious blow has been dealt to municipal ownership in Detroit. The Supreme Court of Michigan, in an unanimous decision handed down July 6th, states very positively that the McLeod act, under which the Detroit Street Railway Commission was created, is unconstitutional. The decision is very sweeping in its scope and covers every point of the proposed purchase plan by Governor Pingree and his friends.

This decision, which is given in full on another page, has had a very dampening effect upon municipal ownership in Detroit. In the first place the financiers from the East who had figured on taking the large issue of bonds that was necessary in making the deal, state positively that, should the ex-commissioners and the city council endeavor to formulate some plan to get around the action of the Supreme Court, that with this very strong and positive decision just handed down, that it would be impossible to dispose of the bonds in the financial market.

However, Governor Pingree still claims that the plan as outlined in the "Review" last month, that is, the formation of the Detroit Municipal Railway Co. to buy the properties and operate them for the city, will be pushed on just the same as if nothing had happened. The security franchise, running for 48 years, which is necessary for the successful carrying out of this plan, has been sent to the city council and there it received a very cold reception. It is in the hands of the ordinance committee with a good chance of never being heard from again.

So it can be said that Governor Pingree has on his fighting clothes once more. His lieutenants are already building the fences, and Hazen S. Pingree for the fifth time is a candidate for mayor of the city of Detroit. Aldermanic candidates that will favor anything that looks like municipal ownership are being selected in the various wards of the city and that question will be made the sole issue in the next campaign.

The local representatives of Messrs. Wilson and Johnson, in behalf of the street railway owners, have nothing to say in regard to the change in the situation.

(By telegraph, July 12th.)

By a vote of 19 to 14 the city council of Detroit last night granted the Detroit Municipal Railway Co. a 48-year franchise over all streets now occupied by street railway tracks. The company consists of Gov. H. S. Pingree, E. G. Stevenson and J. C. Hutchins, the present vice-president and general manager of the Detroit Citizens' company. By the terms of the ordinance the Detroit Municipal Railway Co. is to buy all of the street railway property in the city and operate the same. The rates of fares are to be six tickets for 25 cents, with universal transfers to all lines; eight tickets for 25 cents two hours in morning and evening. All profits from the operation are to go to the city aside from providing a sinking fund to care for bonds issued to the amount of $17,500,000. The present owners have agreed to sell to the new company, taking this franchise for security, for $16,800,000 in 4 per cent gold bonds and it is generally believed that the franchise passed last night can be passed over the veto of the mayor; this requires only three more votes. Mr. Hutchins entered the street railway commission yesterday on the resignation of Carl Schmidt. From his connection with the Citiens' company it is thought that the present city ownership plan was assured before he entered the new company. Governor Pingree today stated positively that should the present franchise be defeated that he would run for mayor this fall on the Republican ticket, indorsing only candidates for aldermen pledged to this franchise and thereby carry out in name and effect his municipal ownership ideas.

Shops of the Consolidated Traction Co., Pittsburg, Pa.

The Frankstown barns and shops of the Consolidated Traction Co., of Pittsburg, which were somewhat briefly mentioned in the "Review" of February, 1899, are now fully equipped, and the completeness of the entire installation is such as to make it one of the finest shops of its kind in the country. The plant comprises three main buildings each being the full length of the city blocks, the buildings being separated by two intersecting streets. There are also two smaller buildings used for store houses. The first of these buildings is known as the operating barn which, in addition to the main barn, contains a number of offices and rooms for special purposes arranged along the Frankstown Ave. side of the building.

First comes the receiver's office where the conductors make their returns. There are six divisions of the road from which returns are received at this office, and the returns of each division are kept separate by being deposited in separate drops arranged along the side of the office, each bearing its special route number. This saves the receiver the work of sorting out the various returns. Next to this comes the despatcher's office, the division superintendent's office and the motormen's room. The latter deserves a word of commendation, as it is neatly and comfortably furnished and provides a pleasant and attractive room for the conductors and motormen. One side of the room is entirely covered with lockers, each man being provided with a separate locker, in which are kept the uniforms, rubber coats, hats, etc., when not in use. A row of long tables placed along the center of the room are used for lunch tables, and on several of them are to be found checker boards and other games for passing away the time when not on duty. That this room is appreciated is shown by the number of the employes who are to be found there at almost any time.

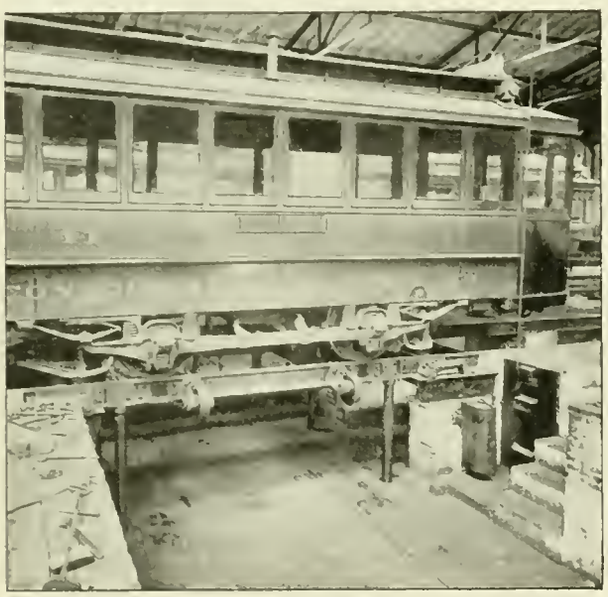
Next to the motormen's rooms is a lavatory, which is fitted up with marble and contains the most modern sanitary appliances. Beyond this is located a heating plant for heating the barns and offices by hot air. The air is distributed through the building in large galvanized iron pipes, containing numerous outlets, which are carried on the roof trusses around three sides of the building. The hot air from the furnace is forced through these outlets into the room by means of a fan driven by a small steam engine. All of the buildings are heated in the same way, and there is a small boiler plant situated in a separate building for supplying steam for the engines which drive the fans. The steam from the boilers is all piped underground to the different heating plants, and the offices are also all supplied with steam radiators for use at such times as the general heating of the barn is not required.

A room for the night repair men completes the subdivisions of this barn. This room contains a locker for each night employe, a small store room containing such small parts as may be required for light repairs at night; this room is also used as the office of the barn foreman. The open part of this barn contains eight parallel tracks which are divided in the center of the building by a transfer table and track. The cars are brought into the building on either of the first four tracks, where they are washed, and are then placed on one of the other four tracks, all of which are pit tracks, by means of the transfer table. Here the car equipments are inspected and if found to be in good order the car is run out into the operating yard ready for service again. The transfer table, which was designed by the general foreman of the shops, Mr. John Rogan, deserves a word of attention. The frame is of the ordinary construction and contains a wooden platform, on one side on which is mounted a No. 3 Westinghouse motor of 30 h. p capacity, which is geared to one axle of the transfer table. The motor is controlled by a street car controller which is mounted on the platform alongside the motor. The current is supplied from underground conductors placed in a conduit between the transfer table rails exactly similar to an underground electric sys-

MACHINE AND REPAIR SHOP—CONSOLIDATED TRACTION CO., PITTSBURG.

tem. There are five of these transfer tables across the different shops all of the same design. There is a single circuit breaker in the operating barn which controls all of the circuits in the barn and in case of any trouble on those circuits the entire barn is cut off from the line.

Outside the operating barn is the operating yard, where the cars in service are temporarily stored. On one side of this yard are a sand house, coal and wood bins, and a lubricant store room. In the sand house wet sand is dried for use on the cars in a dryer, which consists of a stove around which a large hopper is placed. The wet sand is shoveled into this hopper and after being dried falls out through an opening around the bottom of the hopper. Although only a small amount of sand is dried at one time in this way, the operation of drying is kept up every day, and enough dry sand is stored away in the summer, when but little is used on the road, to supply the amount required during the winter. The coal and lubricants stored in this yard are only for a few days' supply for the cars and are always accessible to



BRYAN CAR DISMANTLER.

the employes. These stores are recruited at short intervals from the main store house.

The machine and repair shop is situated at the further end of the operating yard, and it is in the equipment of this part of the plant that the greatest interest centers. Directly in front of the entrance is a Murphy wheel grinder, by means of which the car wheels are trued up without being removed from the car. The car is run over the pit where the wheel grinder is located and is supported independent of the wheels. The journal box covers are opened and each axle is centered between a pair of adjustable lathe head centers and the track underneath the wheels removed, so that the axles and wheels revolve on the centers by operating the car motors. Four emery wheels are used, one being placed against each wheel, and these are revolved in a direction opposite to that of the wheels by means of a system of shafts and belting. The emery wheel shafts are driven at a speed of 1,600 r. p. m. by a No. 3 Westinghouse motor. The operation of grinding up a set of car wheels in this machine is complete in about a half hour from the time the car is run over the pit.

Further along on the same pit track with the Murphy wheel grinder are situated two Bryan car dismantlers, the operation of which is perhaps the most interesting of any work in the repair shop. These machines consist essentially of a section of track a little longer than the wheel-base of a car which has a vertical movement upon four screws. These screws are turned all at the same speed by means of lines of shafting placed beneath the pit floor, which form three sides of a rectangle, and are connected together and to the screws by means of bevel gears. The shafting is driven by a No. 3 Westinghouse motor. At the four ends of the fixed track, just outside of the movable section, are pivoted arms which may be turned up vertically and on the ends of which are shoes which turn in under the frame of the car truck to support the weight of the car when the section of track under the wheels is dropped.

The operation of the dismantler is as follows: The car is run over the pit so that the wheels rest on the movable section of track and the arms on the stationary track are turned up to catch the frame of the truck. The straps and covers of the journal boxes are then removed, allowing the wheels and axles with the car motors upon them to be dropped down from under the car upon the movable track and onto a truck which carries them off sideways from under the car into an extension of the pit. They are lifted out from this part of the pit by the overhead crane which deposits them on the floor of the repair shop. A number of sets of wheels, axles and motors, all mounted and ready for use, are kept on the floor near the dismantler and a pair of these is picked up by the crane, lowered into the side pit, rolled onto the movable rails, lifted into position and fastened under the car. The whole operation of removing both pairs of wheels and car motors and replacing them with new ones ready for service requires but 23 minutes. The crane which handles this work operates over the entire central section of this building where all the heavy repair and machine work is done. It is a 10-ton crane built by Pawling & Harnischfeger, of Milwaukee, and the operations of the shop keep it in pretty constant use.

In this same section of the repair shop are also several other interesting machines, one of which is a 100-ton hydraulic wheel press, in which the car wheels are pressed upon the axles. Here is also situated a 38-in. New Haven Machine Works' lathe, which is used exclusively for turning up axles and steel centers for steel tired wheels. This company is now using wheels with steel tires 1¼ in. thick and with 2¼ in. tread, which are shrunk onto steel centers turned to 30½ in. diameter. The steel tires are faced up on the inside to gage and are then placed on a special heater where they are heated and expanded by natural gas. The heater consists of a cylindrical drum on top of which is a 1-in. gas pipe bent into a circle a little larger than the diameter of the tires. This pipe acts as the gas burner, being bored with a row of small holes all around the inside. The tire is laid down inside of this circular pipe, the gas flames from which impinge upon it, and a circular iron disk is laid over the tire to concentrate the heat upon it. In about 15 minutes the heat expands the tire sufficiently to allow the steel center to be slipped into it and after cooling the two are shrunk rigidly together.

There is another special machine in this part of the shop, designed by the foreman of the shop, on which keyways are cut in the car axles without removing the wheels. The machine is composed of an ordinary drill press on the table of

which is fastened a bed about 3 ft. in length. A carriage with clamps for holding the axle and wheels travels on this bed, its motion being derived from a screw which is driven by a belt from a shaft which engages with the shaft of the drill press. The tool used for cutting keyways is a side and end cutting tool which is set in the chuck of the drill press, and the axle travels along under this tool over the length of the keyway to be cut.

The standard keyway for the axle gears are 7 in. long, 1 in. wide and ½ in. deep, and these keyways are cut in an axle without removing the wheels in 20 minutes.

Along the side of the building parallel to the central section where heavy repairs are made are the blacksmith shop and the general repair shop. The blacksmith shop contains four forges, one of which has a movable hood and stack which can be raised to any height necessary for handling large or high pieces of metal in the fire.

In these shops, as well as throughout the whole of the company's buildings, each man is supplied with a locker for keeping his tools, etc., and each workman is supplied with a set of tools for which he is held responsible. If a man loses a tool he is charged for it, but when tools are worn out in service a new tool is issued from the tool room in exchange for the worn-out tool.

The tool room is a small room partitioned off from one side of the general machine shop and here all the tools used in the shops are made and repaired. This room contains a 16-in. Blaisdell lathe, a No. 2 Brown & Sharpe universal milling machine and a No. 2 Brown & Sharpe universal grinder. Besides containing the tools this room is also used as a sub-storeroom for repair parts. This stock, in quantity about sufficient for one day, is drawn from the general storehouse daily on a requisition from the foreman of the shop, and is then given out to the workmen from the tool room. This method of giving out stores is followed in all the different departments.

The general machine shop is very fully equipped with machinery for making all the metal repair parts used on the cars, and these parts are all made to standard dimensions and are interchangeable. The machines here include a screw cutter which is used for recutting all the old bolts, etc., removed from the cars, three upright Prentice drill presses and one Smith Machine Co. radial drill press, one Gould & Eberhardt shaper, one emery stand, a 24 in. Pond planer, a Bullard boring mill for boring car wheels, a 12 in. Betts slotter for cutting keyways, a 24-in. Johnson lathe used exclusively for armatures, a 12-in. Prentice lathe for boring armature bearings and a 22-in. Blaisdell lathe for general work.

The Prentice lathe used for boring armature bearings is equipped with a special arrangement for this work. The armature bearings are iron boxes with babbitt linings. The babbitt is run into the boxes, the parts of which are clamped together in a jig mounted on the tool carriage of the boring lathe, and the babbitt is bored out with a boring bar.

A special iron mould is also used for pouring the babbitt axle bearings, which has a smooth finished iron core on which the bearing surface of the babbitt is molded. This produces a finished bearing which is taken out of the mold and is ready for use on the car without any machine work or finishing.

INTERIOR OF CARPENTER SHOP—CONSOLIDATED TRACTION CO.

The electrical repair department occupies one end of the general repair shop and contains the usual machinery, tools, and apparatus for winding armatures and fields and for making any kind of electrical repairs. This department does not contain any special apparatus, however, which need be mentioned here.

The entire shop is run by a 50-h. p. Westinghouse motor belted direct to the overhead line shaft, which runs the full length of the shop. Each machine has a separate countershaft belt to the line shaft. The building is heated by a hot air plant identical with the one described above. An electric transfer table, the same as already described, runs across all the tracks in the machine and repair shop. A compressed air plant is also used in this shop for cleaning the motors, armatures, controllers, car cushions and the machines in the shop. The air is piped to outlets all through the building from a cylindrical reservoir at one end of the shop. The

pressure in the reservoir is maintained at from 65 to 100 lb. by means of an automatic regulator worked by compressed air. The air is compressed by a small rotary pump and a direct connected motor of the Westinghouse make, which runs when the pressure in the reservoir falls to 65 lb. and stops when it reaches 100 lb. The regulator is merely a starting switch in which the handle is connected to a plunger which works against a spring by compressed air, stopping and starting the motor within the limits of pressure, as stated.

The machine shop, carpenter shop and paint shop are each of about the same size and are contained in the same building, which is partitioned into three divisons by two brick partition walls. The middle division of this building is the carpenter shop, which contains all the necessary machinery for building complete cars. The wood working machinery is all of the manufacture of J. A. Fay & Co., and includes a mortise machine, a tenon machine, a double head reversible shaper, a 26-in. planer, a sticker machine for cutting any kind of molding, a boring machine, a band saw, cross cut circular saw and a circular rip saw which cuts at any bevel up to 45°, a joiner and a 12-ft. turning lathe used chiefly for turning out drums for controllers.

Besides these wood working tools, this shop also contains an edge grinder for planers and joiners, and a Rodgers saw sharpener adapted to either band, cross or rip saws. The machinery of this department is run by a 50-h. p. Westinghouse motor placed in a basement about 10 ft. below the shop floor. This drives a line shaft in the basement to which the machinery is belted down through the floor. In this shop is done both repairing and also the complete building of cars. A number of the Allegheny Traction cars which were injured by fire last year were entirely rebuilt in this shop, and several baggage and pay cars have also been built by the company. The pay cars are handsomely finished both inside and outside, and are run all over the different divisions of the company's lines, paying off the men wherever they are employed without occasioning any loss of time. There is now building in this shop a flat truck car which is to be used exclusively for hauling wheels, axles, motors and other heavy machinery from the store house and between the different shops.

The paint shop occupies the third division of this building and contains eight parallel tracks which are crossed at the center of the shop by an electric transfer table. Each of the eight tracks is long enough to hold four cars, two on each side of the transfer table, making the total capacity of the shop thirty-two cars. This shop is often filled with cars to be either entirely or partially painted, as the company make it a rule before putting out either the summer or the winter cars to have them all painted so as to look perfectly fresh and new. Located in the center between each of the eight tracks are rows of posts about 12 in. square and 6 ft. high. Each of these posts is provided with two swinging brackets which may be turned toward either track, one bracket being about 2 ft. from the ground and the other near the top of the post. By turning these brackets all one way and laying a plank across them a scaffold is formed from which every part of the car may be reached by the painters. This system is very convenient, as it saves the use of ladders and also the work of moving scaffolds about the shop. These brackets are always ready and are placed in every part of the shop alongside of all the tracks.

INTERIOR OF PAINT SHOP—CONSOLIDATED TRACTION CO.

On one side of the paint shop is a brick fireproof storeroom with iron doors, where the supply of paints, varnishes and oils are kept. Along the partition wall are placed a large number of racks where sash, glass and sash materials are stored.

On first coming into the paint shop a car is dismantled of its polished brass parts. These are first washed in lye, then in muriatic acid, after which they are rinsed in water and packed in sawdust to dry. The old varnish and paint on the car is then removed with a special varnish remover, which takes off all the old varnish and paint without discoloring the wood underneath at all. The car is next painted in flat colors, then varnished, and refitted with the cleaned brass parts, giving it the appearance of an entirely new car.

The chief remaining parts of interest about this plant are the storage departments, both for cars and supplies, both of which are installed on an unusually large scale. The car

storage barn is similar in general to the buildings already mentioned and is practically a continuation of them separated by an intersecting street. This building contains 12 parallel tracks each long enough to hold 10 cars, giving the building a capacity of 120 cars. A transfer table runs across the center of this building. There are two separate buildings besides those mentioned used for the storage of materials in large quantities. One of these is divided into three rooms, the first containing oil, paint and waste, the second scrap brass and copper, and the third, coal and salt. Next to this building is a large lumber shed which is well filled with seasoned wood for repairing and building cars, and the last building of this group is a general storage house for all the supplies for each division of the road. The materials in this house are all assorted in bins and racks and on the front of each is painted in large letters just what materials it contains. There is a track through the center of this building on which all the bins and racks face, and a storeroom delivery car runs through this building to all the divisions of the road distributing the supplies wherever they are needed.

This company also has another large car barn quite a distance from the Frankstown Ave. barns, situated at the corner of St. Clair and Bunker Hill Sts., which is known as the Bunker Hill barn. The receiver's office and motormen's room here are fitted up in about the same manner as the Frankston barns. This barn has 18 parallel tracks running through it, all of which have pits about 25 ft. long just where the tracks enter the building. A transfer table crosses all the tracks a little beyond the end of the pits, and this barn is also heated by a hot air plant. Only light repairs such as can be done without the aid of machinery are made here, the pits being chiefly used for inspection purposes.

MAINTENANCE AND REPAIR OF ROLLING STOCK.

BY J. W. GREER, GENERAL MANAGER YOAKUM TEX. IMPROVEMENT CO.

PART III.

In the old horse car days a hay fork, a spade, a scrubbing brush, and copious supplies of water from a convenient hose, backed by plenty of elbow grease, served the dual purpose of relieving the cars of the mixture of mud and hay and other accumulations of filth, and also of the paint, which seemed to be put on the cars largely with the idea of having it scrubbed off again at the earliest possible moment. Of course the nature of animal traction was such as to require a great deal more scrubbing and the freer use of water both inside and outside the cars than is necessary with mechanical traction, or would be admissable where electricity is used as a motive power, but even in horse car days the writer could never see the necessity of flooding a car day after day or night after night, thereby causing the posts to rot off at the sills, and eventually the sills themselves to decay and destroy the whole car body. More panels have cracked, more joints have worked loose, more sash have rotted off at the tenons, in short more cars have been destroyed by the too free application of water than have ever been worn out by the strains of service. Water is a good thing in its place, but one of the poorest uses to which it can be put is in flooding either the inside or outside of a modern street railway car. The class of material in which a modern car is finished, and the skill of the mechanic who does the work are equal, and in many instances superior, to that employed in the construction and finish of the average piano, and the cost of the car is much greater. No one ever thinks of turning a hose on a piano, either inside or out.

Compressed air for cleaning cars, motors, dynamos, switchboard equipment, and in fact everything connected with electrical equipment, has nearly all the advantages of water without its disadvantages, and has many superior claims as a cleaning agent where water could not be employed at all. The reader need not fear that the writer having mentioned compressed air is going to advocate a change in equipment. No one appreciates better than the writer how sore a subject "change of equipment" is to many managers, as he has seen everything in the line of street railway motors from the Sprague Nos. 5 and 6, F 30, S. R. G., W. P., etc., down to the latest General Electric, Westinghouse and Walker single reduction series-parallel equipments. But the man who believes that compressed air has no field in street railway work is badly mistaken. Whether it will prove a success as a motive power on railroads we shall leave, for the present, to the capitalists now backing the latest experiments in that line; if they succeed we ought not to sulk in our tents, but accept the result.

At present the applied field of compressed air on railways is in braking, cleaning cars and motors, operating hoists for lifting car bodies, motors, wheels, and other heavy parts, and for operating punches, pneumatic drills and other tools. Its field of usefulness is even greater in the power house, and the writer may at some future time discuss its use in lifting water from deep wells, circulating and cooling condensing water for re-use, etc. An air plant for the uses here enumerated is a simple and inexpensive affair, consisting of any antiquated street car motor belted to a compressor of suitable capacity, from which leads of ordinary 1-in. or 2-in. iron pipe are carried to the point of use desired. There is practically no serious loss in transmitting air, and the pipes can be laid overhead, on the surface, or in the ground, as is most convenient. A small automatic compresser, say 6 in. x 6 in., costing about $300, will usually be sufficient for the shops and car sheds of the average street railway. If your water supply is taken from city mains through a meter, the cost of the air plant will be saved many times over, in decreased water tolls alone.

If you are fortunate enough to have your power plant, car sheds, and shops, all located at the same point, one compressor of the duplex or cross compound type will furnish air for all of them. Locate the compressor in the power plant and belt it directly to the counter shaft; you can pick it up or let it go with a clutch equally as well as a dynamo. If your electric machinery is direct connected, then use a motor belted to the compressor. Small compressors are, when self contained, usually provided with small slide valve engines, which are so wasteful that it is more economical to use current generated by highly efficient units than to take steam directly from the boilers for the self contained compressor. Air compressors offer the greatest resistance at the end of the stroke and for this reason they are inclined to have a jerky motion when direct connected to a motor or engine. Flexibility is gained by belting, and ease of action by "duplexing" or cross compounding, which enables the maker to so arrange the two crank pins with reference to each other that the load is coming on one as it goes off the other. The writer uses a cross compound compressor, 12

x 12 in. and 6½ x 12 in., turning at 110 r. p. m., which has a capacity of 174 cu. ft. of free air per minute and delivers at 135 lb. This machine is belted to a counter shaft, which also turns high frequency alternating lighting machines, yet the action of the compressor is so smooth that no perceptible fluctuations of voltage occur. This compressor along with other duties lifts 400,000 gallons of water each day out of a 4½-in. well. The indicated horse-power at full load is 30. We have also a self contained tandem compound compressor (one of the best of its type) of the same dimensions as the first mentioned, which does the same work and can be made to compress up to 200 lb. pressure.

The method of using compressed air to clean cars, motors, and other equipment is through a hose and nozzle just as water is used, a separate hose being used for cleaning motors or other parts liable to be oil soaked. The pressure used varies with the work to be done, from 5 lb. for floor sweeping or dusting a dry car, to 100 lb. or more for removing mud or grease. After the dust or mud has been blown off the paint, the outside of a car can be gone over carefully with a sponge and chamois skin dipped in water and stains removed from the varnish, which cannot be blown off. The air pressure may be constant from the compressor and varied as desired by the use of a valve nozzle. As little oil as possible should be used to lubricate the air cylinders of the compressor so that the air will be free from contamination. If the cars are upholstered it is best to heat the air quite hot when cleaning the cushions, as the heat destroys disease germs and insects, while blowing the dust out equally as well as if cold.

Accumulations of dust and dirt among the cables and lead wires beneath the seats of closed cars, and under the floors of open cars, lay the foundation for deterioration of insulation and consequent short circuits. Blow the dust and dirt out of the cables, off of the sills, from around the posts, between the lining and side walls, in fact, reach every crevice and crack from motors to roof, and after you think you are through it often pays to go over the car again.

The car cleaner if not a painter by trade should at least have worked in a paint shop until thoroughly familiar with the properties of the various materials used in painting a car and the proper method of cleaning paint and varnish without injuring it. A man who knows that if the varnish is abraded the color will "peel," or who notices that the varnish has "crawled," or the paint "turtle-shelled," or that the putty is "working," or that some places need retouching, is cheaper at any price than an ignorant man. While one is able to see at a glance the points that need attention, and thus report to you, so that the stitch in time may be taken, the other simply knows how to squirt water or air through a hose, and has no conception of whether what he is doing is a detriment or a benefit, and oftener than otherwise, does not care.

One of the most important points in the maintenance of rolling stock is to see that the cars are kept thoroughly varnished, for as long as the varnish retains elasticity and thoroughly covers the car neither the paint nor woodwork can deteriorate. As long as varnish retains elasticity it will catch dust and dirt and is susceptible to stains. Considerable skill is required to clean a newly varnished car without injuring the polished surface, and when once the gloss has been removed the varnish soon gets "dead," then it "scales," and as there is nothing left to hold the paint on, it in turn "flakes" or "peels." Put a man to cleaning cars who knows these things and the work of your paint shop will decrease about half, and the cars will always look well, for the intelligent interest of a thinking mechanic is behind the work.

Clean cars make business, and it is largely due to the fact that the cars are neater and better kept since the substitution of electricity for mules that the patronage has so greatly increased. The expectoration ordinances passed by the city councils of several progressive communities have helped greatly in keeping cars clean.

Cars should be swept out and dusted every night, but should be cleaned only in daylight. An extra car should be provided for each cleaner, and the cars run in and thoroughly cleaned in rotation as often as necessary, depending on the weather, nature of the soil and habits of your patrons and employes. Never under any circumstances allow a car to go out on the road filthy; it will pay far better to run one car short on the line until it can be cleaned. It is the little things which make and save dollars in the street railway business, but not littleness.

The writer worked at one time for a street railway company doing a business of $400 per day, one-third of which was net, and yet owing to a difference of opinion between the president and the landlord as to who should pay for $12 worth of plumbing there was absolutely no water available in the office of the company for drinking or bathing. That the president's office was in another part of the city it is needless to say. Put the means of keeping clean in the way of your employes and you will never have to complain of lack of neatness. In one corner of the engine room of our plant a board partition was built enclosing a space 8 x 10 ft.; in this was placed a 6-ft. copper lined bath tub costing $6.50, and a porcelain basin costing $4; the men about the plant ran a ½-in. pipe from the exhaust steam heater, and another from the cold water pipe to the bath room. We hung an 8-in. shower head above the tub and at a total cost of $14.50 had a bath room which so far as convenience and effectiveness is concerned is just as good as can be desired. A sign was put on the door, "No one but employes allowed to bathe in this room." The result was: An engine room kept clean, the machinery kept bright, the fire room swept, and a set of men who leave the plant for their homes looking and feeling like gentlemen. Further, and largely because of such little things, the corporation enjoys the confidence and respect of its employes. Say a word against the company or its methods to one of them and you either retract or fight on the spot.

The owner of the aggregation of interests under the corporate head of the Yoakum Improvement Co. is an English gentleman living in Liverpool; when the Spanish-American war began he purchased an American flag (cost probably $3) and sent it over with his compliments, requesting that it be raised above the standpipe of the water works, the highest point in the city. This was a little thing, but if you could have seen the crowd at that flag raising and hear the cheers for the Englishman you would have realized strikingly what a little tact will do to make a corporation popular with its employes and also with the masses, upon whom its existence depends.

Put a bath room and a reading room at each car shed and fit them up cheaply but efficiently. Do not fill the reading room with agricultural reports and Sunday school books, but buy paper backed novels, take the daily papers, subscribe for all the best electrical and mechanical publications, buy sets of chess, dominoes and checkers, and have the thing

absolutely free; then provide for keeping it clean and orderly by appointing a competent janitor, and furnishing him a barber's chair and a shoe polishing outfit, letting him take all he receives from the men for work in his line as his salary. Limit his charges to one-half or two-thirds the usual rates and prohibit him from annoying the men by soliciting patronage. The result will be, an employes' club, a set of contented men; when you need an "extra" you can put your hand on the crew instantly; gambling houses and saloons lose patronage; habits of neatness inculcated which prevent the employe from defiling the cars or allowing others to do it; less car cleaning is needed; less repairs to rolling stock; more patronage because everything is in good order, and goes with a snap only found where the employe has the interest of the company at heart, because he knows the company is interested in him. In the next paper, will be discussed the handling of car bodies and motors with the pneumatic lifts, cleaning motors with compressed air, and the use of pneumatic tools in the shops.

CHICAGO UNION TRACTION CO.

The organization of the Chicago Union Traction Co. was perfected at meetings of the stockholders held June 29th and 30th. Mr. W. S. McCrea was chosen temporary president of the Union Traction and as such received from Mr. Yerkes the two leases of the North and West Chicago properties giving as the nominal consideration therefor two silver dollars. The necessary formalities, examination of papers, transfer of stock, etc., occupied the greater part of two days and the delivery of the two leases was made at 11:45 p. m. June 30th. The terms of these leases and data concerning the property were given in the "Review" for June, page 374.

The stockholders of the new company elected the following directors: W. L. Elkins and P. A. B. Widener, Philadelphia; R. A. C. Smith and H. B. Hollins, New York City; Jesse Spalding, Charles L. Hutchinson, William Dickinson, Walter H. Wilson and C. K. G. Billings, Chicago.

The directors chose officers as follows: President, Jesse Spalding, Chicago; first vice-president, R. A. C. Smith, New York; second vice-president, Walter H. Wilson, Chicago; general manager, John M. Roach, Chicago; treasurer, J. H. Eckles, Chicago; assistant treasurer, L. S. Owsley, Chicago; secretary, J. C. Moore, Chicago; auditor, F. E. Smith, Chicago. John P. Wilson was appointed general counsel.

Mr. Spalding, the president, was born in Bradford County, Pennsylvania, Apr. 15, 1837, and graduated at the Athens Academy.

His early life was spent upon his father's farm, and later he was engaged in rafting logs down the Susquehanna River and Pine Creek. He was soon buying lumber for his employers, and when 23 years of age he was buying and shipping for himself. In 1860 he came West and realized the possibilities of Chicago as a lumber mart, and he determined to come here at no distant date. He accordingly established mills at Menekaunee, Wis., and at the mouth of the Cedar River, and established a sales yard in Chicago at Lumber and 12th Sts. Mr. Spalding was largely interested in the opening of the new lumber district at 22d St., which then had no street car connections. Partially through his energies the Lake Michigan Ship Canal & Harbor Co. was organized, which opened a canal across the peninsula from Sturgeon Bay to Lake Michigan, shortened the lumber route to Chicago by 150 miles and placed the shipping of lumber upon a safer basis. In 1892 the Government purchased the canal and made it free to the public. It was Mr Spalding who built Camp Douglas at the breaking out of the war. He has been always prominent in the counsels of the Republican party, and in 1883 President Arthur appointed him collector of the port at Chicago and in 1889 President Harrison made him one of the commissioners of the Union Pacific R. R. Under Mayor Colvin Mr. Spalding was for three years a member of the city council, and was instrumental as chairman of the finance committee in completely restoring the financial credit of the city. There are few men who have exercised a wider influence over the mercantile, political and social interests of Chicago than Mr Spalding, he is now a director in the Commercial National, Garden City and Hibernian banks and is president of the Spalding Lumber Co.

John M Roach is too well known among street railway men to require introduction to them, having been the general manager of the Yerkes System in Chicago; J. C. Moore has been secretary and treasurer of the North Chicago Street R. R.; L. S. Owsley has been secretary and treasurer of the West; J. H. Eckles is president of the Commercial National bank and was comptroller of the currency under Mr. Cleveland. F. E. Smith resigned as auditor of the Massachusetts Electrical Cos. to accept his present position; prior to the Massachusetts combination he was auditor of the Lynn & Boston and the Beverley & Danvers roads, of Lynn, Mass.

ELECTRIC CARS ON CHICAGO CITY CABLE LINES.

A little over a year ago the Chicago City Ry. was obliged to erect overhead electric wires on the down-town cable lines in order to accommodate its patrons while the Clark St. line was closed by reason of the railroad track elevation work at 16th and Clark Sts. These wires were removed as soon as the necessity for bringing electric cars over these tracks was over; now electricity is to be again used on the State St. line, this time because of repairs at the 21st St. cable station.

It will be necessary to rebuild the foundation of the cable driving machinery at this station. Recently one of the iron bedplates cracked; in addition to this the brickwork of the foundation has been injured by the oil and tar from the cable that fell upon it, and collected in the pits under the driving drums. This driving plant was erected in 1881, when the cable engines developed only 500 h. p.; they are now giving 3,000 h. p.

There are in this station three pairs of steam engines; the foundations of the pair first installed are in need of repairs, but it has not yet been decided whether to rebuild them, or take out these engines and put in a motor.

The State St. line between Van Buren and 63d Sts. will be operated by electricity, that portion north of 39th St. from the 21st St. station, and south of 39th St. from the 52d St. station of the company.

The company has for some years used a 600-h. p. motor for driving cable machinery in the 52d St. station; and this motor is now being placed in the 21st St. station, where it will run as a generator, being driven from a flywheel on the station jack shaft.

It has not yet been decided what provision will be made for handling the traffic on State St. north of Van Buren. The original intention was to run cars east on Van Buren to Wabash, and thence north on Wabash and around the cable loop; the Union Elevated Railroad Co. objected to having wires attached to its structure, and until a settlement is reached horse cars will probably be used on the State St. line below Van Buren St.

In the course of erecting the overhead work, which was done between June 22d and July 11th, 137 poles were set in one day, which is believed to be a record in pole setting.

ENJOINED FROM SELLING BONDS.

Justice Lambert, of the New York Supreme Court, has enjoined the Lima-Honeoye Falls Railway Co. and its receiver, Chas. B. Hill, from selling $40,000 worth of bonds issued for the sole purpose of rebuilding the road and erecting an electric lighting plant. D. A. Crage and Wm. F. Tench, a firm of Buffalo contractors, rebuilt the long abandoned steam road between these two cities, remodeling it into an electric line. The trolley road lost money and was again partially abandoned while still owing the contractors $10,042.50. The bonds were held in trust by A. F. Williams to be delivered to the contractors when the road was completed and it is alleged that Williams transferred the bonds to other parties for $10,000, which was much less than their value, and that no part of this money was paid to the contracting firm. The contractors ask that the transfer be declared illegal, and that judgment be given them against the railroad.

The tramway on the Blackpool (Eng.) promenade has been changed from the conduit to the overhead trolley system.

Decision in the Detroit Case.

Text of the Decision of the Supreme Court of Michigan Holding the Law Providing for Municipal Ownership of Detroit Street Railways to be Unconstitutional—Interesting Resumé of the Question of State Ownership in Michigan.

Mr. Justice Moore wrote the opinion of the court as follows:

Horace M. Oren, attorney general, vs. Hazen S. Pingree, Elliott G. Stevenson, Carl E. Schmidt.

This is a proceeding brought to test the validity of an act entitled "An act to authorize the City of Detroit to construct, acquire, maintain and operate street railways, and to construct extensions thereof." The provisions of the act material to this discussion are as follows:

"The people of the State of Michigan enact:

Section 1. That the common council of the city of Detroit, be, and is hereby authorized and empowered to appoint by resolution at any time within the next twenty years, three persons, electors and free holders of said city, who shall constitute a board of commissioners, to be known as the Detroit Street Railway Commission. One of said commissioners shall be appointed for the term of two years, one for a term of four years, and one for a term of six years. Their successors shall be persons of like qualifications, and shall be appointed by the common council on the nomination of the mayor of said city at the expiration of said term for the term of six years. Vancancies shall be filled by appointment by the mayor, and persons so appointed shall hold office for the unexpired term. All members of said commission shall hold their offices, respectively, until their successors are appointed and qualified. Any person otherwise eligible may be appointed as aforesaid, notwithstanding he may hold other office, excepting that of alderman.

Sec. 5. The said commission may in their discretion and upon such terms and conditions as they may deem advisable for the interests of said city aquire, by deed, lease or other satisfactory conveyance from the company or companies owning the same to said city, any street railway or railways existing at the time of the passage of this act and lying wholly within or partly within and partly without said city, operated by the same company or companies, together with the property, assets, rights, privileges, etc., owned and used in connection with or pretaining to said railways, including rights to routes belonging to such company or companies upon which a railway shall not be in operation, and may operate and maintain said street railways so acquired, for the carriage of passengers and freight for hire.

Sec. 6. Said commission may provide for the payment of rentals or other obligations and may provide for a sinking fund for the discharge of any liens upon any of the property acquired by them, and may pledge the earnings and receipts of said railways for these purposes, and may use the earning in operating and maintaining the same, and may use any surplus of earnings in acquiring any bond secured by lien upon the property so acquired, or may use such surplus in making needed extensions or betterments to said railways. Said commission shall have no power to incur any obligation on behalf of said city except such as shall be chargeable only upon the railways and property so acquired and the earnings and increments and extensions thereof.

Sec. 7. The said commission shall manage, maintain and operate any street railway so acquired or extended, and may purchase from the revenue therof all lands, tracks, cars, motors, dynamos, machinery, equipments, tools and furniture necessary and useful therefor to be used in connection therewith, and may establish rates of fare for the carriage of passengers and freight, provided the rates of fare shall not exceed those now charged by the Detroit Citizens' Street Railway Co. In operating any railway so acquired, the commission may exercise such other general powers as are possessed or exercised by boards of directors of corporations organized under the laws of this state providing for incorporation of street railway companies.

Sec. 8. After acquiring any railway or railways pursuant to section five hereof, said commission shall have the power to enter into agreements with any street railway company having a line of street railway, for or in relation to the exchange of tickets and transfers, and for the carriage of passenger, use of tracks or operation of cars, provided that such agreements shall not be inconsistent with or in violation of the terms of the conveyance or contract mentioned in section five hereof.

Sec. 11. All causes of action relating to or arising out of the owning, operating or control of any street railway constructed or acquired by said commission shall be prosecuted by or against said commission by the name herein designated and said commission shall carry into effect, pay or discharge any order, degree or judgment, in any suit or proceedings to which it shall be a party, in like manner as if the same were prosecuted or defended by said city: Provided, that no action for negligent injury arising out of operation of said railway shall be maintained unless it be commenced within one year from the time when the injury was received, nor unless notice shall be given in writing within thirty days from the time of such injury to the said commission, its secretary or attorney, of the time, place and circumstances of such injury and of the nature thereof.

Sec. 12. Nothing in this act shall be construed as granting any franchise to any of the existing street railway companies, or as extending the life of any existing franchise, or as implying any franchise rights in the case of reversion of the property to the grantors or their successors; and said commission is hereby expressly prohibited from granting or extending the life of any franchises under any of the powers conferred upon it by this act."

After the passage of the act the common council at an adjourned special meeting appointed the defendants as members of the commission, and they at once entered into negotiations for the purchase of the various street railways in Detroit.

The case is one of vast importance not only because of the magnitude of the interests involved, but also because the law provides an entirely new departure in this country, in relation to the ownership and management of one of the most important interests in the business world. We are not favored with precedents which will aid us, because with all their zeal and ability, counsel have not yet been able to find where an undertaking just like this has been entered upon. We have, however, had the benefit not only of well prepared written briefs, but of such oral arguments as the learned counsel who have given the questions involved special thought and investigation, cared to make. We have endeavored to give the case such attention as its importance deserves.

It is claimed on the part of the attorney-general the act is unconstitutional and void for the following among other reasons:

1. Because said act undertakes to confer upon the city of Detroit authority to engage in a work of internal improvement, contrary to the provisions of section 9 of article 14, of said constitution.

2 Because said act undertakes to confer upon a municipal corporation powers which are neither local, legislative nor administrative, contrary to the provisions of section 38, of article 4, of said constitution.

3. Because said act purports to give to said "Detroit Street Railway Commission" mentioned in said act, unlimited and unrestricted power to contract debts for and loan the credit of said city of Detroit, contrary to the tenor and effect of section 13 of article 15 of said constitution, which provides that the legislature shall provide for the incorporation and organization of cities and villages, and shall restrict their powers of taxation, borrowing money, contracting debts and loaning their credit.

4 Because the powers to contract and purchase sought to be conferred by said act upon said "Detroit Street Railway Commission" cannot be either conferred upon or exercised by said commission, under said constitution.

5. Because said act attempts to clothe said "Detroit Street Railway Commission" with legislative powers as to street railways and the operation and management of the same.

6. Because said act is an unlawful interference with the rights of local self government vested by said constitution in the citizens of said city, in that it undertakes to take out of the control of the Common Council and Board of Estimates of said city the several matters of purely local concern, above mentioned, and vest the

same in the said "Detroit Street Railway Commission," which is a body of members of which hold their offices for long appointive terms, are a law unto themselves and are subordinate and responsible neither to said citizens nor to their representatives in any manner or form."

Is the act contrary to section 9, article 14, of the constitution? The section reads as follows: "The state shall not be a party to or interested in any work of internal improvement nor engaged in carrying on any such work, except in the expenditure of grants, to the state, of land or other property." It is doubtless true, as argued by counsel, that the state legislature is given a general grant of legislative power and that its power to legislate is subject only to such limitations as are imposed thereon, by the express or implied limitations contained in the constitution of the state or the constitution of the United States.

To understand the force and effect of the provisions of our constitution in relation to the attitude of the state toward internal improvements, it may be well to consider the experience of other states, and of our own state prior to the adoption of our present constitution.

The war of 1812 demonstrated the great need of a better system of intercommunication between the various portions of the country; the condition of the highways, both land and water, was such that troops and provisions could be moved but slowly and at great expense. This was also true of the products of the country.

Succeeding the war of 1812, the state of New York entered upon the construction of the Erie canal. Its construction was doubtless of great benefit to the agricultural and commercial interests of the state, and especially to the city of New York. Other states were prompted to follow the lead of New York and projected the digging of canals, the improvement of waterways and the construction of railroads. Nearly all the state constitutions adopted between 1830 and 1850, either gave the legislature permission or made it mandatory to "encourage internal improvements within the state." Many enterprises of this character were entered upon, which were ill-advised; so many of them were undertaken, many of the states incurred obligations they were unable to meet. The rate of interest in these new countries was much higher than capital commanded in Europe. Money from there after 1830 was furnished almost without limit to be invested in the various projects devised by the several states. The state debts increased from thirteen millions in 1830, to one hundred millions in 1838. After the financial crisis of 1837 came, foreign capitalists who sought to draw out this money were unable to do so. An effort to collect these obligations proved abortive. Upon one pretext or another, many of the states repudiated their debts made for internal improvements. The states most disastrously affected were Maryland, Pennsylvania, Indiana, Illinois, Louisiana, Mississippi and our own state. 2 Cyclopedia of Political Science, 571.

For the period between 1835 until the financial panic of 1837 occurred, the state of Michigan had a wonderful growth. The opening of the Erie canal, and the facilities for travel furnished by the great lakes, made it comparatively easy for the residents of New York, New Jersey and New England who were seeking to better their condition to reach our borders. The climate was good and the soil was fertile. The example of New York in constructing works of internal improvement was thought worthy of imitation. The constitution adopted, upon the admission of the state into the Union, provided "internal improvements shall be encouraged by the government of this state; and it shall be the duty of the legislature as soon as may be to make provisions by law for ascertaining the proper objects of improvements in relation to roads, canals and navigable waters, and it shall also be their duty to provide by law for an equal, systematic and economical application of the funds which may be appropriated to those objects." The governor of the new state in a message to the legislature called its attention to its duty to act under the constitutional provision. The legislature was not slow to respond. A canal was projected from Mt. Clemens to the mouth of the Kalamazoo River, and one around the Falls of the St. Mary. A number of state railroads were surveyed and their construction entered upon. To meet the expense the governor was authorized to borrow upon state bonds, issued for the purpose, five million two hundred thousand dollars. These bonds were all negotiated, though owing to the failure of one of the companies and one of the banks, which undertook to negotiate them, the amount for which they were negotiated never found its way into the state treasury. It became evident the amount of the loan would not begin to complete the internal improvements already begun. Then came the financial panic, bankruptcy and financial ruin were upon every hand. The state, at a great sacrifice of its property, made an arrangement with its creditors, which left its credit good, but left it badly in debt

Cooley's History of Mich. 279.

Campbell's History of Mich. 495.

As the result of this experience, the state had the canal at the St. Mary's River which was afterwards taken over by the federal government, and is now one of the most important improvements upon the great lakes; a short section of a canal which has never been of any use except to furnish water power to private parties, and some uncompleted railroads which the people were glad enough to have sold to private corporations. Justice Cooley states the situation in detail: Cooley's History of Mich. 289.

"The works of internal improvement still remained on the hands of the state, and in the day of its poverty and trial they were continually calling upon a depleted treasury for money to keep them in progress. But now that the great bubble of speculation and inflation was burst, it became plain to the comprehension of the dullest that some of the state's projects were wild and chimerical, and they were abandoned altogether. Such was the case with the projected canal from Mt. Clemens to the mouth of the Kalamazoo River, which it is now seen would be worthless, if constructed. The only works, of much promise, were the central and southern of the three railroads, which were now very well under way. But doubts were arising in the minds of the people, whether the state had been wise in undertaking the construction and management even of these; whether it was possible for the state to do either the one or the other with the same prudence and economy as could private owners.

"These doubts soon matured into a settled conviction that the management of railroads was in its nature essentially a private business, and ought to be in the hands of individuals. By common consent it came to be considered that the state in entering upon these works had made a serious mistake; and the legislature in an act for funding the loan bonds, invited proposals from state creditors for the purchase of the state railroads. The times were not then propitious; but in 1846 the Central and Southern Railroads, so far as they were then constructed, were sold by the state, to corporations which had been chartered, for the purpose of purchasing. The aggregate price was two millions and a half, a sum very much below what had been their cost to the state. But the people felt the roads were well off their hands, and as has been said by one familiar with the whole history. 'Here virtually ceased to exist all our works of internal improvement. Nothing but the debris of our airy castles remained; and that only to plague our recollections.' The two great railroads when taken up by corporations went rapidly forward to completion; and they soon became great national highways, whose utility to the state was quite equal to the highest expectations ever formed concerning them.

"Having all their bitter experience with internal improvements fresh in mind, when they formed a new constitution, in 1850, the people resolved to put it out of the power of the legislature again to involve them in extravagant projects. And here we reach another landmark, significant in itself, but especially notable when contrasted with the provision respecting internal improvements which has already been quoted from the constitution of 1835. In 1850 the people deemed it necessary to prohibit what in 1835 they commended; and they now provided that the state shall not subscribe to or be interested in the stock of any company, association or corporation, and also that the state shall not be a party to or interested in any work of internal improvement, nor engaged in carrying on any such work except in the expenditure of grants to the state of land or other property. These were very positive provisions; and by adopting them the people believed they had rendered it impossible that projects of doubtful wisdom and utility should be engaged in at the public cost.

"But diseases in the body politic, like those in the human system, are likely to take on new forms from time to time and they are not to be exorcised by words, or kept off by constitutional inhibitions. The mania for internal improvements at the cost of the public when it returned fifteen years later under the administration of Gov. Crapp took on the form of aid to railroad corporations by the several municipal bodies of the state. Such aid was being given in other states, and railroads as a consequence were being constructed

with a rapidity never paralleled. Michigan was lagging behind the rest of the country; why should not this be so? Every town which should subscribe to the stock of a railroad would immediately receive a full return in the enhanced value of its landed property, and would have the stock besides. This was what was commonly said and commonly believed; and the legislatures, well reflecting the common desire, passed a general law under which townships and cities were to be permitted to vote aid to railroads. The railroads, under another general law, might be laid out anywhere by the projectors at pleasure, so that monopoly in these public conveniences seemed to be effectually provided against. The governor vetoed the railway aid act, but the legislature passed it over his veto. The business of voting aid to railroads was soon active, and the most visionary scheme was found as likely to receive aid as any other, perhaps more so, for more work would be done for it. Nothing is so easy as to build railroads if it can be accomplished by dropping votes into a box. Only fossils and croakers will disturb the public mind by reminders that the sums voted must at some time be paid, and that the roads when built may pay nothing towards them. The state in detail, by its corporations, was fast plunging into indebtedness, which had already reached an aggregate of several millions, when the process was arrested by a decision of the state Supreme Court that the act under which the voting had taken place was unconstitutional.

"The decision was a bitter disappointment to many, and the public clamor for a time was loud and earnest; but a movement to obtain an amendment to the constitution which would permit such municipal aid to railroads was unsuccessful, and the excitement soon died out. The people had taken the "sober second thought," and had become convinced that municipal corporations in their power to contract debts or to expend public moneys should be confined closely to proper municipal purposes. And this conclusion may be taken as a third conspicuous landmark in the history of internal improvements in Michigan."

The cases referred to by Justice Cooley were, People vs. Salem, 20 Mich. 487; Bay City vs. State Treasurer and Thomas vs. Port Huron, 27 Mich. 320.

We think it may fairly be said of the case of People vs. Salem, the opinion was rendered upon the ground that the tax proposed would be levied for a private rather than a public purpose. This, however, cannot be said of the case of Bay City vs. State Treasurer. In the last named case it is held the construction of the railroad was an internal improvement within the meaning of the constitution, and that what the state could not do, it could not authorize the townships and cities to do. The language of the opinion is not susceptible of any other construction. It is very clear from what has been quoted from the history of Michigan, written by Judge Cooley and published in 1885, that he so construed the decisions cited. The language of the opinion is as follows:

"Our state had, once before, a bit of experience of the evils of the government connecting itself with works of internal improvement. In a time of inflation and imagined prosperity, the state had contracted a large debt for the construction of a system of railroads, and the people were oppressed with heavy taxation in consequence. Moreover, for a portion of this debt they had not received what they had bargained for, and they did not recognize their legal or moral obligation to pay it. The good name and fame of the state suffered in consequence. The result of it all was that a settled conviction fastened itself upon the minds of our people, that works of internal improvement should be private enterprises; that it was not within the proper province of government to connect itself with their construction or management, and that an imperative state policy demanded that no more burdens should be imposed upon the people, by state authority, for any such purpose. Under this conviction they incorporated in the constitution of 1850, under the significant title of 'Finance and Taxation,' several provisions expressly prohibiting the state from being a party to or engaged in carrying on any work of internal improvement, or engaged in carrying on any such work, except in the expenditure of grants made to it; and also from subscribing to, or being interested in, the stock of any company, association or corporation, or loaning its credit in aid of any person, association or corporation. Article 14, sections 9, 8 and 7.

"All these provisions were incorporated by the people in the constitution as precautions as against injudicious action by themselves, if in another time of inflation and excitement they should be tempted to incur the like burdensome taxation in order to accomplish public improvements, in case they were not content to wait the result of private enterprise. The people meant to erect such effectual barriers that if the temptation should return, the means of inflicting the like injury upon the credit, reputation and prosperity of the state should not be within the reach of the authorities. They believed these clauses of the constitution accomplished this purpose perfectly; and none of its provisions had more influence in recommending that instrument to the hearty good will of the people."

The doctrine of these cases was again affirmed in Thomas vs. Port Huron, 27 Mich. 320. These cases all hold that what the state cannot do itself, cannot be done through the aid of inferior municipalities.

Counsel urge that the doctrine announced in People vs. Salem; Bay City vs. the State Treasurer and Thomas vs. Port Huron, was never accepted as correct by the profession in this state, and is contrary to the decisions of other courts. If we understand the logic of the argument, it is, that those cases should be overruled. We have had occasion recently to consider a contention of like character and supposed we had so clearly expressed ourselves, that the doctrine of those cases could no longer be questioned. We do not deem it necessary to repeat what was said upon that subject in Dodge vs. Circuit Judge, 76 N. W. Rep. 315.

Counsel suggest it is as competent to authorize the city to own and operate a street railway as to acquire and maintain a public park, water works, a lighting plant or a fire department, or to construct drains or construct sewers. It may be somewhat difficult to draw the line as to what a municipality may properly do and what it may not do, but all the things above mentioned are authorized and defended because it is a proper exercise of the police power. An adequate supply of water is needed for protection against fire. Fourth edition Dillon Municipal Corporations, sections 144, 146.

There can be no matter of higher public concern to any city than the supply of pure and wholesome water for all useful purposes and as population becomes more and more compact and cities grow, the ability of the individual member of the municipal corporation to supply his individual wants in that direction constantly diminishes and in all larger places it becomes a matter of absolute public necessity that the city itself should directly or indirectly provide the supply. Nothing so affects the health of the community as the character of its water supply. Prentise on Police Powers, 303.

Drains and sewers and parks are all needed in the interest of public health; 2 Dillon Munic. Corp. 4th ed., Sec. 598; Kinne vs. Bare, 68 Mich. 625; Prentise on Police Power, 56, 131, 242. Lighted streets tend to the prevention of crime. Police powers have their origin in the law of necessity; Prentise Police Power, 4. The exercise of these powers has little in common with what is sought to be done here.

It is urged that the internal improvements contemplated by the constitution must be of sufficient magnitude as to concern the people of the state. Citing Sparrow vs. Commissioner, 56 Mich. 575, and that street railways are mere local improvements, or a strictly local interest not known at the time the constitution was framed, and are not such improvements as are contemplated by the phrase, internal improvements, citing Street Railway Company vs. Detroit, Federal R., 646; Railway Co. vs. Mills, 85 Mich. 634.

It is not claimed these cases are directly in point, but that some statements contained therein lead to the conclusions just stated. The questions involved in this case were not at issue in the cases cited, and the opinions do not tend, in our judgment, to support the contention of counsel. We shall have occasion later to consider whether the improvements are of sufficient magnitude to be deemed internal improvements.

It is said if the theory of the atorney-general is sound, the city of Detroit cannot construct a macadamized road, or pave a street, or build a sewer. It is a complete reply to this suggestion to call attention to the fact that by sections 23 and 38 of article 4 and section 1 of article 11, the constitution has given to townships the control of highways, and to the cities and villages the control of the streets, for all purposes germane to their use.

It is said that while steam railroads are in a sense public highways, in another and legal sense they are not public highways, but that street railways are in every proper sense, public improvements within the meaning of our constitution. Our attention is called to the case of the Sun Printing & Publishing associa-

tion vs. Mayor, etc., N. E. R., 503, as sustaining this contention. It is true that case holds that it is within the legislative power to authorize the city to construct a street railway under the streets of New York, and when constructed to lease it for not less than thirty-five, nor more than fifty years, at a rental not less than the interest paid by the city for the construction, and one per cent in addition. The writer of the prevailing opinion stated the case was not free from difficulty, and the court considered the case, "hoping to reach a result that will afford necessary relief to the city and at the same time preserve the general policy of our system of government." It appears in that case that pursuant to the provision of the act the commissioners entered upon their duties and located a road to be built under the streets, through the main portions of the city, and then tried to induce private capitalists to undertake its construction. No private capitalists were willing to undertake the construction of the road and it was undertaken by the commissioners for the city.

In the course of the discussion reference was made to certain cases decided by the Ohio court, and this language is used: "We do not understand that the views above expressed are in conflict with the Ohio cases. In that state the constitution does not limit municipal expenditures to 'a city purpose.' We do not, however, wish to be understood as approving of those cases especially in so far as they sustain the right of a city to construct a railroad mainly outside of its own territory and state." In conclusion the opinion is as follows:

"Our government was established by the people for their own protection and welfare. Their policy was to foster and protect individual industry and enterprise. To such policy we owe our advancement as a nation, and to such we may look for our future prosperity. The constitution should be construed with reference to this general policy, and ordinarily railroads should be constructed and operated by private capital. The situation, however, in the city of New York, is most peculiar. A long, narrow island lies between two rivers, so narrow in places that there are practically but two or three streets through which the masses must reach its business center. The population of the city during the last half century has increased from three hundred thousand to over a million and a half of people. The travel upon its existing railroads during the last twenty years has increased from one hundred and fifty million in 1874 to upwards of four hundred and forty-eight million in 1894. It was conceded upon the argument that the crowded and congested condition of the travel upon the streets in the city renders the proposed structure necessary. These considerations have induced us to give to the provisions of the act a most liberal construction. The commissioners located the road, and tried to induce private capital to construct and operate it. In this they have failed and the situation is such that the city must itself construct the road or go without it. Here we have a demand for a great public highway, which private enterprise and capital will not construct. It is necessary for the welfare of the people, and is required by them. It is public in character and is authorized by the legislature. Our conclusion is, that under the circumstances and situation here presented, the proposed road may properly be held to be 'for a city purpose,' and that the acts are not in contravention of the provisions of the constitution."

The doctrine stated in the Ohio case cited Walker vs. Cincinnati, 21 Ohio S. 14, is contrary to the holdings of this court, as has already been shown, and cannot be reconciled with the later cases of Taylor vs. Commissioners, 23 Ohio St. 22; Wyscaver vs. Atkinson, 37 Ohio St. 80 and Counterman vs. Dublin, 38 Ohio St. 515. It is evident the conclusion reached in the prevailing opinion is based upon the ground that because of the crowded condition of the city and its peculiar shape, the improvement was a necessary one and that as private capital and enterprise would not enter upon its construction, it was lawful to authorize the city to do so. None of the conditions existing in New York justifying the city, if it was justified in entering upon the construction of the road, exist in Detroit. The city is already well supplied with means of transit, and if abuses exist in the management, the authorities have ample power to correct them. The dissenting opinion in this case is more in harmony with the law in this state, than is the prevailing opinion.

We are not entirely without light in relation to what constitutes an internal improvement within the meaning of the constitution. We have already seen that steam railroads come within the category. In the case of Ryerson vs. Utley, 16 Mich. 270, it was held that an attempt to improve the navigation of the Muskegon River by removing therefrom sand flats, came within the constitutional inhibition. In Hubbard vs. Springwells, 25 id. 152, it is said that a macadamized road is a work of internal improvement. "The shortness of the road does not change its character. The restriction is not against great works, but against all works of that kind, and the case comes within the language and intent of the prohibition." The court held that work of that character must be done by the local authorities because under the constitution they had been entrusted as we have already stated, with the care of the highways. In Anderson vs. Hill, 54 Mich. 477, it is held that a township cannot be authorized to vote money to aid in deepening or straightening the Dowagiac River, because it is an internal improvement. The court said "that the straightening or otherwise deepening the channel of Dowagiac River in Van Buren County expresses a work of internal improvement, needs no argument." * * * * If the legislature has the authority to pass a law permitting the majority of the legal voters of a particular township to impose a tax to aid the state in the work of an internal improvement, it has the authority to impose such by direct enactment without the intermediate step of a vote of the people and against their wish, and the rule is well settled if it has not the power to impose such tax directly, it cannot authorize the imposition of the tax indirectly through a vote of the municipality or people."

In Sparrow vs. Com. of Land Office, 50 Mich., 367, it was held that straightening and opening the channel of Cedar River was an internal improvement, though the decision was put upon another ground. Justice Campbell used this language: "There can be no doubt of its being a work of internal improvement. That phase is as broad as language can make it. It can make no difference for what direct or indirect purpose of public utility an improvement is made so long as it comes within such definition, and it can make no legal difference over how much of the state it passes. All works of convenience, whether for travel, drainage or irrigation, are similar in their nature when small and large, and works for all of these purposes have been made of all dimensions, and for large and small districts. It is impossible to draw any line of magnitude. Any such work that is deemed important enough for the state to construct is within the rule, and if not built in the permitted way is within the prohibition." Justice Champlin agreed with this statement, while Justice Cooley said he did not intend to question the correctness of the decision in Ryerson vs. Utley and Hubbard vs. Springwells. In Wilcox vs. Paddock, 65 Mich., 23, it is held that the straightening and deepening of Maple River is an internal improvement within the meaning of the constitution. The constitution of Minnesota has a provision that "the state shall never contract any debts for works of internal improvement or be a party in carrying on such works." A bill was passed providing for a board of railway and warehouse commissioners, who were authorized to erect a state warehouse or elevator at Duluth, for public storage of grain. This was held to come within the constitutional inhibition and the learned judge enters upon an extended discussion of what constitutes internal improvements and the authorities relating thereto. It is too long to insert here. This language is used in the opinion: "The time was when the policy was to confine the functions of government to the limits strictly necessary to secure the enjoyment of life, liberty and property. The old Jeffersonian maxim was that the country is governed the best which is governed the least."

At present the tendency is all the other way and towards socialism and paternalism in government. This tendency is perhaps to some extent natural as well as inevitable as population becomes more complex in its relations. The wisdom of such a policy is not for the courts. The people are supreme and if they wish to adopt such a change in the theory of the government, it is their right to do so. But in order to do it, they must amend the constitution of the state. The present constitution is not framed on any such lines.

When the reasons arose for placing in the constitution the provisions in relation to internal improvements, judged from our standpoint, the railroads were imperfect, their passenger cars were not much heavier than the large stage coaches and would carry from eighteen to twenty-four passengers. In many instances the rails were flat bars of iron, less than an inch thick, laid upon rails of wood and kept in place by spikes. The roadbeds were not well graded nor heavily ballasted; the locomotives weighed from two to six or seven tons. Cars were passed over the steeper grades by counter weights of box cars, weighted with stone, which balanced them like

window weights balance window sash. As there were no long railways, there was no freighting, except light articles, for any considerable distance. The rolling stock was cheap and scanty; great weight and great speed would have destroyed the tracks. The entire cost of building what is known as the Michigan Central road to Marshall was about $2,000,000, and it is probable the value of all internal improvements entered upon by the state was less than $5,000,000.

Campbell's History of Michigan, 484.

The pleadings show that the various street railway companies own and operate in Detroit, one hundred and forty-one miles of street railways which the defendants propose to take over; if the tracks inside the car barns and abandoned tracks be added, the single track milage is about 179 miles. There is a bonded debt upon these roads of upwards of $10,000,000, and their property is regarded as worth between $5,000,000 and $17,000,000. It is currently reported the commission propose to pay upwards of $16,000,000 for this property, besides assuming its indebtedness. By virtue of agreements made between these companies, there are run on their lines in Detroit, cars owned by other companies, which start from Pontiac, Oakland Co.; Mt. Clemens, in Macomb Co.; Ann Arbor, in Washtenaw Co., and the city of Wyandotte, in Wayne Co. The tracks of these roads are laid in a very substantial manner. The cars of the outside roads will accommodate fifty to seventy-five passengers each, are of great size and run at frequent intervals. It is a matter of common knowledge that over some of these lines, cars marked "special" are now run at frequent intervals carrying freight. An electric road is now projected from Ann Arbor to Lansing, and from other of the lines now reaching Detroit to various points in the interior of the state. This method of transit or some improvement thereon is yet in its infancy. It does not require one with the ken of a prophet to see that in the near future the villages and cities of the state will be connected with a network of methods of rapid transit.

By the terms of the bill, section 5, "The said commission may in their discretion, and upon such terms and conditions as they may deem advisable for the interest of said city, acquire by deed, lease or other satisfactory conveyance from the company or companies holding the same to said city any street railway or railways existing at the time of the passage of this act, and lying wholly within or partly without said city, operated by the same company or companies, together with the property, assets, routes, privileges, etc., owned and used in connection with or pertaining to said railway, including rights to routes belonging to such company or companies upon which a railway shall be in operation, and may operate and maintain the said street railways so acquired for the carriage of passengers and freight for hire."

Another section provides that after acquiring any railway pursuant to section 5, the "commission shall have the power to enter into agreements with any street railway company having a line of street railway for or in relation to the exchange of tickets and transfers and for the carriage of passengers, use of tracks or operation of cars," provided such agreement shall not be contrary to the provisions of section 5.

It is stated in the briefs of one of the counsel for defendants that during the past year the railways of Detroit carried forty-five millions of passengers. The state roads of 1850, crude as they were, provided improved methods of moving passengers and freight over what had before been in vogue. The electric roads of 1899 are still greater improvements for the same purpose. The rails used by the electric railway are much heavier, and more substantial. The track is much more substantial than those used prior to 1850. The cars will accommodate three or four times as many people. The transit is much more rapid.

The entire cost of all the improvements entered upon by the state would not amount to one-half the amount which the record discloses the commissioners expect to pay for the property they intend to take.

To say the system of railroads as it existed in 1850 constituted internal improvements within the meaning of the constitution, and that the system of roads existing in Detroit, which are to be taken over by the commission, and the lines leading thereto with which said commission is allowed to make agreements for deeds, leases and in relation to the exchange of tickets and transfers, is not a system of internal improvements within the meaning of the constitution, is to deny to words in common use their ordinary and accepted meaning. If the legislature may authorize the city of Detroit to enter into the proposed arrangement, it may authorize any other municipality to do so, and by concert of action, between the various municipalities, they may cover the state with means of rapid transit, owned and operated by the municipalities. This would enable the state to do so by means of agencies called into being by itself, what it cannot itself do, and what the constitution forbids it doing.

It is said that the constitution was adopted a long while ago, and this is a gigantic age in which enterprises are being formed on a scale so vast as to be almost beyond comprehension, and the constitution ought to be given a construction in keeping with the spirit of the age. This argument is more properly addressed to the people than to the courts. Constitutions do not change as public opinion changes. Their provisions do not mean one thing one day and another another day. The written constitution is the most solemn declaration of the people in relation to the powers of state. It was drawn by their representatives selected especially for that purpose; it had their approval at the polls. Every officer of every kind in the state is required to take an oath to support it, before he can enter upon the duties of his office. It is not a pleasant duty to declare that a law passed by the legislature and approved by the governor is not valid. When such a law is enacted courts cannot for a moment hesitate in performing that duty, disagreeable as it is. The provisions of the constitution involved in this controversy have been in existence for nearly half a century. As we have already shown, they were construed along the lines of this decision nearly thirty years ago. The people of the state have not indicated in the way provided by the organic law any dissatisfaction with these provisions. The courts cannot substitute their judgment of what the constitution ought to be for what the people have made it. Its provisions must remain and control until the people see fit to change them in the way provided by the constitution itself.

McPherson vs. Secretary of State, 92 Mich. 377.

It is not necessary to discuss the very serious question whether a commission could be authorized to buy from five to eighteen million dollars' worth of property and subject the city of Detroit to the liability growing out of the operation of upwards of one hundred miles of electric street railways without giving the citizens and taxpayers an opportunity to say whether they wanted to purchase and operate such a business or not; nor is it necessary to discuss the other questions raised by counsel, for if we are right in our conclusion that the law is unconstitutional this disposes of the case.

We were asked by one of the counsel in his oral argument whatever our decision in this case might be to decide the question whether the city under any circumstances may build or buy lines of street railway in its streets all lying within the city limits and lease them upon such terms as the city authorities shall deem to be for the best interests of the citizens. It is not necesary to pass upon the question just stated in order to dispose of this case. The law under consideration involves much more than the simple question of municipal ownerhip of the tracks within the corporate limits, and in the decision of the case before us we do not deem it wise to express any opinion upon any question other than the one before us. It will be soon enough to pass upon the other question when it is necessarily before the court, and when the court can have the benefit of the conditions and surroundings then existing.

We think the law unconstitutional, that there is no such office as the "Detroit Street Railway Commission," and that defendants have no title thereto, and that judgment of ouster be entered.

The other justices concurred.

DETROIT & LAKE ORION RAILWAY CO.

The management of the Detroit & Lake Orion Railway Co. has cause for congratulation in the rapid progress it is making with its enterprise. The power house is a brick building designed and erected under the supervision of J. G. White & Co., of New York and Baltimore. The equipment comprises two 250-h. p. Cahall boilers, two 300-h. p. Ball & Wood engines, two 200-kw. Crocker-Wheeler direct-connected railway generators, one 60-kw. Crocker-Wheeler booster and one 90-kw. lighting generator.

The Metropolitan Street Ry., of New York, has decided to issue $5,000,000 more stock; its present stockholders will be permitted to take one-eighth of their holdings in the new stock at par.

WHICH HAS BEST RIGHT TO GONG?

Down in Savannah, Ga., the street cars have for a long time been equipped with a special type of rotary gong, the pealing tones of which penetrate a long distance. Recently the fire department became enamored of these bells and straightway equipped all is apparatus. Then nobody could tell whether it was a steamer coming down the street and to be scared, or just the electric car and pay no attention. The city council finally ordered the street railway people to pull off their gongs and go find themselves others which are different. It was at this critical juncture that the vice-president of the company, J. H. Fall, expressed himself as follows on the relative responsibilities of fire department and street cars:

"I cannot help but think that the council acted hastily in this matter. I have no doubt that the intentions were of the best, but if some representative of the street railway company had been given an opportunity to discuss the question the council might have been brought to see the matter in a different light. The only question is how the number of accidents resulting from collisions with street cars can be decreased. If two vehicles are approaching each other rapidly, even on a narrow street, an accident can be avoided by the driver of each vehicle sticking rigidly to the right hand side of the street. A street car motorman cannot avoid an accident in this manner. The car is pinned down, as it were, to two lines of rail. Either the vehicle or person occupying the track in front of it must clear the right of way or there is trouble, unless the motorman is fortunate enough to stop the car in time to prevent the accident.

"Again, an engine or a patrol wagon coming along the street, can avail itself of the entire street. If a man or child or a wagon suddenly comes upon its route from a cross street the driver can swerve his team to one side or the other and thus avoid an accident. The street car has no such advantage. It must either keep straight ahead or come to a full stop, and the latter is not always possible. Again, admitting rotary bells to be of advantage in preventing accidents, I think the argument is altogether in favor of their use by the street cars as against the fire apparatus. We have a number of street cars constantly on the street for the greater part of twenty-four hours. The fire department, with a less number of vehicles than we have cars, makes a run once a day, or once a week, and sometimes only once a month. The rotary gongs are, of course, an advantage to the fire engines, and they should not be without them, but the proportion of our need to theirs is as 100 to 1. In all probability, estimating the number of hours which each car is upon the streets, and placing against it the estimated number of hours which each vehicle of the fire department is upon the street, the proportion is probably nearer 500 to 1. That is, supposing all the street cars to be equipped with rotary gongs as well as the vehicles of the fire department the street car bells would be heard 500 times on the streets to every time a fire engine bell was heard.

"What we want to do is to reduce the possibility of accidents to a minimum. The bells are not attached to the cars for ornament. If the council says so we will attach a church bell to each car."

RAILWAY CONSTRUCTION IN MEXICO.

The manner of obtaining concessions from the Mexican Government for building railways and the way in which the roads are built and operated are explained in an interview with Mr. John P. Ramsey, general manager of the Rio Grande, Sierra Madre and Pacific Railroad, published in Modern Mexico.

Charters are obtained through the Department of Public Works and Communications, usually by individuals who reserve the right to transfer them to a company to be afterwards organized. The Government of Mexico maintains a monopoly of all railroads operated in the Republic, but the right to operate them for a specified time is often conferred upon corporations. When governmental assistance is given in the way of subsidies the franchise is usually given for 99 years after which the road reverts to the Government.

The Government then maintains representation on the board of directors and an inspector at all times on the work, not only when the road is under construction but after it is in operation. General offices may be located at any convenient place, but if not in the City of Mexico a representative must be stationed at that city. All plans must be approved by the Government. Subsidies vary in amount according to the difficulties met with in construction and range from $7,000 to $25,000 or even higher per kilometer. They are paid in Government bonds, in lands, or in both. The cost of construction of a standard gage road will vary from $10,000 to $50,000 per mile in mountainous districts.

Across the barren desert lands the work is performed most economically with teams and scrapers. The men live in camps along the line and food and water is drawn by teams from the nearest point of supply. Where sand is encountered the expense of supplies is very high. Water costs 50 cents in gold per barrel in camp. After the track is laid trains are used in covering the sand with clay and a heavy form of disintegrated lime called "calichi" which is found in large quantities. The labor employed is largely of the native "peon" class and a certain proportion of white and black Americans, the lowest wages being $1 per day in Mexican money.

There are no duties charged on materials of construction imported from the United States or elsewhere. After completion one man for every two miles will keep the track in good condition where traffic is light.

The fuel used is bituminous coal and cord wood. Coal costs from $4.25 to $6.00 per ton and wood is as low as $2.75 per cord. The wood used is principally "grease wood" roots dug from the sand hills by the Mexicans and transported to market on the backs of burros.

The rolling stock must include first, second and third class cars in accordance with Government regulations. No changes in the rates of fare may be made without authority and publication for 15 days if decreased, or 30 days if increased.

NOTES FROM NIAGARA FALLS.

The Niagara Gorge Railroad Co. commenced running under its new management on Saturday, July 1st.

It is expected that the International Traction Co. will open its electric car service across the new suspension bridge at Lewiston on the lower Niagara river some time during July.

Sunday, June 25th, was the heaviest day the Youngstown & Lewiston electric road ever had. Under the management of Mr. Frank G. Lott this road is capturing much new business.

Mr. L. D. Rumsey, president of the Youngstown & Lewiston electric road, has purchased river front property in the village of Youngstown for $3,500. It is the intention of the company to build a wharf on the property for the purpose of affording dock facilities for excursion steamers, the idea being to book excursions for Rumsey Park, on the line of the road on Lake Ontario. It is understood several thousand dollars will be expended in beautifying the park before next season.

The International Traction Co. hopes to have connection made between its Falls St. tracks and the upper steel arch bridge at Niagara Falls before August 1st. Plans have been submitted to the commissioners of the New York State reservation covering the proposed track on the Riverway from Falls to Niagara St., and as soon as the commissioners approve the plans, at a meeting soon to be held, the work of track laying will commence.

New York state factory inspectors are investigating the working hours of the employes of the Rochester Railway Co. The law in question provides that the men shall not be required to work for 10 consecutive hours. According to the schedule of the company, the men work 11 hours a day, in beats of five and six hours, with intermission of from one to five hours, and such an arrangements, the company holds, does not run counter to the provisions of the act.

A CORRECTION.

In describing the attractions of Sans Souci Park, the new Chicago pleasure resort, in our June issue, page 423, it was stated that Mr. W. R. Inshaw had built the large switch-back merry-go-rounds which are now operated in New Bedford, Mass., and Schenley Park, Pittsburg. Messrs. Norman & Evans, of Lockport, N. Y., advise us the statement as printed was incorrect, they having themselves built the two merry-go-rounds mentioned. We regret having inadvertently credited them to the wrong party.

IN THE POWER HOUSE.

This department is devoted to the construction and operation of electric railway power houses. Correspondence from practical men is specially invited. Both the users and makers of power house appliances are expected to give their views and experiences on subjects within the range of the department.

IMPORTANCE OF THE POWER HOUSE.

Mr. Granville C. Cunningham, who is well known to American street railway men as chief engineer of the Montreal Street Railway Co from 1892 to 1897, when he left Canada to become manager of the Birmingham (England) tramway system, recently read a paper before the Institution of Civil Engineers on "Mechanical Traction by Electricity," in which he gives his preferences in power house equipment and summarizes the results obtained in the plants under his management.

It is pointed out that the financial superiority of electric traction all lies in the saving in power, and for this reason the power house is the point on an electric system to which the skill and intelligence of the engineer should be mainly devoted.

Horse traction—by which is meant the cost of horse-keep, wages of grooms, shoeing, veterinary expenses, but excluding drivers' wages—is 3½d. per car-mile in Glasgow and 5d. in Liverpool. Glasgow is level and the annual car mileage is 7,000,000; Liverpool is hilly and the annual car mileage 4,000,000. As opposed to these figures the cost for fuel, wages, oil, and maintenance of the plant is placed at a little less than ½d. per car-mile for a level city and a little more than ½d. for a hilly city. Mr. Cunningham continues:

"But in order to insure this low cost of working, every care must be taken in the power house. In choosing its site, it should be placed so close to a plentiful supply of water, where all that is requisite for condensing purposes may be had at a nominal charge, or merely for the cost of pumping. A river, canal, pond, or the sea, would afford what is needed. It should be conveniently situated for the supply of coal from railway line, canal, or wharf, so as to save the charges of handling fuel. One shilling per ton saved in cartage would amount to a very considerable sum in a year in a large traction station. But, needless to say, the most important matter is the type of engines, boilers, and heat-savers to be used. The writer favors low-speed (70 revolutions) compound condensing engines, such as are built by numerous firms; boilers of the Lancashire or Galloway type, with Green's economizers. A plant of this character was constructed and worked under the writer's charge on the Montreal Electric Street Ry., with the result that the cost of producing current was a little under our farthing per kilowatt-hour, and the cost per car-mile less than a half-penny in the open months of the year, when coal could be obtained for 9s. per ton. The consumption of coal was 3.38 per kw. h., or 2.60 lb. per e. h. p. h., and this was maintained during months of working. The average for a whole year was only 2.75 lb. per e. h. p. h. It is not pretended that this is a phenomenally low rate of consumption. On board many of the large ocean-going steamers as low as 1.50 lb. of coal per h. p. has been reached with triple-expansion engines; but the writer believes that few electrical power houses have been able to show better results than those mentioned. Nor is the result to be attributed to a very large output; precisely similar results can be obtained by using similar appliances on a smaller scale. In the Montreal house there were six 800-h. p. engines, and the daily output of current averaged 43,000 units. But the author has recently obtained similar results with a small cable plant on the Birmingham cable system. In 1897 this plant consisted of a pair of single-cylinder engines running at 53 revolutions of 287 maximum horse-power, with Galloway boilers, and no special heat-saving appliances. It was necessary to increase the engine power to meet increased traffic. The author put in a pair of superposed compound condensing engines of 400 h. p., running at the same speed as before, and obtained condensing water from a well in conjunction with a tank and cooling tower. The result was that the consumption of fuel was reduced from about 325 tons per month, or 8.9 lb. per car-mile, to 6.5 lb. per car-mile; and the introduction of Green's economizers has further reduced the consumption to 4.7 lb. per car-mile, or to about 3 lb. per h. p. h. On the Birmingham small cable system, the saving does not amount in money to a large sum, but on a great electric system running, say, 7,000,000 car-miles in the year, 4 lb. of coal saved per car-mile, at 9s. per ton, amounts to 5,625l. per annum; and it is this consideration that gives emphasis to the plea for an economical power-house plant.

"To return to the previous line of argument. Note what a large saving is effected when a cost of ½d. per car-mile for power is substituted for 5d.; on a car-mileage of 7,000,000 it means no less a sum than £131,250 per annum! and indicates the source whence the increase of net earnings may be obtained to pay for the heavy cost of electrical installation. The whole cost of working a large electric system, including working charges of all kinds, should be under 5d. per car-mile; but this can only be obtained with a carefully constructed power house, where the works-cost of the current is cut down to a minimum.

"The limits to which this note had to be confined prevent the introduction of any more elaborate figures or statistics than those given; but enough has been said to indicate that, in the writer's judgment, it is to the power house that the chief attention should be directed in order to insure the financial success of an electric system. Other parts of the system claim attention, but it is on this that success or failure mainly turns. More money can be lost on the one item of power than would pay all the other working charges; and whether the high potential system with transformers, or the multiple unit system be adopted, the successful working ultimately depends upon having engines and boilers that will do their work with a low consumption of fuel."

STEAM VS. ELECTRIC AUXILIARIES.

At the recent meeting of the National Electric Light Association in New York Mr. W. S. Barstow presented a very interesting paper entitled: "A Local Transmission System—Development and Operation." The paper described the system of the Brooklyn Edison Co. and contained valuable data on the relative advantages of electric and steam station auxiliaries. On this subject Mr. Barstow said:

"When the Union station was first discussed, the Brooklyn company made every endeavor to weed out all details that tended to poor economy, and thus start the system with a modern, up-to-date generating plant. Among the various items was discussed the question of station auxiliaries. As a result of these investigations the Union station was designed and equipped with all auxiliaries electrically operated, the steam from the boilers being used only in the main engines.

"There is often brought forward the question as to whether the loss in feed-water temperature, etc., will not more than balance the high efficiency of the electric auxiliary. Owing to the fact that it is impossible to find two plants of equal size operating under similar conditions, an exact actual general comparison between steam and electric auxiliaries is difficult to obtain. The ideal conditions of a steam auxiliary in regard to efficiency would be: First, no loss of radiation from supply piping or the device itself; second, sufficient waste exhaust to be entirely condensed in a supplementary heater at all station loads; and, third, the replacing of such condensed exhaust back in the boiler. Under these ideal conditions all heat units of the exhaust of the auxiliary could be recovered, and such a system would be perfection. In the ordinary central station we find that the radiation of supply piping and the pumps themselves involve a loss of 25 per cent, and that the pumps require more steam than can be condensed in the feed-water heater under different conditions of load, thereby allowing surplus steam or heat units to escape to the atmosphere, and also that it is impractical in the majority of cases to return to the boiler the steam condensed by the feed-water heater,

COST OF POWER FOR ELECTRIC RAILWAYS.

Output Measured by Wattmeter in Each Case.

STATION.	MONTH, 1899.	Monthly Output, Kilowatt-Hours.	Cost of Electrical Output per Kilowatt-Hour Cents.						Gals. Cylinder Oil per 10,000 k. w. h.	Gals. Lubricating Oil per 10,000 k. w. h.	Lbs. Water per Lb. Coal.	Lbs. Fuel per k.w.h.	Price of Fuel per Ton of 2,000 Lbs.	Kind of Fuel
			Fuel.	Labor	Supplies, Oil, Waste, etc.	Water.	Repairs.	Total.						
1	Mar.	1,048,052	.313	.145	.035	.034	.035	.562	3.57	.01	11.82	2.66	2.36	Bituminous
3	"	226,002	.559	.263	.053	.026	.057	.958	4.3	2.8	..	5.26	2.12	"
4	"	409,945	.346	.146	.026	.005	.012	.535	2.38	4.0	.	3.20	2.16	"
5, Metropolitan Elevated, Chicago.	Feb.	1,605,472	.386	.163	.022	.025	.058	.654	.83	.29	5.68	4.22	...	"
5	Mar.	1,424,815	.404	.176	.026	.029	.041	.671	.83	.29	6.06	4.81	...	"
8	"	488,075	.425	.234	.036	.016	.019	.729	...	..	..	...	...	"
9	"	835,246	.631	.257	.050	.026	.026	.991	..	..	..	...	...	"
10Central Av., Metropolitan, Kansas City, Mo.	"	487,122	.288	.104	.008	.006	.006	.415*	1.1	2.1	..	4.89	1.18	"

*Miscellaneous .002.

owing to the presence of oil, and that the methods of separating the oil from such water are naturally slow and in themselves involve a loss of heat or expenditure of energy. Thus the entire problem becomes one of actual practice rather than theory. With electric auxiliaries driven from the main engine, or auxiliaries connected with the main engine, the economy of the auxiliary is very nearly the economy of the main engine itself. In other words, the electric auxiliary can develop a horse-power on the shaft of the pump with about 18 pounds of steam, including losses. This is about one-fifth of the energy required by a steam auxiliary best suited to the conditions; but, on the other hand, the electric auxiliary returns no energy back to the plant, and a certain allowance must be made for the loss in feed-water temperature. In considering the two systems in any individual plant, comparisons should be made both with systems using economizers and exhaust heaters, one using supplementary heater with steam auxiliaries and the other electric auxiliaries without supplementary heater. In many cases the highest efficiency can, no doubt, be secured by using a few steam auxiliaries that would furnish just sufficient steam to be condensed in the supplementary heater, varying the use of the steam auxiliaries with the load.

"The actual energy required by the electric auxiliaries at the Union station, with a load of 2,732 i. h. p. on the main engine, is as follows:

	Electric horse-power.		Per cent.
Air pumps on surface condensers	11.6	or	.42
Circulating pumps on surface condensers	14.4	"	.53
Boiler feed-pumps	23.6	"	.87
Total of main auxiliaries	49.6		1.82

"Reducing this to indicated horse-power at main engine, 66.8 i. h. p., or 2.45 per cent of the total steam used in the station.

"In addition to reducing to a minimum the energy required by the station auxiliaries under ordinary conditions, the building was so constructed as to alter somewhat the conditions and reduce to a considerable extent the amount of work itself which the auxiliaries were to accomplish. This applied particularly to the method of circulating the water for the surface condensers. Two large tunnels, each 12 ft. high and 8 ft. wide, were constructed, side by side, beneath the entire foundations of the building, with their openings below the mean tide level and extending out into the bay. These tunnels, constructed of heavy masonry and extending directly beneath the large surface condensers, are always filled with water, which rises and falls in both tunnels equally, according to the tide of the bay. The circulating water is taken from one tunnel by a direct-connected electric centrifugal pump, passed through the surface condenser and discharged into the other tunnel, the discharge pipe extending below the lowest water level. This construction forms a water loop in which both legs are of equal length, and in which loop are located centrifugal pump and surface condenser. Thus, when the water is once started, the columns balance one another, so that very little power is required by the centrifugal pumps. In order to prevent an air pocket from forming and breaking at intervals the discharge column, an air-pipe connection is carried from the top of the discharge opening in the condenser to the air pump, a very slight turn of the valve sufficing to keep all of the air out of the system. Whereas, under ordinary conditions, about 26 h. p. would be required, under these new conditions but 7 h. p. is necessary to circulate water sufficient for furnishing 26 in. of vacuum to 1,500 h. p.

"Among the auxiliaries might be classed the generator field-exciters. The question of economically exciting the fields of large alterators has been one which has often been overlooked to a large extent as a matter of small importance. Exciters directly connected to the shaft of the engine operating the alternator, or belted to the same shaft, have introduced more or less trouble, as any variation in the speed of the main engine produces a cycle in variation of field regulation which is at once disastrous to the good operation of the system. After carefully studying the subject, the following plan was adopted in the Brooklyn installation:

"A high-tension, synchronous motor, directly connected to a low-tension, direct-current generator, is directly connected to the bus-bars of the station, to which are connected the main alternators. The low-tension, direct-current generator, connected in multiple with a small regulating storage battery, excites the fields. Should the voltage on the main system vary to a greater or less extent, no variation occurs in the voltage of the field excitement, since the synchornous motor which depends for its speed on the speed of the main generator, and not on the voltage, supplies power to the direct-current exciter. Should the speed of the engine vary to any extent the battery acts as a regulator. The battery also is of such a capacity that the entire exciting set can be shut down for one hour without any variation in the exciting voltage, the battery automatically discharging. If, in place of a synchronous motor set, a rotary transformer were used, the result would be somewhat unsatisfactory, since a variation in voltage, as well as speed on the main generator, would affect the field current. Of course, belted or direct-connected exciters can be used with the battery with equally good economical results, but independently operated exciters furnish a more flexible system."

Mr. Barstow's paper contained other matter of interest to lighting station engineers, but the discussion turned principally on the question of auxiliaries. In reference to another of the company's stations where steam auxiliaries were used the author stated that the boiler capacity increased over that necessary with electrical auxiliaries and about balanced the extra capacity of engine and generator for the latter equipment. Steam auxiliaries used 11 or 12 per cent of the total steam and electrically operated auxiliaries about 3 per cent.

Mr. Creden stated that in the Harrison St. station of the Chicago Edison Co. the steam auxiliaries took about 14 per cent of the total steam and that 10 per cent of the heat was returned in the feed water, leaving 4 per cent as the net steam required to operate the auxiliaries.

Mr. Walker pointed out that for electrical auxiliaries to be economical economizers must be used to heat the feed.

In conclusion, Mr. Barstow stated that the relative economy of the two systems depended on local conditions, and largely on the char-

acter of the load. In some plants electrical auxiliaries would be costly and in nearly all cases a combination of steam and electrical auxiliaries is preferable.

Another interesting comparison made by Mr. Barstow was the influence of the load factor. By shifting 2,000 h. p. from other stations the load at the Union station was so manipulated that on one day the load factor was 80 per cent and on another 25 per cent, the total kilowatt-hours generated being the same. A careful record of the costs on the two days, 24 hours each, showed the cost per kw. h. to be 70 per cent less with the 80 per cent load factor than with the 25 per cent load factor.

MECHANICAL DRAFT.

Mr. Walter B. Snow, of the engineering staff of the B. F. Sturtevant Co., Boston, in the course of a lecture before the Engineering Society of Columbia University, discusses the quantitative efficiency of a boiler as affected by the system of draft as follows:

"No greater waste occurs in modern steam boiler practice than that which is inherent in the employment of a chimney for the production of draft, namely, the loss of heat in the escaping gases. As the chimney depends for its action upon the maintenance of a temperature difference between the internal gases and the external air, it is manifest that, with a chimney, this waste can never be eliminated. It may be palliated, it is true, by the building of higher chimneys, so that the same intensity of draft may be obtained with a lower stack temperature. But such means of providing for the utilization of the otherwise waste heat is expensive. For instance, if, with an external temperature of 60° and an internal temperature of 500°, sufficient intensity of draft is produced by a chimney 100 ft. high, it will require a height of 175 ft. to produce the same draft when the temperature of the gases is reduced to 250°. In addition, the means provided for extracting this heat will increase the resistance, and provision for overcoming the same will have to be made by greater chimney height.

"In the case of a fan, however, the power expended as measured in heat units necessary to produce the same results, may, under ordinary conditions, be only about one seventy-fifth of that necessary with a chimney. In other words, the fan renders available for utilization practically all of the heat wasted by the chimney, while it possesses the further advantage of readily creating the additional draft required when heat-abstracting devices are introduced.

"Messrs. Donkin and Kennedy, in 17 independent boiler tests, found the heat lost up the stack when no economizer was used, to range between 9.4 per cent and 31.8 per cent of the total heat of combustion. As it is not practicable to cool the gases to atmospheric temperature, it is evidently impossible to utilize all the heat, but the ordinary economizer should, with mechanical draft, show a saving of between 10 and 20 per cent.

"The average results obtained by Roney from tests of nine plants thus equipped were as here presented:

Temperature of gases entering economizer	526.3°
Temperature of gases leaving economizer	269.6°
Decrease in temperature of gases	256.7°
Temperature of water entering economizer	150.4°
Temperature of water leaving economizer	297.1°
Increase in temperature of water	146.7°
Fuel saving, in per cent	14.64

Although not developed to the same extent as the economizer, the air heater, by which the heat is transferred from the gases to the air supplied to the furnaces, has been introduced to a considerable extent with satisfactory results. In experiments with the Marland apparatus, Hoadley showed that the waste of the flue gases could be reduced to only 5 per cent of the total heat value of the fuel, with an accompanying expenditure of only 1 per cent of the steam generated for driving the blower.

"The latest practice points to the introduction of flue air heaters for the abstraction of further heat from the gases after their passage through the ordinary type of economizer.

"The importance of mechanical draft in the adoption of means for utilizing the waste heat, is well exemplified in the introduction of retarders and of ribbed tubes. Both of these increase the resistance and almost invariably require fan draft to enable them to create the saving of 5 to 10 per cent which may be thus secured.

"The facility with which the intensity of the draft and the volume of air supplied can be regulated when a fan is employed for draft production, has always been recognized as one of the most valuable characteristics of this method. Such regulation makes possible the most perfect distribution of the air and its reduction to the minimum amount will produce satisfactory combustion.

"Variable draft is necessary to maintain a constant steam pressure. The operation of the fan is automatically regulated, so that the slightest variation in the steam pressure causes considerable change in the speed, and consequently in the draft."

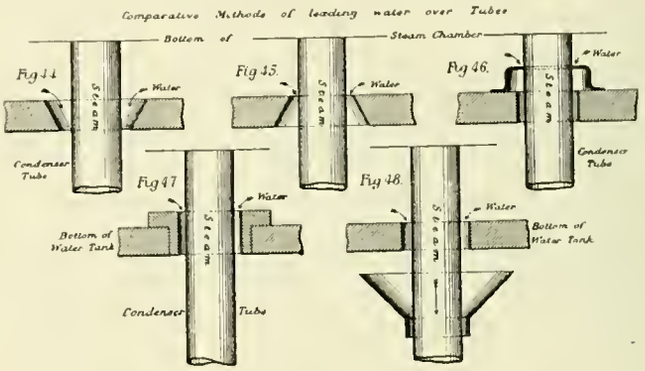
EVAPORATIVE CONDENSERS.

Abstract of a paper read before the Institution of Mechanical Engineers, England, by Harry G. V. Oldham.

Continued from page 383.

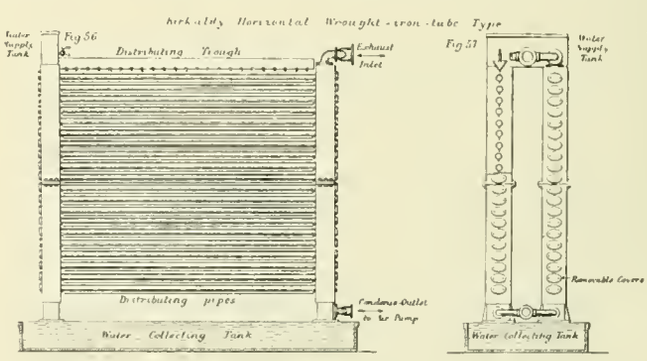
Some difficulty has been experienced with vertical types in getting the water to start down the tubes evenly. Figs. 44 to 48 show various arrangements adopted. Fig. 45 works better than Fig. 44; Fig. 46 is the Wright construction and is designed to provide a place for sediment in the condensing water so that it would not clog the openings about the tubes.

An evaporative condenser of the horizontal type built 26 years ago in London, is still working, giving a satisfactory vacuum. It



consists of 8 sections each with 32 wrought iron tubes of the type shown in Fig. 11; the tubes are 1 in. internal diameter and about 13 ft. long.

A similar condenser is shown in Figs. 56 and 57, and is principally in use abroad. It consists, as usual, of two end boxes into which galvanized wrought iron tubes are expanded. The ends of these boxes have small gland-shaped covers opposite the end of each tube, to facilitate the expanding and examination of the joint. The water distribution is carried out by means of a triangular V-shaped



trough with holes drilled through the bottom. This condenser is suitable for condensing 2,000 lb. of steam per hour. Its height is 10 ft., its total length 12 ft., and its width 5 ft. Such condensers weigh about 3.7 lb. per lb. of steam condensed.

A cast iron condenser of the vertical type, Figs. 58 and 59, consists of two rows of vertical pipes S leading out of two horizontal pipes connected at the top by bends. A is the exhaust main, and B the air-pump suction pipe for drawing off the condensed steam. The vertical pipes are 4 in. diameter. A cast iron trough D is fixed above the vertical pipes, and immediately above each pipe the

trough is perforated by a hole which allows the water to fall directly on the center of the bend, the water passing down the whole length of the pipe to the collecting tank F. The delivery pipe from the circulating pump is shown at E. The whole apparatus is supported above the cast iron tank F. The vertical pipes are about 5-16 in. and the larger pipes ½ to ⅝ in. thick. In connection with the above condenser some valuable experiments were made by Mr.

TABLE I.

1.	Date	Sept. 12	Sept. 13
2.	Weather	Wet	Fine
3.	Barometer in.	29.8	29.5
4.	Temperature of air deg. Fahr.	?	60
5.	External surface of condenser .. sq. ft.	272	272
6.	Duration of trial .. min.	99	115
7.	Weight of steam condensed lb.	809	809
8.	Boiler pressure per square inch ,,	60	60
9.	Weight of water in circulation about ,,	1830	1830
10.	Weight of fresh water added .. ,,	600	640
11.	Weight of water lifted by circulating pump .. lb.	11,200	?
12.	Vacuum in condenser, per gauge .. in.	23.36	24.1
13.	Initial temperature of circulating water in trough D .. deg. Fahr.	117.5	113 9
14.	Final temperature of circulating water falling into tank F.. .. deg. Fahr.	128.4	125
15.	Temperature of supplementary fresh water from town main .. deg. Fahr.	58	58
16.	Temperature of water in hotwell ,, ,,	136.5	1318
17.	Weight of steam condensed per minute lb.	8.08	6.95
18.	Weight of circulating water delivered into trough D per minute .. lb.	113.1	..
19.	Weight of supplementary fresh water poured into tank F per minute .. lb.	6.66	5.57
20.	External surface condenser per pound of steam condensed per minute .. sq. ft.	33.7	39.1
21.	Volume displaced by air-pump bucket per minute (up strokes only), per pound of steam condensed per minute cub. ft.	2.5	2.9
22.	Volume displaced by bucket of circulating pump (up strokes only), &c.	0 31	0 36

Michael Longridge in his report to the Engine, Boiler & Employers' Liability Insurance Co. in 1892.

Table I, with a diagram, Fig. 60, are taken from this report, showing the temperature of the circulating water and circulating pump discharge with the number of pounds of circulating water per hour. The conditions were unfavorable, owing to damp weather and the position of the overflow tanks. The pipes were coated with a thin scale outside, but were clean within. It will be seen in line seven of the table that 800 lb. of steam are condensed per hour, and also that the make-up water on line ten was 600 lb. per hour. This works out to ¾ lb. of water being evaporated per pound of steam condensed.

In a paper read by Mr. Row before the Manchester Association of Engineers in 1897, some interesting experiments were described

Vertical cast-iron-tube Type.

Fig 58

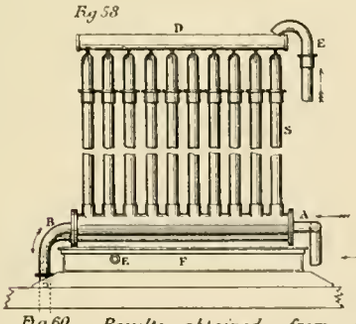


Fig 59

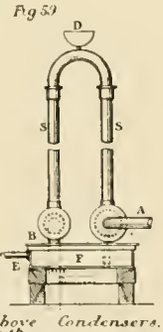
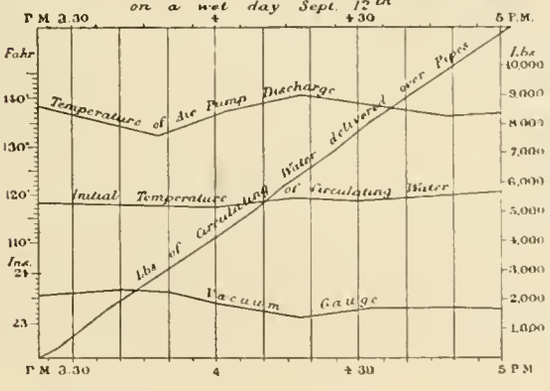


Fig 60. *Results obtained from above Condensers, on a wet day Sept. 12th*



showing the value of air currents directed upon vertical tubes with water passing over them. Figs. 61 and 62 represent the experimental apparatus used. The plain tube test was conducted with a tube shown in Fig. 61 before being indented. The steam was admitted into the tube at the valve A, the condensation water dropping into the receiver B, the vacuum being induced by the ejector C, while the condensation water was drawn at stated periods from the cock D. The cooling water was raised by pumping and allowed to trickle in a thin film from the pan F; the water not evaporated fell into the receivers G and G1 and was repumped. The test shown in Fig. 61 was conducted in a precisely similar way with the addition of the casing H, through which an air current was induced by an ejector in branch J. The plain tube in No. 1 test was 16 ft. long, 1½ in. internal diameter, and 16 standard wire-gage thick. This was afterwards indented, as in Fig. 7, for tests 2 and 3, when it measured 14 ft. 5¾ in. long. The total condensing surface exposed to the atmosphere was 8 sq. ft., including the surface in the pan G and receiver B. Table II shows the results of these tests.

On the basis of Mr. Row's tests with air current, deducting 25 per cent of the results obtained under experiment, and taking the condensing efficiency of indented copper as equalling 6 lb. an hour per square foot of surface, it is possible for an evaporative condenser for 200 h. p., allowing 20 lb. of steam per i. h. p., to be enclosed in a casing 3 ft. 6 in. square, standing 12 ft. high. With reference to the foregoing single-tube experiments, the air current was induced to pass the surface of the tube in a way that is not obtained in present practice. The fan, if placed at right angles to the tubes at the bottom, would force the air against the opposite casing, almost entirely destroying the nature of the air current, after which it would have to find its way at any angle past the tubes. It

TABLE II.

Description of Test.	No. 1. Plain Tube and Condensing Water only.	No. 2. Indented Tube and Condensing Water only.	No. 3. Indented Tube and Condensing Water, Assisted with Air Current.
Time, one hour { Commencement	10.45	12.0	3 0
Time, one hour { Finish	11 45	1.0	4.0
Temperature in receivers, G and G1 .. deg. F	133	129	115
Quantity of condensation lb.	20.62	39.69	63 4
Temperature of atmosphere, deg. F.	65	70	64
Vacuum .. lb.	10	10	10
Temperature of condensation at D .. deg. F.	154	155	153
Quantity evaporated .. lb.	10 62	27.0	50
Evaporation / Condensation	0.51	0.68	0.78

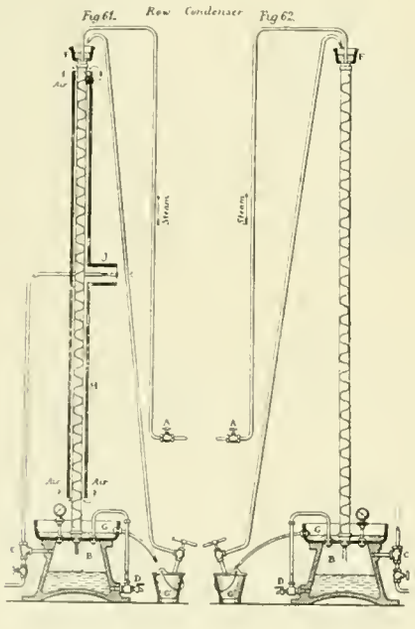
is very doubtful whether a condenser of the size given would be capable of dealing with 200 h. p.

It has been shown by experiment that by the use of a current of air passing over the surface of a tube upon which water is running, the efficiency can be increased from 40 to 50 per cent. Taking full advantage of this 50 per cent reduction in surface, an evaporative condenser of the vertical brass-tube type should not require more surface than an ordinary surface condenser—that is, about 2 sq. ft. per i. h. p.—though satisfactory results have not yet been obtained on these lines. Various arrangements of fans are shown in Fig. 65, which represents a tube with a small fan at the lower end, the tube being exposed to the atmosphere. This tube might be enclosed, as in Figs. 66 or 67, without great loss of efficiency. Fig. 68 shows a fan working in the center of a circular condenser with concentric rings of tubes. The fan may be arranged at the top of the condenser as in Fig. 69, but such an arrangement would have little if any advantage over the former method shown in Fig. 68. A fan fixed directly under rectangular boxes, as shown in Fig. 70, is not so good as the fan placed as in Fig. 68. An even more inferior method is that in Fig. 71, in which the fan is arranged, as shown, below rectangular boxes. The fan in Fig. 72 at B is also very inefficient, while the design at A is not to be commended at all. The type of condenser in most cases governs the arrangement of the fan. The efficiency of the fan itself is not here considered so much as its steam-condensing value. The examples given in Figs. 65, 66 and 67 are merely theoretical. These various arrangements are working in one or the other of nearly all vertical type condensers, and the efficiency of the apparatus is to a certain

extent increased thereby in all cases. It is not advisable to use a fan at all in horizontal condensers, and this type should really be designed with sufficient surface to do without their use. In the horizontal wrought-iron tube condenser each square foot of surface should condense from 2 to 4 lb. of steam per hour—that is, about 8 sq. ft. per i. h. p. The value of a fan as increasing the hourly condensation under existing circumstances when working with vertical-type condensers cannot be taken at more than 20 per cent. and very often this amount is reduced to 10 or 5 per cent, or even lower. Where condensers are not designed to take the maximum load, fans are sometimes used to carry the engines over the maximum load. The style of fan that appears to find most favor for this class of work is one with blades such as could be laid on the surface of the cone, the backs being radially straight. The faces delivering the air are concave with convex backs. The blades are set at an angle in the usual manner. Water should not be allowed to fall on the fan blades. The power required to drive the fan varies from 1 to 2 per cent, or sometimes more of total engine power.

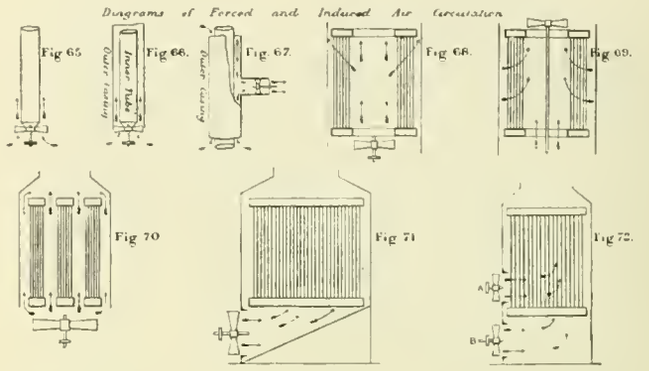
DESIGN.

It is very important that ample means should be allowed for cleaning, especially upon the outside surface of the tubes. One square foot of tube surface would evaporate half a gallon of water per hour, so that if the water is only moderately hard the amount of deposit in a year would be considerable. The circulating water itself should be kept clean. One method of removing very hard scale from the tubes is to stop the water in circulation and to pass steam into the condenser, when the difference of expansion between the tube and the scale causes the latter to crack; it can then, as a rule, be easily removed by hand. The exhaust pipe may enter either at the top or bottom of the condenser. This pipe is generally made of mild steel plate 3-16 to ¼ in. thick, with substantial faced flanges riveted to each end; and pipes 18 to 24 in. diameter are often erected in complete lengths 40 to 50 ft. long. They should, if possible, have a fall towards the condenser, but if circumstances do not permit of this, they can be



so arranged as to drain back into a chamber at the lowest point in the run from which a pipe is led to the air pump. The outlet pipe from the bottom of the condenser is led with a fall direct to the air pump. Where the condenser is about 29 or 30 ft. above the hot well, this run of pipe may be dispensed with. The condenser water then drains through a pipe directly into the hot well. The air pump then deals with the air from the top of the condenser only, from which a much smaller pipe is led to the air pump. Between the condenser and the air pump a cooler is fixed, into which a spray of water is admitted as in an ordinary jet condenser, thus reducing the final temperature of the air.

All joints should be machined, and made even more carefully than steam joints. The joint may be made with rubber insertion, asbestos, or asbestos soaked in boiled oil. When the whole of the pipe work and condenser is erected it should be tested under water pressure, the pressure from a water main being usually sufficient for this. On the occasion of starting a certain condenser it was found that the vacuum could not be maintained. Examination was made of all the points, and a few noticeable leaks were stopped, but still it was very far from being tight, and continued to give trouble. At last it was decided to test the whole apparatus under water pressure, when the leaks were detected and made good, with the result that the required vacuum was obtained. Another case in which air leakage caused trouble was when the feed pumps were abnormally large for the boilers they were feeding, and



pumped a considerable amount of air along with the water. It is desirable to place the condenser as near the engine as possible to save cost of pipes, bends, etc., and also to reduce the risk of leakage. Condensers are working satisfactorily at a distance from the engine of 100 to 120 ft., and in some cases even more. The horizontal type should be exposed as much as possible, the best place being upon the roof. Care should also be taken, especially in the plain tube or wrought iron horizontal type, to shield the tubes from the direct action of the wind, which the author has observed to sweep a portion of the nest of tubes quite devoid of circulating water. Vertical condensers with fans and without casing are invariably placed in the open. The practice of connecting several large engines up to one condenser should be discouraged, but where the engines are small they may be connected into one exhaust main with controlling valves to shut off each as required. Where the engine room is being extended or newly built, the roof should be flat and made water-tight, and in one or two places sloped to a gully, covered by a wire grating. Connections are made from these gullies to the circulating pump. The condenser is built upon girders, and the circulating water after passing over the tubes should be allowed a fall of 3 or 4 ft. before it reaches the roof. This is a very effective means of lowering the temperature of the cooling water, or, a wrought or cast iron tank of ample area and about 2 ft. deep may be placed under the condenser. Duplicate plants are not required with a condenser, the steam being exhausted into the atmosphere while any slight repair is made good.

The average cost of evaporative installations is about 20s. per h. p., exclusive of the cost of air and circulating pumps and connections. When compared with jet condensers the cost is no doubt greater, but including reservoir construction and cooling apparatus the evaporative condenser is more economical. Some judgment must be used when selecting a condenser for any particular purpose. When ample room and good foundations are at hand and the condenser has to be worked under rough conditions, the cast iron type is more suitable and cheaper than other types. The horizontal condenser, fitted with wrought iron or copper tubes, is far more efficient weight for weight, and occupies much less room than the cast iron condenser. The scale can be more easily removed from the plain tube than from cast iron tubes. Greater success has been obtained with a distribution of water over the tubes in the horizontal type than with the vertical type, and when space permits the former is recommended.

The vertical brass tube with fan is adopted when space is very limited. Condensers of this kind do not at present give those results which were expected, too much value having been placed upon the fans; but even if ample cooling surface is allowed, the

author considers that no difficulty whatever should be experienced with them.

Various kinds of pumps are used, but that which seems to find most favor for this class of work is the ordinary centrifugal pump

It is very important that an efficient air pump should be used The size as designed or an ordinary surface condenser would be generally suitable for an evaporative condenser of the same capacity.

SIX-MINUTE HEADWAY ON SINGLE TRACK.

Newark, N. J., June 30, 1899

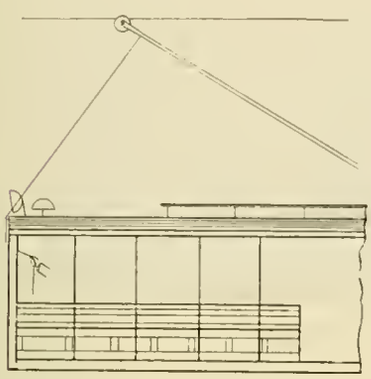
Editor "Review": If your correspondent "Single Track" (May issue, page 295) will place his passing sidings equidistant, ¾ mile apart, and run his cars or trains at a uniform speed of 15 miles per hour, he can give the six-minute service required. Let him also adopt a reliable system of block signals and it will prevent much anxiety.

R. R. B.

CONDUCTORS' ORDER.

Oakland, Cal., June 27, 1899

Editor "Review": The following copy of an order recently issued on our road may be of use to managers who have had trouble from similar causes. In writing orders to the men the endeavor is made to have them perfectly plain.



"To conductors: I have endeavored in the following sketch to give you an idea of how I want a trolley rope held at crossings, switches and curves. Do not stand away from the window (storm fronts are used) and put your arm through the rope and your hand in your pocket; you would not hold it in that manner if you expected the trolley to jump, and I want you to hold the rope as though you expected it to jump every time. Stand up close to the glass, take in all the slack rope and then keep a tight hold on the rope until the danger point be passed. Do not attempt to collect fares with one hand and hold the rope with the other; the fares can wait until you have passed the point of danger. I shall expect to see every man obey this order to the letter, and thereby avoid further breakage or delay on the line."

Yours Truly,

G. Robertson,
Div. Supt. Oakland Transit Co.

FREIGHT ON TROLLEY ROADS.

Last month we published an editoral note on the freight traffic of urban and suburban electric railways which has caused Mr. J. C. Bonner, of the Bonner Rail Wagon Co., of Toledo, to write us the following interesting letter on that subject:

"We note with interest your editorial in current issue of the 'Review,' relative to the carrying of freight on trolley lines, and quotation from decision of Judge Marean of New York. In the freight business perhaps no one has endeavored to give the subject of this haulage, more consideration during the last three years than ourselves, and we feel assured, you have taken the only true position relative to its developement on the trolley roads.

"Very many managers, as you know, are earnestly considering the question. All that remains now, is a few more injunction proceedings, and favorable court decisions such as secured in the Supreme Court of New York, and this field of operation will be generally enjoyed. Probably the most active undertakings in this line have been at neighboring cities, Detroit, Cleveland and Pittsburg and we are inclined to think to some degree the result of our personal efforts to induce freight haulage. All the roads are doing well, and so far as we have learned, with no objection from any source. Of course, our interest in the matter has been to encourage the use of rail wagons and we think our system is dearest in the affections of the road managers and their patrons. They have been experimenting, and there were as many plans for the operation of freight service as there are different road managements.

"You will be very much interested in our more recent experiences. Briefly, we have always contented the haulage of packages alone either in cars carrying passengers or in separate express cars does not develop the best results. Still this service is most gratifying to freight patrons, nor does it meet with any objection from country dealers. On the other hand the latter are very liberal and it is to such business the roads owe their largest portion of package freight.

"The present situation in Pittsburg is that four express cars are hauling the suburban package freight. At Cleveland, four roads with a central station for receiving and distributing freight, are thoroughly and systematically conducted. Their freight auditor visited us recently and stated they must look for greater facilities in order to care for the heavy shipments and also the farm produce. A change was under consideration when the late strike was declared. At Detroit, the roads first operated suburban package delivery using passenger cars, and charge alike for passengers and packages. Now, two of the roads have rented passenger cars from the Detroit Citizens Railway Co., making two or three round trips a day. The seats have been taken out of the cars for the purpose of placing freight. All the roads, however, maintain independent or individual freight departments.

"The Detroit managers have promised, as soon as the question of municipial ownership is decided, to take up and favorably consider our proposition, that is, a central freight station for the interchange of freight under one management, and a pro rating of the earnings of the package haulage express freight, which is to be transported in remodeled passenger cars; these cars to act as motor propellers for rail wagons as trailers to them, for carrying the heavy and bulky freight, this last class of freight being by far the largest part of business offered to trolley roads.

"I will quote from a few of many recent letters endorsing our efforts in the development of freight haulage. Hon. Martin Dodge, Director of Road Inquiry of the U. S. Department of Agriculture, writes us in part as follows: 'In my last report to the U. S. Government, I made special mention of your rail wagons and recommended them. This will be published as a Farmer's Bulletin and generally circulated throughout the country.'

"We have about 25 letters that come from the most representative jobbing houses of Detroit. The B. Stroh Brewing Co. says: 'Your freight service between here and Pontiac is excellent, as a customer can place his orders in the morning and having the goods reach him the same day. It also saves cartage at both ends as your wagons call for the goods at the shipper's place of business and deliver them to the purchaser's door. We wish the same service could be established between Detroit and other suburban towns like Mt. Clemens, Wayne, Plymouth, etc. Phelps, Brace & Co., wholesale grocers write: 'We wish to say that the Bonner rail wagon system for delivering freight, is admirable for the jobber, the manufacturer and the retailer. It gives quick delivery of freight, much quicker than our customers have been having. We would patronize the system extensively if it were extended, and we hope it will be.' Dwyer & Vhay, wholesale dealers in foreign fruits, write: 'We have given you the bulk of our business to Pontiac, as the trade orders goods shipped that way. It is especially serviceable in shipping perishable goods as their is less handling than in any other way.' J. C. Hamblen, wholesale oyster house, says: 'Your system of collecting, transporting and delivering freight is far superior to anything of the kind, that has come under my notice. Our consignees express themselves as well pleased with the service.' Other letters are of a similar tenor.

"Just now, we are building an invoice of rail wagons to be shipped to England, within 30 days, where we have sold the wagons and where they will be installed in the service of the Isle of Man Electric Co., operating some 75 miles of road at Douglas, Ramsay and other towns. The wagons will be utilized in the haulage of farm produce, granite, ores from the mines, farm fertilizers, etc."

The street railway employes of Macon, Ga., have effected an organization with a large membership of motormen and conductors. Their charter was adopted at a meeting on June 10th which was held at midnight so that the men could all attend after finishing their last night run.

LONG DISTANCE TRANSMISSIONS FOR ELECTRIC RAILWAYS.

There seems to be no doubt that in the near future long distance transmissions by means of polyphase currents will form an important feature of electric railway practice. A number of instances of this practice have already been mentioned in the "Review," and a new road has just been projected in the Kootenay country of British Columbia which will be operated by means of a power plant which contains a number of most interesting and unique features. It should also be added that this is but one of a considerable number of polyphase transmissions in the Pacific Northwest, where there has lately been remarkable activity in the projection and construction of long distance transmissions operated by water power. While for the purpose of supplying power for general purposes and especially to mining machinery the induction motor has now become a worthy rival of direct current machinery, street railways will undoubtedly continue to be operated from substations containing rotary transformers for the production of 500-volt, direct currents.

The West Kootenay Power & Light Co. whose plant is described in detail in the Journal of Electricity of May, 1899, contains an unusual number of useful and instructive features. This plant is essentially a power plant, only a small percentage of its output being applied to lighting purposes, and so various are the uses to which this power has been applied and with such eminently satisfactory results that a considerable extension of the service is to be made, which will include an electric railway which is to be installed at once

The engineering features of this plant are most interesting. The power house is situated on the Kootenay River which forms a connecting link between Kootenay Lake and the Columbia River, and the Bonnington falls from which the power is supplied are situated near the lower end of this river. At low water these falls, both upper and lower, are capable of delivering 267,000 horse-power but the lower falls, a part of which the West Kootenay company has utilized have an available head of 40 ft. at low water and are capable of delivering 100,000 horse-power.

The company constructed a canal cut out of hard rock, 650 ft. in length and 26 ft. wide, the lower end of which widens out into a forebay 54 ft. wide. The forebay is shut in by a dam of solid concrete 32 ft. high and 26 ft. wide at the bottom, tapering to 6 ft. wide on top. Across the head-race 150 ft. from the concrete dam is a wooden dam sloping at an angle of 42°, constructed of sills and timbers securely fastened between two high bluffs. This dam is 44 ft. high and has 5 sluiceways across the bottom, the object of which is to control the supply of water to the forebay at all times.

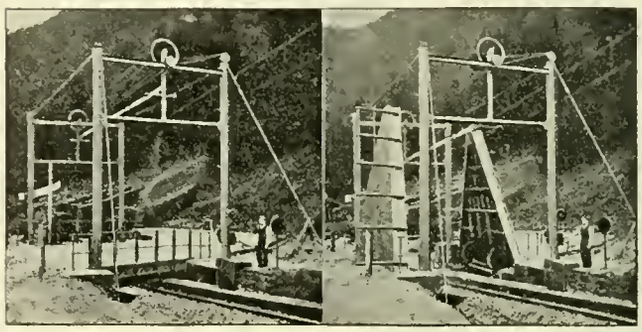
The back of the dam really forms one side of the power house and of the tail-race which runs at right angles to it, being a pit 20 ft. wide by 30 ft. deep and extending nearly the length of the power house, which is 66 ft. The dam is provided with two feeders of 9 ft. each and one of 10 ft., the upper ends of which are closed with wooden gates. Two outside frames extend upward of 30 ft. and the racks for raising and lowering the gates are bolted to the wall of each pit. The gates are each provided with a small iron floodgate, and the main gates are raised and lowered by means of headgate irons bolted to the top of the dam. The winches controlling these is operated by one man. Three steel penstocks run through the dam into the hydraulic room of the station, each penstock carrying a standpipe nearly as high as the top of the dam. To the lower end of each penstock is bolted a housing which contains a pair of 39-in. horizontal cylinder gate turbines, the housing being supported on I-beams laid on the retaining walls of the tail-race. The draft tubes 22 ft. long and 10 ft. in diameter are bolted to the bottom of the housings. The generators are coupled direct to the turbine shafts, and three exciters are driven by three independent 12-in. horizontal gate turbines contained in cast iron flumes connected to the housings of the large wheels from which they derive their water supply.

The dynamo room contains two 750-kw. generators and one of 1,500 kw., all of the standard General Electric revolving field type. These run at a speed of 180 r. p. m., have 40 poles and deliver 3-phase currents at 1,100 volts.

The transformer room is a separate compartment at one end of the dynamo room and contains the necessary capacity of air-blast transformers; they are 12 in number, each of a capacity of 250 kw. These deliver a potential of 20,100 volts to the line. The pole line is a double line extending to Rossland, a distance of 31 miles, the profile of which varies in height by over 2,200 ft., and a step-down transformer station is situated at the latter town. A branch is taken off the main line at a point three miles from Rossland which runs to Trail, B. C., a distance of four miles. At this town is situated the great smelter of the Canadian Pacific Railroad and a transformer station at this point provides 3-phase currents at 550 volts for the operation of various parts of the smelter. At this point an electric tramway is to be immediately built, the operation of the plant in all kinds of weather having been so successful as to encourage the company to extend its operation to railway work.

LIFT BRIDGE FOR A GRADE CROSSING.

A recent number of the Schweizerische Bauzeitung has an illustrated description of a peculiar grade crossing which was installed on an electric railway between Stansstad and Engelberg, in the Canton of Unterwalden, Switzerland. This road, which is about 14 miles long, is operated on the overhead trolley system and a rack is employed on the steep grades. This rack is in the center of the track and projects about 3 in. above the tops of the track rails. At a point near Engelberg the electric line requires a



A SWISS GRADE CROSSING.

rack, where it is crossed by a post road, and to prevent the rack from becoming clogged with dirt from the post road and also to give more headroom that the ordinary height of the trolley wire allowed an elaborate crossing was built.

There are two lift bridges, triangular in shape, and a movable section of the overhead conductor. The bridges are shown open and closed in the illustration; as the bridges are opened the trolley wire is lowered, and vice versa. The bridges are operated by gears and the wire by a windlass.

IN THE ORIENT.

Press dispatches contain the following item concerning electric railroading in the Far East: "Since the introduction of trolley cars into Korea several children have been run over and killed in Seoul. The people to the number of several hundred burned one car and smashed another. The Japanese and European engineers narrowly escaped death. The ignorant people attributed the drouth which has continued for some time to the construction of the electric railways."

Further reports published here under date of July 3d say: "Late oriental advices say that 20 ringleaders of the rioters who destroyed and burned the electric tramway cars at Seoul last month were executed in public at Korea's capital four weeks ago. They met their fate bravely. Their heads were cut off and exhibited in public as a warning to all evil doers. It was believed that this summary action would also have important influence upon the leaders of the Korean rebellion, which was assuming large proportions."

The Employes Mutual Benefit Association of the Syracuse Rapid Transit Railway Co. formally opened its club house last month with an entertainment lasting through the afternoon and evening. The rooms were handsomely decorated and a musical and literary program was given.

RECENT STREET RAILWAY DECISIONS.

EDITED BY J. L. ROSENBERGER, ATTORNEY AT LAW, CHICAGO.

PASSENGERS DO NOT CEASE TO BE SUCH AT ONCE ON ALIGHTING.

South Covington & Cincinnati Street Railway Co. v. Beatty (Ky.), 50 S. W. Rep. 230. Mar. 22, 1899.

There was no error, the court of appeals of Kentucky holds, in refusing to give an instruction that "a passenger upon a street car ceases at once to be such, upon alighting from such car." It does not think that such an instruction embraces the law. The injury, for which it here affirms a judgment for damages in the plaintiff's favor, was caused by his being struck by a car on a parallel track, going in the opposite direction to that of the one from which he had just alighted, and crossed behind in an effort to go to the other side of the street.

AN INVITATION TO ALIGHT.

Citizens' Street Railroad Co. v. Hoop (Ind.), 53 N. E. Rep. 244. Mar. 14, 1899.

The allegations of the complainant in this case, that, as the car approached the crossing, the conductor, who was standing near the plaintiff (Hoop) on the platform, invited and notified the latter "to alight from said car by stepping one side, and with his hands, passing plaintiff by him, to allow him to step down and off said car," were not contradicted by any answers to special interrogatories, of which there were a number. And, the appellate court of Indiana, in affirming a judgment for the plaintiff, goes on to say, after stating this fact, the rule is approved by many authorities that "a passenger is justified, as a general rule, in obeying the direction of the employes of the carrier; and, if he receive injuries obeying them, the carrier is liable, even if it appears that, if he had not obeyed, he would have escaped injury."

RIGHT TO SELECT SWITCHMEN.

Grand Avenue Railway Co. v. Lindell Railway Co. (Mo.), 50 S. W. Rep. 302. Mar. 21, 1899.

Where a city charter such as that of the city of St. Louis empowers any street railway company to use the tracks of any other company upon payment of just compensation for the use thereof under such rules and regulations as may be prescribed by ordinance, and an ordinance is passed requiring the company desiring to use another company's tracks to construct and keep its connections with such tracks, the supreme court of Missouri holds that the duty of keeping the connections justifies the requiring of switchmen to be employed to handle the switches; and that, when the whole cost of paying the switchmen is thrown upon such company, along with the responsibility of keeping the connections, the right to select the agents, for whose conduct it is responsible, and whose wages it must pay, is properly conferred upon it, instead upon the company owning the tracks.

PERSONS CROSSING STREETS MUST EMPLOY PROPER PRECAUTIONS FOR THEIR OWN SAFETY.

Dieck v. New Orleans City & Lake Railroad Co. (La.), 25 So. Rep. 71. Nov. 21, 1898. Webster v. Same Company, 25 So. Rep. 77. Jan. 23, 1899. Rehearings denied Feb. 6, 1899.

In the first of these cases, the supreme court of Louisiana says that the authorities are numerous and uniform to the effect that a person whose business or pleasure occasions him to use the streets of a city which are traversed by electric cars, and particularly at crossings, is guilty of negligence if he fails to employ proper precautions for his safety. He is bound to look and listen for the approach of cars, and to exercise ordinary care and caution to avoid possible danger of a collision; and, should he see an approaching car in close proximity, it would be his plain duty to halt until same could pass by, rather than run the risk of an accident by attempting to cross the track in front of it. Failing to take such necessary precautions for his safety, the injured party is guilty of that negligence which deprives him of the right to reimbursement for injury received. In the second case, the supreme court declares that one who heedlessly attempts to cross ahead of a car properly managed if injured, has no one to blame but himself. It is true that one on foot has a right to cross the street where he pleases, provided he exercises the right with due caution. It is his duty to use due care

INCREASE OF DANGER MUST BE MET WITH AN INCREASE OF CARE.

Price v. Charles Warner Co. (Del.), 42 Atl. Rep. 699. Jan. 6, 1899.

It was contended in this case that the doctrine of the superior right of a street railway company has no application to street crossings. But the superior court of Delaware answers that it would certainly be contrary to public policy, and in violation of the rights of a street railway company, to allow its tracks to be blocked at street crossings by the negligence of drivers of vehicles. The public, using due care, have the right, in vehicles or on foot, it goes on to say, to cross street railway tracks, as well within the blocks as at street crossings. There is, however, this difference: The company has knowledge that at street crossings a larger number of persons and vehicles are usually found crossing the track than at other places, and this imposes upon the company the need of greater care at street crossings than where the danger is less. The company and the traveler are required to use such reasonable care as the circumstances of the case demand, an increase of care on the part of both being required when there is an increase of danger. The right of each must be exercised with due regard to the right of the other, and the right of each must be exercised in a reasonable and careful manner, so as not unreasonably to abridge or interfere with the right of the other.

HAD RIGHT TO SUPPOSE BOY WOULD REMAIN WHERE HE WAS.

O'Rourke v. New Orleans City & Lake Railroad Co. (La.), 25 So. Rep. 323. Mar. 7, 1899. Rehearing denied Mar. 20, 1899.

Here it appears that a boy 11 years of age, standing at night on the off side of the down-town track of the defendant's street railway, waiting for a car on the up-town track (which was furthest from him) to pass, and, that car having passed, without looking up the track nearest him, to see whether or not it was safe to cross, stepped on the track, 12 or 15 feet in front of an aproaching down-town car, tripped and fell, having his foot crushed. This, the supreme court of Louisiana holds, was a case of want of care on the boy's part, barring recovery of damages; it being shown that, notwithstanding effort on the part of the motoneer to arrest the car, it could not be done in that distance.

The motoneer had a right, the court particularly holds, to suppose that the boy was waiting for his car to pass, and to expect that he would remain where he was out of danger until it had passed.

The projection above the rail only half an inch of an unbeveled plank, placed between the rails of a street railway track, the court further holds, constitutes no such faulty construction or dangerous obstruction as would justify holding the street railway company responsible in damages because of a person tripping over the same and falling, all that is required of municipal corporations being that they keep the streets in a reasonably safe condition for a person exercising ordinary care and prudence, which rule can hardly be extended further as to street railways.

ACCIDENTS SAID TO SOMETIMES PRODUCE RESULTS STRANGER THAN FICTION.

Basting v. Brooklyn Heights Railroad Co. (N. Y.), 57 N. Y. Supp. 119. Mar. 24, 1899.

In this case, where the second appellate division of the supreme court of New York affirms a judgment for $6,500, with costs, in favor of the plaintiff, a young woman about 20 years of age, the

court remarks at the outset that the trial was peculiar in the fact that the plaintiff was the only witness to the accident, but that a careful reading of her testimony satisfied it that there was no possible alternative to the submission of the issues to the jury, and that it is difficult to predicate error of a submission of questions to the jury when a failure to submit would have involved reversal.

Among other things, the plaintiff testified that the car had stopped, and that she was in the act of alighting from the rear platform, with her right hand upon the rail of the dashboard, and one foot in the air, ready to step off, when the car started, by reason of which she was thrown forward, instead of backward. Counsel for the company insisted that such a story bore its own refutation. But the court answers that it is not prepared to agree to that, as the study of accidents shows strange and inscrutable results, sometimes stranger than fiction. And so, while it is unable to tell the method, it holds that was just the question properly submitted to the jury, and that it cannot interfere with the verdict.

Furthermore, the court holds that it is not strange that, in the excitement of her fall, she did not clearly notice, and afterwards remember the number, of the car. And this is the more important in this connection, because it appears that the plaintiff's inability to remember the number prevented the defendant from making a witness of the motorman or conductor, it having no report of such accident, although its rules required reports of accidents.

SIGNAL MUST BE COMMUNICATED BY CONDUCTOR TO IMPOSE LIABILITY.

Armstrong v. Metropolitan Street Railway Co. (N. Y.), 55 N. Y. Supp. 498. Jan. 24, 1899.

It is not doubted that if the jury could find from the evidence that the conductor communicated to the gripman the passenger's signal to stop, and that the gripman, in response to that signal, slackened the speed of the car for the purpose of allowing the passenger to alight, it would be proper for the latter to prepare to get off the car, and it would be negligence for the gripman to suddenly, without warning, increase the speed of the car before he had reasonable time to alight, says the second appellate division of the supreme court of New York. But, the evidence in this case not going beyond proving that the plaintiff signaled the conductor, the court a second time reverses a judgment against the company, on the ground that no negligence on its part was shown.

True, the plaintiff testified that, after he gave the signal to the conductor, the car slowed up; but, the court insists, there is no necessary connection between the two facts. When the location of the accident is considered, having in mind the duty imposed upon the company to operate its cars with a reasonable degree of care, so as not to injure pedestrians or vehicles lawfully in the highway, the court continues, a mere change in the speed of the car is not to be presumed to be in response to a signal from the conductor; nor does it evidence on the part of the gripman an intention or purpose to give the passenger an opportunity to alight.

The slackening of the speed of a car may be due to the exercise of reasonable care in the operation of the car with respect to pedestrians or vehicles; and in the absence of knowledge that the conductor had signaled the gripman to stop, and that he was in the act of doing so in response to the signal, the court holds that the plaintiff would have no ground for assuming that a change in the speed of the car was intended for his benefit or convenience.

STREETS MUST BE MAINTAINED IN REASONABLY SAFE CONDITION.

Citizens' Street Railroad Co. v. Ballard (Ind.), 52 N. E. Rep. 729. Jan. 24, 1899.

The apellate court of Indiana, in affirming a judgment against the street railroad company, holds that the trial judge properly instructed the jury that the decedent had the right to presume, and to act on the presumption, unless he had knowledge to the contrary, that the street was in a reasonably safe condition for travel by him if he used due care; and the fact that he knew or had reason to believe the street unsafe would not perclude him from using the street, but in such case he must use care proportioned to the danger of which he knew or had reason to apprehend; and if he did not know or had reason to apprehend danger, or knew it, and used care proportioned to the known or reasonably apprehended danger, and notwithstanding such care was injured, then, so far as contributory negligence was concerned, there might be a recovery.

Even if the street railway was built under a contract with the county commissioners, when the highway became a part of the city, the court holds, it was the duty of the company to maintain its track so as to preserve the public highway in a reasonably safe condition for public use and travel; and that it was its duty to do this whether there was any ordinance requiring it to be done or not. In other words, it says that it was the duty of the company to keep its tracks in such condition as not to render the highway unsafe for the public, regardless of any privilege granted or attempted to be granted by the board of commissioners; and that this duty continued as long as the remained a public highway, no matter within what jurisdiction it might be.

The cases cited by counsel denying the right of a municipality to impose additional burdens to those provided for in the contract with the municipality the court says are not in point. Requiring a street railway company to keep its tracks in such condition as not to interfere with the public use of the street, it insists, is quite a different thing from requiring the company to make a certain kind of improvement prescribed by the municipality, and not provided for in the original contract between the ocmpany and the city.

ACCEPTED ORDINANCE A VALID CONTRACT CONTROLLING LIBILITY FOR STREET IMPROVEMENTS.

West Chicago Street Railroad Co. v. City of Chicago (Ill.), 53 N. E. Rep. 112. Feb. 17, 1899.

On July 30, 1883, there were three street railway companies operating street railways in the different divisions of the city of Chicago; and an ordinance was then passed providing for the payment of an annual car license by said companies. Section 2 of said ordinance provided as follows: "Each one of said railway companies shall hereafter, as respects the filling, grading, paving and otherwise improving or repairing the streets or parts of streets upon which it has constructed its railways, or any of them, fill, grade, pave and keep in good repair, during all of the time the privilege of using said streets or parts of said streets shall extend, eight feet in width where a single track is used or sixteen feet in width where a double track is used, the said eight or sixteen feet to include the railway track or tracks, in accordance with such ordinance as the city council may pass respecting such filling, grading, paving or repairing; and the same shall be done by the railway companies with like material, in like manner and at the same time as required as to the rest of said street not embraced in the eight or sixteen feet in width, except that it may use stone as authorized, or such other material as may hereafter be authorized by the city council, * * * for the space between the rails of each track." In consideration of the acceptance of said ordinance by the companies, the right to maintian and operate their railways was extended 20 years.

This, the supreme court of Illinois holds, made a valid contract between the plaintiff company and the city establishing the share or proportion of the former's contribution for the purpose of grading and paving a street, so as to preclude the imposition upon it of additional burdens therefor.

The language of the ordinance, the court holds, can only be construed as fixing and specifying the duties of the railway company in regard or with respect to all such improvements; and it means that, when the company constructs its railway through a street or a part of it, it shall fill, grade, pave, and keep in repair the width specified.

TOWN COULD NOT EXEMPT FROM TAXATION.

South Covington & Cincinnati Street Railway Co. v. Town of Bellevue (Ky.), 49 S. W. Rep. 23. Jan. 13, 1899.

This was an action brought to enjoin the collection of certain taxes. Involved, especially, was a town ordinance, which provided, among other things, that, "in consideration of said reduction of fares between the town of Bellevue and the city of Cincinnati, and the city of Cincinnati and Bellevue, and in consideration of equipping said line with electric power, and so insuring rapid transit over said line, the South Covington and Cincinnati Street Railway Company is hereby released from any and all obligations to keep

any part of the streets occupied by its track in the town of Bellevue in repair, and is released from the payment of car license except as hereinafter provided, and from the payment of taxes of any and every kind, except an ad valorem tax upon its real estate and personal property."

In affirming a judgment in favor of the town, the court of appeals of Kentucky holds that a provision in the charter of the town that the board of trustees should not grant any special privilege to any person, corporation, or company, nor exempt any such person or persons from the payment of an annual tax, prohibited the town from making the contract claimed by the street railway company; and, besides, that the new constitution, which was at the time in full force, would also seem to prevent the making of any such contract; and that, for these two reasons, the contract, even if it attempted to exempt the value of the company's franchise from taxation, would be null and void.

Moreover, the court expresses the opinion that a fair construction of the contract only exempts the company from the payment of a license tax or fee proper; that is a specific tax for the privilege, without regard to its value. And it says that section 4077 of the Kentucky Statutes does not levy a tax for such purpose, but merely fixes a basis for determining the value of certain franchises; and that it was wholly immaterial, so far as this action was concerned, whether the town authorities of Bellevue were bound to adopt the state valuation as the value of the franchise for city taxation or not, though, as matter of law, the valuation by the state board of the property was, in law, conclusive as to its value for city assessment.

PASSENGERS NOT REQUIRED TO EXERCISE SAME CARE AS CONDUCTORS.

Cobb v. Lindell Street Railway Co. (Mo.), 50 S. W. Rep. 310. Mar. 7, 1899.

On the trial of this case the defendant asked that the jury be instructed that, if the accident resulted in a mutual mistake of the plaintiff and the conductor in relation to the signals that passed between them, and if the mistake was such as reasonably prudent persons in like circumstances might make, the plaintiff could not recover damages. But the judge modified the instruction to read that if it was such a mistake "as a reasonably prudent passenger and a careful and skillful conductor, exercising a very high degree of care, would make under like circumstances, then the plaintiff could not recover." By doing this, it will be observed, he laid down one degree of care incumbent on the passenger and a higher degree of care on the carrier's servant. And now the supreme court of Missouri holds that he made no mistake when he drew the demarkation between the degree of care that devolved on the passenger and that which devolved on the conductor.

The degree of care that a railroad company is bound to exercise for the safety of its passengers, the court holds, is not limited to the construction and equipment of the road, but includes service also.

Moreover, the court says that the position taken by the defendant all through this case seemed to assume that the plaintiff was bound to know as much about the movements of the train as the conductor himself; but, it declares, the law did not charge her with such knowledge.

It also holds that it was negligence to start the car with a violent motion while she was in the act of alighting, even if she was slow in her movements. But, it adds, that if it could be inferred, from the petition, that the accident resulted from an attempt of the plaintiff to alight while the car was moving, that would be the end of her case. And then it says that the petition distinctly stated that the car had so nearly stopped that its motion was scarcely perceptible, and that its sudden and violent starting while she was in the act of alighting was the cause of her fall, and holds that the petition was sufficient to support a verdict for the plaintiff.

GLANCING UP AND DOWN STREET FROM SIDEWALK NOT ENOUGH.

Hickman v. Nassau Electric Railroad Co. (N. Y.), 56 N. Y. Supp. 751. Jan. 3, 1899.

To hold that a woman 56 years of age, in good health and in the possession of her faculties, with an unobstructed view of a street railway track for a distance of several blocks, has met the obligation resting upon her of exercising reasonable care, when she has glanced up and down the street from the sidewalk, and then, with no further exercise of her faculties, walks slowly and deliberately upon the track, with an approaching car fully in view, with its bell ringing, the second appellate division of the supreme court of New York pronounces absurd.

This, the court goes on to say, was not an accident at a crowded street crossing, where the rights of the parties were equal, and where the company was charged with the duty of having its cars in full control, so that while the company was then, as at all times, charged with the duty of exercising a reasonable degree of care in operating its cars, the plaintiff, the court holds, had no right to assume that the car would be in such control that the motorman would be able to protect her against her own negligence.

Nor does the court think that the motorman was bound to assume that this plaintiff, in broad daylight, would continue to advance until she should be in a position of danger. She was walking slowly; she could stop anywhere within two or three feet of the car, and allow it to pass in safety; and, the court insists, unless there was something in her conduct to indicate an intention of crossing regardless of the approach of the car, the motorman was not bound to assume that she would recklessly or heedlessly walk into the danger.

It is not enough, continues the court, that the plaintiff should merely look in both directions; she must look for the purpose of seeing if there is danger; and if her rate of progress in passing over the danger point is so slow that a car, in traveling at a reasonable rate of speed, may be reasonably expected to have come within view, and in such a position as to cause danger, she is not excused from the duty of using her eyes because she may at some previous time have discharged this duty.

Moreover, the fact, if it was a fact, that the plaintiff was somewhat hard of hearing, the court holds, only increased her obligation to make such use of her eyes as was intended, to avoid danger.

Plaintiffs, it adds, have some duties to perform.

PROVISION AS TO FARES IN ACCEPTED ORDINANCE HELD OBLIGATORY.

People v. Suburban Railroad Co. (Ill.), 53 N. E. Rep. 349. Feb. 17, 1899. Rehearing denied April 7, 1899.

A village ordinance granting to a street railway company authority to enter upon its streets and construct and operate its road there, provided that the fare charged shall not be above a certain amount, the acceptance of the ordinance, and the enjoyment of the benefits of its provisions by the company, the supreme court of Illinois holds, must be regarded as establishing, so far as the company is concerned, and as estopping it to deny, that the exaction of a greater sum for the transportation of passengers than said maximum is an unreasonable exaction, and unjust discrimination against those of the public who may desire to travel over said road.

The fact that the ordinance requires that the company shall formally accept it as conditioned, the court holds, has no effect to render the grant a mere private contract, and that there is nothing in the nature of the duty in question rendering it impracticable to enforce the performance of it by writ of mandamus.

Furthermore, if any consideration could be deemed necessary, the court holds that the privilege of entering upon the streets of the village, and erecting poles, stringing wires thereon, and constructing and operating the road by electricity upon and along such streets would constitute ample consideration to render the obligations imposed by the ordinance binding.

That one of the points covered by such restriction of fares is beyond the company's own line, the court apparently does not think makes any difference, if the company has made running arrangements with other companies, and is engaged in transporting its passengers, by means of its own cars and the cars of connecting lines, to said point, especially where the purpose is merely to prevent a discrimination in rates charged in said village and those charged at a specified other place on said company's road, for transportation to said point off its road.

Referring to article 11 of section 12, of the constitution of the state, the supreme court says that it vests in the general assembly

ample authority to enact laws to prevent extortion and unjust discrimination in the rates charged for the transportation of passengers by street railways, and that, notwithstanding the fact that the general assembly has not enacted legislation to carry this provision of the constitution into operation, yet the provision cannot be otherwise regarded than as a declaration of the sovereign power that a corporation operating a street railway owes it as a duty to the public to demand only reasonable prices for transportation of passengers, and to serve the public without unjust discrimination.

JUST COMPENSATION FOR USE OF TRACKS.

Grand Avenue Railway Co. v. Citizens' Railway Co. (Mo.), 50 S. W. Rep. 305. Mar. 21, 1899.

This was a proceeding by the plaintiff company, a street railway corporation of the city of St. Louis, to determine the compensation it must pay the defendant company, under a city ordinance, for the use of the latter company's tracks between certain points. Both companies objected to the award. The plaintiff company, on the ground that the amount was excessive. The defendant company, because too small, in that among other things,, no damages were allowed it for its loss of business by reason of the competition in a field it had occupied as a pioneer, and for the reason that the plaintiff company was not required to pay its proportion of the license or franchise tax imposed upon the defendant company by the city for the privilege of constructing and operating its road.

Now, if the defendant company had an exclusive right to occupy this street with its tracks, the supreme court of Missouri says, its right to compensation for loss of profits from competition would not be a question admitting of discussion; but the contrary, it holds, was absolutely true. When it received its franchise to construct its road and carry passengers for hire, the court maintains, it was not an exclusive right, and under the laws in force, could not be.

The court says that streets are dedicated for public use, and the trust is confided to the municipality to preserve them for that purpose only, so that it necessarily follows that it would have been competent to have granted a rival corporation the right to lay its tracks also on that street, and no action would have accrued to the defendant company for the diversion of its business by reason of this competition. For this reason, and because, in addition, the defendant company accepted its franchise under a contract to permit any other road to use its tracks, the court holds that the idea of compensation for loss of profits from competition must be banished.

It also holds that, inasmuch as the rights to use a part of the defendant company's tracks did not make the plaintiff company a joint owner of its franchise, it need not pay any portion of its franchise tax.

Furthermore, the damages recoverable being limited, by the charter of the city to "just compensation," the court holds that the law excluded not only the diminution of profits by reason of compensation, but as well also the delays, inconveniences, and jolts arising from permitting one road to cross another, as the right of crossing in a public highway is an absolute one, and cannot be made the basis for an allowance of damages.

Then, the court declares, it is the value of the trackage occupied, and not its cost, which must form the basis of the computation of the compensation to be allowed.

Here, after such value was ascertained, the plaintiff company was required to pay interest at 6 per cent on one-half thereof. It was also required to pay one-half of the annual taxes, half of the annual cost of repairs and maintenance of the tracks on the defendant company's own estimate, one-half of the cost of sanding, watering, cleaning, and salting the tracks, and one-half of the cost of renewing said tracks and granite and wood paving whenever said renewals should be required, the plaintiff company being required to give a bond for $15,000 conditional that it would pay its said part of the cost of said renewals. Besides this, and the plaintiff company, having at its own expense, constructed the switches and connections with the tracks of the defendant company where their roads intersected, it was required to maintain the same, and keep switchmen at each, and employed at all hours when trains were running, and pay the same. The plaintiff company was also forbidden to hinder or delay the defendant company in the use of its tracks, and whenever the cars of both companies approached the intersection the defendant company was given the right of way.

These items, the supreme court holds, covered all the grounds upon which compensation could be lawfully allowed.

LEAVING SEAT INSIDE TO STAND UPON PLATFORM.

Terre Haute Electric Railway Co. v. Lauer (Ind.), 52 N. E. Rep. 703. Jan. 26, 1899.

The law applicable to this case was fairly stated, the appellate court of Indiana holds, in this instruction of judge to jury: "If you find from the evidence in the cause that the plaintiff was a passenger on one of defendant's cars, and was occupying a seat inside, in a safe place; and you further find that said car was crowded with passengers, and all the seats were taken, and that the plaintiff arose and vacated his seat to accommodate some lady passengers who had entered the car, and that, on account of the crowded condition of said car, instead of standing therein he voluntarily left it and passed out to the platform, and remained standing on the outside, where the accident occurred—then as to whether or not in so conducting himself he was guilty of negligence is a question of fact, which I submit to you. If his conduct in this respect, in doing what he did under the circumstances, was the conduct of an ordinarily prudent and cautious man, then he was not guilty of negligence. If, on the other hand, in going out upon the platform, under the circumstances, he did that which a prudent and cautious person would and ought not to do, then he would be guilty of negligence."

The appellate court says that it is not negligence per se (in itself) for a passenger to ride upon a platform of a street car, going there directly from the street, or from the inside of the car. The court will not presume that it is dangerous to ride upon the rear platform of a street car.

Furthermore, whether one ride on the platform of his own motion, or upon the request of the conductor, the court holds, would not be material. The rule, it says, would be the same in either instance.

Here the contention on behalf of the company was, not that it was negligence in itself for a passenger to ride on the rear platform of a street car, but that it was negligence for the one who had sued it to leave a place of safety, which he was occupying, for a place obviously more or less dangerous, upon a general request of the conductor, such as a request that some of the gentlemen should vacate their seats in favor of ladies, who had boarded the car, and stand upon the platform.

To this, the court replies that it thinks it clear that it is the duty of the passenger to follow the reasonable instructions, and rely on the judgment, of those in charge of the car, in regard to moving from one part of the car to another, unless it is apparent to the passenger that the movement would be attended with danger. The fact that this particular passenger had responded to a general request, which appealed to him as directly as to any one else in the car, the court holds, should not deprive him of any right he would have had, growing out of a compliance with a request addressed to him individually.

To the further objection that the request was unreasonable, the court answers that the request to gentlemen to vacate seats occupied by them in a crowded public conveyance, in favor of ladies, who would otherwise stand, is not, in this country, so regarded.

The conductor represents the company in the management of the car, so far as concerns the location of passengers. A request from one clothed with authority is practically equivalent to a direction.

INJURY OF INTENDED BOY PASSENGER RIDING IN PLACE OF DANGER.

Udell v. Citizens' Street Railroad Co. (Ind.), 52 N. E. Rep. 799. Feb. 15, 1899.

A boy, finding an open street car which he wished to take crowded, went, on the suggestion of a bystander, to the left-hand side, got upon the forward part of the car, a trailer, placing his feet on the boxing of the axle, and holding onto a portion of a seat with his hands. He neither paid any fare, nor offered to do so,

nor was he asked for his fare by any employe of the company. He had a nickel in his pocket, with which he could have paid such fare, and he intended to do so, if asked for it. He rode in the place described, in a stooping position, on the outside of the car, for about three-fourths of a mile, and until he arrived where he intended to get off and the car began to slow up. Here he was unable to retain his hold and fell off, and was run over by the wheels of the trailer. It further appears that on the left-hand side of the car there was no step or other means of entrance, and wooden strips extended from end to end, to prevent the ingress or egress of passengers. Besides, no passengers had been invited to enter the car on that side that day; the boy had not made his presence known to any of the employes of the company, and none of them saw him when the train was in the act of starting, or while he was hanging on the outside of the trailer after the train was under way, although they might have seen him, if they had made an examination of that side of the car.

Upon a careful review of these facts, giving to the conduct of the boy the most favorable construction, the supreme court of Indiana holds that they do not sustain the proposition that he was a passenger upon the company's car, to whom it owed the duty of safe carriage and immunity from injury. It says: He was not in a place intended for passengers. He was not received as a passenger. His presence on the car was not made known to the company's agents and servants. He did not conduct himself as a passenger.

The company's servants, the court continues, were not required to search for trespassers before starting the cars, and it was not bound to discover the boy, and remove him from the perilous situation in which he had voluntarily placed himself.

The distressing consequences of the boy's act in standing on the outside of the car, or the iron boxing of the axle, it insists, could not be said to be the result of any act or omission of the company or its employes.

The circumstance that the boy had a nickel in his pocket, with which to pay his fare when called upon, it further holds, did not make him a passenger. If he did not intend to pay his fare unless called upon, and left the car, or attempted to leave it, without paying his fare, it says that fact of itself would be entitled to weight in determining the question of his right on the car.

Moreover, as the special verdict failed to show that the boy was a passenger, the court declares that the rules concerning the overloading of street cars and the duty of street car companies to passengers did not apply.

Nor does the court consider that the fact that the boy was but a child aged eight years and seven months made him any less a trespasser, if the other facts found compelled the conclusion that he was wrongfully upon the car.

If, after an ineffectual attempt to get on the car at a proper and usual place, he abandoned that intention and became a trespasses, the court holds, he lost the right to that measure of care and protection which a carrier of passengers is required to extend to one who seeks to be carried as a passengr.

A judgment for the defendant is affirmed.

CONSENT OF ABUTTERS NOT NECESSARY TO ACQUIRE USE OF OTHER ROADS.

Ingersoll v. Nassau Electric Railroad Co. (N. Y.), 52 N. E. Rep. 545. Jan. 10, 1899.

Since 1839 there has been a statute in the state of New York providing that "it shall be lawful hereafter for any railroad corporation to contract with any other railroad corporation, for the use of their respective roads, and thereafter to use the same in such manner as may be prescribed in such contract." This provision is now incorporated into section 78 of the railroad law. But it has been left until this case for the judicial consideration by the highest court of the state of the question of whether it is in conflict with the constitutional proviso that "no law shall authorize the construction or operation of a street railroad except upon the condition that the consent of the owners of one-half in value" of abutting property be first obtained, and with state statutes requiring the consent of such abutters to the construction or operation of such railroads, extensions or branches thereof. The conclusion reached sustains the statute.

After reviewing the legislation of the state upon the subject of consents, the court of appeals says that it is evident that the legislature, from the beginning to the end of this general legislation, has never intended to require consents of local authorities or property owners to the operation by one railroad company of its cars over the tracks of another railroad company by virtue of a traffic contract with such other railroad company, but that it intended to require such consents only to the construction, maintenance, or operation of new railroad tracks constituting either main lines, branches, or extensions.

By the general railroad law, the court says, in order to acquire the right to construct, extend, or operate a railroad upon a public street there must be obtained First, consent of the municipal authorities; second, consent of a majority in interest of the abutting owners, or, if that cannot be had, the consent of the appellate division of the supreme court of the state. When these consents have been obtained, and the railroad corporation obtaining them has in all other respects complied with the commands of the general railroad law, it acquires what is known as a franchise, and one of the important features of that franchise consists in the right to contract with another corporation for the use of its tracks, which right becomes a part of the franchise—a right that neither the municipality nor the abutting owner can take away or impair.

Upon the subject of the granting of similar franchises, the court says that the state constitution has been the subject of amendment, and later of revision, but no single sentence can be pointed out that indicates a purpose of changing the established public policy so far as it authorizes railroad corporations to contract with other railroad corporations for the use of their roads.

It is well settled, further says the court in this case, that a perfected railroad franchise, constituted either by direct legislative grant or by consent of local authorities and property owners in pursuance of the constitution and general laws, especially when followed by actual construction and operation, is a property right that cannot be afterwards taken away or diminished, either by subsequent constitutional amendment or by legislative or municipal action, except in the exercise of the police power or the right of eminent domain.

Salability is an essential element of property, and the destruction or diminution thereof is a taking of property that cannot be done except through the exercise of the eminent domain or of the police power. The salability of the property right in qustion is affected, and its value diminished, if not destroyed, if the assignee thereof cannot make use of it without the consent of the abutting owners.

It therefore follows, declares the court, that if the legislation which it was argued required consents of abutting owners attempts to prevent a railroad corporation from possessing the right to contract for the use of its road with another corporation, from conferring on that other the absolute right to make such use, it is wholly without authority and void. But it adds that it seems to it, as above stated, that the legislature has made no such attempt.

MAKING MILEAGE TAX CONDITION OF GRANTING LICENSES.

Chicago General Railway Co. v. City of Chicago (Ill.), 52 N. E. Rep. 880. Oct. 24, 1898. Rehearing denied Dec. 14, 1898.

This was a controversy over the power of the city to impose a mileage tax in the ordinance granting the company named authority to construct and maintain a street railway on certain streets. It was not denied by the company that the city had the power to impose a money condition as a license fee, or to protect it against liabilities and expenses occasioned by reason of the construction of the railroad in its streets, or for expenses and the like of the city. But the company contended that the ordinance showed an unlawful attempt on the part of the municipality to sell its license, and that it was clearly within the power of the council, by its ordinance, purposes of municipal government; also that, because the ordinance contained other terms and conditions for the protection of the city against loss or disbursements, such as a license fee of $50 per annum for each car operated, there was no room for the presumption that the condition for the payment of the tax per mile was with a view to such purposes.

In these contentions, the supreme court of Illinois, however, declares itself unable to agree with counsel for the company. It holds that it was clearly within the power of the council, by its ordinance, to make this additional condition if it so desired, and that the

courts cannot indulge the presumption that the act was done for an illegal purpose, it being apparent that it could be done legally.

Moreover, if it were true, as contended by counsel, that the purpose of the mileage tax was to compensate the city for granting the privilege to the company to lay down its tracks and operate its street railway, the supreme court declares that it is still, in its opinion, a valid condition, and comes fully within the scope of the power granted to the city by section 3 of the horse and dummy act.

Neither does the supreme court consider that the ordinance in question was unconstitutional on the ground that the company was, by the condition, denied the equal protection of the laws or was deprived of its property without due process of law; nor does it concur in the argument that a general law may be made applicable to all street railways in the city, but no special ordinance can be enacted, and that, because other ordinances had been adopted by the city granting privileges to other railway companies to occupy the streets without exacting this condition, this one was unconstitutional. The statute having given the municipality power to grant or withhold its consent as "it shall deem for the best interest of the public," the power being discretionary, the court thinks that it is manifestly not to be exercised by a general ordinance applicable alike to all cases, but each case must be acted upon with reference to its peculiar conditions and circumstances. If, in the exercise of its sound discretion, the city council shall determine that the best interests of the public do not require the imposition of any conditions whatever, the court goes on to say, it may grant its license without qualification; but if, on the other hand, the public interest requires that the occupancy of particular streets, under peculiar conditions, demands that certain exactions shall be made of the company for the privilege conferred, then the city council has a right to so provide, and no constitutional right or privilege is interfered with.

The supreme court is also of the opinion that, even though it might be held that the condition upon which the permit or license was granted to the railway company was ultra vires, the city not having the power to impose it, nevertheless, the ordinance having been accepted by the company with the condition attached, agreeing thereby to perform it, it became a valid contract between it and the city, the validity of which the company is now estopped to deny.

RUNAWAY HORSES ARE NOT AMONG THINGS TO BE EXPECTED BY MOTORMEN.

Phillips v. People's Passenger Railway Co. (Pa.), 42 Atl. Rep. 686. Mar. 13, 1899.

The injuries to recover damages for which this action was brought were sustained in a collision between a street car and a runaway horse behind which the plaintiff had kept his seat as it ran down a cross street onto the street railway track. The negligence charged against the street railway company appears to have been in the failure of its motorman to stop the car, when called to by the plaintiff to do it. But the supreme court of Pennsylvania reverses a judgment obtained by the plaintiff, declaring that it is unable to see in the testimony any evidence of negligence on the part of the motorman. Indeed, there was no evidence that he heard the plaintiff call to him, or that he was otherwise made aware of the approach of the runaway horse.

It was the motorman's duty, undoubtedly, says the court, to look for approaching cars and other vehicles which might collide with his car; but anything moving with the speed of a runaway horse was not to be apprehended, and he might very well have assured himself that none of the ordinary dangers of street crossings threatened him, without having either heard or seen the approach of the plaintiff.

He had not brought his car to a full stop at the crossing, nor was there, continues the court, any reason why he should, so far as the testimony showed. A motorman certainly cannot be required to stop at every crossing, and look for such extraordinary perils as the one in this case; nor can he be required to stop at all, unless the circumstances are such that it would be imprudent for him to do otherwise.

Moreover, even assuming that the motorman knew the situation perfectly, the court holds that it cannot be said that he was bound, upon being confronted by so sudden and immediate danger, to do what, after mature deliberation, would have seemed to a prudent man to be the wisest thing under the circumstances. Where the sole basis of liability is the omission to perform a certain duty suddenly and unexpectedly arising, there must be not only a consciousness of the facts which raise the duty on the part of the person who is charged with its performance, but also a reasonable opportunity to perform it.

Finally, notwithstanding the disastrous outcome, the court wants to know how the jury could say that the motorman, with the duty uppermost in his mind of saving his passengers, if possible, from an imminent collision, did not judge—and that with reason—that his best chance of doing so lay in attempting to clear the runaway's course ahead of it? And how could they say that such a course would not have seemed to the majority of prudent men, if placed as he was, to have been the best. If he knew anything of horses, it says, he knew that no human foresight can predict the course of a runaway, even for a short space, and that the horse was as likely to attempt to go around the car at the rear as at the front, and that, if maddened, it might dash into his car no matter in what part of the street it was.

A NEW TRANSFER PUNCH.

The accompanying illustration shows a novel form of transfer punch, which is the invention of Mr. Clyde Landers, of Tacoma, Wash., and has for its object the economy of time and money in issuing transfers on street railways. The picture gives a good idea of the size of the instrument, which may be carried in the pocket. The one shown holds 250 transfers in the magazine and by slightly enlarging the case at one end the capacity may be doubled.

The magazine is filled, the date adjusted, and the instrument locked at the office of the company. To issue a transfer the conductor sets a pointer, which is on the end of the small cylinder opposite the time dial, to indicate the route for which the transfer is intended, and then turns the time dial through one revolution, when a transfer ticket bearing the date, time, place of issue and destination is pushed out as shown. The instrument shown will issue for ten routes; the intervals of time are five minutes.

LANDERS TRANSFER PUNCH.

The advantages claimed for this device are that the time cannot be "backed up" and thus mistakes in issuing "late" transfers are entirely avoided; the transfer tickets are more quickly issued than when printed forms have to be punched in several places; the ticket is more easily read; and, as the date is set at the office, the conductor cannot accidentally make an error in or willfully change the date.

The firemen and policemen of Oshkosh, Wis., may ride free on the street cars, notwithstanding the anti-pass law, the company having concluded that the provision in its franchise for carrying firemen and policemen will protect it.

ELECTRIC RAILWAY IN JAMAICA.

The United State consul at Kingston, Jamaica, describes the electric railway in that city as follows:

For some years there has been a mule railway in Kingston, but an electric road covering the lines of the old cars and other thoroughfares as well has just been completed. This new line has about 25 miles of track in and around Kingston, divided into three districts, viz., the lines north of the city, those east of the city, and those in the city. It is a private enterprise, started by Canadian capital, and is called the West India Electric Co. The government license is for a period of 30 years, renewable for further periods at the pleasure of the governor. The company pays 4 per cent of its gross earnings to the government, and assumes the maintenance of the roads and streets occupied by it to the extent of 18 in. on each side of the tracks.

The rates of fare are four cents for each passenger from any point within a district to another point in the same district by most direct route; that is, the fare is practically four cents for each section of the line, and from the end of the line to the east, through the city to the end of the line north, would be three fares, or 12 cents. In addition, the company reserves three front benches on each car, on which a first-class fare—six cents—is charged. The tickets are sold as follows: Seven four-cent tickets for 24 cents, five six-cent tickets for 24 cents, and 10 children's tickets, for under 12 years, for 24 cents.

Passengers are allowed to stand. There are no restrictions as to number of passengers carried, and the same complaints of overcrowding are heard. Cars run every 15 minutes in the city. In addition to regular motors, this company runs market cars before 9 a. m. and after 5 p. m. for country people who carry produce. These cars are trailers, and the fare on them is three cents.

SITUATION IN WICHITA, KAN.

A correspondent in Wichita answering an inquiry in reference to the street railway situation there, states that the press reports are greatly exaggerated and do the city, the judge and the company injustice, to say the least.

In 1890 the city council granted the Wichita Electric Ry. a 20-year franchise for the construction and operation of an electric street railway; this franchise was sold in 1893, together with the entire plant, to the Wichita Electric Railway & Light Co., which now owns the property and is operating under this old franchise. This is the franchise that the city is now bringing action to annul, because, it is alleged, that the company has permitted the line to run down and get out of repairs, and in other ways forfeited the rights granted under the franchise.

When the city brought injunction proceedings in the District Court to compel the line to stop running, the judge granted the petition, but at the same time required the city to give sufficient bond to indemnify the company; but after considering the matter further the city decided that it could gain nothing by the continuation of these proceedings and failed to file the required bond, consequently the cars are still running, and in all probability will continue to do so for some time to come.

The present owners of this line have had financial reverses and being unable to put more money into the line so as to make it a profitable institution, are obliged to dispose of it.

In 1897 the Wichita Railway, Light & Power Co., was organized for the purpose of buying up the old line, rebuilding it and installing an electric light station in connection with the railway; after 18 months of hard work financing the company and fighting the existing Light company, the new company has not yet been able to get the thing started, but is still at it and may make the deal go in spite of all opposition. The present outlook is more favorable than ever.

The franchise which was given to the new company had a time limit in it for the completion of the work, besides a cash forfeit, which the city proceeded to take when that time was up and the line not finished.

Our correspondent has been assured that the city will stop the pending litigation and grant new franchises to a new company which will buy up the present line and invest money to make necessary improvements. The property of the old company may be had for little more than its scrap value.

The present condition of the street railway line can be attributed to the boom of some 10 years ago when everybody went wild and laid a foundation here for a city of the size of Chicago; the car lines then went all over the town and into the corn fields in the country; every new addition had its car line. When the boom burst it carried down with it the majority of the people, and the car company found itself with miles of lines that paid nothing; these lines were from time to time pulled up, until we have now about 17 miles left. This mileage, if in proper shape, would prove profitable. Wichita is fact growing now, and in a very substantial manner; its wholesale and jobbing interests are enlarging every day, and there is certainly a future for it.

The newspaper notoriety which has been given the litigation is unfortunate, because, as stated, the report does all parties injustice and makes it more difficult to finance a new company.

EXCURSION PERMITS.

The Birmingham (Ala.) Railway & Electric Co. has for some time made a practice of giving half-rates to excursion parties in charge of teachers, and has found the traffic profitable. Until recently it has been necessary to make arrangements in advance to secure the reduction in fare, but Gen. Mgr. J. B. McClary has devised a means for those desiring to secure the reduced rates to do so without any inconvenience whatever. Teachers' excursion rate permits have been sent to all the teachers in the county and when one of these is presented with a party of 20 the conductor collects for the round trip and gives the holder of the permit a certificate of payment good for the return trip.

BIRMINGHAM RAILWAY & ELECTRIC COMPANY.

TEACHERS' EXCURSION RATE PERMIT.

To Conductors East Lake, Ensley and Bessemer Divisions:

The bearer, _____

Is entitled to half fare rate for the round trip, for twenty or more, when in a body both ways. The holder of this permit will show it to Conductor, who will collect one fare on outgoing trip and give bearer return check for the number of passengers paid for. This return check will be accepted by conductor on incoming train as full fare. Check to be made out in duplicate, original to be turned in by outgoing Conductor.

This permit good until _____

No. _____ _____ **Gen. Mgr.**

Not Good for Any Number Under 20.

BIRMINGHAM RAILWAY & ELECTRIC CO.

_____ DIVISION.

This Certifies that _____

holder of Excursion Permit No. _____ *has paid me for* _____ *passengers to* _____ *Conductor on incoming trip will accept this for* _____ *passengers without further payment. Good only for this date* _____ *Conductor.*

Signature of holder of Excursion Permit O. K. _____

Date _____

INSTRUCTIONS TO CONDUCTOR. You will fill this out in duplicate and get holder of permit to sign both original and duplicate. You will turn in original with cash to balance and give permit holder the duplicate, which will be good for return passage. J. B. McCLARY, G. M.

NOT GOOD FOR ANY NUMBER UNDER 20.

The permit is on a card $4^1/_2 \times 2^5/_8$ in. and the certificate is a blank $5^1/_2 \times 3^3/_8$ in. Both are shown herewith somewhat reduced in size.

The conductors and motormen of the Middletown (O.) Traction lines were granted a raise of wages from 15 cents to 17 cents per hour last month.

The projected electric railway between Grand Rapids, Muskegon and Grand Haven, Mich., is being delayed for want of steel and copper. The promoter, however, says it will be completed this year, notwithstanding.

ELECTRIC TRACTION ON TRAMWAYS.

Extracts from a paper read before the Cleveland Institution of Engineers, Stockton-on-Tees, by J. Clifton Robinson, May 29, 1890.

Mr. J. Clifton Robinson, managing director and engineer of the Imperial Tramways Co., and several other tramway enterprises, delivered an admirable paper before the Cleveland Institution of Engineers, in which he recited in careful detail the history of the progress of the electric railway, and described the installation and construction of several of the most conspicuous tramways of Great Britain. We regret that space forbids its publication in full, and we content ourselves with extracts, which are valuable as showing the prevailing views of the best English engineers on the several forms of electric propulsion.

THE ACCUMULATOR SYSTEM.

There cannot be a question that the ideal method of electric traction would be to have the power "self-contained" in the car —in other words, the "accumulator system." It would rid us of many difficulties, if only those which it itself possesses could be got rid of. In the first place, the ordinary rails (if the line had been properly built) would suffice, no "bonding" or other special preparation being required. But against this there arises the fact that from the "dead weight" required to be carried by the car—from three to four and one-half tons on each car, in addition to the electric motors—a very strong road-bed is required, and few of our existing horse tramways have been laid with either rails or road-bed sufficiently strong to carry such traffic.

There would be no poles or wires above ground and no danger of electrolysis from leakage of current underground, so that two very material objections that at first told against the progress of the overhead system would be removed. The electric power used would not be exposed to such risks as floods and snowstorms impose on everyone of the underground systems yet proposed, and whether for overhead or underground, all objections under the Board of Trade restrictions, or the obligation placed upon us because of the near vicinity of our lines to Kew Observatory, would at once disappear. It may be asked why, with all such advantages, I am not a whole-hearted advocate for the promotion of accumulator traction, and the answer is not difficult to give—practical success with the system has not been as yet secured. The present disadvantages are many. If the road-bed has to be reconstructed owing to the existing construction being insufficient to carry the great weight of the cars, the accumulator system presents no saving in that direction. It is true the copper bonding of the rail joints for the return current is not required, but what is saved here is in my opinion balanced by the extra strength of the track which the enormous weight of the accumulator car would require. Again, the cars themselves are rendered much more costly in proportion to the paying load they carry, and this goes far to meet the cost of the poles and wires of the overhead system, if indeed it might not exceed it.

Owing to the opposition in Hanover and some other continental cities to the use of overhead wires in the central and more showy parts of the town, the system has been adopted of using a combination of overhead and accumulator traction and of the accomplishment of very fair results under this method there can be no doubt. But it will at once be seen that this is a most costly expedient, combining practically the costs and disadvantages of both systems, for the weight of the accumulators has to be dragged by the car during the whole of its course, however many miles it may run outside the boundary with the power drawn from the trolley wire. The only economy in the use of the joint method is this, that current not only sufficient to move the car is obtained through the trolley wire, but also current to re-charge the accumulators. The system works fairly well, but like all compromises, it is not one that can be de plano recommended for adoption. A portion of the Birmingham tramways has for some years been worked by accumulators, but the results there have not been such as to encourage the extension of their use, the latest figures showing that the expenses per mile considerably exceed the receipts.

About two years ago I carefully inspected and reported upon a most interesting line in Paris, newly inaugurated and running from the Madeliene to three terminal points at Levallois, Courebevoie, and the Pont de Neuilly. It is a reproduction, on a sufficient scale to give practical results, of a system introduced at Hagen in Westphalia, Dresden, etc., and may be considered as showing the use of accumulators under their most favorable conditions. The accumulator in use is constructed on a later principle, capable of bearing the shocks and jars of every-day tramway life, each car carrying 200 "units" of 40 lb. each, making a total dead weight of 8,000 lb. for each car. The chief novelty in this interesting line appears to be in the provision for re-charging the accumulators on the car. The method of distribution of current is arranged on simple lines. The cars carry enough power to run into the city from the several termini and back again, and the re-charging of the accumulators is done at the outer point. By this means any delay or crowding in the city center is avoided, and the cars there move in and out, as automatic machines. From the power house three feeder cables are led; the first, about 700 yd. in length, reaches a distribution post at the main terminus at Pont de Neuilly; the second, a mile and a quarter in length, carries current to the terminus at Courbevoie; and the third, two miles in length, crosses the river and proceeds to Levallois, the remaining terminus. (St. Ry. Rev., Aug. 1897, p. 505.) At each of the termini the feeder is led into a distribution post placed at the roadside, and outwardly resembling a pillar letter box. When a car reaches the terminus, the conductor places a length of elastic cable, connecting one end with the necessary apparatus in the distributing post, and the other with the terminals of the cells in the car. No electric skill is required from the conductor, the attachment of the elastic cable being automatically signalled to the power station and the charge being regulated there. The defect of this system is that the act of charging occupies seven or eight minutes, and more often 10 or 12 minutes, so that unless the distribution posts are increased in number the headway of the cars running is thus restricted. The three lines join up at various points, and the Madeleine furnishes a common terminus. Thus the cars there start off every three or four minutes, but the individuals local services are restricted in the manner stated.

UNDERGROUND SYSTEMS. I.—CONDUIT.

In another part of this paper I have hinted at the restrictions laid upon electric traction in this country by the Board of Trade rules, and when we leave the overhead system to consider the various inventions for providing haulage through electric currents borne and distributed underground, it is found that this restriction is not lightened, and that so far as the United Kingdom is concerned, stringent limitations are placed upon such a use of electric power.

Underground electric traction takes one of two forms. (1.) A continuous conductor, from which current is taken off by direct and sustained contact, similar to the contact of the trolley wheel in the overhead system, and (2) by intermittent contact with points provided on the surface of the road. In either case, certain requirements for the public safety are demanded, and these, while perhaps stronger in the case of surface-contact systems, are needful in any form of underground working. These requirements are:

1.—The Board of Trade regulation as to the drop in potential. This, of course, only applies where the rail is used for the return current, but even where a separate metallic return is provided, leakage requires to be provided against.

2.—The open slots and rails (in the conduit) and the metal studs (in the case of surface contact) and any other visible fittings must offer no impediment to ordinary street traffic.

3.—There must be no possibility, mechanically or electrically, of accident to persons, horses or other animals, or property arising from the electric currents leaking to earth.

4.—Interruption from flood, frost, or other climatic causes must be reduced to a minimum.

I do not wish to dwell on cost, but it must be evident that constructionally any underground system must considerably exceed in cost the overhead trolley. In operation, maintenance, loss from interruption and other features, the underground systems are more costly and are thus eventually less economical from a commercial point of view. The question of cost may perhaps be set aside in certain circumstances, such as the impossibility of obtaining assent to the use of any other system, but the question of "possibility" must in this country be subject to the operation of the first condition set forth, for if the Board of Trade rules as to potential and insulation cannot be satisfied the question of the use of underground currents in any form must be put aside. I am not satisfied that any invention yet set forth can fulfil those conditions, although the at-

tention of electrical engineers is being steadfastly directed to the solution of the problem. And until probably our own experience at Hammersmith is fully solved, the discussion of underground conduits or surface contacts has in Britain only an academic value.

The earliest conduit system in Europe was that at Blackpool in Lancashire, which was opened in 1883, and has been working since then till now. It is a line of under two miles in length and is worked by means of a conductor borne in a space between the rails. Contact is made by a "collector" from the car taking off current, and the return current is taken by the rails, which are bonded. The line has not been extended or imitated. Indeed, I believe an application to the Board of Trade is even now being made by the corporation for an order to convert this conduit to the overhead trolley.

The leading example of the use of the conduit system in Europe is at Buda-Pest, where since 1888 about 14 miles of tramway track have been operated on a system devised by Siemens & Halske. The remainder of the Buda-Pest tramways "outside the zone," are, it may be mentioned, worked by overhead wires, and the conversion of all horse tramways to electric traction has been completed, the conduit thus operating little more than a fifth of the tramway systems of the joint cities.

The conduit in Buda-Pest has several well-marked features. The rail on both sides is double, the slot on the right hand or inner rail receiving the flange of the wheel, which is here in the middle of the wheel surface in place of being at the edge, as in ordinary railway and tramway practice. On the outer side this slot serves a double purpose, receiving the wheel flange and also admitting the electric conductors which take off the current from the fixed conductors in the underground channel. The channel is constructed practically in the same way as that used for cable traction, with shaped metal yokes at distances of 4 ft., and a concreted hollow, heart-shaped, held in place by the yokes. In the chamber thus formed are two electric conductors, formed simply of T iron, and insulated with porcelain insulators. The positive conductor conveys the current to the car motor and the return current is carried with the negative. In this way it is claimed that electrolysis of gas and water pipes cannot arise, but it is obvious that this only remains true so long as there is a perfectly insulated earth return. A good deal of pains is taken to prevent ordinary rainfall from affecting the line, by means of sumps and manholes every 50 yd. and at street crossings, and ordinary obstructions in the slots are removed by wooden shovels or clearers of special form. The defects in this as a workable system in this country are several. The width of the slot is, in some instances, 1½ in., and the wear and tear of the traffic is constantly tending to increase this space. In these days of bicycles—not to speak of ordinary light traffic—such openings could not be permitted here, and the widening of the opening of course increases the possibility of the electrically charged conductors being reached, either intentionally or accidentally.

II.—SURFACE CONTACT SYSTEMS.

Although the course of electric experiment has during the past ten or twelve years brought forth many proposals for a system of "closed conduit" or surface contact, my remarks beyond a few general facts will be confined to three illustrations—two of them in actual operation, and the third now in process of development and perfecting, which appears to promise a fairly good solution of the problems presented. It must be kept in mind that the demands made upon a surface contact system are greater than in the case of a conduit. In addition to the difficulties inherent in both, the surface contact presents, as its name implies, an actual living electric current flush with the roadway, and therefore some more or less elaborate means must be provided by which these points where the current is brought to the surface must be "dead" except when the car that is to take off current from them is momentarily passing over the charged stud. Methods more or less ingenious have been devised to secure this but it must be evident that such apparatus tends to be costly in whatever form, and presents a serious risk at all times that the "cut-off" may fail and that the metal surface stud may remain as a great danger to every one crossing or using the roadway and particularly the foot passengers. In outward actual appearance a surface contact line presents no difference from an ordinary horse tramway beyond the presence of the metal "studs" with more or less frequency.

The records of the Patent Office indicate that Professors Ayrton and Perry were the first to devise and patent a surface contact system. They did not, however, proceed to practically test such a system, and the idea did not come into prominence until some years later. Diatto invented a system having some merits. The switches floated in mercury actuated from a solenoid carried on the car. A short piece of experimental line was constructed and the results obtained were satisfactory. The Claret Vuilleumier system in Paris was the next to be put into practical operation. (St. Ry. Rev., July, 1897, p. 451.) In this system the contacts are electrically charged from rotating switches placed at intervals in the streets. These switches have a number of contacts corresponding to the number of street contacts they are to operate. As the car moves ahead the switches rotate by a ratchet action synchronously with the cars, and maintain electrical contact with the studs underneath the car. The results obtained in operation are of an encouraging nature, although there have been times when the rotating switch would get out of synchronism with the car, and herein lies the weak point of this system. The Johnson-Lundell system was first tried in the streets of New York, and the results were, in a general way, satisfactory. The switches are placed under the street, and are worked by a solenoid connected in series with the car, the solenoid working one contact switch being in series with the solenoid in the preceding switch, so as to ensure the closing of one switch before the breaking of the other. The street contacts are placed at intervals of 8 ft.

The Claret-Vuilleumier system has this objectionable feature that no two cars can approach each other within the distance covered by the distributing chambers, that is to say a distance of about 100 yards. This is a serious drawback in the event of any breakdown or interruption of the line, as this space of 300 ft. remains dead and and inoperative; and it has the further disadvantage that no car can approach another within the block, so that in case of pressure of traffic when it is desirable to run cars at very short intervals, a limit is imposed which is not desirable. This system presents a further difficulty militating against its general adoption in this country, namely, that from the number and intricacy of its parts it would probably be found impracticable, or at least very costly to work it without the rail return current. Despite its ingenious mechanism and its two and a half years of successful working, I am not able to speak favorably on the system for this country, and its chief value must lie in its testimony to the practical success of a "surface contact" working.

In the Monaco surface-contact electric tramway there are two rows of studs, each placed about 10 in. inside the rail, and the car is in consequence furnished with two skates for a double row of contacts. The studs are round and stand above the road level about half an inch, and an arrangement of levers and springs provides that the skates shall always press sufficiently on the studs to make good and efficient contact. A small battery is carried on the car to start the current, and from it a slight current is given to the left hand bar (looking forward as the car goes) which is really used for the return current. The first contact makes connection direct to the supply current, which is then transmitted to the motor by the right hand contact bar, then returning through the left hand skate to the power house. At the instant of contact with the "positive" stud, current is set up through the feeder cable actuating a switching apparatus in the distribution vaults, and so the power is carried to the motor. When the shoe leaves a stud it becomes electrically "dead," and the current is being drawn from the next stud in advance, and so throughout the journey. The distributing vaults in this case are at a distance of about 218 ft., each chamber controlling 45 studs. These vaults, or rather pits, are about 6 ft. 6 in. in depth and measure $8\frac{1}{2} \times 3\frac{1}{2}$ ft., a manhole gives access to the pit for inspection, and the working of each car as it passes over the section can actually be watched in the subterranean vault as the connection is made and broken for each stud in succession. The rails are used for the return current. One feature of the working is that the cars can run back and forward on the single line with equal facility, and can closely follow one another when required.

More recently Professor Silvanus Thompson and Mr. Miles Walker have devised a very ingenious improvement in surface contact systems, combining the more salient advantages of the Johnson-Lundell, Diatto and other systems.

The disadvantages generally of surface contacts are:

1.—Complications.

2.—The disadvantage as compared with the slot conduit that double insulated earth returns lead to complications.

3.—The contact "studs" are objectionable, in that they present an irregular street surface.

4.—In the case of a network of tracks, there would be difficulty in preventing short circuiting during the passage of the car unless the contact "studs" are raised to such a height as would make them objectionable.

When a "mixed system" is used, the "overhead" and "accumulator" systems work easily together, because in that case the car, being in contact with the overhead wire, passes on without delay, the trolley just simply remaining idle. With a combination of overhead and underground conductors, the "surface contact" claims advantage over the open "conduit," as there is no delay as in the case of conduit, in fitting the plough or conductor into the slot or removing it on return. The car only requires to be fitted with the "shoe" or skate underneath, and passes on indifferently from the overhead to the surface contact portion of the route.

CONCLUSION.

I have very carefully examined into every new proposal for tramway traction, and have visited many places to test by actual inspection every new invention. But at the present moment my judgment is that the electric trolley "holds the field." It is simple in construction, easy in maintenance, cheaper than any rival in capital cost, and more economical in working cost from day to day than any other method yet known.

NEW SUPPLY HOUSE.

The firm of Gates & Randolph has been formed for the purpose of selling electric appliances and contracting for the complete outfitting of electric railways and electric lighting plants. The firm is composed of J. Holt Gates and Robert J. Randolph, both men having been long and intimately connected with electrical matters. Offices and warerooms have been opened in the Monadnock Building, on the ground floor. Connections have been made with several large and important electric appliance manufacturers and in its wareroom the firm proposes having some displays which cannot fail to prove interesting and attractive.

Mr. J. Holt Gates has also had an extensive experience in this

J. HOLT GATES.

field. In 1885 he became associated with Westinghouse, Church, Kerr & Co. in the Chicago agency it had just taken of the Westinghouse Electric & Manufacturing Co.

This house had only recently been organized in Pittsburg and Mr. Gates spent an entire year in the shops of the company there, studying the details of the business. The knowledge thus obtained he has since put to good use. Leaving Pittsburg, Mr. Gates went to Texas for the company, staying there for three years. He then came to Chicago, and after seven years service with the Westinghouse company, took the position of manager of the sales department for the Siemens & Halske Co. He remained with this concern for some years, but eventually went into business for himself, as the agent for various electrical manufacturing houses. He has been thus engaged for the past five years. Mr. Gates in-

R. J. RANDOLPH.

stalled the Auditorium Hotel electric plant, one of the model plants in Chicago.

Mr. Robert J. Randolph is one of the pioneers in the electrical field so far as Chicago is concerned. He began his work in it about 30 years ago and was associated with Charles J. Vandepoele in the company he organized in the early 70's. Mr. Randolph sold the first five arc light machine made by this company to a Rockford, Ill., manufacturing concern and it is still in working order. Soon after this the company turned out a 40-light machine and it created no end of speculation among electrical people.

The Vandepoele Co. became merged into the Thomson-Houston Electric Co. and Mr. Randolph went with the Excelsior Electric Co. and has been manager of its Chicago office ever since until about a year ago, excepting an interval during which the Excelsior closed its Chicago branch. It was the final closing of this branch about a year ago which led Mr. Randolph to look for other connections. He accepted the management of the Sterling Arc Lamp Co., of New York, where he has remained until the present copartnership with Mr. Gates was formed on the first of last May.

The experience of both Mr. Gates and Mr. Randolph in connection with electric work and appliances is all the guarantee needed that the new firm will meet with success.

HALF FARE BILL DEFEATED.

A bill was recently introduced in the Connecticut Legislature providing that during school hours, New Haven and Hartford school children should ride in the street cars at half fare. The bill also contained a similar clause for workingmen. The bill was referred to the Committee on Railroads, which reported unfavorably upon it, holding it to be unconstitutional, being class legislation. A substitute bill was then introduced making the same provision for school children, which applied to the whole state. In this shape the bill passed the House and came up in the Senate on a motion to concur with the House and reject the report of the Railroad Committee. Several senators opposed the bill on the grounds that it would be the entering wedge for a great many other bills of a similar nature, that workingmen of all descriptions would demand the same right, and that many of the roads in the state could not afford to issue the half fare tickets required.

A viva voce vote showed about twelve senators opposed to and four or five in favor of the bill, which was rejected.

The Montreal (Can.) Street Railway Co. is engaged in making some extensive improvements. It is building new shops and car house, new office buidings and laying new track.

NOTES FROM DENVER.

From Our Own Correspondent.

The consolidation of the street railway systems of Denver, Col., as noted in the "Review" for March last has been followed by a great deal of work in rebuilding track and rolling stock and further extensive improvements are contemplated. The Denver City Tramway Co. now owns and operates all the street railways of Denver except the Denver, Lakewood & Golden R. R., and it is interested in that one.

The company has decided to abandon the use of trailers and all single truck cars as rapidly as they can be replaced by the new type of rolling stock. Since the consolidation the company has taken on 128 new men. New cars are being turned out at the rate of 12 per month, six at the company's shops and six by the Woeber Bros. Car Co. Forty-nine cars have been finished and 16 more are in the shops. All of these are combination cars and were made by splicing closed motor cars and open trailers, thus disposing of 130 cars of the old equipment.

All of the smaller cars which were of suitable size were thus used. There were 79 open trail cars, 57 of which were old 28-ft. cable grip cars, and 69 motor cars which could not be spliced for combination cars because of wide difference in the hight, width and shape of roof. These will be spliced to make long open and long closed motor cars.

The company now has 158 miles of track and is preparing to build about 20 miles more if franchises are secured. The old cable lines, aggregating 32 miles, and what is known as the Argo horse line, 5½ miles, will be changed for electric traction. The old West End Street R. R., 10 miles, is to be changed from standard gage to 3 ft. 6 in. to conform to the other lines. Some of the West End cars have already been changed for the narrow gage, and all are to be painted red which is the company's standard color.

A new "Y" has been placed at the terminus of the Aurora line and the track improved by laying some new rails; the center poles have been removed and side poles substituted.

The line to Fairmount Cemetery has been extended a quarter of a mile into the cemetery and a loop, waiting room and two sidings built to provide better terminal facilities for the funeral train service. The present arrangements bring the funeral trains directly to the rear of the chapel at the cemetery.

A number of 32-ft. combination cars equipped with G. E. 800 motors have been put on these lines and make the round trip of 12 miles in one hour. They are run on a 15-minute headway. The traffic is very heavy, particularly on Sundays.

At Colfax Ave. and York St. where a number of lines center, the company in conjunction with the Gallup Floral Co. has erected a handsome station. The flower company has its office and displays its cut flowers and plants in the waiting room, while a large lawn set out with flowers makes the surroundings very attractive. At night the waiting room is illuminated by about 1,000 incandescent lamps.

The company has 75 pairs of Brill No. 27-D ("perfect") trucks which are being placed under the new cars. A number of maximum traction trucks, which have given good service for several years, are on hand but as the company has decided to use only trucks with wheels all of the same size it will rebuild these, using two pairs of large wheels to make a swing bolster truck.

The company has 125 new double equipments of G. E. 58 motors which have been substituted for the old equipment. Among the new equipment are 200 Syracuse electric headlights.

The car service has been improved on a number of lines, the headway being reduced wherever the traffic justified it. The company is now operating 136 regular cars and 22 extras are put on night and morning for the park line. It is the intention to build a central power station and a down-town car barn.

Iron poles are being placed in the business section of the city and the wooden poles removed. Within the last two months a great deal of new trolley wire, hangers, etc., has been put up. Some of the cable tracks are being removed as they are not needed since the consolidation.

The first trolley party of the season was given on May 27th; the party filled four large 16-bench cars.

One of the stockholders in one of the old companies is contesting the legality of the consolidation in the courts; the decision will doubtless turn on whether the law prohibiting the consolidation of railways is held to apply to street railways. It is generally understood here that the persistent attacks on the company made by one of the daily papers are largely because the manager of that paper failed in an effort to become the company's attorney.

The Boulder Railway & Utility Co. has been organized and has a franchise to build and operate street railways in Boulder and the adjacent county. It will get 18 cars from the Tramway Co.

It is reported that the H. J. Mayham Investment Co. is behind a new company organized to build between Denver & Boulder by way of Westminster University, Louisville, Marshall and other towns; this line is to be 32 miles long and cars will enter Denver over the Tramway's tracks.

The Denver, Lakewood & Golden R. R. has put in service a number of combination baggage and express cars.

The company had decided to adopt safety gates manipulated only by the motorman.

Smoking is permitted only on the two rear seats, and if a passenger begins smoking when in any other seat the conductor hands him a printed slip (shown reduced) which never fails to take effect.

Smoking is permitted only on the two rear seats of open or combination cars.

The Denver City Tramway Co.

The company has had more or less trouble of late because of poles breaking, and when the broken pole was reported the car crew could not readily tell the exact location so that the wreck crew would lose time in getting to the place. Now each pole has its number painted on it. Each line is numbered consecutively, beginning with 1, the two poles which are opposite one another being given the same number. Where several lines use the same track for a portion of their routes and then branch off, the poles on the branch lines follow the numbers on the main line. A broken pole may now be exactly located, as "Pole 47, right side, 11th Ave. line on Ogden St.," and no time is wasted in finding it.

The Denver City Tramway Co., in 1897, completed down town terminal loops which were illustrated in the "Review" for February, 1898, page 91. These loops are now used by the cars on 23 lines and the company is engaged in laying the connecting tracks necessary to bring the other 12 lines operated by it to this terminal. A new transfer station has been built at the loops for the convenience of passengers.

The Loretto Heights Railroad Co., which operates a line of horse cars, 3½ miles, from the terminus of the Tramway's South Broadway line west and south to Ft. Logan, has been engaged in litigation with several of the steam railroads trying to secure a grade crossing. There are five steam tracks used by eight railroads, and a compromise has been reached under which the street car line will tunnel under the track, the expense of $6,000 to be borne half by the Loretto Heights and half by the steam roads.

R.

WAGES INCREASED AT MONTREAL.

Last month the following order was issued by Mr. J. L. Wanklyn, general manager of the Montreal Street Railway Co.:

"(1) On and after July 16th, all permanent employes in the operating department and workshops will be insured in an accident insurance company of good standing, and the premium will be paid by the Montreal Street Railway Co. This insurance will amount to $1,000 in the event of death from accident either on or off duty, one-half of this amount for total disablement, and $5 per week indemnity for time lost through injuries or diseases specified in the policy, full details of which will be given when the final arrangements are made with the insurance company.

"(2) Motormen and conductors who have been regularly in the company's service for two years and over will have their wages increased to 15 cents per hour.

"(3) In addition to the above advantages, motormen and conductors who have been regularly in the company's service for five years and over will receive free uniforms."

HEAVY ELECTRIC SHOP LOCOMOTIVE.

The value of electric locomotives for industrial purposes is becoming more and more generally recognized and almost every week sees them adopted by some industrial establishment. The J. G. Brill Co. has just turned out a very interesting example of this type of machine for the Sandusky Portland Cement Co. Fig. 1 shows the machine ready for operation; it is mounted upon double trucks and is to have four motors. By means of very heavy constructive features and special ballast the weight is to be brought up to 14,000 lb., which will give a draw bar pull on a dry rail of considerably more than 3 000 lb. as ordinarily calculated. Probably under favorable circumstances the electric motors will bring this up to 4,000 lb. The machine is 19 ft. long over the end sills by

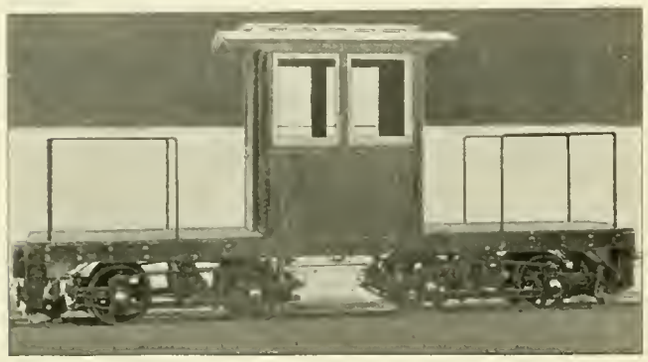


FIG. 1—BRILL ELECTRIC SHOP LOCOMOTIVE.

4 ft. 3 in. wide, and is intended to run on a shop track of 2 ft. gage; the height over the trolley board is 9 ft.

Fig. 2 shows the special form of Brill truck designed for this class of work. The truck frame is a steel casting and the ends are of T-iron. A center-bearing bolster rests an nests of helical springs; there are also journal springs. This combination makes not only a very compact but a very easy riding truck for work of this character. An ingenious arrangement of the parts makes the bolster have what is practically a swing motion. It is allowed to rock on the helical springs and in order to bring it always to a central position four small helical springs are provided which bear against the central columns of the frame. With a truck which runs at such moderate speeds this amount of swing or side motion

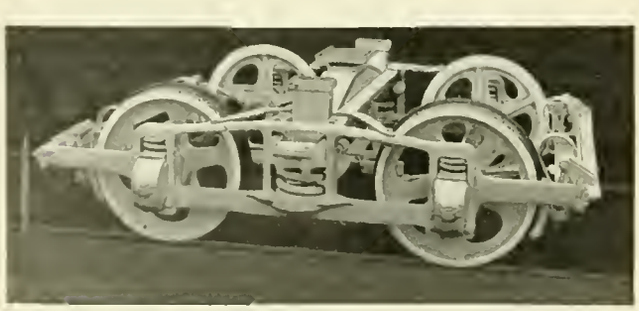


FIG. 2—TRUCK FOR ELECTRIC LOCOMOTIVE.

is ample for the purpose and reduces the danger of climbing the rails to a minimum. With a 4-ft wheelbase such a locomotive as this can run around any curve that is likely to be required in shop practice.

The motorman is protected by a small cab placed in the center of the platform. This cab is 5 ft. long and is provided with a sliding door. Pipe railings are provided on both sides, with openings next the cab. The machine seems to be one specially well adapted for use of establishments where heavy pulling is required and where the sharpest curves are of necessity encountered. The use of a double track of the kind described is of great advantage, making derailment very difficult. At the same time in spite of the heavy total weight it is very easy on the track. With all the weight on that has been contemplated the load per wheel will be considerably less than 2,000 lb.

STRIKE AT AKRON, O.

June 20th the employes of the Akron (O.) & Cuyahoga Falls Rapid Transit Co. went on a strike. Some time previously the men had asked for an increase in wages and the matter was referred to arbitration; the decision provided for an increase of 2 cents per hour for trainmen and 2½ cents for other employes. A broad article for the arbitration of all questions that might arise in the future was tacked onto the findings and the refusal of the company to accept this caused the strike.

The following day the article was modified to read as follows: "When any meritorious grievance or dispute arises and we cannot agree upon a settlement among ourselves, we will agree to submit the same to a board of arbitrators, one to be selected by each of the parties hereto, and the two thus selected to choose the third, provided that no demand shall be made to arbitrate any question involving the violation of any rule of the company now in force or any reasonable rule that may hereafter be adopted, or the conduct, carelessness or competency of any employe." There was no objection to this form and the men returned to work.

GRASSES AS SAND AND SOIL BINDERS.

The protection of earth embankments has long been an important question with the steam railroads and the increasing number of interurban electric roads is making the subject of interest to our readers. The U. S. Department of Agriculture has received many inquiries concerning grasses as sand and soil binders, and we take from a recent publication the following extract describing the grasses suitable for protecting embankments:

For holding embankments where a firm turf is required, couch or witch grass does excellently well in the Northern and Middle States. This well-known grass is widely distributed throughout the north temperate regions of the Old and New World. It presents a number of forms, some of which have been regarded as distinct species. All are good hay grasses, but are objectionable in fallow land because of their widely spreading and very persistent joined rootstocks. In the Northwest—Nebraska, Montana, etc.—there is a variety called "blue stem," which is very highly prized and much used for hay. In rich soil the stems grow to the height of 3 or 4 ft., and the heads have a striking resemblance to those of wheat. Hence the common names "wheat grass" or "creeping wheat," which have been applied to it by some. Couch grass makes a very tough sod, and is particularly valuable for binding railroad embankments, banks of canals, ditches, or other slopes which it is desired to hold in place. A well-marked variety of the species grows in sands along the sea coast, and is useful there as a sand binder.

Hungarian brome grass is a good turf former, and may be employed in much the same way as couch grass. The creeping rhizomes of the brome grass are not so strong as those of the couch grass, and as a soil binder it is less to be depended upon.

In the Southern States, where the couch grass does not succeed well, Johnson grass or the finer Bermuda may be substituted for it. Johnson grass produces a great mass of extensively creeping, strong rhizomes, and when once the ground is filled with them, it is almost impossible to eradicate them. Bermuda grows more upon the surface, and upon a light or sandy soil succeeds better than Johnson grass. In binding together and holding levees of sand and loose soil against floods, in preventing lands from washing, or in filling gullies, Bermuda is of the greatest value, and at the same time is one of the very best pasture grasses for the South. If there is considerable moisture in the land, and the soil is somewhat clayey, knot grass may be substituted for Bermuda. In the Southern States knot grass is especially well adapted to cover silt or bare slopes on the banks of ponds or rivers, or for covering the soil of "sink holes." Moderate submersion does not injure it.

BRAKE SHOES.

At the Atlanta convention of the American Street Railway Association, in 1894, a committee consisting of D. F. Henry, president of the Federal Street & Pleasant Valley Passenger Railway Co., of Pittsburg, Pa., and Powell Evans, foundry sales agent for Wm. Wharton, jr., & Co., Incorp., of Philadelphia, presented a special report on the subject of brake shoes. (Report A. S. R. A., 1894, pp. 152-180; St. Ry. Rev., 1894, p. 621.) At this meeting a committee consisting of Henry C. Moore, of Philadelphia; Ernest H. Davis, of Williamsport, Pa., and Powell Evans, of Philadelphia, was appointed, with instructions to investigate the subject of the adoption of a standard style of brake shoes, conduct experiments, and report the data collected, and the committee's conclusions at the next meeting. So far as can be learned this committee never made a report.

The A. S. R. A. committee of 1894 estimated the total annual expenditure of the street railways of the United States for brake shoes and labor in changing shoes when worn out to be in excess of $670,000 per annum. The subject is of fully as much importance now as it was five years ago, and it is our intention to collect here the available data concerning the coefficient of friction, the wear of the wheels due to brake shoes, and the durability in service, which are three of the important points to be considered in choosing brake shoes.

For the following summary of brake shoe patents, early tests and digest of the literature of brake shoes, we are indebted to Mr. John C. Whitridge, associate editor of the Railroad Gazette, who courteously placed at our disposal an unpublished manuscript on "Brake Shoes for Cars."

PATENTS.

An examination of brake shoe patent records for the last 30 years is interesting, but not very instructive, as the large majority of the brake shoes patented are useless and have never come into general use, if they have been used at all. A list of about 40 patents, issued since 1865, includes all the best known ones or those under which large numbers of brake shoes have been made. Among these 40 are the Congdon, Ross, Meehan, Lappin, Sargent, Schoen, Whitcomb, Corning, Allen & Morrison and Kinzer patents.

Beside these several hundred patents have been issued which are of no value, many of those of early date covering crude devices for attaching the brakeshoe to the head or holder; the adoption by the M. C. B. Association of standard dimensions for brakeshoes and a standard brakehead of the type originally patented by Mr. James Christie has been of great benefit in making this important detail uniform on almost all roads.

Almost every common material has been suggested or tried for brake shoes, such as wood, stone, glass, metal with rubber inserts, wood inserts, cork inserts, and one patent provides for the use of rope packed into cavities in a cast iron body; more lately what is known as the "composition" brake shoe has appeared, consisting of a mixture of iron turnings and borings, saw dust, asbestos, resin, plumbago and linseed oil pressed into a cast iron casing. Another composition material is made from iron turnings, asphaltum and mineral cement. All the common metals have been tried in many different forms and combinations; thus there are plain brake shoes of cast iron and cast steel, forged iron and forged steel, malleable iron and chilled iron, while it would seem that these materials have been combined in almost all conceivable ways.

Among the patents which are interesting because they show what a meager notion their inventors had of the requirements of a suitable brake shoe, are the following:

J. H. Champlin, Jan. 24, 1865, No. 45,975. Case for insertion of stone block which bears on wheel. Set screws permit of an adjustment of the block for wear.

O. J. Hardgrove, Feb. 27, 1866, No. 52,848. Hinged brake shoe, which grips the sides of the wheel, as well as bearing on the tread and flange.

H. L. Perrine, May 7, 1878, No. 203,495. Brake shoes made from rolled channels and the sections.

J. H. Mitchell, Sept. 30, 1879, No. 220,165. Brake shoe with cast iron body having cavities filled with rope or other textile material.

C. F. Wohlfarth, Aug. 16, 1892, No. 480,982. An oil chamber in the cast iron body connected by wicking to recesses in the face filled with sections of belting or other similar material. The surfaces in contact to be oiled to prevent squeaking. Linseed oil has been found to answer best "in practice."

J. O'Brien, Nov. 6, 1894, No. 528,553. A brake shoe having a nest of rollers on the face of the shoe which are brought in contact with the wheel during an application. Object to avoid "danger of sliding wheels" and "to provide a brake shoe which is strong and durable and at the same time simple and inexpensive in construction."

TESTS PRIOR TO 1895.

The data on friction between dry metal surfaces given in the earlier editions of the Engineers' Pocket Books are from the experiments of Morin and Rennie; in later editions the subject is treated in a different manner, but the relations which pressure, speed and contact bear to one another are not correctly stated.

Kent's Pocket Book, 1895, contains a table of coefficients of friction of rest as the result of experiments made by Rennie in 1829 which would indicate that as the pressure per square inch increases the coefficients of rest increase up to the point where abrasion takes place. The range of pressures used was 187 to 784 lb. per square inch, and the metals tried were wrought iron on wrought iron, wrought iron on cast steel, steel on cast iron, and brass on cast iron. It is questionable whether these results have any value.

Morin's "Laws of Friction" are also stated and explained to be in error. They are as follows:

1. The friction between two bodies is directly proportional to the pressure; i. e., the coefficient is constant for all pressures.

2. The coefficient and amount of friction, pressure being the same, is independent of the areas in contact.

3. The coefficient of friction is independent of velocity, although static friction (friction of rest) is greater than the friction of motion.

Morin's experiments were made in 1831 and these erroneous "laws" are to be found in many text books on the subject published within the next 50 years. They also appear in even modern works, for instance, the Century Dictionary contains the following misleading statement, evidently copied from some old work:

"Friction is partly due to the adhesion of bodies, but the greater part of it is the result of their roughness. The friction proper is independent of the velocity and of the area in contact, it depends solely upon the nature of the two surfaces and upon the pressure upon them to which it is directly proportioned."

No really reliable data are given by Kent on the friction of dry metal surfaces.

It was demonstrated by M. Poiree, in 1851, that constancy of friction held good for velocities not exceeding 10 or 11 miles per hour, but for greater velocities the resistance of friction appeared to diminish in the same proportion as the velocity increased. Other experiments for the purpose of deducing laws of friction have been made by Coulomb, Rennie and Jenkins, but in all cases they were made with bodies at comparatively low velocities.

In 1878 Capt. Douglas Galton made some experiments with trains on the London, Brighton & South Coast Ry. for the purpose of determining the coefficient of friction between surfaces in contact, moving at high velocities, in connection with the action of brakes in use at that time. These experiments gave excellent results, but were of narrow scope, covering only the action of cast iron and wrought brake blocks when used in connection with steel-tired wheels. These tests were reported to the Institution of Mechanical Engineers of London by Capt. Galton and these reports were reprinted in book form by the Westinghouse Air Brake Co., in 1894, with a preface prepared by Mr. R. A. Parke, its eastern representative. Mr. Parke also calculated a formula covering the relation between the mean coefficients of friction and the speed which would conform closely with the observed data of the tests.

A committee of the M. C. B. Association in 1891 reported the principal results of a series of shop tests conducted at the Aurora shops of the Chicago, Burlington & Quincy R. R. for the purpose of determining the friction of different metals, principally hard, medium and soft cast iron, malleable iron and wrought iron in connection with chilled iron wheels. The apparatus used was a Thurston oil testing machine adapted to the purpose by introducing a chilled wheel 11½ in. in diameter and by using miniature brake shoes 4 in. long by 1 in. wide. The load on the shoe was maintained constant and weighed by means of levers and weights,

while the tangential pull was measured by means of weights and lever scales. Each test was of 10 minutes duration and the shoes were weighed before and after each test, to determine the wear. During the following year similar tests were made with a steel-tired wheel, but these latter experiments were never made public. The most striking feature of these tests is that with soft and medium cast iron the highest friction is given at the beginning, while with hard cast iron and malleable iron the maximum is not reached before from three to four minutes run, after which the friction is about constant, and about equal to that of soft and medium cast iron; wrought iron does not show this action to so marked a degree.

In 1891 and 1892 the Pennsylvania R. R. made some useful experiments for the purpose of obtaining a comparison of the retarding power where one and two brake shoes were used per wheel, the same total pressure per wheel being used in each case. The effect on the retarding power of long and short brake shoes and brake shoes of different materials was also investigated; likewise the relative wear of these different kinds of shoes in continued service and the relative effects of the various brake shoes on the wheels. These tests were made by allowing cars to run down a grade of 80 ft. to the mile and applying the brakes after the desired speed had been attained. The observations were recorded in a dynamometer car. The results of these tests were presented to the M. C. B. Association in 1893 and were abstracted in the A. S. R. A. report of 1894, and are unsatisfactory in so far as the stops were made from low speeds, a limited variety of shoes and only chilled wheels were used, and because the measurements were obtained in units not properly comparable with similar work done at other times.

At the annual meeting of the M. C. B. Association in 1893 a general committee of twelve was oppointed to outline and conduct a series of service tests to determine the relative wear of a wide variety of brake shoes, each member representing a separate road. Five of these roads eventually declined to take part, leaving seven roads to carry on the work, namely, the Fitchburg, Chicago, Burlington & Quincy, Chicago, Burlington & Northern, Chesapeake & Ohio, Lake Shore & Michigan Southern, New York Lake Erie & Western and Norfolk & Western. Each of these roads conducted tests with the shoes selected, a list of which will be given in connection with the laboratory tests. Each car under test had one truck equipped with soft cast iron brake shoes made by the Pennsylvania R. R., entirely of new metal, no scrap being used, while the other truck was fitted with a set of the special brake shoes which were included in the test. The cast iron wheels under test were principally 33 in. in diameter and the steel-tired wheels were quite evenly divided between 33-in., 36-in. and 42-in. wheels. The wear of the shoes in each case was reckoned relatively to the wear of soft cast iron reference shoes.

The wear of the wheels was determined by the Lake Shore & Michigan Southern only, by making plaster casts of the tread and flange before and after the tests. These records plotted together showed the amount of wear. The diagrams taken are reproduced in the proceedings of the M. C. B. Association for 1895.

LITERATURE.

The following references to articles in the Railway Master Mechanic and the Railroad Gazette may prove of convenience to those who wish to investigate the subject more fully.

1889. Ry. M. M., Nov., p. 678—R. R. G., Oct. 18, p. 193—Paper by Mr. W. D. Sargent, "The Best Metal for Brake Shoes," before Western Railway Club.

1889. R. R. G., Nov. 22, p. 767—Paper by Mr. E. C. Case, "Metal for Brake Shoes," before Western Railway Club. Recommended a cast iron body with insert of lead and antimony.

1890. R. R. G., May 30, p. 374—Testing machine used in M. C. B. shop tests at Aurora, with principal results.

1891. R. R. G., Mar. 13, p. 176—Mr. James Howard on the advantages of two brake shoes per wheel.

1891. Ry. M. M., July, p. 102—R. R. G., June 19, p. 422—Report of M. C. B. shop tests at Aurora.

1892. R. R. G., Sept. 16, p. 679—Variation in retarding power of different brake shoe materials.

1893. Ry. M. M., July, p. 319—Report of M. C. B. committee.

1893. R. R. G., May 26, p. 393. Coefficients of friction as shown by West Albany Brake Tests.

1897. Ry. M. M., Dec. p. 178—R. R. G., Nov. 26, p. 829—The Sargent tests of the "Diamond S" brake shoe.

1897. R. R. G., Oct. 8, p. 700—Oct. 22, p. 739—Effect of temperature on friction.

FRICTION OF BRAKE SHOES.

As practically all the available data on the subject of the friction of brake shoes are from the results of the M. C. B. laboratory tests a proper introduction will be a summary of the work done by that association.

In 1879 the relative efficiency of different brake shoes was discussed, and some rough experiments made on a pair of car wheels mounted in a lathe were described. In 1880 a report was presented giving the results of shop tests to determine the relative wear of cast iron, wrought iron and Congdon brake shoes. In 1881 was begun a discussion as to the advisability of adopting a standard form of shoe; in 1886 the Christie form of shoe and head became the standard of the association.

In 1889 the question of the best metal for brake shoes came up for discussion and a committee to make shop tests was appointed. In 1891 the results of tests on small shoes (previously referred to) made at Aurora were presented.

In 1893 a committee on laboratory tests and a committee on road tests were appointed; both committees reported progress in 1894. In 1895 the committee on road tests made a final report, which appears in the M. C. B. proceedings for 1895, pp. 111-131. The committee on laboratory tests filed a report in 1895 (M. C. B. Proceedings, pp. 131-160) and in 1896 presented in full the results of between 1,200 and 1,500 tests (M. C. B. Proceedings, 1896, pp. 198-278.)

Since 1896 the only brake shoe tests on the M. C. B. apparatus, results of which have been made public, were tests of the "Diamond S" shoe made for the Sargent Co. at Wilmerding in 1897 and tests of the Corning shoe made at Purdue University in 1899.

The M. C. B. brake shoe testing machine was removed to Purdue University, LaFayette, Ind., in 1898. An illustrated description of this machine was published in the "Review" for November, 1898, page 830, and nothing further concerning it need be said here.

The brake shoes tested were of the M. C. B. standard dimensions, 3⅜ in. wide by 13¾ in. long, to fit the standard brake head. The face of each shoe was turned or ground to fit the test wheels, which were without taper and approximately 33 in. in diameter.

All tests corresponded to emergency applications of the brakes, that is the full pressure was applied and kept on until the wheel was stopped.

The great majority of the tests were made from initial speeds of 65, 40 and 30 miles per hour, and with braking pressures of 10,733 lb., 6,750 lb., 4,000 lb. and 2,798 lb. on the shoe.

The table showing the mean coefficients of friction was prepared from the data published in the M. C. B. Proceedings, from the report of tests made for the Sargent Co., of Chicago, by Mr. Whitridge and from the report of tests made for the Corning Brake Shoe Co. by Professor Goss, of Purdue University, and gives all the results obtained with 13-in. brake shoes on 33-in. wheels at the three speeds and four pressures. But few tests were made on the E, F, G (malleable iron) and N shoes, because the makers did not care to continue the tests. The I, J and K shoes were so easily broken and required so much time to fit them to the wheel that complete records were not obtained. The P shoe was submitted at too late a date for extensive tests to be made.

The tests were run in series of three or more under similar conditions as to speed and pressure, and on some shoes many different series were made under similar conditions. In the table the mean coefficients of friction only are given. For each shoe and each set of conditions there are three figures: The first one is the average of all the averages of the different series made under similar conditions. The second line is the highest mean coefficient from any individual test. The third line is the lowest mean coefficient from any individual test. They are all given in per cent, that is the tangential pull due to the friction of the shoe on the wheel is the given per cent of the braking pressure on the shoe.

Where the braking pressures for tests were different from those given in the headings of the table, foot notes call attention to the fact.

The reports of the tests also show the coefficient of friction near the beginning of the application and also 15 ft. from the end of the stop. The coefficient near the beginning was usually a few per cent greater than the mean. The coefficient 15 ft. from the end of the stop was in general considerably higher than the mean;

MEAN COEFFICIENT OF FRICTION OF 13-IN. BRAKE SHOES ON CHILLED AND STEEL TIRED WHEELS.

FIRST LINE — AVERAGE FROM AVERAGES OF ALL TESTS AT SAME SPEED AND BRAKING PRESSURE — PER CENT.
SECOND LINE — HIGHEST INDIVIDUAL TEST — PER CENT.
THIRD LINE — LOWEST INDIVIDUAL TEST — PER CENT.

SHOE.	10,733 LBS. BRAK. PRES.						6,750 LBS. BRAK PRES.						4,000 LBS. BRAK PRES.						2,798 LBS BRAK PRES.					
	65 M.P.H		40 M.P.H.		30 M.P.H		65 M.P.H.		40 M.P.H.		30 M.P.H.		65 M.P.H.		40 M.P.H.		30 M.P.H.		65 M.P.H		40 M.P.H.		30 M.P.H.	
	CH. WH.	S.T. WH.	CH. WH.	S.T. WH.	CH. WH.	S.T. WH	CH. WH.	S.T. WH.	CH. WH.	S.T. WH.	CH. WH.	S.T WH.	CH. WH.	S.T. WH.	CH WH.	S.T WH.	CH WH	S.T WH	CH WH	S.T. WH	CH WH	S.T WH.	CH. WH.	S.T WH.
A SOFT CAST IRON	13.1 16.2 10.4	12.1 19.7 9.2	18.0 20.0 16.4	23.1 24.1 21.9			21.0 22.3 20.0	19.5 18.3 12.6	26.2 29.3 21.7	24.3 27.9 21.9	26.4 27.0 25.1	24.3 25.3 22.1	19.7 20.3 17.8	22.7 27.1 16.1	28.2 29.9 27.8	31. 33.2 27.8	32.0 33.1 31.6	32.2 33.4 31.3	20.8 22.3 19.7	20.6 20.3 17.6	31.7 32.5 26.9	26.3 26.6 25.1	34.3 36.2 31.8	37.9 40.1 36.1
B HARD CAST IRON	10.7 11.0 10.3	9.0 10.6 8.2	17.3† 17.8 16.7	21.8 22.4 16.7			13.3‡ 13.5 12.7	12.5 12.8 12.3	16.6 18.1 13.9	20.3 23.2 18.0	22.0 22.8 20.5	20.5 22.8 18.7	13.7 19.3 13.2		28.1 21.4 18.7	25.8 27.6 22.4	23.9 25.4 22.4	28.0 20.5 26.9	14.1 15.8 12.1	16.5 16.8 16.3	21.3 25.6 17.8	20.5 27.6 16.9	25.3 27.8 23.0	30.2 32.1 27.0
C SOFT O.H. STEEL	10.5 11.4 9.4	14.8 13.4 12.2					13.6 14.6 12.7	14.5 15.4 13.9	17.2 20.2 13.3	22.0 22.8 20.5	17.0 19.8 13.6	25.4 24.5 22.5	14.2 16.2 11.4		17.6 21.8 11.5	22.9 24.9 21.1	20.3 24.6 17.2	30.3 33.2 24.0	15.3 17.1 11.8	13.9 19.7 12.0	19.6 22.4 11.7	17.7 19.6 15.1	22.6 27.8 12.3	27.1 31.4 23.0
D HARD O. H. STEEL	9.2 9.4 9.0	11.2 11.6 11.0					13.8 14.3 13.3	12.2 12.4 12.0	18.7 19.1 18.2	16.7 18.2 15.6	16.9 17.2 16.7	20.1 20.7 19.6			18.9 19.0 18.8	21.8 22.2 21.6	20.7 21.5 20.2	24.6 25.0 23.9	20.2 22.3 20.8	13.0 19.3 13.0	25.0 26.5 23.5	22.9 23.3 21.6	27.7 29.0 26.0	26.5 27.7 25.3
E MALLEABLE IRON		7.8 9.8 6.9					14.0 15.7 13.2		17.0 18.2 16.0												16.5 17.6 16.1			
F MALLEABLE IRON(S.T.)	9.0 10.5 8.4	8.0 8.3 7.6					12.9 14.1 12.3		17.7 18.3 16.3												22.7 23.5 21.7			
G MALLEABLE IRON(C.W.)	9.6 10.9 8.4	7.8 7.9 7.6					11.7 13.6 10.8		19.6 20.3 19.0												21.8 23.6 20.1			
H CONGDON CAST BODY—W.I. INSETS	10.8 11.4 10.5	9.7 * 10.0 9.3						10.6 10.8 10.2	16.6 17.6 16.1	14.0 14.4 13.9	19.7 20.5 19.2	15.0 15.9 14.3	17.4 18.6 15.7	13.3 13.8 12.9	22.4 23.1 21.1	18.3 15.8 14.4	24.9 26.0 24.2	15.8 17.0 15.0	18.2 19.1 17.2	14.9 16.2 13.6	23.9 25.0 22.6	16.5 17.1 15.8	26.4 27.3 25.6	18.5 19.3 18.1
I MEEHAN CAST BODY—STEEL INSETS	10.4 11.8 9.5	9.7 10.3 9.1					13.7 14.7 11.2		16.2 19.1 14.7		17.5 19.2 17.1				19.1 20.0 18.4		21.0 21.5 20.5				24.4 25.2 23.6		23.0 23.4 22.7	
J LAPPIN	10.0 10.3 9.7	7.4 9.3 6.7					11.2 11.9 10.7		18.1 12.8 11.7												16.8 17.6 16.1			
K "COMPOSITE" WOOD PLUGS.	16.2 17.2 14.8	10.9* 11.6 10.1						14.0 16.4 12.5		27.5 27.8 27.3		26.0 26.5 25.6				31.6 33.5 29.9		34.8 35.0 34.5		25.5 27.4 26.0	26.8 29.0 20.8	33.7 40.2 39.1		38.3 40.8 37.9
L SOFT PRESSED STEEL	10.4 11.1 9.3	14.2* 15.1 13.3					14.9 15.9 13.8	17.0 18.7 15.4	19.3 20.0 18.7	25.1 25.8 24.3	18.3 18.4 18.1	27.0 27.2 26.9			19.4 19.6 17.2	28.6 30.7 25.5	21.0 21.7 20.5	29.8 31.6 28.8	17.7 19.6 16.7	16.2 16.7 15.6	25.3 28.2 23.6	24.7 27.1 24.0	23.7 23.6 23.9	27.1 29.4 26.5
M WROUGHT IRON	10.8 11.6 9.7	13.8*					14.8 15.8 14.0	15.1 16.7 13.6	19.7 20.5 19.2	19.3 20.4 18.6	18.1 19.3 16.9	24.4 25.3 23.4			20.0 21.1 19.3	24.7 26.5 22.0	21.7 22.5 20.2	29.5 30.0 29.0	17.8 18.9 17.1	19.0 19.8 16.6	23.7 25.0 21.4	25.6 27.3 24.6	24.2 24.8 21.9	31.3 32.0 30.2
N SARGENT SPECIAL C.I. BODY—CHILLED INSETS.									17.1 20.6 13.5												21.0 22.7 20.0			
P KINZER	18.7 20.4 17.4						22.3 25.7 19.6	19.8 20.0 19.6	27.0 30.3 23.6	23.1 23.9 22.6											33.7 35.5 31.5			
2 SOFT DIAMOND "S"	12.4 14.0 11.2	11.7 16.0 9.0					16.1 17.3 15.0	13.6 14.5 11.1	20.9 21.5 20.5	20.3 22.3 18.2									18.0 18.9 17.0	16.1 19.0 14.3	24.1 25.1 23.0	25.4 25.6 25.3		
6 HARD DIAMOND "S"	10.0 10.3 9.7	7.5 8.0 7.0					13.7 14.2 13.5	12.8 12.9 12.3	17.7 18.3 17.3	13.2 19.1 12.6									17.2 18.6 16.0	16.8 17.5 16.4	21.7 22.6 20.9	17.2 18.3 15.8		
X CORNING								11.7▲ 12.9 9.4		17.8‡ 21.1 13.9		17.6* 20.8 15.6		10.8▲ 13.1 8.7		22.3▲ 24.6 18.0		21.5▲ 22.4 20.0		13.1 17.6 8.3		23.6 24.3 22.7		28.0 29.3 21.7

DATA FOR SHOES A, B, C, D, E, F, G, H, I, J, K, L, M, N AND P FROM M. C. B. TESTS. * BRAKING PRESSURE — 10,000 LBS.
DATA FOR SHOES 2 AND 6 FROM SARGENT TESTS. + BRAKING PRESSURE — 6,831 LBS. † " " 9,000 "
DATA FOR CORNING SHOE FROM PURDUE TESTS. ▲ " " 4,143 " ‡ " " 5,000 "

steel shoes on both chilled and steel tired wheels frequently gave coefficients 15 ft. from the end of the stop which were twice as great as the mean. The P shoe had a coefficient 15 ft. from the end of the stop that was but little greater than the mean.

The diagram, Fig. 1, shows the range of the mean coefficients graphically, for braking pressures between 6,750 lb. and 2,798 lb. The heavy solid lines are steel tired wheel tests and the dotted lines chilled wheel tests. In general the higher pressure gives the lower mean coefficient, the lower pressure the higher mean coefficient, and intermediate pressures would give intermediate values for the coefficient. The fact that these lines have considerable length shows the variation of the coefficient with the pressure.

The relative position of the groups of lines shows the variation of the coefficient with the speed.

For the convenience of those who prefer to compare the frictional qualities of shoes by considering the lengths of the stop rather than the coefficients of friction the diagram, Fig. 2, has been prepared. This diagram is based upon the coefficients of friction

13-IN. BRAKE SHOES ON STEEL TIRED AND CHILLED WHEELS.

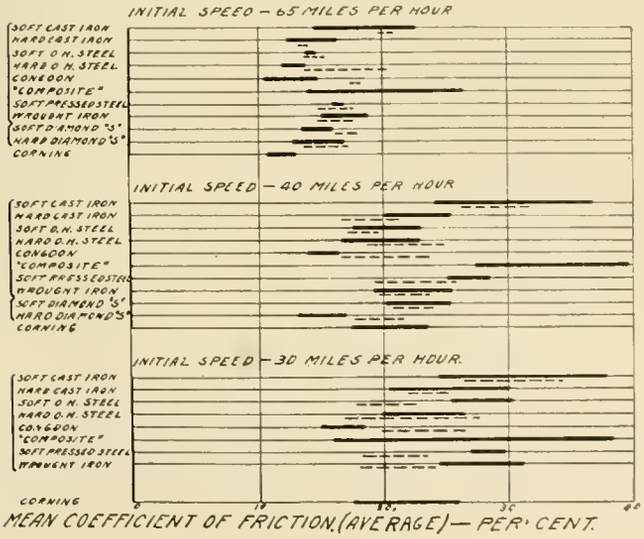


FIG. 1.

RELATIVE LENGTHS OF STOPS.

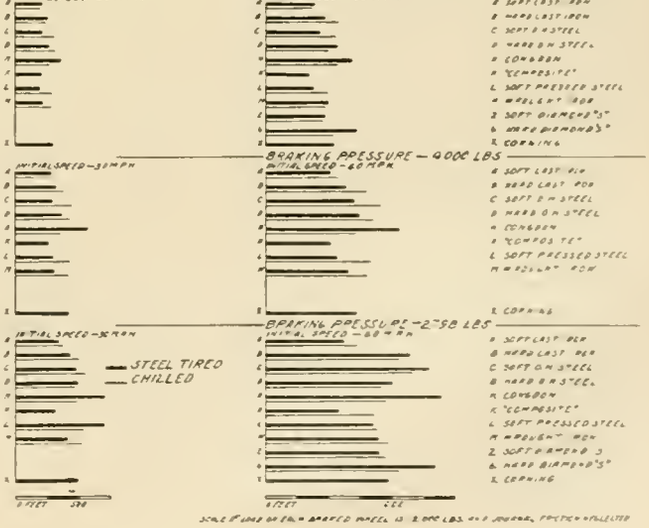


FIG. 2.

given in the table; journal friction and retarding forces other than the friction of the brake shoes are neglected. It should be remarked that the lengths of stops obtained on the testing machine cannot be properly compared, because the initial speeds varied slightly, though nominally the same, and the friction of the bearings of the machine varied greatly, thus causing variations in the lengths of the stops even when all other factors were equal.

The scale of feet on Fig. 2 is computed on the assumption that each shoe has to absorb the energy of a mass of 12,000 lb.

In Fig. 2 the heavy lines are for the tests on the steel tired wheel and the light lines for the tests on the chilled wheel.

Only the stops for 30 and 40 miles per hour are plotted, as street cars seldom run at much higher speeds.

The various shoes tested are to some extent described in the table; the following list also gives the makers:

A.—Soft cast iron; made by Pennsylvania Railroad Co., Altoona, Pa.

B. Hard cast iron; made by Ramapo Iron Works, Ramapo, N. Y. The ordinary cast iron so extensively used for brake shoes corresponds to this rather than to the A shoe.

C.—Soft open hearth steel; made by Solid Steel Co., Alliance, O.

D.—Hard open hearth steel; made by Solid Steel Co.

E.—Malleable iron; made by the Dayton Malleable Iron Co., Dayton, O.

F.—Special steel tire malleable iron; made by same company.

G.—Special chilled wheel malleable iron; made by same company.

H.—Congdon shoe, cast iron body with wrought iron inserts; made by the Sargent Co., Chicago.

I.—Meehan shoe, cast iron body with crucible steel inserts; made by the Sargent Co.

J.—Lappin shoe, chilled iron; made by the Lappin Brake Shoe Co., New York.

K.—Safety ("Composite") shoe, body of hard cast iron with wooden plugs set in the face; made by the Composite Brake Shoe Co., Boston.

L.—Soft pressed steel; made by the Schoen Manufacturing Co., Pittsburg, Pa.

M.—Wrought iron (pressed); made by the Schoen Manufacturing Co.

N.—Sargent special shoe, cast iron body with chilled iron inserts; made by the Sargent Co., Chicago.

P.—Kinzer shoe, cast iron shell filled with a composition made of iron turnings, saw dust, asbestos, plumbago and linseed oil; made by the Kinzer & Jones Co., Pittsburgh, Pa.

2.—Soft "Diamond S," soft cast iron poured about a bundle of expanded steel sheets; made by the Sargent Co.

6.—Hard "Diamond S;" made by the Sargent Co.

X.—Corning shoe, chilled body with soft gray iron insert; made by Corning Brake Shoe Co., Corning, N. Y.

Tests made with brake shoes 17 in. long showed practically the same coefficient of friction as did the 13-in. shoes. This was due to the ends of the long shoes lifting from the wheel when heated during a stop so that the area in contact was practically that of a 13-in. shoe.

A few tests of flanged brake shoes showed a higher coefficient than plain shoes at 65 miles per hour and a lower coefficient at 40 miles per hour; the tests were too few to warrant conclusions.

EFFECT ON THE WHEEL.

The effect of the different shoes on the surface of the chilled wheel as observed in the laboratory tests is as follows:

A. Small particles adhere to surface of wheel making it rough; this roughness increases with the number of applications.

B. Same tendency but to a less degree.

C. Tends to smooth surface of wheel. Metal of shoe flows somewhat when heated and particles accumulate at the end of shoe last in contact with wheel.

D. Tends to smooth surface of wheel and metal of shoe flows as with C but to a less degree. Particles pile up on surface near end last in contact with wheel, the effect being to decrease the extent of the surface in contact.

H and I. Metal of insets flows and is forced into cast iron body between insets. These shoes roughen the surface of the wheel slightly.

K. Roughens surface of wheel about the same as B.

L and M. Effect on wheel similar to C.

P. No tendency to roughen the wheel and imparts a high polish.

On the steel tired wheel the effect of the various shoes was as follows:

A, B and K. At low pressures tend to smooth surface of wheel. At high pressures particles adhere to wheel and tend to make it rough as with chilled wheel but to a less degree.

D. Scores wheel badly.

C, L and M. Score wheel but not so badly as D.

H and I. Steel and wrought iron insets roughen wheel.

P. Fills irregularities of wheel surface and imparts to it a high polish.

From the remarks of Mr. A. M. Waitt, then general master car builder of the Lake Shore & Michigan Southern, in discussing the report of the M. C. B. Committee on Road Tests of Brake Shoes, we take the following data concerning wheel wear. (M. C. B. Proceedings, 1895, p. 164, et seq.) The method pursued by Mr. Waitt was to take plaster casts of the wheel trials before and after the shoes were in service. The wear, taking the soft cast iron shoe as a basis, was:

Shoe.	Chilled wheel.	Steel tired wheel.
A	Standard.	Standard.
B	Not tested.	About equal.
C	Much less.	About 4 times as much.
D	Slightly more.	About 50 per cent more.
E	About equal.	About equal.
F	About equal.	About equal.
G	About equal.	About equal.
H	About equal.	About double.
I	About equal.	About double.
J	About equal.	About 50 per cent more.
K	About equal.	About equal.
L	Less.	About 50 per cent more.
M	Much more.	About 3 times as much.
N	About equal.	About equal.

DURABILITY OF BRAKE SHOES.

The M. C. B. Committee on Road Tests (M. C. B. Proceedings, 1895, pp. 128-129) tabulated the comparative wear of different shoes for the same service as follows:

Shoe.	Chilled wheel.	Steel tired wheel.
A	1.00	1.00
B	.86	1.06
C	.17	.42
D	.10	.31
E	.53	.51
F	.83	.67
G	.83	.81
H	.31	.30
I	.31	.21
J	.55	.27
K	.70	.77
L	.11	.29
M	.11	.29
N	22	.33

These comparisons were made by equipping one truck of each test car with the soft cast iron (A) shoes and the other truck with the shoes to be compared with it, and the number of pounds of metal ground of the two sets of shoes compared.

While it is usual to say that under such conditions each set of shoes is subjected to the same service it is not true. The energy absorbed by a brake shoe is, other things being equal, a direct function of the coefficient of friction, so that if a shoe have only one-half the coefficient of friction of the standard shoe it does but half as much work in running the same mileage and hence should wear out two of the standard shoes to give the same service as the latter.

But as comparative service tests are usually made in the manner described, and as the coefficient of friction of the shoe to be tested is not always known, perhaps the accepted method is the best one.

NEW SCHEME OF FARE COLLECTING.

Mr. Romie Loomis, whose letter head bears the words "versatile painter" Chattanooga, Tenn., writes he has fully solved the problem of collecting fares, in a manner entirely new and novel, and desires to have a committee appointed to witness a demonstration of his method.

MOTOR POWER ON TRAMWAYS.

From a paper read at the Engineering Conference of the Institution of Civil Engineers, England, by Thomas Parker, M. Inst. C. E.

Horse traction is the oldest method by which tramways have been operated, and there are ample data available. Its slowness, the occupation of a great length of the road, and the bad sanitary conditions caused by the refuse from the animals, the element of risk in the temper of the animals, variable cost of food, the great destruction of the horses by the very heavy work. These facts and conditions by long usage have become unnoticeable, and do not appear to come within the scope of public vision, when judging of the efforts made by engineers to replace the horse by mechanical means. But the always present cash quantity has condemned horse-traction on tramways.

Steam is quicker than horses, less costly for results, but has greater disadvantages, viz., much greater weight, and occupying greater length of road, the emission of carbonic acid, sulphurous acid, steam and smoke, practically into the dwellings along the route, and among the people, the unsightliness and noise, make its use in public streets a painful burden to the community, and as experience shows, not to be borne when better means can be found. The objections leave little hope for the future of direct steam-driven tramways.

Compressed air is a more congenial agent, and has better prospects of success than steam, if the two had to settle their differences alone.

It is free from many objections compared with steam. There is little interference with the atmosphere; the small amount of direct firing makes it possible to use only one carriage for motor and passenger; water need not be carried; the total dead load to passenger is in its favor; it needs frequent stations for supplies, as the distance it is possible to run with one store of pressure is limited. Its friends are very active at present, and it is hoped we may hear their case and obtain some practical account of its working. It appears to have higher economy than can be obtained by steam direct. The author has no working data he can give.

Endless cable, as a method for driving tramways, has high merits in many respects. It occupies a minimum length of road; its speed is fair; it is free from nuisances of steam or horses, and it is handy. Its drawbacks are: Heavy initial outlay; its occupation of the street; the slot difficulty, of carrying sewer and other requirements in or across the street in which it is laid; the continued noise of the running rope under the streets, causing, in some instances, considerable depreciation in value of property; the stoppage of the whole system upon the breaking of the cable; and the heavy costs attendant upon the system. Taking the statistics of installation, there are very few cable roads being put down now, and we may accept the verdict of the public that the cable has ceased to compete successfully with other methods.

There are some tramways being driven by gas engines working on the car, but no reliable practical data are available. The verdict of passengers is that they are required to inhale a considerable admixture of coal-gas with the atmosphere in the neighborhood of the cars.

At the present time, electricity is, by general accord, selected as the best method for driving tramways. In electricity we have a very flexible system which admits of great variation of powers being used at varying points on the same system. There is no nuisance, as with steam or horses. The minimum length of road occupied; speed can be low for inter-town work and high for suburban traffic; cars are easily handled; energy is used efficiently; maintenance is not excessive; streets are not more occupied than simply by the pair of rails, so that taking up streets for laying sewers and pipes, or other needs, is not complicated. The disadvantage is the conductors being carried overhead. Conductors have been used in other forms, but it appears fairly that the overhead wires, by their small cost, the simplicity and security of insulation, and the readiness with which repairs can be carried out, are accepted, at least for the present.

Accumulators have been introduced on to cars to carry them through the crowded streets, being charged while in the suburbs, running from the line and discharged by inter-town running. Accumulators have been installed, on their Bournbrook section, by the Birmingham Central Tramways' Co.; but, although still running, have not met expectations. The loss of capacity of the cell under the conditions of use was a great difficulty.

The energy required to drive the accumulator cars was approximately 4.6 horse-power hours per car-mile, while the quantity of energy necessary to drive a car of equal capacity with overhead conductors, 2.15 electrical horse-power hour per car-mile, the speed being much faster and the gradients heavier.

Operative Costs of Running One Car-Mile by the Different Systems Enumerated.

	Horse Traction.	Steam Traction.	Cable	Electric Overhead.	Liverpool Overhead Railway.
	d.	d.	d.	d.	d.
Drivers' and conductors' wages	2.5	3.5	2.67	2.43	
Generating station, including coal, oil, wages, waste, &c...	..		..*	0.46	
Repairs, locomotive engines ..	..	1.75	..		
Motors	..	..	.	..	
Machinery	..	..	0.84	..	
Cars	..	0.50	0.42	0.037	3.9
Harness, &c.	0.92	..	..	..	
Fuel	..	1.65	0.25	..	
Lighting	0.02	0.33	0.04	0.02	
Horses, including forage, shoeing, attendance, renewals, &c.	3.61	..	..	.	
Management: General expenses	0.73	1.26	0.18	0.15	0.416
Total	7.78	8.99	4.40	3.157	4.316
Carrying capacity .. .	26	54	54	30	140
Weight empty .. .. tons	2.75	12	4.7	4.3	31

* Could not obtain reliable figures for generating costs.

Electricity as a means of driving light or heavy railways is under best conditions if employed for long runs, and under its most inefficient conditions when called upon to make frequent startings. There is by the steam locomotive practically the same energy with one journey per day as fifty journeys per day. For electricity it is necessary first to put down the motive plant, dynamos, and conductors, throughout the system, and to provide the motors for hauling the trains. For lines where few trains are required, electricity does not compare with steam, as the capital outlay for running a few trains is the same as for running a number.

If we take a case, say, for two towns 50 miles apart, such as London and Brighton, which would support a continuous connection, and by the length of the run put electricity under good conditions, electricity could give 15-minutes' interval trains, and run at 75 miles an hour, doing the distance in 40 minutes by trains of 100 tons, at 2½d. per train-mile, covering costs of power. Such a case shows how completely electricity takes the field under fair conditions, and the advantages are not only in point of power, cost, and speed, but the track need not be so costly, as the weight can be evenly distributed throughout the train, the weight of the train being brought in for adhesion and traction. A 100-ton train would be equal capacity for passengers to a steam train of 140 tons. The cost of maintenance of permanent way and risks would be much reduced.

If we turn to a case where electricity is under its worst conditions in comparison with steam, we are able to refer to well-matured data. The Liverpool Overhead Ry. is such a case. It has been running for nearly seven years, and is in direct comparison with a number of similar lines worked by steam.

A most important difference between electric motors and the steam cylinder when starting into motion is, that in the electric motor no effort is obtained unless current is passing through the motor, and the torque is proportional to the quantity, while steam gives its efforts and is liberated to exhaust only in proportion to motion.

Steam was early in the field, but the requirements needed to make moderate success possible are only of modern achievement. The conditions of the vehicle and road make still further variation of the boiler, engine, and condenser necessary before the steam motor car can be a standardized article of manufacture. With regard to gear, steering, brakes and wheels, there are openings for improvements and new applications.

There are some good approximations to success of the steam type.

Much has been done to render tolerable the close association of passengers with mechanical movements and rapid explosions form-

ing the combination we call an oil car. Still much is needed with regard to safety from explosion and fire, reduction of vibration, and efficient transmission. The prospect is that it may be practical, with reasonable first outlay, depreciation, and cost of fuel, to run an oil car successfully for a much less cost than horses. The movement has brought about great improvements in the oil engine, but only light oils have been successfully used. Electricity is chiefly used as a means of igniting. Speeds of 1,000 revolutions are obtained, or 500 explosions per minute.

In applying electricity to motor cars, we first met the question of weight of accumulators. This has, by improved motors, gear and accumulators, within very recent date been reduced to 1 horse-power-hour delivered on to the car at about 56 lb. inclusive, so that 5 cwt. of cells is sufficient to operate a car, as against 16 cwt. two years ago. Motors, gearing, and methods of steering have been much improved. The following data is one of the best examples I have had the opportunity of testing:

Weight of car, complete, without batteries	9 cwt.
Weight of batteries	5 "
Total	14 "
Total weight, with four passengers	20 "
Discharge, on level, 12 amperes at 80 volts	9 miles per hour
Approximate horse-power	1½
Safe distance	40 miles
One motor, double reduction gear	1,200 revolutions

WISCONSIN LAW TO PREVENT THE MISUSE OF TRANSFERS.

The Wisconsin Legislature at its last session passed an act to prevent the unlawful and fraudulent use of transfer tickets issued by street railroad companies, which was approved Apr. 8, 1899. This law is as follows:

Section 1. No transfer ticket, or written or printed instrument, giving or porporting to give the right of transfer to any person or persons from a public conveyance operated upon one line or route of a street railroad to a public conveyance upon another line or route of a street railroad, or from one car to another car upon the same line of street railroad, shall be issued, sold or given, except to a passenger lawfully entitled thereto.

Sec. 2. No person shall issue, sell or give away such a transfer ticket or instrument as aforesaid to a person or persons not lawfully entitled thereto, and any person or persons not lawfully entitled therto who shall receive and use, or offer for passage, any such transfer ticket or instrument, or who shall sell or give away such transfer ticket or instrument to another with intent to have such transfer ticket or instrument used, or offered for passage after the time limit for its use shall have expired, shall be guilty of misdemeanor, and upon conviction thereof shall be punished by fine of not less than five dollars nor more than ten dollars for each offense.

Sec. 3. Emergency clause.

WORCESTER & WEBSTER STREET RAILWAY CO.

The Westinghouse Electric & Manufacturing Co. is providing an electric equipment for the new road now under construction by the Worcester & Webster Street Railway Co. The road connects Worcester, Mass., with Auburn, Oxford and Webster, a distance of 17 miles, passing over one of the most picturesque routes in New England. The line terminates at Lake Chaubunagungamuag, the prettiest inland water in Massachusetts, much frequented by excursion and pleasure parties. The power house is centrally placed, and will contain two 250-kw. Westinghouse "engine type" generators, direct connected to steam engines, to work at 120 r. p. m. Great care is being taken in constructing the track; the rails are specially heavy and the roadbed is ballasted with gravel. The cars are to be of extra size, having a seating capacity for 36 persons, and capable of carrying 90 passengers. Each car will be provided with double trucks, and two 50-h. p. Westinghouse high speed motors. The 100 h. p. applied to each car will give an average speed of 35 miles an hour. Westinghouse air-brakes will be attached to the cars, together with compressed air whistles, telephones, and all the latest appliances.

PRESERVATION OF TIMBER.

Abstract of a paper read before the Western Society of Engineers by Samuel M. Rowe, July 5, 1899.

Perhaps the largest single drain on our timber supply is that for cross-ties for standard gage railroads. There are now in the United States about 185,000 miles of railroad, which, when second, third and fourth tracks and sidings are added, will aggregate 245,000 miles. Each mile requires one tie every two feet, or 2,640 per mile, making a total of 650,000,000 cross-ties. The average life of ties does not exceed eight years; oak a year or two more, but the softer woods much less. Then, assuming that the mean life be put at nine years (much too high) it would require for annual renewals, 72,000,000 ties, nearly 200,000,000 cu. ft. or 2,400,000 M-ft. B. M. of timber. Each annual demand for cross-ties alone must strip half a million acres of our best forests, and the rate of renewal is about 140 cross-ties every minute, night and day, throughout the year.

Until quite recently white oak has been specified by many railroads, the softer woods being rejected, but in other cases, where oak was not obtainable, arbor vitae has been accepted on account of its lasting qualities and lightness, but, because of a failure to resist crushing, tie plates are necessary. In the middle and far West, where oak cannot be used, recourse is had to the pines and the softer woods, the life of which is perhaps not more than half that of oak; in this case the cost of renewals very quickly becomes a matter of importance, reaching 25 per cent per year in some known cases. Another feature deserves attention. The demand for nothing but the soundest and best oak results, to some extent, in the destruction of the softer and less valuable timbers in the scramble for the latter timber; making a still further draft on the timber stock, which is a total loss. The improvidence here practiced will be better appreciated when it is shown that much of this wasted timber can be made to serve equally as well as the best oak and last twice as long. The saving in the first cost is by no means a trifling sum.

The three best known processes for preserving timber, any one of which is effective in this direction, are the Burnett, the zinc-tannin, and the creosote or dead oil process; the basis of the two former is chloride of zinc. There is probably no question but that the creosote process is the most effective, but its great and increasing cost generally tends to inquiry in the direction of a cheaper method or agent. The chloride of zinc process has so far met this and passed through a sufficient test to show its efficiency and reasonable cost.

In all these processes the timber is first prepared for the absorption of the chemicals. So far steam has been used for this purpose at such a temperature as will not injure the fiber of the wood, but still be hot enough to permeate the pores of the timber and start the natural saps; freeing the cells preparatory to the extraction of the sap by vacuum after steam is withdrawn. It is presumable that in steaming the saps are altered and cooked so as not to so readily ferment should any fail to be expelled during the operation of steaming and the treatment in the vacuum. The steaming and vacuum are common to all processes; the result to be secured being the opening of the pores of the wood and the expansion of the vapors, thereby giving the best possible exposure to the solution to be absorbed. It is claimed that this can be done thoroughly by drying, by heating the retort by steam coils without exposing the timber directly to the steam, but to this there are two objections. A sufficiently intense heat to dry in any reasonable time would injure the fiber of the timber and cause serious checking; and when it is said that to dry timber sufficiently, three or four days are required, it will be seen to be out of the question where it can be done by direct steam in four to six hours.

The second step common to the three processes is to let the solution containing the chemicals into the retort without admitting air, so as to give every facility for rapid absorption. Then by a force pump additional pressure is put on the solution, generally up to 100 lb. per sq. in., under which the charge is held for some hours, the time varying according to the character of the timber.

With the creosote or the Burnett processes, withdrawing the solution completes the process. With the zinc-tannin process the charge is subjected to a further similar contact with a solution of glue, which, being withdrawn, is followed by a solution of tannin extract; both of which are subjected to pressure as with the chloride

application. Generally the glue is mixed with the chloride solution, thus saving one operation. Which is the best, is still a question not altogether settled, but the preponderence of reason seems to be on the side of the separate application of the glue, it being reasoned that the chloride will be more viscous with glue added, and hence will not be absorbed so freely. Another weighty reason is that as the glue and tannin absorption, being largely superficial where most needed, there is no need for the glue to penetrate deeper than the tannin with which it is to combine; and, indeed, should it go further than the tannin, the gelatine not being neutralized by combining with the tannin, may be deleterious, and become an agent of destruction instead of a preservative. The Wellhouse, or zinc-tannin process, from which good results have been secured, has been to apply the glue with the chloride so that this question may not be deemed vital.

Relative to the effect on the zinc-tannin treated wood, that may be attributed to the steaming or to the absorption of the chloride and glue, or to both, a somewhat peculiar effect may be noted. This was noticed where a block of treated wood was subjected to a test as to its absorbing power along with a block of untreated timber, both being immersed in cold water. Both pieces were of heart timber, and there was little or no observable difference in density. The untreated timber absorbed water much the more rapidly at first, but afterwards losing, in its rate of absorption, the treated block reached and passed it. This would seem to indicate considerable disturbance to the pores of the wood by the treatment, and also some loosening or parting of its fibers. In this connection it is well to say, with regard to the efficiency of the described operation, that what was secured by natural absorption of clean water in 30 days, is secured in this treatment by four hours' steaming and a like time with 100 lb. pressure on the solution.

The glue and tannin are added to the Wellhouse process with a view to plug up the outer pores of the stick, protecting the chloride, which is very soluble, from wasting out by repeated wetting and drying, as happens in the case of railroad cross-ties in seasons of rains.

The Burnett process uses the chloride in much the same quantities, and where laid in a dry country, show excellent results. The Southern Pacific R. R. has used the Burnett process for a number of years, and as a result has brought its cross-tie renewals down to a little over 4 per cent, which indicates a life of 20 years, and this largely with soft timbers.

As before mentioned, soft timbers, short lived without treatment, can thus be made useful and lasting, no doubt taking the absorption more freely than hardwoods, yet, it is in no wise conceded that soft woods alone should be treated. It is believed that experience will show that the hardwoods and the heart timber of the pine, usually retained for other purposes than for cross-ties, will take sufficient; and that, all in all, they are valuable about in proportion to their density and maturity of wood and not in proportion to the amount of chloride or other antiseptic absorbed. The variation in different timbers should not be deemed of so much importance, since the varition in any lot of timber of the same kind is very marked; no two parts of each stick are the same, neither is any one piece just the same as another. Hence the conclusion that some general rule or average is alone practicable. In calculating the amount of antiseptic necessary, the average character of the timber must be considered. Usually from 1½ per cent solution for very dry and open grained pine, to 3 per cent for obdurate or green timber is deemed sufficient. One quarter to ½ lb. of pure chloride is deemed sufficient per cubic foot of timber, and the strength of the solution is governed by the limit of absorbing power of the timber. The writer has a section of a sawed tie that absorbed not over ¼ lb. per cu. ft. (probably less than 1-5 lb.), which, after 13 years' service in the track, is as sound as the day it was cut from the tree, excepting ¾ in. on the bottom and less on the sides. It is believed possible to benefit the best timber that is offered. Nine years is a high average life for a good white oak, probably too high, but it is believed that these same ties can be made to last 15 years. Seasoning a year under shelter will do much toward it, as well as vulcanizing, or steaming and drying; and if a pine tie, that usually goes to pieces in less than 5 years, can be found after 13 years, to be good for three or four years, then surely a white or burr oak can be made to last 20 years.

The writer has observed ties, treated and in track about 12 or 14 years, that, upon removal, were still better than the average tie in an overland railroad with which he was familiar some years since. And there were none of these treated ties in the condition usual at the time of removal, 10 or 12 years earlier; that is so far gone as not to be recognized as ties. Also hemlock ties have been seen that were put in during construction and entirely replaced in 8 years, while treated hemlock ties, after 8 to 12 years, were still in the track and largely serviceable; the removals on the same line were also largely serviceable had they been left in.

One of the principal drawbacks to the adoption of a policy in this direction has been the large first cost of the plant, which is heavy for a road that is living only from "hand to mouth." In such cases there has been little use to discuss the matter, but, now, railroads are, as a rule, thriving, so that for managers there remains little excuse for clinging to past shiftless and wasteful practices. No attempt will be made to go into the economics of the matter, as the correctness of the position is so patent as to obviate any necessity of argument.

The first cost of treating the woods deters many railroads from adopting some process of wood preservation, and it is only by its importance being impressed upon those in authority that this difficulty can be overcome.

The timber which railroads use is bulky and large in quantity, and improved methods are required for handling both the timber and the solutions used in the process. But when the plant is installed a small force only is needed to operate it, and the savings in cost of renewals of cross-ties and bridges are so great that the cost of the works when capitalized becomes insignificant.

S. L. NELSON'S BIRTHDAY.

Mr. S. L. Nelson, general manager of the Springfield (O.) Railway Co., was 40 years old on June 23d and celebrated the occasion by making a personal gift to each of the employes of the company. The amount was proportioned to the length of service and the total was in excess of $600. Supt. L. O. Williams, who has ably assisted Mr. Nelson for the last four years, received $250.

Mr. Nelson was not permitted to have the gift making all his own way, and was the recipient of a handsome leather covered chair from his men and some silver mounted desk furniture from the office force; Mr. W. B. McKinley, president of the company, presented a gold watch.

Mr. Nelson's letter to the men was as follows:

"Dear Sir: A man has but one opportunity to celebrate his 40th birthday. On such an occasion, when other events, in which you have taken an important part, it becomes a pleasure to associate you with the event. I celebrate not only my 40th birthday, but practically my seventh year as manager of the Springfield Railway Co. Some of you as employes have gone through the many ups and downs with me, and to your aid, assistance and efforts many of our accomplishments have been due. To show my personal regard for each one of you and my personal appreciation of your services, I desire to present and hope you will accept a small contribution. Having advocated a gold standard, and to be consistent so far as practicable, the contributions are to be made in that coin of the realm. Wishing you and yours continued good health, prosperity and happiness, I am, your friend,

"S. L. Nelson."

CHANGES IN ATLANTA.

The financial merger of the Atlanta Ry. and the Atlanta Consolidated Ry., of Atlanta, Ga., has resulted in a number of changes in the operating department. H. N. Hurt has been chosen superintendent of the Atlanta; W. H. Glenn, purchasing agent; N. W. L. Brown, electrician and superintendent of construction, and Thomas Elliott, chief engineer. All of these gentlemen held similar positions with the Consolidated. In May last Ernest Woodruff, president of the Atlanta Ry., was chosen president of the consolidated.

A system of transfers will be operated between the Atlanta line and the Consolidated, and the two will be connected at Neal's school and the cars for Decatur will then run through Inman Park. A fifteen-minute schedule to Inman Park will give the residents of that place a seven and one-half minute schedule to the city.

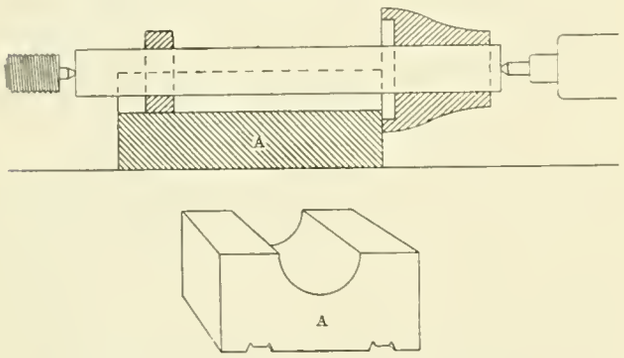
A successful trial trip of an electric car has just been made at Leeds, England, between Boar-lane and Headingley

MECHANICAL DEPARTMENT

CASTING SOLID BABBITT BEARINGS.

Taunton, Mass., May 25, 1899.

Editor "Review": The accompanying sketch will show the method used by me in casting solid babbitt bearings for the armature and axle bearings of G. E. 800 motors. There is always some wear on the outside of a bearing shell and also on the hole in the bottom bearing which receives the pin to prevent the shell from turning, and this wear determines the life of the shell; when the wear becomes enough to allow the shell to rock, the life is greatly shortened. If solid babbitt bearings are used the whole bearing may be thrown into the melting pot when the wear becomes excessive and new bearings made at only the cost of labor; there is no shell to throw away or partially worn bronze bearing to scrap.



FOR CASTING SOLID BABBITT BEARINGS.

The block A is made of cast iron; it is machined to fit the guides on the lathe bed and turned to the exact diameter of the outside of the bearing, with a boring bar carried between the lathe centers. When bearings are to be cast an arbor of the exact diameter of the inside of the bearing is placed in the centers; on this arbor are two collars, which are movable, so that the length of bearing may be varied. If the bearing is a flanged one a collar with a recess turned in it is used at one end as shown in the sketch.

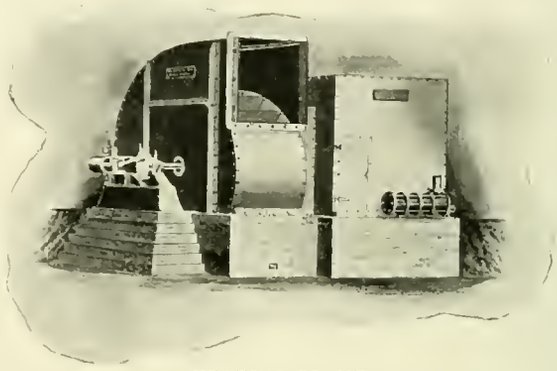
F. S. RANDLETT.
Taunton Street Ry. Master Mechanic.

HEATING CAR BARNS BY THE BLOWER SYSTEM.

The blower system, whereby heated air is forced throughout a building by means of a fan, has already found general adoption in many classes of buildings. In some instances such as in the case of car barns, peculiar advantages are claimed for it. The car barn should necessarily serve a double purpose; it should protect the cars from the weather, and should provide a means for the ready removal of snow and ice in winter. To secure the latter result the pit system has been generally adopted, and in the older installations, steam pipes were strung round the sides of the pits. The melting of snow and ice on the trucks and car body above is under this arrangement a relatively slow process.

With the blower system, however, great rapidity is secured, the hot air pipes being laid beneath the floor and between the pits, into which large volumes can be readily delivered. The heated air as it passes up beneath the car greedily absorbs all moisture in its path, while at the same time playing its part in heating the entire structure.

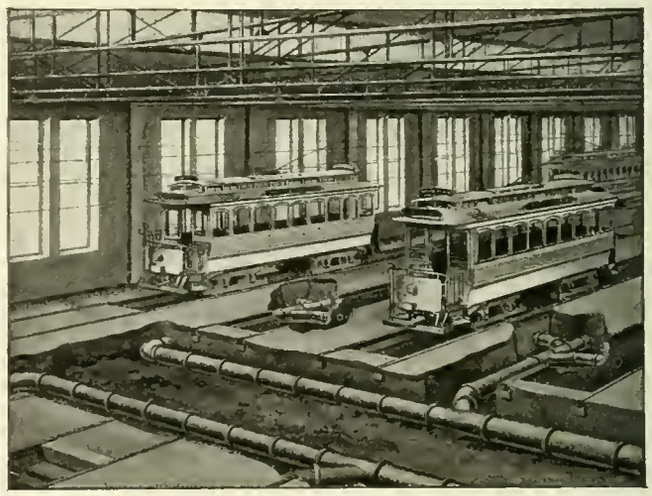
A car house equipped in this manner is shown in the accompanying engraving. The pipes are of tile with tight joints, and the air is supplied by a hot blast apparatus such as that shown in the other engraving. This apparatus consists of a steel pipe heater made up in sections through which steam is passed. The entire heating surface is enclosed within a steel plate jacket, and air is drawn across the pipes by means of the fan. This fan, which is of steel plate with suitable braces, is in the plant illustrated, driven



HEATING PLANT.

by a direct connected engine, so that it may be operated at all times independently of all other machinery.

From the outlet of the fan, connection is made to the various pipes and ducts. Incidentally a pressure above the atmosphere is



CAR BARN HEATED BY BLOWER SYSTEM.

maintained within the building, so that the leakage is outward, and the ingress of cold air at cracks and crevices is obviated. This type of apparatus is designed and built by the B. F. Sturtevant Co., of Boston, Mass., and the car barn illustrated is one of a large number which have been equipped by this company.

A NEW ACETYLENE HEADLIGHT.

A new headlight for the use of acetylene has been tried experimentally on the Lafayette (Ind.) Street Ry. and has given most gratifying results. In the ordinary acetylene headlight for use on locomotives, the gas is made in a separate apparatus and stored in a small gasometer from which it is supplied to the lamp. In the new lamp, which is the joint invention of Supt. E. B. Gunn, of the railway company, and Mr. Laban Sparkes, the gas is gener-

ated in a small reservoir similar to that of an oil lamp, and is made only as fast as it is consumed. The details of this apparatus will be seen by reference to the following diagram.

The reservoir A was taken from an ordinary oil headlight and divided in the center by a sheet iron diaphragm into two compartments, one for the calcium carbide, the other containing a coiled pipe one end of opening into the carbide chamber and the other end leading to the burner. The cylinder B is fastened on top of the coil chamber into which it opens, and contains a cap on top by means of which cylinder B and the coil chamber are filled with water.

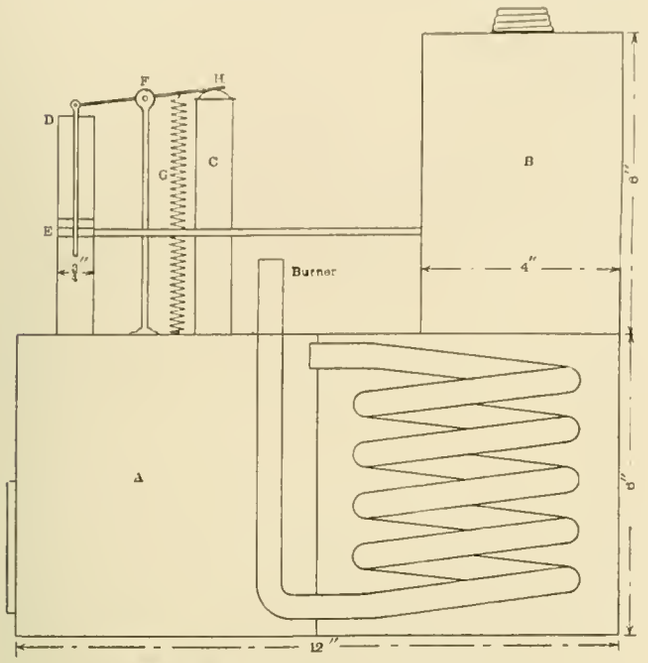


DIAGRAM OF ACETYLENE HEADLIGHT.

From the top of the carbide chamber where the gas is generated rise two ¾-in. pipes, C and D. The top of the pipe C is covered with a rubber diaphragm, which rises and falls according to the pressure of the gas in the carbide chamber. The pipe D, contains a valve E, the globe of which is moved by the vertical rod connected to the lever F, and the water is led into this pipe from the lower part of cylinder B by a small horizontal pipe as shown in the diagram. The operation of the lamp is as follows: A suitable amount of calcium carbide is placed in the reservoir A, and the cylinder B, and the coil chamber are filled with water. The water passes through the horizontal pipe to the pipe D from which it falls into the carbide chamber and generates the gas. The amount of gas made is regulated by the valve E. When there is no pressure of gas in the chamber the diaphragm lies flat on top of the pipe C, and this allows the spring G to pull down the lever F, which opens the valve E, this admitting water to the carbide chamber. As the pressure of gas increases the rubber diaphragm swells up and raises the lever F, closing the valve E and shutting off the supply of water from the carbide. The generation of gas is thus regulated automatically by the position of the diaphragm which varies with the pressure of the gas in the chamber A. The gas is taken out from the top of this chamber through the coiled pipe which keeps it cool by being immersed in water and passes from the other end of the coil to the burner. Considerable trouble was experienced in devising a method of regulating the lamp which would not get out of adjustment from the jolting of the car but the regulation by means of the rubber diaphragm has been found to meet this requirement perfectly.

The lamp used in this test was provided with a [illegible] cu. ft. burner which was found to be rather larger than necessary, as small objects on the track were readily seen at a distance of 600 ft. from the car. The lamp is said to be quite economical.

NEW TYPES OF SUMMER CARS ON THE WEST CHICAGO.

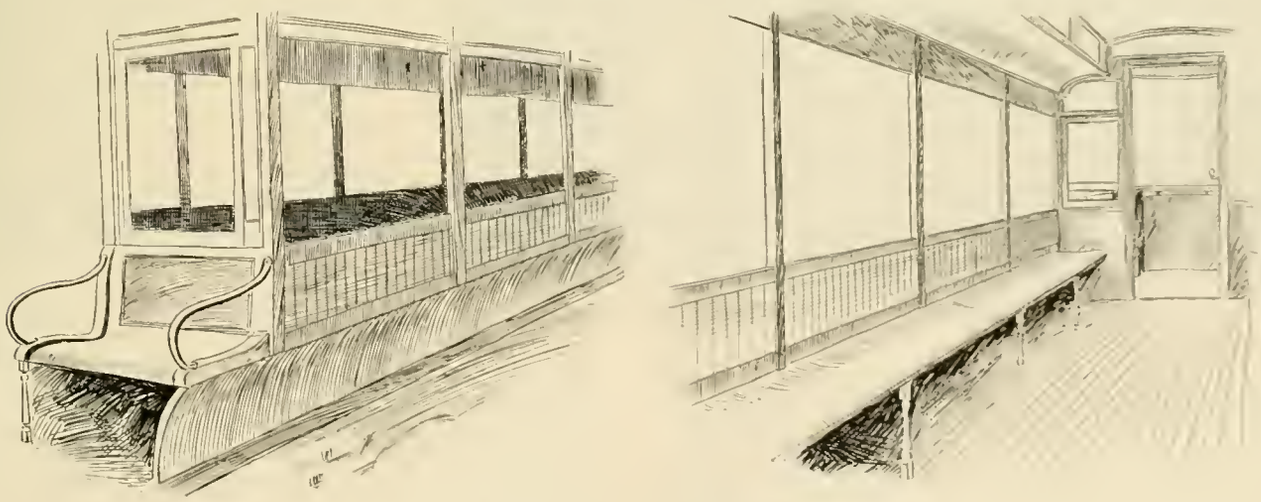
The West Chicago Street Railroad Co. has as an experiment put in service two summer cars which are quite different from the types heretofore used on the city lines in Chicago. The object in view is to find a car which will be convenient and yet offer fewer chances for passengers to get hurt through carelessness.

One of the cars is the regular open, side entrance summer car with the foot boards cut off except at the platforms; these short pieces forming the platform steps are hinged and those on the left side of the car are folded up against the sill and fastened so that passengers cannot stand upon them. This car has short cross seats with center aisle and seats 40 passengers. Along the sides are two rails, the upper one being at the height of the top of the seat. The platforms are large. The car has curtains at the sides.

The other car has been altered from a cross-bench open car by boarding up the sides between the end bulkheads to the height of the ordinary window sills, and removing the cross seats and replacing them by two longitudinal seats facing the interior of the car. The end seats, that is the two short benches at each end which face the dashers, were left in place.

These cars have now been running for about three months. Neither the patrons nor the company like the car with cross seats. While it holds the regular number of passengers the narrow aisle makes it crowded and it is almost impossible for the conductor to work his way through.

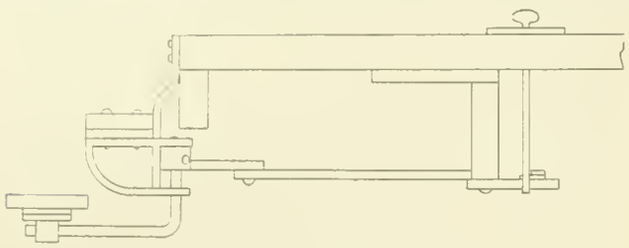
With the other type, however, everybody seems much pleased. The longitudinal seats have a large space in the middle of the car and the capacity is only two less than regular. But the company has not yet decided to adopt it. A test of its merits will be made this summer and if it proves entirely satisfactory, the lines will be equipped with this type of car.



SUMMER CAR ON THE WEST CHICAGO.

EXTENSIBLE CAR STEP.

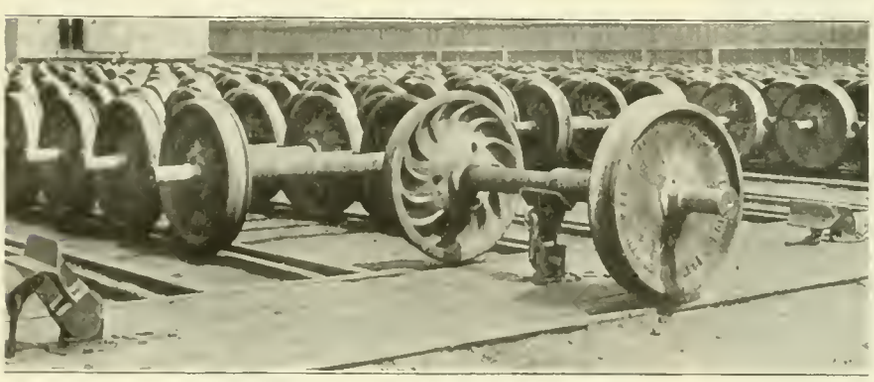
Mr. Albert Blum of Cincinnati has recently patented an extensible step particularly adapted for side entrance street cars. Instead of using only one running board placed midway between the car floor and the rail it is proposed to place this stationary running board higher, so as to make an easy step to the car floor and place a second movable step about midway between the stationary step and the ground. The movable step will be supported on a number of metal arms pivoted in brackets fastened to the car-body and also pivoted to the step, so that as the arms swing in a horizontal plane the step is swung out for use. The step is to be manipulated by a hand or foot lever on the motorman's platform or by a suitable arrangement of solenoids as may be desired. We understand that a car on the Millcreek Valley line is to be equipped with this step.



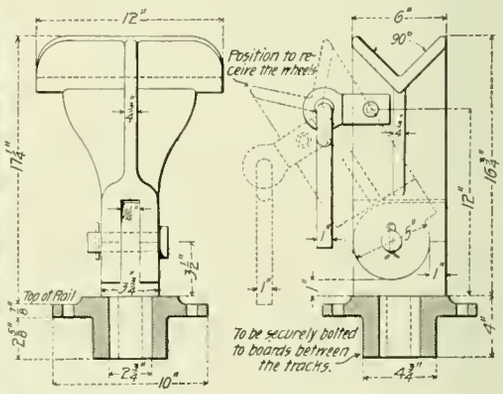
BLUM EXTENSIBLE STEP.

JACK FOR TURNING MOUNTED CAR WHEELS.

The accompanying illustrations for which we are indebted to the Railroad Gazette, show a jack for turning mounted car wheels designed by Mr. D. C. Ross, general foreman of car department of the Michigan Central R. R., and installed at the Detroit shops of the company. The tracks for storing the wheels are at right angles to the shop track, and the jacks are placed at the intersections of the center lines of the tracks. A casting with a 2¾-in. hole in the center is fastened in place for a base plate; the jack consists of two parts, the lower portion fitting into the hole in the base plate and the upper one turning about a horizontal pivot. When in use the jack is inclined as shown dotted in the line drawing, being supported by a swinging link. The momentum of the moving wheels carries the jack to a vertical position and lifts the flanges clear of the rails so that they can be swung around and pushed off onto the spur track. When not in use the jack may be turned over flat on the ground as shown at the right of the half tone.



WHEEL STORAGE TRACKS, MICHIGAN CENTRAL SHOPS.



JACK FOR TURNING MOUNTED CAR WHEELS.

A Northern Pacific passenger train ran into a Grant Street electric car in Seattle, Wash., June 3d, killing 1 passenger and severely injuring 18 others. The accident occurred near the Washington Iron Works. In the scramble to get out of the car the people jumped into the bay and had a narrow escape from drowning. The water is 15 ft. deep.

THERMAL TESTS FOR CAR WHEELS.

During the past six months Professors Goss and Smart of Purdue University, have made some very interesting experiments for Mr. T. A. Griffin, president of the Griffin Wheel Co., of Chicago, on thermal tests of car wheels, and the heating to which a car wheel will be subjected in service.

The wheel specifications of the Pennsylvania Railroad Co. provide for a thermal test, which consists in pouring a ring of cast iron 1½ in. by 4 in. in section about the tread of the wheel; this ring is to be poured from one point on the circumference and is to be removed two minutes after the pouring has ceased. It has been urged that this test is much too severe in view of the maximum heating that occurs in actual service, and also that wheels made to pass this test have a shorter life in service. The wheel makers can make a car wheel to withstand the Pennsylvania thermal test, but if the generally accepted belief that such wheels have a shorter life is true it is evidently to the interest of all parties that specifications be modified, if in fact they are too severe.

The first series of tests were made at Purdue and were to determine the maximum heating of the wheels due to braking. The tests were made on the M. C. B. brake shoe testing machine. In order to determine the temperature reached by the wheel under the action of the brake shoe four series of holes were drilled in the back of the wheel, and were filled with beeswax, sulphur, tin and lead, having melting points of 140°, 240°, 440° and 610°, all Fahrenheit, respectively. When beeswax melted in a hole 2 in. from the circumference it was assumed that the plate of the wheel at that point had reached a temperature of 140° F.

A soft cast iron brake shoe, M. C. B. standard, was applied with a pressure of 2,800 lb. and the wheel driven continuously at the rate of 30 miles per hour for 20½ minutes. After six minutes' running the brake shoe was heated to a cherry red and continued so to the end of the test, throwing off scintilating sparks. At the end of the test, an examination of the wheel showed that sulphur (204°) was melted in hole No. 2, 3 in. from the tread, and wax (140°) was melted in hole No. 5, 8 in. from the tread. The tread of the wheel was blue and in spots small cracks were visible where the chilled iron had disintegrated. The body of the wheel showed no cracks. After 29 minutes the heat had worked into the wheel so that wax melted on the hub. No part of the wheel more than 2 in. from the tread was hot enough to melt tin (440°).

A second wheel was tested by a continuous run of five minutes at 50 miles per hour under a braking pressure of 2,982 lb. After two minutes the brake shoe was dark red, and after three and a hali minutes bright red all through, particles of the shoe following and adhering to the tread of the wheel. At the end of five minutes the conditions were so severe as to threaten the destruction of the shoe and the test was stopped. The wheel at the end of this five minute run showed the tread to be badly burned, with heat cracks in spots. The body of the wheel showed no cracks. Wax (140°) had been melted 4 in. from the tread, and sulphur (240°) at one point 2 in. from the tread. After standing 21 minutes the heat had penetrated into the wheel sufficient to melt wax (140°), 12 in. from the tread of the wheel, and after 30 minutes the same temperature was reached at the hub. Sulphur

(240°) was not melted at a distance greater than 2 in. from the tread. No part of the wheel 2 in. removed from the tread was hot enough to melt tin (440°).

The Pennsylvania thermal test was applied to similar wheels at the works of the Griffin Co. in Chicago. Holes filled with tin and with a mixture of tin and bismuth melting at 350° F., and radial lines drawn on the wheel with stick sulphur were provided to show the temperatures attained. The results showed that in the thermal test the heat does not permeate the wheel equally all around, the rise in temperature being most rapid in that side next to the pouring, and least rapid at a point diametrically opposite. The difference was shown in the record of the thermal test presented. Thus, a point 2 in. from the tread reached a temperature of 240° in 1 min. 24 sec., while a point diametrically opposite was 2 min. 28 sec. reaching the same temperature. On the other hand, the action of a brake shoe must lead to uniform heating, a condition which probably is less severe upon the wheel than the unequal heating of the thermal test.

In the brake shoe test sulphur was melted 3 in. from the tread. During a 20 minute run sulphur did not melt at a more distant point than this. In the thermal test, however, sulphur melted at the same distance from the tread (3 in.) in 1 min. 24 sec. That is, the time required to heat the plate of the wheel 3 in. from the tread is 14.64 times as long with the brake shoe as in the thermal test.

As showing the severity of the braking test one car with its eight wheels braked as in the test would require the full power of a 90,000-lb. locomotive to keep it in motion at the speed of the test.

The maximum temperature of a point 3 in. from the tread was 240° in the braking test and was 350° in the thermal test in from 4 to 5 minutes after pouring.

A third series of tests was made in which the channel provided for the molten iron had different dimensions from those called for in the Pennsylvania specifications. They were as follows: Width at the bottom, 1 in.; width at the top, 1½ in; depth, 3 in. The channel extended down to the beginning of the fillet between the flange and the tread. These dimensions give a weight of metal cast about the wheel which is about 75 per cent that prescribed by the Pennsylvania test.

The molten iron was poured into the mold from two diametrically opposite points. The ring was poured in two parts, the first filling the channel-way for one-half its depth (1½ in.). An interval of one minute was allowed to elapse between the end of the first pouring and the beginning of the second, after which the pouring was resumed and the channel-way completely filled. The time of pouring each section was about eight seconds. The temperature of the iron was such that the ring when cool was free from wrinkles and layers. The ring was not removed from the wheel, but was allowed to cool in place.

The maximum temperature of a point 3 in. from the tread was 440° F.; the time required to reach the temperature of 240° in these tests was to that in the braking test as 3.56 is to 20.5, or as 1 is to 5.75.

From these tests Mr. Griffin draws the conclusion that the thermal test of the Pennsylvania road is very much too severe and the modification of the specifications followed in the third series of tests is thought to be amply safe.

SALE OF SAN JOSE (CAL.) R. R.

The San Jose (Cal.) R. R. was sold under foreclosure proceedings on May 19th to George Tourney, secretary of the German Savings & Loan Society of San Francisco, who stated, however, that he was acting for himself and other individuals, and not for the society. This road comprised nearly 10 miles of track and was the property of Jacob Rich. Mr. Rich spent $475,000 in its construction and operation; he complied with every demand of the public for extensions, though the business did not warrant them, and as a result was forced into insolvency. The judgments against the road amounted to $350,000. It was bought for $225,000 cash.

Of late the road has been doing a good business, and under the new management it may become a paying investment.

The Chicago, Harvard & Geneva Lake Ry. was opened for traffic July 4th.

LONDON UNITED TRAMWAYS.

The first company to introduce the overhead trolley system within the City of London, is the London United Tramways Co., and this concession was obtained only after persistant effort on the part of the company's engineer, Mr J. Clifton Robinson, who had been pressing his proposals on the attention of the council since 1894. Concessions have now been obtained for about 17½ miles of route of which 4½ miles are within the County of London. The company is also endeavoring to obtain franchises for 13½ miles more which with some further extensions in view would bring the total length of the line up to 40 miles. The whole of the system will be equipped with the overhead trolley system except about a mile and a half, which will be constructed with the electric conduit system.

The general features of these lines were described in a paper on "Electrical Traction on Tramways," read by Mr Robinson before the Cleveland Institution of Engineers, at Stockton-on-Tees, and the engineering details in some respects are quite different from anything to be found in this country. The overhead system is a notable departure from general practice having a double trolley line connected up on the 3-wire system. The territory covered by these lines is in the western suburbs of London. A map of the system was published in the "Review" for November, 1898, page 841.

The entire system will be operated from one station near one end of the lines which are now being built in Chiswick. This is a large one-story building of brick and freestone, 154 ft. long and 106 ft. wide, divided into an engine and boiler room. The engine room will contain a 25-ton travelling overhead crane carrying over the length of the room. There will be three vertical cross-compound condensing engines of 750-h. p. each, connected to two 250-kw. generators each, running at 90 r. p. m. A fourth engine running at 94 r. p. m. will be direct connected to a 500-kw 3-phase 5,000-volt generator with a frequency of 25 cycles per second.

The lighting units will consist of two 2-crank tandem compound engines each directly coupled to a 75-kw. 500-volt generator running at 400 r. p. m. Surface condensers of the Admiralty type will be used.

One motor generator set, consisting of one 3-phase synchronous motor of 500-kw. capacity at 5,000 volts and two direct connected 250-kw. 500-volt generators, will be located in the engine room for converting from direct to alternating currents and vice versa, for convenience on light loads and as a spare generating unit.

The boiler room has a steel frame construction of extra strength in order to carry the weight of the coal storage bunkers holding 500 tons of coal, economizers, flue and water tanks which are to be carried on the floor above the boilers. There are eight horizontal water-tube boilers in this room each having a capacity of evaporating 8,250 lb. of water per hour at a steam pressure of 160 lb. These will be fed by mechanical stokers of the "Coking" type to which coal is delivered by weighing hoppers from the coal bunkers above, thus securing a record of the exact amount of fuel consumed by each boiler. The economizers will consist of 360 tubes in 36 sections, provided with motor-driven scraping and cleaning arrangements.

The stack is built of steel plates in rings, lap jointed and rivetted, tapering upward and ending in an ornamental cap. It is entirely self supporting and is lined with fire bricks. Its height is 200 ft. above the foundations; the clear inside diameter is 10 ft.

The coal supply is delivered from the ground level outside the station to the coal bunkers over the boilers by a gravity-bucket type of conveyor capable of handling 40 tons per hour. The same conveyor also removes the ashes, dumping them into a special bin from which they can be readily removed. An additional coal storage of 2,000 tons capacity will be provided north of the boiler room from which it is intended to deliver coal direct from the railroad depot 700 ft. distant by means of a gravity bucket conveyor. Alongside the coal siding entirely below the ground will be placed a receiving hopper with the apparatus for delivering coal to the conveyor, thus enabling it to be automatically handled from the railroad cars to the company's coal storage and to the stoker hoppers.

The current will be distributed over the whole of the system by lead-covered paper-insulated cables drawn into cement-lined, wrought-iron pipes laid under the sidewalks. Thirty cables radiate from the central station at Chiswick, over 1,000,000 ft. of pipe being required.

The system is almost entirely double track, and over the rails of each track will be located two trolley wires, the two inside wires of which will be inter-connected to form the neutral wire. On account of extreme caution to protect the instruments of the Kew Observatory the company has been prohibited from using the rails as a ground return which makes the double overhead system necessary. This would double the amount of copper required for a single trolley, if connected on the 2-wire system, and in order to avoid this the 3-wire system is used, the two inside wires forming the neutral and the two outside wires the positive and negative sides. The neutral wire is grounded at the station and at that point only.

The overhead system is divided into half-mile sections, and according to the Board of Trade requirements each mile and a half of the line will be supplied by an independent feeder running direct to the station, the neutral side also having a separate feeder for each mile and a half.

Sections of the line extending more than six miles from the Chiswick station will be supplied from sub-stations. These will be fed from the central station through duplicate 3-core lead covered cables carrying 5,000-volt currents on the 3-phase system. The sub-stations will be provided with static transformers for converting the 5,000-volt current to approximately 350 volts. Suitable fans for cooling the transformers will be driven by electric motors. The 350-volt current will be led into rotary transformers which deliver direct currents at 550 volts for the line. The electrical connections are such, owing to the rotary converters feeding into a 3-wire system, that these machines will act both as rotary converters and balancers; that is, in case one side of the 3-wire system is overloaded the rotary converter acting on the other side of the system will act as a motor, and thus assist the overloaded machines.

ELECTRIC RAILWAYS IN SWITZERLAND.

The following data concerning the electric railways in Switzerland have been taken from a report made by Mr. A. L. Frankenthal, U. S. Consul at Berne, published by the State Department under date of June 19, 1899.

The existing electric lines are:

1 main trunk railroad	4	km
2 narrow gage railroads	9	"
1 cog road (Gornergrat)	9.08	"
5 cable lines using electric motors	7.63	"
19 street car lines	103.82	"

Also one narrow gage railroad and one street car line on which electricity is used to some extent.

Sept. 1, 1898, there had been concessions granted for the building of 120 lines of all kinds, with an aggregate projected length of 2,032 km.; 47 of these are to be equipped with electricity. The electric tramway projects were 15, with an aggregate length of 82.5 kilometers.

The concessions for all railways of whatever kind are granted by the Federal Government and are cheaply and easily obtained; the maximum time for which a grant is made is 80 years. When the receipts show a profit of over 6 per cent per annum the maximum fare must be reduced. After May 1, 1915, cantonal or Federal authorities may purchase any road in existence on giving three years' notice.

If an agreement to purchase be entered upon and concluded up to May 1, 1930, 25 times the value of the net earnings for the 10 years previous has to be paid; between the years 1930 and 1945, 22½ times the net value; between the years 1945 and the end of the concession, 20 times the net value is to be the sale price. In case the Canton is the buyer, and the Federal authorities demand control of the property, the Canton is compelled to deliver to the Federal authorities the property acquired at the price paid.

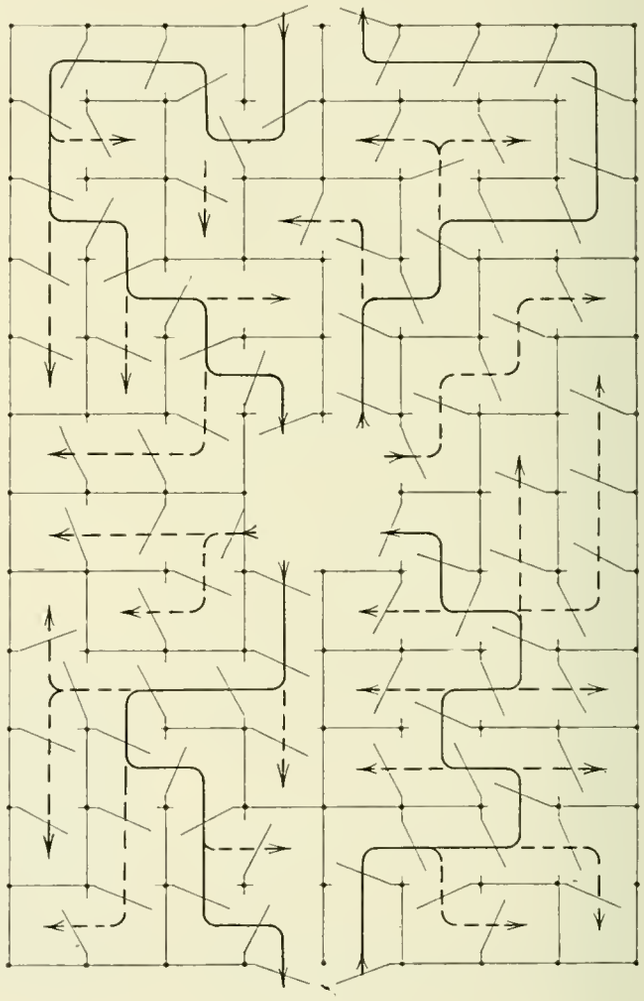
In conclusion the report says:

"The attitude of the Swiss Government is very favorable towards the building of railroads, especially mountain roads, and also electrical conveyances to places which otherwise would be difficult of access by the summer tourist.

"All things considered, the investment of American capital in small mountain roads and electric tramways must be a paying one. Firms interested in this line should send competent men to look over the field of the concessions held. No doubt, profitable arrangements can be made either for the building of roads or for giving financial support to some of them. There is no lack of brains in Switzerland to conceive profitable projects in this line, but there is a lack of means to carry them out. The exceptional conservatism of the people may be another reason why meritorious projects have not been carried out."

AN OPEN MAZE.

The accompanying sketch represents an "open maze" which, doubtless, would prove an attractive feature at almost any park where other than natural attractions are provided. It can easily be built by almost anyone and at small expense. The size of the maze and the arrangement of the true and blind paths may be varied according to the means and ingenuity of the builder. One of the points to be observed in laying out the plan is to have as many cells as possible with more than one door.



OPEN MAZE.

The Albany & Troy Steamboat Co. has a park on an island in the Hudson River near Troy, in which is an open maze with 96 cells each about 4 ft. square. The foundation consists of stringers laid on the ground and covered with planks, making a floor about 32 x 48 ft.

On this floor are set posts of 2 x 4 in. pine about 6 ft. high; they are placed 4 ft. apart each way and fastened to the floor by knees made of strap iron. The tops are fastened and braced by 6 x 1 in. planks running both crosswise and lengthwise of the maze. The partitions, or sides of the cells, are made of rectangular frames covered with wire netting such as is used for fencing chicken yards. The immovable partitions are exactly similar to the doors save that they are nailed in place instead of being swung on hinges. Spring hinges are used so that the doors are all self-closing. The doors are hung to the posts, a cleat being placed on the opposite post so that the door swings only one way.

In the center is a larger cell, 8 x 8 ft., through which both of the paths lead. As shown in the sketch one may start at either

end and go to the center and then return to either end. The doors are so hung that they swing away from the person going through except when he has strayed from the true path into a cul-de-sac and must retrace his steps, then the doors open towards him.

WHY SO MANY ROADS IN SMALL CITIES LOSE THEIR PATRONAGE.

BY J. A. P.

The reasons for so many street railways in small towns and cities losing patronage may be put under five heads:

First. Poor service on other lines when they have "big days" on some one line.

Second. Insufficient attention paid to keeping cars on regular time.

Third. False economy in the purchase of cheap material, etc.

Fourth. Reducing expenses in wrong directions.

Fifth. Failure to keep cars, parks, etc., in proper condition.

When, a few years ago, electricity took the place of horse and mule power in the street railway field no small cities and towns were considered at all progressive until they were equipped with an electric road. Naturally the residents appreciated the novelty and a rushing business was the result. However, the novelty soon wore off and there came a lull in business; what was the result? In place of "keeping everlastingly at it" to bring success managers would reduce the number of cars operated, thus making the service poorer, and this leads to taking up the five causes enumerated.

First. Some street railway officials may be very excellent business men in their particular lines, but when it comes to the operation of a road, they display a notable lack of foresight. One of the most noticeable of these is that whenever they have a big day at a park, ball game or what not, cars are taken off of the regular service on other lines and rushed out to the particular point, thereby giving such poor service on other lines that patrons must either walk to the point where the "Grounds" cars are, or take chances on not reaching the point of interest until late.

Again, when the entertainment is over all cars will be held at the grounds, thus leaving those who desire to ride home from town without cars. At the grounds the cars are loaded and rushed to some point in town, where the passengers are unceremoniously "dumped" and obliged to walk home, while the cars are sent back for another load.

This may be doing a rushing business for one day, but the result on the regular business is bad. Patrons who are regular passengers on some one of the other lines were obliged to walk home, perhaps fully as far as the distance they came from the grounds. These people are the mainstay of the road, year in and year out, yet for the sake of having a big days business managers will put them to all sorts of inconvenience to accommodate a few hundred strangers who may use the cars but once a year. An instance of the effect of such a policy came to the writer's attention a short time since. A road in a small town had attractions at a park, and on all big days the people were hustled from the grounds to the transfer point (?) up town (but all cars were on the "grounds" line); there they were unloaded and obliged to walk the remainder of the way to their homes, while the cars were sent back to get more passengers. One family, whose regular trips every day amounted to twelve, became so bitter, that they declared they would not use the cars again, and have not done so in six months. And numbers of others use the cars only when absolutely necessary since that time.

In a small town distances are not great and if the road displeases the public, the road, not the public, will be the principle sufferer.

Second. A most important feature in street railway operation is to keep the public posted as to when, that is, what minute they can depend on a car. It is too often the case that small roads never place their cars on a regular schedule, but give a car so much time in which to make the round trip. If a line has say 15 minutes between cars, how are the people to know when a car will put in an appearance? People in most instances use cars because they want to reach their destinations quickly; if they do not know when a car is due they walk unless a car "just happens" in sight.

Third. Regular receipts decreasing, officials conclude that expenses must be cut down. This is accordingly done by stopping the operation earlier in the evening. If receipts decrease because a road has secured the ill will of a large number of citizens, it can not be expected that an increase, or even a continuation of present receipts, can be had by still further antagonizing or disappointing the public by a decrease in the number of cars operated or by reducing the number of running hours.

Fourth. Perhaps some may think it ridiculous to assert that buying cheap goods and running a road on a cheap scale, would affect the traffic in any way. Yet experience proves it to be true. A merchant making a show of prosperity always does a better business than his neighbor who is constantly complaining and the same holds good in the railway world. The road whose management is always seeking to keep the plant, cars, etc., in first class condition has the well wishes of the citizens and the more attractive and substantial everything is made, the more pride the citizens take in the line, and the more nickles the road takes in. Can this result be accomplished by using poor material in construction, etc., especially when by using such material you are constantly being interrupted by "break downs"? The purchase of poor goods always results in the road paying out more for repairs than if it confined itself to the best, to say nothing of the annoyance which poor material causes.

Fifth. One of the most important features is to keep cars, parks, etc., in clean and respectable condition. The lack of this is very noticeable in many places. Cars are operated month after month without even being washed, and several years may pass before a paint or varnish brush ever touches them. Dust and grease are allowed to accumulate on both exterior and interior, all of which tends to disgust patrons and they will only ride when absolutely necessary. As for parks, you can not expect to keep your crowds in attendance by charging a high price of admission, and giving a cheap entertainment. Neither can it be expected that respectable people will attend when "all sorts" are allowed to make the park their resort. Too much attention can not be paid to keeping parks respectable.

In this connection it might be well to call attention to unnecessary waste in throwing away "scrap" of any sort. Because a wire or other piece of metal is very small it is perhaps buried in the rubbish pile, or elsewhere than in its proper place. Cents make the dimes; dimes the dollars, and dollars make dividends.

BROKEN JOURNALS CAUSE MISHAP.

A peculiar case of two broken journals on one side of a car was the cause of an accident on the Prospect St. and Lonsdale Ave. line of the Pawtucket Street Railway Co. last month. When within 1,500 ft. of the end of the route both journals on one side of the car broke off causing the car to topple to one side, turn completely around, run up onto the sidewalk and fall over upon its side. There were no passengers on the car, but the motorman and conductor were both severely hurt.

Gen. Mgr. Charles F. Luther of the railroad company made a thorough examination of the car and track at the scene of the accident, and the appearance of the roadway at this point showed that the forward left side journal of the car broke first causing the left wheel to leave the track. The car hanging down at the corner put so much stress on the rear journal on the same side of the car that it broke also with the effect of upsetting the car on its left side. Both journals must have broken within a second of each other, and further examination showed that the brakes had been set on all four wheels at the moment of the accident.

The Camden (N. J.) & Suburban Railroad Co. it is announced must now pay a tax of one dollar for every pole erected along its line. The railway company claims 25 cents to be the proper fee.

The Bay Cities Consolidated Railway Co. contemplates building a new central power house and car shed in Bay City in the event that a franchise can be secured for the streets necessary to give access to the barns.

Two cars came in collision on June 17th on a line of single track of the Milwaukee Electric Railway & Light Co. at a turn in the road near the city limits of Wauwatosa. One of these was an empty east-bound passenger car and the other a west-bound car carrying 12 men to their work at the end of the line. The collision pretty well demolished the cars, but the men escaped without serious injury.

THE CLEVELAND STRIKE.

The strike of the employes of the Cleveland Electric Railway Co. —the Big Consolidated—which began June 10th and ended June 25th was a struggle solely for the recognition of the employes, union, the company having before the strike expressed a desire to adjust all other differences by conference with a committee of its employes and if necessary by reference to a board of disinterested arbitrators. The company took the solid ground that it could not free itself from the entire burden of responsibility for the safe and proper carriage of its passengers, and therefore must be free in the selection and discipline of its employes for whose acts it is responsible.

Cars were operated with great difficulty and it was necessary to cover the platforms with wire netting to protect the non-union men from the missiles thrown at them; eggs and bricks were favorites. About 200 men were brought from Chicago, Toledo, Cincinnati, Pittsburg and other cities to replace the strikers. Every day from the 10th until the 25th, except on Sundays there was a great deal of rioting; firearms were used in some instances but most of the casualties were from stone throwing. The city afforded better police protection during the second week of the strike when it was realized that the disorders would surely grow more serious if not repressed with a firm hand. This of course was deprecated by a certain portion of the public.

Probably no better idea of the issue can be given than by publishing the demands of the strikers, the proposition first made by the company and the agreement which was finally concluded.

The men first placed their demands in writing on June 20th, when the following was submitted:

"First, that the Cleveland Electric Railway Co. upon all matters of differences or grievances existing or arising between said company and its employes will at all times recognize and negotiate the settlement of the same with such committee of its employes as they may from time to time appoint, or any agent or attorney selected by them.

"Second, that in all cases of suspension or discharge of an employe, said railway company shall furnish to such committee of its employes, upon request of the committee, a written statement of the reasons for such suspension or discharge.

"Third, in all cases where it is impossible for the company and the committee to reach a mutual agreement the same shall be submitted to a board of arbitration to consist of three disinterested persons, one to be chosen by the company, one by the committee representing the employes and the two thus selected to choose the third. Their award to be final. That upon the request of such committee the discharge of any employe since April 1, 1899, shall be treated in the manner hereinbefore set forth.

"Fourth, that all the employes now on a strike shall be reinstated to the positions formerly held or occupied by them prior to the 10th day of June, 1899; excepting such employes as have or shall have been found guilty in a court of proper jurisdiction of the charge of malicious destruction of property; otherwise their reinstatement to be made without prejudice.

"Fifth, the parties hereto shall conform to all the terms and conditions herein stated for and during the period of one year from the date of the settlement hereof, and upon which settlement such terms and conditions shall be in writing, and a copy of the same to be filed with the committee of the street railway employes submitting the same, and a copy to be filed with said railway company and the committee of the council to whom the matters herein set forth are submitted."

June 22d the company and a committee of the men reached this agreement:

"The company declares that, in order that its men may have a proper sense of security in their employment, the company will not discharge any man except for cause, which cause will, at his request, be given to him, and he will be given a full and fair opportunity to explain or disprove the same. It declines to submit to arbitration any question of its schedules or the wages it pays.

"The company must reserve the ultimate right to hire and discharge men, contracting with the men individually and not collectively. It is ready and willing to take back into its employment, as it has ever been, such of its former employes as its business demands, aggregating, at the present time, 80 per cent of such employes, and as other vacancies occur will give preference to such former employes, excepting always those who have committed unlawful acts against the company, its property, or employes during the present strike. But the rehiring of all men is upon the express condition that their service with the company's present employes must be loyal, and the latter must not be subjected to annoyance or abuse by them and any violation of this condition shall be deemed cause for discharge.

"The service of employes will be distributed as equally as possible under existing conditions. The company will today be able to give, upon the return of its former employes to its service, 80 per cent of the runs to the former employes; 20 per cent of the runs to its present employes, the remainder of its former and present employes to be placed on the extra list in the same proportion. The method of apportioning these runs between former and present employes to be as follows: The first four runs on the time table of each line to go to the former employes, the fifth to go to the present employes, the next four runs to go to the former employes, the tenth to the present employes, and so on through the time table with the day runs, late runs, and extra list. Temporarily, this adjustment may work some inequality to some men, but the same will be adjusted as equitably and promptly as possible upon these lines."

This was repudiated by the strikers in mass meeting who then drafted an agreement which was said to be "just the same" as the one suggested by the company.

This, the company's lawyers found, was so different from its proposition that it declined to accept it.

June 25th a committee appointed by the city council secured the acceptance by the men of a proposition substantially the same as that first offered by the company. There were five points covered, as follows:

1. Restoration of former time schedules as announced by the company before the strike.
2. Questions of wages of men working short hours, the distribution of extra runs, etc., to be submitted to arbitration if the company and its men fail to agree.
3. Men to be given a full and fair opportunity to disprove charges against them.
4. Questions of schedules and wages not to be submitted to arbitration. The company to take back 80 per cent of the strikers; new men not to be subjected to annoyance.
5. Work to be divided among old and new men as in the offer of the company.

After the strike was thus settled disturbances on the street continued, new men being annoyed and abused by the late strikers and their sympathizers.

The position taken by the public press in general is shown by the following extracts:

"There is no law of Ohio that compels an employer to deny work to a man who does not belong to a labor union, or a Masonic lodge, or the Knights of Pythias, or the Methodist church or the Republican party. The employer is at full liberty to employ any man who is willing to work on the terms offered, union or no union. That is the law, and the civil authorities are bound to protect the employer in the exercise of his legal rights."—Sandusky (O.) Register.

"At the very outset of the trouble the company granted everything save its right to employ whom it pleased. In other words, it refused to recognize the union and insisted on the privilege of managing its own business without interference from its employes. But the strikers were not satisfied. They wanted to dictate the company's policy and when they found that the company would not yield its position they resorted to violence, thereby injuring their own cause and losing what little sympathy they may have had from outsiders. By their actions they not only disgraced themselves, but they injured the cause of labor, to say nothing of giving the city of Cleveland a bad name."—Springfield (Mass.) Union.

"Street car strikers in Cleveland, Wheeling and other cities will not advance their cause much by assaulting women and children and other defenseless passengers on the cars. That sort of work will alienate all public sympathy for the strikers. That kind of striking is not popular."—St. Paul (Minn.) Dispatch.

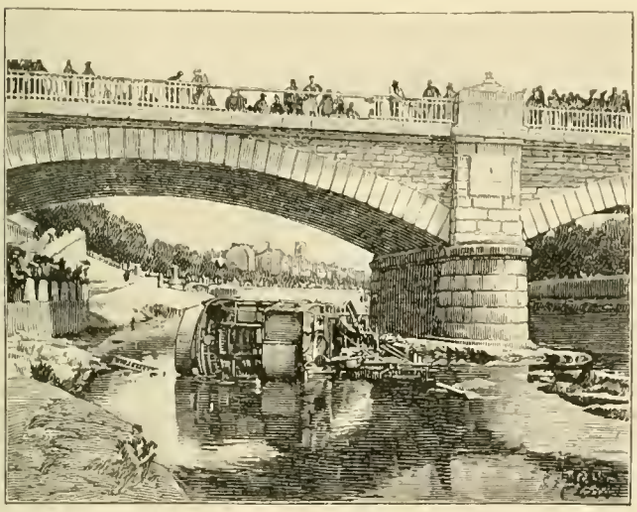
"A significant fact in connection with labor strikes in this country during the last few months is that they have been confined largely to street railroad employes. * * * The explanation is

to be found evidently in the fact that strikes among street railroad employes of late are of a political rather than an industrial character. Labor leaders are taking advantage of the sentiment that has been kindled against street railroad corporations in certain communities to create trouble for their own purposes." New York Commercial Advertiser.

"That this resolution (the resolution adopted June 12th by the company) embodies nothing but priciples of reason and common sense is so plain that even the most blatant of walking delegates should, it would seem, hardly presume to question its terms or its conclusion. * * * The stand taken by the Cleveland railway people is the stand that all free Americans must take unless anarchy is to run riot through the land and law and order is to give place to lawlessness and disorder. There can be no compromise of, and no arbitration on the question that is now uppermost at Cleveland, O." Los Angeles (Cal.) Times.

FALL OF A TRAMCAR INTO THE RIVER DOUBS.

A serious street railway accident occured at Besancon, France, on the evening of May 31st. An electric car running at an excessively high rate of speed became derailed just as it entered upon the bridge of Canot. The car ran onto the sidewalk and after tearing down the iron railing fell a distance of 27 ft. into the river landing on a bed of rocks. In this singular accident there were 3 peo-



TRAMCAR ACCIDENT IN FRANCE.

ple instantly killed and 4 others seriously wounded. The illustration, taken from La Nature, shows the position of the car in the river and also where the railing of the bridge was torn down, which the workmen are temporarily replacing with a wooden rail. In falling the body of the carriage turned on its side and was almost completely demolished, while the wheels and the electric motor fell perpendicularly and stood upon a shelf of rock.

CONTROLLER BURNED OUT.

On the 19th of June a panic was caused on one of the Union Traction cars at Pittsburg, Pa., by the burning out of a controller. A picnic had been held that afternoon at Calhoun Park by one of the churches of the city and the party left for home about 8 o'clock on one of the open cars of this line. The car was crowded with passengers and had reached Reynoldton, where it was proceeding at a 10-mile gait, when a flash occurred at the controller followed by a brilliant display of burning copper. The car was quickly brought to a standstill but not before a number of excited passengers had jumped off, several of whom sustained injuries, though none was fatally hurt. The passengers remaining aboard the car were unhurt.

ELECTRICAL TRACTION AND INDIAN LIGHT RAILWAYS.

Reported by the Philadelphia Museum.

From the viewpoint of the electrical engineer, a very important conclusion has been arrived at by the Indian authorities regarding the motive power of one, at least, of the light railways about to be extensively constructed throughout the Empire. This is the railway that will enter the Kashmir valley.

Hitherto it has been considered likely that the Kashmir road would be more or less of the same pattern as the other Indian hill railways already in existence. The fuel question was one, however, which bristled with difficulty. There was wood enough, but it was not considered desirable to denude the hillsides, and coal would have had to be brought all the way from Bengal. Under these circumstances it is not strange that the eye of the engineer should have fallen wistfully upon the boundless store of water power rushing to waste at his feet. The point was to apply it. The use of electricity as a motive power for locomotives was no new thing; but its application to the working of a line of railway 180 miles in length would hardly have been deemed practicable until quite recently. The progress achieved in the last few years, however, in the matter of transmitting electric power over comparatively long distances with comparatively small loss of efficiency has been so great as to render the suggestion quite feasible. Besides, the electric power possesses advantages peculiar to itself which specially recommended it for the uses of a hill railway. The experience of short lines already established on this system proves that electric traction gives a more uniform turning effort than does the locomotive in steam traction. The difference has been put at something like 40 per cent. This allows the use of a much lighter engine to draw the same load, and admits of working up by gradients which a steam engine could not surmount, except with the assistance of a rack rail. These advantages are so essential in hill work that in some cases it has actually been found expedient to use electric traction rather than steam, even where the electric power has to be obtained by a steam engine in the first instance.

The Kashmir line will extend from Jummu to Srinagar, a distance of 180 miles. Halfway between is Ramband, on the Chenab River, and here it is proposed to establish the central station. At this point the fall of the river is from 20 to 25 ft. to the mile, and the state engineer, Mr. Nethersole, calculates that a canal of 7½ miles giving 150 head would develop 100,000 h. p., which would be more than enough for the purpose.

The road is estimated to cost between $3,500,000 and $5,000,000. Its gage will be either 2 ft. or 2 ft. 6 in. It has not been determined whether the state of Kashmir itself will do the work or grant a concession to outside capitalists. The important matter for the electrical world is that electricity is being at length recognized as a valuable traction power in such a country as India, where light railways are every year becoming more necessary to the requirements of agriculture and commerce generally. Here there will be wonderful scope for business in the various supplies and equipment necessary for light railroad traffic, and which United States manufacturers are so well able to furnish.

The state of Kashmir is the most northerly and most mountainous in the Empire, and has an area of 80,000 miles. Its chief town is Srinagar. It is reached more easily from the western side of the territory, and Bombay is, therefore, its port of entry.

TROLLEY CAR MAIL SERVICE.

The postal authorities have just decided not to abandon the trolley car mail service between St. Paul and Minneapolis which was ordered some time ago to be stopped. The continuance is due to the recent visit of Second Assistant Postmaster General Shallenberger to those cities where he investigated the subject very thoroughly. The street railway company had a contract for the service for which it received $2,000 per year, which amount, however, was thought to be inadequate. The company therefore refused to bid on a renewal of this contract, which expired on July 1st. After conferring with Gen. Shallenberger, the officials submitted a new bid of $2,700, which was accepted. This will result in the continuance of the hourly service between these cities, the same as before.

FOREIGN FACTS.

The Portrush (Eng.) Urban Council is considering a communication received in reference to an overhead electric traction system.

Sir E. Ashmead Bartlett has secured, among other concessions from the Turkish Government, one for an electric railway at Smyrna.

Croyden, Eng., is about to acquire the railway of the Croyden & District Tramways Co., the purchase price for which will be about £50,000.

At a recent meeting of the Tramway Committee of Dundee, Eng., it was decided to build an electric railway in that city to connect the two lines now in operation there.

The tramway system of Aukland, N. Z., has been acquired by an English company, which will considerably extend the system and install electric traction. The estimated cost is $800,000.

The third-rail system will be used this summer on a trial section about 2 1 3 miles long of the Vienna tramways. Two trains will be used, each consisting of two trail cars with a motor car on each end.

The Madras Government has recently given an order authorizing the construction of a system of electric tramways in the district of Madura. This will be the first supply of electricity from a central generating station in India.

The Corporation of Chester, Eng., is considering the advisability of acquiring the railways of that city. The city electrical engineer has prepared a report on the practicability of running the system by electricity in which he recommends the adoption of the open conduit system.

The City & South London Electric Ry. extension which was advertised to be opened in July will not be completed for at least three months. A tunnel has been constructed under the Thames, making the extension practically a new line. A new power house is being built for this part of the line.

The new electric railways of Blackpool, Eng., were inspected last month by Major Cardew, on behalf of the Board of Trade, and a provisional sanction was given to run the cars pending the decision of the Board. The electrical equipment of the cars is being pushed rapidly and is nearly completed.

The annual meeting of the stockholders of the Ottawa (Ont.) Electric Co. was held on June 26th. A dividend of 6 per cent was voted and a sufficient sum set aside to increase the surplus to an even $75,000. President T. Ahearn and the old board of directors were re-elected for the following year.

During the Motor-Car Fete held in Paris last month the excitements of that occasion were augmented by the performance of a motor car named the "Never Content" which is said to have been traveling about at the unusual speed of 65 miles per hour. This car, moreover, is described as "noiseless."

The Glasgow Corporation Tramways is inviting bids for the supply and erection of a complete 3-phase traction plant, the electrical machinery of which includes 3-phase generators, direct current generators, rotary converters, boosters and static transformers. Bids have also been invited for the supply of 80 trolley car bodies.

An action has been brought by Mr. Blackwell, of London, against Messrs. Greenwood & Batley, Albion Works, Leeds, to recover £608, the price of trolley standards and other goods supplied for the electric railway of the Leeds Corporation. One of the trolley standards broke, injuring three passengers, and the corporation was held liable for the damages. It in turn claimed and received the amount, including costs, from Greenwood & Batley, who now counterclaim the sum from the plaintiff on the ground that the standard was of adequate strength and that the fracture was due to abnormal pressure or to a collision previous to the accident. Decision was reserved.

The electric railway on the Isle of Man, between Douglas and Ramsey, was opened for traffic last month over the full distance. Part of this line was opened last year, but the full distance of 17 miles and a double track has just been completed. The line is on the overhead system, and the road opens up a beautiful country practically unknown to tourists heretofore.

The first step towards providing Brighton, Eng., with a much needed electric railway system was taken by the County Council in adopting the report of the Tramways Committee, recommending that aplication be made for powers to construct and operate an overhead system of trolley roads. The route covers nine miles of roadway and the current for the road will be taken from the existing electrical supply station.

Cornelius L. Hester, a London electrical engineer and contractor, who is visiting in Pittsburg, Pa., states that a syndicate has been formed for the purpose of building a network of trolley roads in London as soon as the County Council shall give it permission. In that city the operation of a street railway by a private corporation is almost impossible, and Mr. Hester considers it a matter of course that the lines would pass into municipal ownership after completion.

The Potteries district of North Staffordshire, Eng., will soon have an extensive system of electric railways. Concessions from 18 different local authorities enabled the British Electric Traction Co. to amalgamate various roads under the name of the Potteries Electric Traction Co., which was organized in 1898. The lines when completed will comprise 35 miles of track constructed on a uniform gage of 4 ft. A part of this system is now in operation and the balance is under construction.

The death of Mr. Guyer-Zeller will have the effect of considerably shortening the Jungfrau railway, as it is intended by his heirs to complete this road only as far as the Eier section without proceeding any further up the mountain. The enormous expense and the engineering difficulties of building this line have been so great as to discourage any further extension of the line, especially in view of its uncertain earning capacity. The Eier section reaches nearly 10,000 ft. above the sea level.

Considerable anxiety is felt by the authorities of the Greenwich and the Kew observatories in regard to protecting the magnetic registers from disturbance by a number of new electric railways which are now projected. The value of the magnetic records which have now been carried on continuously for nearly 60 years, will depend, according to the report of the Astronomer Royal, entirely on the conditions under which electric traction is used. Steps have been taken to have a special clause inserted for the protection of these observatories.

The district near Nice, France, is to have an electric railway system, the power for which will be obtained from the water power abounding in that neighborhood. A company was formed which utilized the waters of the Var, by piercing a tunnel and erecting a reservoir from which a considerable fall was obtained. This will provide power for the tramways in the district of Cannes and Nice. These lines will also be extended to Beaulieu and Monaco. The lines at Cannes started running in January but were stopped for several weeks on account of their interference with the telephones. This was remedied and the service was continued in February. A line has also been built from the Monaco station to the town of Monaco, and another from Monte Carlo to the Casino Gardens.

THE WHEELING STRIKE.

The situation in Wheeling, W. Va., has not improved to any great extent, the local papers reporting that on June 20th there were five cases of assault upon individuals growing out of the street railway strike.

This strike began on April 8th and had the active sympathy of the citizens of the city; this sympathy has waned considerably, however, and on June 16th at a meeting of the members of the chamber of commerce and other citizens some remarkable resolutions were passed. In substance they were:

"Whereas the strike has greatly interfered with business and given the city a bad name, and it ought to be settled: First, we urge the parties concerned to come to an agreement before June 20th. Second, if they do not do so we hereby give notice that after that date we shall patronize the street cars."

Surprising as it may seem this is reported to have drawn angry protests from the strikers.

The boycott placed on the Bellaire, Bridgeport & Martin's Ferry Street Ry., of Bridgeport, O., April 25th was raised on June 25th. This line is owned by the Wheeling Railway Co., and the boycott was designed to assist the strikers on the Wheeling line. Experience showed it to be without any affect on the situation in Wheeling, and work a great hardship on the employes of the Bridgeport lines who were satisfied with the wage scale and wanted to work.

A settlement was reached on June 29th on the following terms: 11 hours per day; 18 cents per hour; new men to be retained in service. It will be remembered that before the strike which began on April 8th, the company offered 18 cents per hour, but the men demanded 20 cents. After 83 days idleness the men thus accept what was offered at the beginning.

PECULIAR ACCIDENT ON THE CHICAGO ELEVATED LOOP.

On the evening of July 3d there was a very peculiar accident on the Chicago Union Elevated R. R. In some manner a short circuit was established between the contact shoe of one of the Lake St. motor cars and the arm supporting it, thus making direct connection between the third rail and the track return. A fine electrical display followed for a few instants until the circuit breakers in the power houses opened. There were repetitions of the fireworks at short intervals until the 1,500,000-c. m. stranded copper feeder cables supplying current to loop were burned out at three different points. The traffic was delayed for over an hour because of the mishap. We have been advised that the serious consequences resulted because of the attempts to keep circuit breakers closed after they had first opened.

LIGHT RAILWAYS IN ARGENTINA.

Mr. D. Mayer, U. S. Consul at Buenos Ayres, having received numerous letters of inquiry concerning the light railways in Argentina, prepared a statement on the subject which was published in the Consular Report advance sheets June 14, 1899. The letter is as follows:

On December 31, 1897, the Legislature of the Province of Buenos Ayres passed a law authorizing the construction of light railways of 1 meter (3.28 ft.) gage throughout the Province. The Government was to fix the tariffs, regulate the construction and working of the lines, and the right to expropriate any railway so constructed at cost price was retained; so that it was difficult to determine what benefit there could be for the concessionnaires.

Moreover, there were two articles in this law capable of any interpretation that the authorities might like to give them, when the railways were once built; for instance, paragraph 3 of article 5 says:

"The lines may be laid upon the public roads, or on one side of same, so long as they are constructed under the required conditions, and the company is bound to keep them in order."

This might easily be construed to refer to the whole road; nor do I see in the law any article giving the right to expropriation of land, so that the company would be bound to use the roads or be at the mercy of the landowner, equally disastrous alternatives.

Article 6 says: "Every company shall be bound to construct the works necessary to guarantee the efficient working and security of the railway."

As article 5 gives the Government the right "to regulate the construction and working of the lines," it is at least presumable that it will dictate to the company any work that it may consider necessary for "efficient working and security."

It will not surprise railway men at least to learn that concessionnaires have made little effort to obtain permission to construct light railways under the above law. Six months later (July, 1898), the supplementary regulations appeared; these applied chiefly to the form in which the petitions for concessions shall be made, the periods allowed for presentation of plans, execution of works, etc., and, in agreement with the law itself, left all powers in the hands of the Government, to whom the companies would be bound hand and foot.

For instance, articles 25 to 29 prescribe that fences, barriers, signals, and continuous brakes shall not be exacted except when the Government shall think fit, and a company would hardly be willing to accept such indefinite conditions. The regulations for working are as numerous and as vague as those for construction, and I frankly can not see what profit a railway company can gain, by the time it complies with all the conditions expressed and implied in this law.

But, apart from these considerations, the question presents itself, With what capital are these light railways in the Province of Buenos Ayres to be built? And, secondly, Are they to be constructed with a view to competing with existing broad-gage lines, or as feeders to them?

To the first question, I answer without hesitation, With foreign capital; and for railway purposes it is hardly likely to be other than British capital. If this be admitted as correct, it disposes at once of the second question, for it is improbable such capital would be forthcoming for the purpose of competing with the Great Southern, Central Argentine, Buenos Ayres & Rosario, Western, and Pacific railways.

Another difficulty lies in the condition (article 5, paragraph 1) that the roads shall be meter gage, as this would involve transshipment of produce; further, each light railway branch would need repairing shops, running sheds, etc., for the same reason that the difference in gage would not allow the light-railway engines or wagons to run into the broad-gage railway shops for repairs. As feeders, therefore, it would appear that the light railways can hardly be a success, unless the law be modified and equal gage allowed.

A STREET CAR WRECKED.

A car on the Sherman Heights division of the Chattanooga (Tenn.) Rapid Transit railway was wrecked on the night of June 7th at a point known as Henderson's switch, the car behind the dummy being derailed and ditched, injuring several passengers. At the time of the accident it was thought to be caused by the car wheels splitting the switch, but on investigation it was found that the switch had been tampered with. The switch was in such a position as to warrant the belief that it had been thrown while the dummy train was passing over it, being left open for the engine and closed to the car. A few days previous to the accident an intoxicated passenger named Whittenberg had been put off a car on this line and it is now stated that the Rapid Transit officials have secured evidence to show that Whittenberg, in order to be revenged upon the company, deliberately wrecked the train by manipulating the switch. A warrant has been issued for Whittenberg's arrest, and he has been in hiding ever since.

RAN INTO A CHERRY TREE.

A Hoboken, N. J., trolley car bound for Rutherford, on June 18th, left the track while descending a steep grade. The car was running at a lively speed when it left the track, and crossing the road it dashed through a fence and brought up against a cherry tree with a suddenness that unseated all the passengers, none of whom, however, was hurt. Had the cherry tree stopped its progress, the car would have plunged over an embankment directly in front of where it was stopped.

THE METROPOLITAN MUNICIPAL RAILWAYS OF PARIS.

The Metropolitan underground railway system of Paris, some parts of which have been in course of construction for several months is to comprise nine different routes, six of which have been determined and which will comprise the system which is being pushed to completion as rapidly as possible in view of the Exposition in 1900. The last three routes are to be constructed eventually, but probably not for several years. The total length of these six lines is 62.911 km., which may be subdivided as follows: Underground lines, 40.339 km.; open cuts, 11.725 km., and viaducts, 10.847 km. The routes of this system may be divided into circular and transverse lines. The circular line is an intramural one following the course of the boulevards around the outer edge of the city. The transverse lines run straight through the city and these lines are connected to the circular line by a number of branch lines. The part of this system actually under construction is one complete line

MAP OF THE PARIS METROPOLITAN MUNICIPAL RAILWAY.

and parts of two other lines. The first is the principal transverse line running east and west connecting the Bois de Boulogne and the Bois de Vincennes. It runs through the avenues of the Grand-Armee and the Champs-Elysees, the Rue de Rivoli and the Boulevard Diderot and along the Course de Vincennes up to the gate of the same name. Of the other two parts in course of construction the most important is the one running from the Place de l'Etoile to the Trocadero intersecting the preceding line in such a manner that it will be possible for passengers from the Bastile and the Rue de Rivoli to take a train directly to the Trocadero. The other part being built starts from the Porte Dauphine following the avenues Bugeaud and Victor Hugo to the Place de l'Etoile. The latter portion is the comencement of the circular line mentioned above. The construction of this road is the subject of two interesting articles in La Nature by M. A. Cunba, from which this abstract has been prepared.

The Place de l'Etoile will form a grand central station from which a large number of the lines will radiate in different directions. This station will form the end of the Etoile-Trocadero line at which point the track is in the form of a loop. This will facilitate the movement of trains at the terminus by avoiding any switching. The Porte Maillot-Champe-Elysees line crosses the Place de l'Etoile where it touches the loop of the former line tangentially and at this point of contact, which is opposite Wagram Ave., a double station will be built common to both lines. The Porte Dauphine-Wagram Ave. line crosses the two preceding lines but on a lower plane, the face of these rails being at this point 14 m. below the surface of the ground so that there is no actual junction. The station of the latter line, however, will be placed vertically beneath that of the two former lines so as to permit passengers to change from one line to the other without remounting to the street surface.

The substructure of the Metropolitan is constructed by the city, while the superstructure and management of the road are conducted by a special company known as the Metropolitan Co. The principal line has been divided into 11 parts, which with the two parts of the branches makes 13 parts actually under construction. The building of all of these parts except one has been let to contractors, and the remaining part is being built by the city. There was a great deal of difficulty in carrying on such a considerable work as building an underground railway in the short space of eighteen months in the midst of Paris, and it required all the energy and ingenuity of the engineers to accomplish this remarkable problem of construction without obstructing traffic in the streets.

The method of operation is very simple in principle. The contractors have sunk vertical pits where the earth from the tunnel is raised, and these pits are placed at short distances along the route so as to present as many working fronts as possible, and also to reduce the time necessary for boring between them. In a great many places they have been able to make use of a shield operated by a hydraulic press, which in spite of its high price of $24,000 effects an economy in the whole work by reducing the amount of wood work required for sustaining the roof of the tunnel. The shield in some cases includes the whole section of the tunnel which in this case requires but a single operation for the construction of each successive ring. At other times the shield only includes part of the bore and in this case a second operation is required to remove the earth comprised between the diameter of the shield and the future diameter of the tunnel.

In either case the function of the shield is not to pierce the soil, but to temporarily sustain the roof of the tunnel. The laborers are placed between the head of the shield and the front of the bore where they dig and cut out a space into which the shield advances. When the necessary space has been cut out the hydraulic jack is called into use. This is held in place against the wooden braces in

the finished part of the tunnel and forces the shield to advance into the new cut. In this manner the ground is always sustained by the metal cylinder of the shield. There are always a dozen metal rings behind the shield and when the latter is moved forward the last ring is dismounted and set up next to the shield. The masonry is laid as soon as the shield is moved forward and the ring supporting it is not moved for five or six days in order to give the cement time to set.

Unfortunately it is not always possible to make use of the shield, as, for example, in cutting around curves; and at several points also the contractors have not been able to get the shield delivered in time, and as the loss of even a day was not to be considered they prosecuted the work in the old fashioned way. In this case an advance passage is opened and this is thoroughly boarded and braced with wood and no more of the tunnel is opened until this part is completely finished.

The contractor for the ninth part of this line has devised a bold and novel method of construction which has given excellent results and permits the work to be carried on very rapidly.

He commences by establishing an advance passage of 2 m. in height along the line of the road. Then he constructs a second passage above the former one separated from it by 40 cm. of ground, and the roof is completely constructed in this passage using the upper ground to support the arch. Every ten meters he makes openings in the ground separating the two passages so as to carry away all the excavated material in the lower passage. This lower passage also performs another important service after the masonry has been set and dried. It is then necessary to remove the earth between the two passages and this is done by throwing it down in the lower passage and in falling the whole tunnel is cleared from side to side between the abutment piers. The later are built of concrete 2 meters thick and 3 meters long with a column of earth between parts under construction. The work progresses very rapidly, the passages advancing about 4 meters a day; although it should be added that the work is carried on for 22 out of 24 hours each day.

There is no serious difficulty in making the excavations as the sub-soil of Paris is composed of chalky clays, crystalized carbonates and loam. Occasionally a wall of ancient construction is encountered and there is also considerable filled in ground.

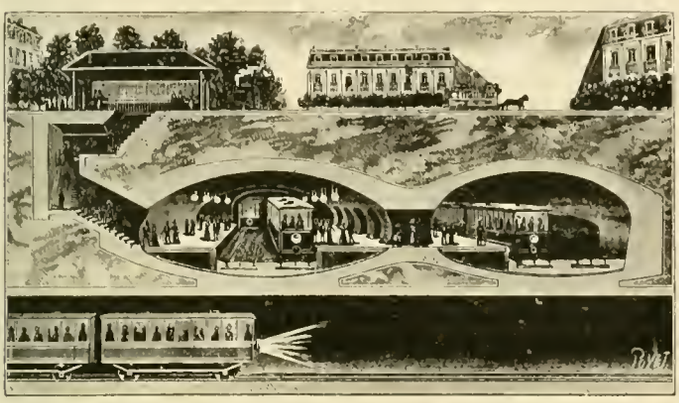
The Metropolitan has upset the system of sewerage in the streets in which it runs, notably in the Rue de Rivoli where the sewer had to be dug out and was replaced by two smaller ones situated one on each side of the tunnel.

There are two types of stations. Where they are sufficiently beneath the surface of the ground they have been built of masonry as in the case of the Place de la Nation. This work requires great prudence. In some cases there has been danger of meeting with bodies of water which would break in upon the station yard. It has then been necessary to build up as close to the side of the rail as possible. In this case the stations have been built with iron beams which sustain the embankments. To do this the foundations of the embankment are first constructed in underground passages opened for this purpose. When these are finished the soil from the street is removed and beams are put in place 14 meters apart which rest on the stone pillars. The embankment is at once built up and the interior soil is removed by means of the vertical pits.

The station at the Bastile is an uncovered one and its construction constituted a very interesting engineering problem on account of the presence of the Saint Martin canal.

One trouble which has been met with from the start is the removal of the excavated earth. From some points tramway lines have been used to distribute it to the suburbs. In other cases lateral passages have been tunnelled for conveying it to the Seine, and when these facilities failed horses and wagons were employed.

The ventilation has not been procured in any special manner and in the completed tunnels no ventilating apparatus will be used. The air will not be vitiated by gas from locomotives as in the ordinary railroad tunnel. The stations and all the underground lines will be brilliantly illuminated by means of electricity



DOUBLE STATION AT THE PLACE DE L'ETOILE.

STATION AT THE PLACE DU PALAIS-ROYAL.

NASHVILLE (TENN.) RY.

The Nashville Railway Co., a new corporation, has been organized at Nashville, Tenn., and has acquired the property of the Nashville Street Railway Co. (46.9 miles), the Nashville & Suburban Railway Co. (7.5 miles) and the Citizens' Rapid Transit Co. (10 miles), and consolidated the three roads under one management. The parties controlling the new company also own and control the Cumberland Electric Light & Power Co.

The officers of the Nashville Ry. are: Frank S. Hambleton, of Baltimore, president; E. C. Lewis, Nashville, vice-president; E. G Connette, general manager; N. P. Yeatman, secretary and auditor; A. H. Robinson, treasurer; Richard Emory, superintendent and engineer.

A NEW CAR HOUSE FOR MILWAUKEE.

The Milwaukee Electric Railway & Light Co. is negotiating for the purchase of the St. Gall's church property which comprises a tract of land 320 ft. by 200 ft. in the heart of the city. Mr. John I. Beggs, manager of the company, states that if this property can be secured there will be built there the finest street car station in the country, at a cost of about $500,000. The building is to hold 100 or more of the company's cars. The building will be four or five stories high and will contain the general offices of the company, an assembly room for employes with a complete gymnasium, baths and library, and an elevator for lifting cars to the upper floors, where light repairs will be done.

The purchase of the property is not yet concluded, and the work on the building will not commence for some time.

CAR TRUST AGAIN.

While it is impossible to get anyone to actually father the statement, there is a lively rumor that the car builders' trust is once more forming, this time under more favorable conditions. Several of the larger builders have again expressed willingness to go into a combination if the Brill Co. is placed at the head of affairs. The truck builders are not included in the deal.

PERSONAL.

MR. MAX BERG, of the Ohio Brass Co., has been spending two weeks vacation with friends and relatives in Chicago.

MR. MITCHELL JEANNES has been appointed general manager of the Fox River Electric Ry., Green Bay, Wis.

MR. J. L. YOUNG, JR., has been appointed auditor of the Richmond (Va.) Traction Co., succeeding Mr. J. A. Cook, who resigned last month.

MR. C. C. LEWIS, formerly with the Pennsylvania Steel Co., has become connected with the International Traction Co., of Buffalo, as engineer of ways.

MR. JOHN R. GRAHAM, president of the Quincy & Boston Street Ry., will be manager of the Quincy division of the lines of the Massachusetts Electric Cos.

MR. C. W. MOFFETT has taken the management of the Boston office of the Heine Safety Boiler Co., succeeding Mr. Russell Walker, who recently resigned.

MR. THOMAS WILSON, lately engineer in charge of extensions recently built at Harrisburg, Pa., has been appointed assistant engineer for the Buffalo Traction Co.

L. B. FRENCH, of Detroit, Mich., advises us that he has in course of construction a line from Toledo to Adrian, a distance of 30 miles, and is in the market for material.

MR. W. A. HELLER, who recently resigned as superintendent of the Lewiston & Youngstown road, has been appointed superintendent of the Niagara Gorge Railroad Co.

MR. J. A. MAXWELL has been appointed master mechanic of the Troy City Railway Co.; he recently resigned as superintendent of motive power of the Cortland (N. Y.) & Homer Traction Co.

MR. ELWIN C. FOSTER, general manager of the Lynn & Boston Railroad Co., will be in charge of the North Shore properties (from Boston to the Merrimac Valley) of the Massachusetts Electric Cos.

MR. S. H. BENNETT, who recently resigned as secretary and treasurer of the Atlanta (Ga.) Railway Co. after three years service, was presented with a diamond ring by the employes of the company just before leaving.

MR. FRED H. FITCH, general manager of the Sioux City Traction Co., was on June 17th chosen a director and vice-president of the Electrical Installation Co., of Chicago, in which he is financially interested.

MR. F. L. HART, of Baltimore, who has been the engineer in charge of the re-equipment of the Anacostia road of Washington has been appointed general superintendent of the Washington railways recently consolidated.

MR. J. L. WEEKS, who has for several years been western manager and special representative of the American Steam Gauge Co. has been chosen treasurer and general manager of the company to succeed Mr. R. G. Harmon, resigned.

MR. O. T. CROSBY, who was one of the leading factors in effecting the Washington consolidation, has temporarily severed official connection with these properties and is now in Europe with his family seeking a much needed rest.

HON. ALEXANDER B. BRUCE, of Lawrence, Mass., has been elected president of the Lowell, Lawrence & Haverhill Street Railway Co., to succeed Col. G. H. Campbell, who has held the position for several years, but has been forced to retire on account of ill health.

MR. CHARLES F. THOMPSON, secretary, treasurer and director of the Lane & Bodley Co., of Cincinnati, on July 1st resigned these positions, thus severing connections with the company with which he has been identified for 35 years.

MR. F. G. LOTT succeeds Mr. W. A. Heller as superintendent of the Lewiston & Youngstown Frontier Railroad Co., Lewiston, N. Y. Mr. Lott was formerly with the Buffalo & Niagara Falls Electric Light & Power Co. in a similar capacity.

MR. SAMUEL G. BOYLE has been elected secretary and treasurer of the Louisville Railway Co. to succeed Mr. James Pettus, who retires on account of ill health. Mr. Boyle is a stockholder and is thoroughly versed in the affairs of the company.

MR. A. F. EDWARDS, formerly general superintendent of the Yonkers Railroad Co., has been chosen general manager of the Virginia Traction Co., and also of the lighting company, of Petersburg, Va.; these two properties will soon be consolidated.

MR. HENRY C. MOORE, president of the Trenton Street Railway Co., has been elected vice-president of the United Power & Transportation Co. controlling about 15 street railways in Philadelphia and near-by territory; he will continue as president of the Trenton company.

SUPT. H. E. REED, of the Gloucester (Mass.) Street Ry., has resigned as such to accept a position in western Pennsylvania, and has been succeeded by Mr. H. C. Pedric, who has been for several weeks assisting the superintendent in order to familiarize himself with his new duties.

MR. H. S. COOPER has resigned as superintendent of the Schenectady (N. Y.) Railway Co. For the last 15 years Mr. Cooper has been engaged in electric railway and lighting work, and since 1893 has been with the Schenectady road which he brought from a receivership to a good paying basis.

MR. AMOS F. BREED, president of the Massachusetts Electric Cos., was accidentally wounded by a stray bullet on July 4th, and quite seriously injured. He is doing as well as could be expected and will recover if no unexpected complications occur. His friends while deeply regretting the accident, are thankful that it was no worse.

PRESIDENT ROSSITER of the Brooklyn Heights Railroad Co. announced under date of June 17th that the railroad and property of the Prospect Park & Coney Island Railroad Co. had been leased, possession being given at midnight of the 17th. Mr. Ira A. McCormack was appointed general superintendent in charge of operation and Mr. J. C. Brackenridge chief engineer in charge of maintenance of way, buildings and construction.

MR. GEO. H. SCRANTON, superintendent of transportation of the Columbus (O.) Street Railway Co., tendered his resignation as such last month, and Mr. George Wishner, foreman of the Oak St. line, has been appointed to fill the place temporarily. Mr. Scranton will leave on September 20th for Havana, where he will superintend the construction of an extensive street railway system in that city which is to be built by a company of Eastern capitalists.

MR. S. F. PEARSON, chief engineer of the Metropolitan Street Ry., of New York, is now in Sas Paulo, Brazil, in which city he and associates have franchises for street railways and lighting systems. Mr. Pearson expects to return next month. Mr. R. C. Brown accompanies Mr. Pearson and will have charge of the construction of the lines; Mr. Brown is well known in this country from his connection with the Widener-Elkins-Whitney syndicate as engineer.

MR. JOHN T. BRAMHALL, of the passenger department of the Monon, recently published an interesting article in the Western Electrician in which he reviews the power generating plants of previous international expositions in relation to that of the Paris exposition of 1900. Nearly three years ago Mr. Bramhall made the suggestion to the directors of the Paris exposition to establish a central power plant at the coal mines of DuNord and Pas-de-

Calais, which are within 100 miles of Paris, and by establishing a long distance electrical transmission plant for the power requirements of the exposition, not only to effect considerable economy and saving of space for exhibitors, but to keep pace with the advance in engineering which has marked every successive international exposition. The Corliss engine of the Centennial exhibition in Philadelphia, 1876, was in reality the first world's fair power plant; the electrical power plant of the Chicago exposition in 1893 marked another great advance in the engineering art, and it remains to be seen what progress in engineering skill shall mark the Paris exposition of 1900. We understand that Mr. Bramhall proposes to follow up his suggestion by making the proposed plant applicable to the street railway system of Paris.

OBITUARY.

MR. CHARLES B. THURSTON, of Jersey City, N. J., died at his home in that city June 14th. Mr. Thurston was born in New York, April 2, 1832, and all his life has been identified with transportation interests. The Jersey City & Bergen Railroad Co., of which Mr. Thurston was president, joined the American Street Railway Association in 1882 at its third meeting and the following year Mr. Thurston was chairman of a committee that reported upon the diseases of car horses, then a vital question with street railway men. Mr. Thurston continued as president of the Jersey City & Bergen until it merged in the Consolidated Traction Co. in 1893. He was also a special agent of the Pennsylvania R.R., president of the Port Richmond & Bergen Point Ferry Co., the Millstone & New Brunswick Railroad Co., the Fayetteville Water, Light & Power Co., of North Carolina, and was a director in a number of other corporations.

MR. W. J. BURNS, treasurer and general manager of the West End Traction Co., of Pittsburg, died in Paris while on a pleasure trip. Mr. Burns was most highly esteemed by all the employes of his company and they are preparing to send an appropriate floral tribute when the remains arrive in this country. Mr. Burns was born in Allegheny about 60 years ago, and has been active in business since a young man. Twenty-five years ago he entered the transportation field becoming interested in omnibus lines, then horse cars and later electric railways.

MR. EDWIN JACOBY, president and treasurer of the Toledo, Bowling Green & Fremont Electric Railway Co., Toledo, O., died at his home in that city on July 5th after an illness of two weeks. Mr. Jacoby was 65 years of age, and was born in Monroe county, Pennsylvania. He came to Toledo during the troubled years of the war, and immediately enlisted and went to the front. After the war, he located in Cleveland with the Fairchilds Scale Co., and there he was married to Miss Isabella Ames, of that city. He returned to Toledo in 1869, and entered the lumber business in the firm of A. Andrews & Co., of which he was the company. In 1871 he established a lumber business for himself and under his own name, and this he maintained up to the time of his death. He was also one of the incorporators of the Holcomb National Bank, and was its vice-president. He belonged to no societies, but counted all who knew him as brothers and friends. He leaves to mourn him his loving wife and two sons, Walter E. and Harvey F.

Shortly before Mr. Jacoby's death, Mr. W. B. Brockway had been placed in temporary charge of the road pending President Jacoby's illness.

ELECTIONS.

THE NORTHERN OHIO TRACTION CO., which is a consolidation of the Akron Traction & Illuminating Co. and the Akron, Bedford & Cleveland Railroad Co., has chosen officers as follows: President, H. A. Everett; vice-president, Will Christy; treasurer, J. R. Nutt; secretary, C. S. Moore; general manager, L. S. Beilstein.

THE MADISON (WIS.) LIGHT & RAILWAY CO., which recently succeeded to the Madison Street Railway Co., last month elected officers as follows: President, John S. Ward, of Chicago; secretary, treasurer and general manager, Charles R. Johnson, jr., of Madison; vice-president, J. A. H. Watson, of Chicago; directors, John S. Ward, J. A. H. Watson, C. R. Johnson, jr., and Benjamin F. Wells.

THE METROPOLITAN STREET RAILWAY CO., of Kansas City, Mo., chose directors on June 15th, re electing all of the surviving members of the old board and C. W. Armour, of Chicago, to succeed the late S. B. Armour. The director chose officers as follows: President, Walter H. Holmes; vice-president, L. E. James; general manager, Conway F. Holmes; treasurer, W. E. Kirkpatrick, of Chicago. It is announced that W. A. Satterlee will probably be appointed assistant general manager.

THE WASHINGTON (D. C.) TRACTION & ELECTRIC CO. has now completed the purchase of the Metropolitan Railroad Co. of that city and the stock of the old company, amounting to 18,000 shares, has been placed in the name of the new holding company with the exception of six shares, one each of which is made out to the gentlemen forming the board of directors. These are Mr. Kountze, the New York banker, C. A. Lieb, O. T. Crosby, F. C. Stevens, Nathaniel Wilson and Arthur P. Gorman. These men will probably also be chosen directors of all the other companies in the consolidation as well as of the holding company.

UNION TRACTION CO. OF INDIANA.

We are indebted to Mr. Charles L. Henry, of Anderson, Ind., for the details of a recent consolidation of electric railways in the gas belt of Indiana.

The Union Traction Co., of Anderson, first bought all the property of the Marion City Railway Co. The Muncie, Anderson & Indianapolis Street Railroad Co. was organized and bought all the property of the Citizens' Street Railway Co., of Muncie. Next the Union Traction and the M., A. & I. were consolidated under the name of the Union Traction Co., of Indiana.

This company now owns the Anderson property, the Marion property, the Gas City property, the Muncie property, the Elwood property and the intervening interurban lines from Anderson to Marion and the line from Alexandria to Elwood now in operation. It is also ready to commence the construction of a line from Anderson to Muncie and one from Anderson to Indianapolis, for both of which it now has complete rights of way. This will constitute the property of the company when completed, with the probable addition of five miles of railway from Daleville (midway between Anderson and Muncie) south to Middletown, and another five-mile addition running east from Frankton to and intersecting with our present line from Anderson to Alexandria. This will give a total of 160 miles of road which will all be operated from one central station to be erected in Anderson. The three-phase system will be used with rotary transformers at Muncie, Daleville, Marion, Alexandria, Elwood and Oaklandon, the latter place being a small village about 12 miles out from Indianapolis. The system will connect with the Indianapolis Street Ry. lines at the State Fair Grounds north of Indianapolis and cars will run into the city over the lines of that company.

The central offices of the company will be at Anderson. The capital stock of the company is $4,000,000.

The directors are Philip Matter, of Marion, president; Charles L. Henry, of Anderson, secretary and general manager; George F. McCulloch, of Muncie, treasurer; William C. Sampson, of Muncie; James A. Van Osdol, of Anderson; Randal Morgan, of Philadelphia, and Frederick Strauss, of New York.

The company has issued $5,000,000 of 5 per cent bonds dated July 1, 1899, due in 20 years.

RIGHT OF WAY OF MILL CREEK VALLEY ROAD.

The Mill Creek Street Railway Co., of Cincinnati, has recently been engaged in litigation with the village of Carthage concerning its right of way. The Court of Common Pleas some time since held that the street railway company had no rights in the village streets, the Circuit Court on July 1st reversed this decision and enjoined the residents in Mill Creek Valley from removing the tracks. The company began operating cars at midnight, July 1st, and will rebuild the tracks which had been torn up, and extend to Glendale

HALF FARES.

The City & Suburban Ry., Washington, D. C., has voluntarily increased the wages of its conductors and motormen from $1.60 to $2 per day.

The first electric car to be run in Portsmouth, N. H., made its trial trip on June 26th. The new road is about ready to be opened to the public.

Lightning struck an electric car on the East Avenue line in Kalamazoo, Mich., May 31st. Ten passengers were badly shocked but none were injured seriously.

Memorial Day tested to the utmost the capacity of the Syracuse (N. Y.) street car companies. It is estimated that between 60,000 and 80,000 people were carried.

The Oakland (Cal.) Transit Co. has gone back to the system of giving transfers for any day and all day, so that passengers can ride all over town for one fare.

The motorman of a car which unfortunately killed a man at Winfield, L. I., was arrested by the local police and locked up all night in the same cell with the remains of deceased.

The Musicians' Protective Association of Denver, is protesting wildly against the proposal of the Denver City Tramway Co. to hire a Chicago band to furnish music in the parks.

A Chicago justice decided in favor of the plaintiff a suit for 5 cents damages for breach of contract, brought against the Lake Street Elevated because a seat was not provided.

An annual picnic was held on June 30th by the street railway employees of Pittsburg, Pa., at Kennywood Park. A program was given which included all kind of sports and amusements.

July 1st the wages of the employes of the Rochester (N. Y.) Railway Co. were restored to the scale in vogue prior to March, 1896, when the hard times made a cut of 10 per cent necessary.

June 14th the Eighth street line of the Cincinnati Street Railway Co., was blocked for some hours by the falling of overhead wires; considerable damage was done to poles, light wires, lamps, etc.

The Collins Park & Belt Railroad Co., Atlanta, Ga., has asked for franchises for extensions which Pres. J. C. Simmons states will involve the outlay of $2,000,000, all of which has been secured.

The employes of the Chillicothe (O.) Electric Co., are to be regaled with free soda water during the hot weather. The company is having a fountain erected expressly for the use of the hot and dusty employes.

The rumor of a consolidation of the Metropolitan, the Third Avenue and the Manhattan Elevated roads of New York and the Brooklyn Rapid Transit is discredited in New York because there has been no reflection of any such deal in the stock market.

On Sunday, June 4th, the Knoxville (Tenn.) Traction Co. carried 24,600 passengers. This is the biggest day any street railway company in Knoxville has ever had and the public is giving Gen. Mgr. C. C. Howell credit for the great popularity of the system.

The breaking of an overhead trolley wire on the Jamaica Ave. line of the Brooklyn City Railway Co. caused a panic among the passengers, who commenced jumping from the car. In the rush to escape from the car five passengers were hurt by falling from the steps.

In return for furnishing it with free current for charging the accumulators for its police and fire departments, the city of Oshkosh has granted a franchise to the Citizens' Traction Co., of that place, to supply patrons with light, heat and power for a period of 35 years.

The Supreme Court of Ohio has affirmed a verdict rendered in favor of Lida M. Hunter against the Cleveland & Elyria Railroad Co. for $10,000 damages for the permanent injury of one leg, suffered in a collision of one of that company's electric cars with the plaintiff's buggy.

The quarterly report of the Brooklyn Union Elevated Railroad Co. for the three months ending Mar. 31, 1899, shows: Gross earnings, $511,764; operating expenses, $299,571; net earnings, 212,192; other income, $21,485; fixed charges, 104,912; net income, $107,495; corresponding quarter last year, $61,305.

The street railway lines of the Milwaukee Electric Railway & Light Co. have opened up a large territory for trolley excursions of which Milwaukee is the center. A universal system of transfers is in vogue within the city limits and the lines have been lately spread out to the surrounding suburbs north, south and west of the city.

The Washington (Ind.) Street Railway Co. opened its new park last month and a free entertainment was given by the Lyons Comedy Co. which attracted large crowds. A theater has been erected in the park with a large seating capacity, and free entertainments will be given during the summer on Tuesday, Thursday and Saturday evenings.

Three electric railway power plants are now in course of construction in New York City whose aggregate capacity will reach the enormous total of 200,000 h. p. The Metropolitan plant will have a capacity of 70,000 h. p., the Third Avenue will have 66,000 h. p. and that of the Manhattan Elevated, though not yet announced, will bring the figures up to about the total mentioned.

The city of Los Angeles, Cal., has less than 100 policemen and the Los Angeles Railway Co. has accordingly issued instructions to carry free only policemen who have badges with a number less than 100 and collect full fare from those having badges with a higher number. There are a number of persons wearing police badges who are not connected with that department.

It has been officially announced by Mr. George Gould, president of the Manhattan Elevated of New York City, that the corporation is well advanced in its plans for changing its motive power from steam to electricity. The system to be employed has not been decided upon further than the fact that it is to be a third rail system. A contract for 9,000 tons of rails for this purpose has already been closed.

The State Excise Board of Ohio, consisting of the attorney general, the state auditor and the state treasurer, have received returns from some of the street railways of the state, which show a large increase in receipts over the previous year. The Columbus Street Railway Co. showed gross earnings amounting to $706,000, an increase of $70,000 over the previous year, and the Cincinnati Street Ry. gross receipts of $2,300,000, nearly $300,000 more than last year.

A war is being waged in Camden, N. J., between the city council and the Camden & Suburban Ry. The trouble arose out of the company's attempt to lay a double track on Haddon Ave. in spite of the council's prohibition to do so unless the company paved Haddon Ave. from curb to curb. President Scull, of the railway company, contends that the company has the right to lay the tracks as the privilege was given three years ago to the West Jersey Traction Co., which has since consolidated with the present company. General Manager Harrington was arrested with a number of laborers on the work, and the question will be settled in the courts.

LATEST FROM DETROIT.

The street railways of Detroit issued orders to trainmen, July 13th, that on and after 6 a. m., July 14th, 3-cent fares were to be accepted.

Governor Pingree on July 13th issued the following proclamation:

"To the People of the City of Detroit: The fight for 3-cent fares which has been going on for ten years is substantially won. If the plans proposed by the Municipal railway are agreed to by the common council of this city, within ten days every citizen of Detroit can ride upon any street-car line by the payment of 3 cents, and at the same time receive a transfer good upon any other line. A person paying 3 cents upon a car of the Detroit railway can receive a transfer for any line of the Citizens' company or the Fort Wayne & Belle Isle railway, and the same will be true of any one purchasing a ticket upon any car of the Citizens' railway or of the Fort Wayne & Belle Isle railway.

"Unless the plan proposed in the working ordinance of the Municipal railway, which provides for a straight 3-cent fare, is carried out, there will be no hope for the people of Detroit to secure the 3-cent rate at any time within the next ten or fifteen years, and perhaps at no time in the future. The opposition to this plan does not come from the tens of thousands of workingmen and workingwomen, who cannot afford to ride in carriages, and many of them who cannot afford to purchase bicycles, but it comes from those who are well able to pay any price that may be demanded by the street-railway trust of the United States, which is closing its grasp upon all of the large cities of the country and hopes to secure Detroit as one of its milking grounds.

"The opposition further comes from a so-called committee of citizens who have raised a large sum of money to retain lawyers to rummage through musty records and ancient charters to see if some excuse can be given for preventing the people from having that which by right and honesty and good government they are entitled to.

"The opposition further comes from scheming and selfish politicians, who hope by delay and childish excuses to deceive the people and postpone the payment of 3-cent fares until a few more elections, to the end that the issue may be kept alive and they may fatten upon it, instead of having it settled and buried, in order that new issues and new plans for the advancement and progress of the city may be undertaken.

"You have stood with me in all these fights, and if you continue to stand with me, and not be deceived by the tongue of slander and the hypocritical claims of pretended reformers, who have slept while you have been fighting, and who expect to fight while you are sleeping, we will win a victory that will make our beloved city famous throughout the world.

"My object in issuing this circular is to call your attention to the conspiracy which has been formed against you and to warn you that the ancient enemy that has followed your tracks and mine in years past has received new life and new blood, has purchased new daggers and armed itself with new bludgeons, in order that the act of assassination may be performed with keener thrust and with stronger blow.

"HAZEN S. PINGREE."

Those who enjoy remarking coincidences in dates will not fail to observe that the Bastille fell on July 14th.

The New Haven Car Register Co. has just closed a contract with the Third Avenue road, of New York, for several hundred registers; it also recently equipped the St. Joseph, Mo., road with registers.

The Simonds Manufacturing Co., Pittsburg, has patented and built a new device for making wire fence. Several of these machines are now in operation in connection with the regular business, turning out three-quarters of a mile of wire fence per day. This fence is especially adapted for the use of street railway companies for fencing right-of-ways and suburban roads. This company is the well-known gear and pinion maker of Pittsburg and has made extended improvements the past year. It has added a new patent department and increased the capacity one-third. It is now building a Bryan car dismounting machine which will take cars from the trucks and replace the motor in 22 minutes. A new gear cutting machine and a wheel truing machine have also been added. The company reports a shop full of orders.

MISSOURI STREET RAILWAY LAW.

A revision of the street railway laws of Missouri was passed by the legislature recently adjourned, the act being approved by the governor on June 19, 1899. This law, which takes effect at once may be briefly summarized as follows: Sec. 1 permits existing railroads which have acquired routes to lay their track notwithstanding the line may be within three streets of an existing road and Sec. 2 repeals the St. Louis street railroad act of 1860 in so far as it is inconsistent with this. Sec. 3 is the same as Sec. 1 but applies to cable roads. Sec 4 is similar to Sec. 2.

Sec. 5 authorizes the carrying of mails but not so as to impede or delay passengers and Sec. 6 requires trolley wires to be 22 ft. high and to be protected with guard wires. Sec. 7 requires a full stop of cars 20 ft. from a railroad crossing. Sec. 8 refers to bridges connecting Missouri with another state and Sec. 9 provides for the conditional sale of railroad property and retention of a lien by the seller until payment is complete. Sec. 10 requires such sales, etc., to be recorded by the Secretary of State, and Sec. 11 provides such contracts already existing may be recorded. Sec. 12 repeals previous laws as applying to these contracts.

Sec. 13 provides that five or more persons may form a street railway company, and Sec. 14 relates to the manner of securing right of way, the rates of fare, and acquiring or disposing of railway property. Sec. 15 makes Sec. 14 applicable to existing companies. Sec. 16 allows increase of capital stock or bonds by majority vote of stockholders and Sec. 17 allows issue of preferred stock by majority vote of stockholders.

In accordance with this law five street railways controlled by the Brown Bros. syndicate of New York have filed notices of increase of capital stock preparatory to their consolidation. These roads are the Lindell, the Union Depot, the Grand Avenue, the Central Traction and the St. Louis Traction.

The Lindell's capitalization is to be increased from $2,400,000 in stocks and $3,000,000 in bonds to $10,000,000 in stocks and $10,000,000 in bonds. This includes the Missouri system.

The Union Depot capitalization is now $4,000,000 in stock and $3,627,000 in bonds. It is to be increased to $10,000,000 in stock and $10,000,000 in bonds.

The capitalization of the Grand Avenue Railway Co. is now $500,000. It is to be increased to $10,000,000 in stock and $10,000,000 in bonds.

The capitalization of the Central Traction Co. is now $3,000,000. It is to be increased to $10,000,000 in stocks and $10,000,000 in bonds.

The capitalization of the St. Louis Traction Co. operating the Fourth St. cable line is $2,000. It is to be increased to $2,000,000 in stock and $2,000,000 in bonds.

STRIKE RIOTS IN LONDON, ONT.

The strike of the street railway employes in London, Ont., culminated in rioting on July 8th. The men having charge of the cars were stoned and forced to take their cars to the barn or abandon them. Several cars were derailed and almost completely wrecked. Finally the mayor read the riot act and called on the regular troops to disperse the mobs.

The company has long been anxious to come to a settlement with its former employes, but the men refuse to make public their grievances.

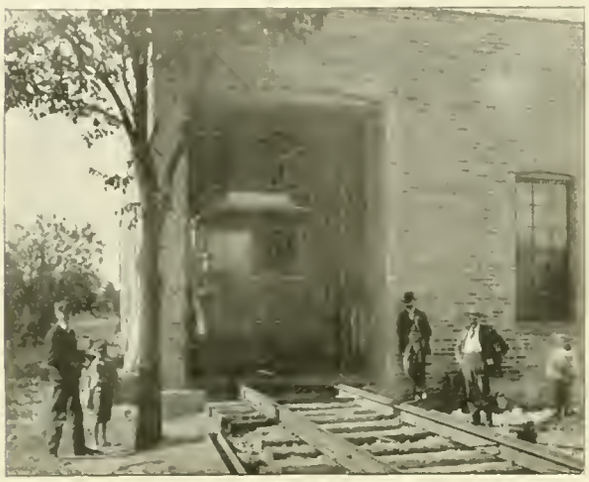
Hayes & Arthur, street railway supply agents of Cleveland, O., have moved to larger quarters in the Cuyahoga Building; they are extending their field, and are now carrying one of the most complete line of street railway supplies in the country. They report a very prosperous season.

The horse cars on the 28th and 29th St. crosstown line of the Metropolitan Street Railway Co., of New York, have been permanently retired and the compressed air cars which have been in experimental service for some time will be regularly introduced. These cars have been awaiting the completion of the compressed air plant at the West 23d St. car barn, which is said to be the largest in the country and which has been built at a cost of $500,000. Fourteen of these cars will be in regular service and six will be held in reserve for occasional trips over connecting routes.

HARVEY CHARGING STATION OF CHICAGO ELECTRIC TRACTION CO.

In the "Review" for May, page 333, was a brief description of the improvements the Chicago Traction Co. was then making. It was expected that the charging station at Harvey (158th St.) would be in operation by June 1st, but because of delays from various causes it was not completed until later and has been in regular operation since July 5th.

The accompanying illustrations show the exterior of the building,



EXTERIOR OF STATION.

the engine, and the basement with its elevator and trucks. The building is of brick, 26 x 70 ft., and divided longitudinally by a board partition having a space 10 ft. 6 in. wide for the car track. The other portion of the building is divided by a cross partition, one room containing the engine and generator, and the other the station battery. The engine is a 50-h. p. Nash gas engine and is belted to a 40-kw. Eddy generator. The generator, the station battery, the charging mains, and the electric elevator for shifting the car batteries are all connected in multiple and thrown in and out ac-

VIEW IN BASEMENT.

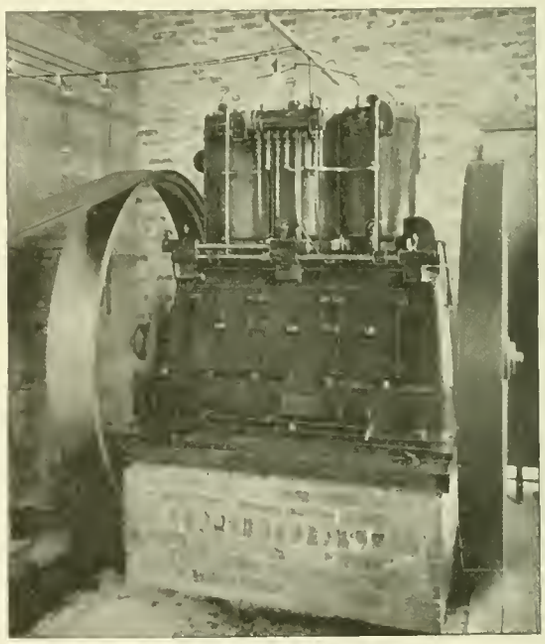
cording to the state of the several batteries as reflected in the station instruments.

The instruments comprise three Weston ammeters and one Weston voltmeter and, together with the necessary switches, are mounted on the partition between the engine room and battery room. The engine is run from 5 a. m. till 12:30 a. m. each day, and is reported as giving the best of satisfaction. There are 95 cells in the station battery; only 81 are used at one time, however.

In the basement, immediately under the car track overhead, is laid a track of light T-rails, 19-in. gage, on which two 4-wheeled cars run. Terminals for charging the car batteries are at either end of this track and in the center is a Sprague electric sidewalk elevator driven by a 30-h. p. motor. When a car reaches this terminus of the road it is stopped over the elevator, which, with one of the small cars upon it, is run up; having received the battery, the elevator is lowered and the small car pushed over to the charging terminals by hand. The track and trucks for handling the batteries in the basement are of the Hunt industrial railway type.

The Nash gas engine, which is made by the National Meter Co., of 84 and 86 Chambers St., New York, has proved that it can meet all the requirements of electric lighting service and numerous direct connected units have been installed for such work. For charging storage batteries or for electric power plants, the company builds a special three-cylinder engine. A 45-h. p. engine similar to the one illustrated but direct connected has been in use since September, 1898 by th Penobscot Central Railway Co., Bangor, Me. As experience in these plants shows that the gas engines are satisfactory, the company expects to install its engines in a number of similar ones at an early date.

The economy of the Nash engine is shown by efficiency tests made at the Stevens Institute of Technology in 1897. A 20-h. p. unit was used for generating electricity for a lighting circuit and the



50-H. P. NASH GAS ENGINE.

candle power of the electric lights was stated to be from 14 per cent to 121 per cent (depending on the age of the lamp) greater than the candle power of the gas used, had it been burned in an ordinary flat flame gas burner instead of the engine.

The engine in the Harvey station uses gasoline, the gasoline tank being in a small wooden building in the rear of the station. The engine here was installed by Mr. W. H. Patton, of the National Meter Co., and he has been in charge of the plant temporarily.

FATAL ACCIDENT AT PITTSBURG.

As the result of a street car collision on July 2d at Pittsburg, 2 people were killed, 5 were seriously injured and 10 more or less hurt. The accident happened on a steep grade near High Bridge, while the two cars in collision, which were heavily loaded with passengers, were returning from Kennywood Park.

There have been persistent rumors that a strike was imminent on the Brooklyn lines, but the opinion prevails that they are circulated with the object of affecting the Brooklyn traction stocks on the stock exchange.

DERAILED ON A CURVE.

A car of the United Railways & Electric Co., of Baltimore, Md., was derailed at the Baltimore & Ohio Bridge near Fort McHenry, on June 29th, causing slight injuries to 14 passengers. In front of the railroad bridge on Fort Ave. is a hill at the top of which the tracks spread slightly before entering the bridge. As the loaded car went up the hill it rocked considerably and as it struck the curve it jumped the track, crossing a space of about 20 ft. and striking a heavy iron girder of the bridge. The girder was bent and twisted and the front platform of the car and all the glass completely demolished. Traffic on the line was delayed an hour while the debris was being removed.

RAILWAY RIOT AT WAUKESHA.

On the morning of July 1st the town of Waukesha, Wis., awoke to an exciting battle between the citizens of the town and a construction crew of the Milwaukee Electric Ry. who were attempting to lay a double line of tracks on Broadway at 5:30 a. m. At this hour the vigorous ringing of the fire bells aroused the town and soon a large crowd congregated where the men were laying the double track which the city had enjoined them from putting down. At about 4:30 in the morning an injunction had been served upon the aldermen and city officials restraining them from interfering with the work of the railway company, but no injunction was served upon the chief of the fire department or upon any of the volunteer members, and when the alarm was rung they turned in and scattered the workmen with streams of cold water. One of the workmen was chased several blocks by a crowd with sticks and stones and three of his assailants were arrested. The general opinion is that the railway company will be eventually successful, but there is considerable disposition to fight shown among the crowd.

WASHOUTS ON STREET RAILWAY LINE.

A bad washout occurred on the line of the East Liverpool (O.) Street Railway Co. at Ralston's crossing, where a trestle formerly stood. On the evening of June 28th the motorman of an approaching car was told by a little boy that the ground was slipping out from under the culvert, and just as he stopped his car at this point about 40 ft. of earth slipped out from under the car and fell into the river. By morning a chasm was formed under the tracks fully 50 ft. wide and 40 ft. deep. The passengers were transferred to the opposite side of the chasm to other cars by walking across the tracks, which were suspended in midair.

Several other slips occurred along the line between East Liverpool and Wellsville. Gravel to the depth of 4 ft. was washed down upon the tracks for a distance of 70 ft. in one place, and before this could be cleared away another large quantity of gravel and dirt came down the hill again, burying the track.

The flood which caused these washouts also left the trestle at Wellsville in a very bad condition, as the trees and logs crushing against the structure threw it about 6 in. out of plumb near its center.

PERTH TRAMWAYS, WESTERN AUSTRALIA.

Messrs. J. G. White & Co., who as previously announced in the "Review" have the contract for designing and supervising the construction of the complete steam and electrical plant of the Perth Tramways, Ltd., Perth, Western Australia, have sent us data concerning the equipment to be installed there.

In the power house will be two 250-h. p. Babcock & Wilcox boilers with wrought headers; two 325-h. p. tandem compound engines built by the Robb Engineering Co., of Amherst, N. S.; two outside-packed single cylinders, double plunger, feed pumps, each capable of feeding the two boilers; two 225-kw. General Electric railway generators direct connected to the engines.

All fittings in high pressure steam piping are made of gun iron; all joints of piping are Van Stone joints. Each boiler is equipped with a No. 12½ Hayden & Derby double tube lifting injector. All valves in steam piping are Chapman's make. All piping will be covered with H. W. Johns fire-felt covering.

The steel roof trusses and purlins for car barn, were furnished by E. B. Gunnaer, of Jersey City, and the corrugated roof covering was furnished by the McCullough Iron Co., of Wilmington, Del.

The cars were made by the J. G. Brill Co., and were described and illustrated in the "Review" for May, page 356.

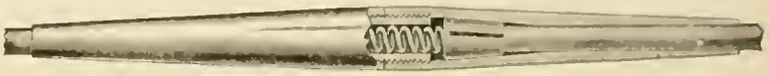
Two miles of the track are laid with 9 in. girder rails, made by the Pennsylvania Steel Co.; the T-rails for the rest of the track were imported from Belgium. The special work is of the hard center construction made by Wm. Wharton, Jr., & Co.

TROLLEY WIRE SPLICER.

Electric railways are not built in a day; however, the element of time is a great consideration and labor saving and quickly applied devices are given first recognition. An article to have high commercial utility in this rapid transit era must be as nearly automatic in action as possible, simple in design, complete in details and offered at an attractive price.

This combination is claimed for the Wood trolley wire splicer, illustrated herewith.

It is made of seamless drawn tubing, divided into two pieces of equal length with a proper tapering towards each outside end to prevent all jarring, and consequent sparking, of the passing trolley wheel. The tubing is amply threaded on joint ends for use with the brass center piece which holds the two splicer pieces firmly together. These splicer pieces are drawn with hole for the trolley



WOOD'S TROLLEY WIRE SPLICER.

wire, but towards the joint ends a tapering chamber is supplied to hold the steel cap, or thimble, which also is regularly narrowed down to automatically clamp itself when drawn outwards by the trolley wire, this reduction in diameter being permitted by slotting the steel cap for seven-eights of its length. The interior of the cap is well corrugated, and firmly engages the trolley wire ends the instant of insertion, and through the taper of cap and chamber, make it impossible to withdraw wires without first removing the steel cap. The electrical conductivity of the splicer is perfect, while the tensile strength is much in excess of the trolley wire.

Wood's trolley wire splicers are made for Nos. 0 and 00 trolley wires. They also are made with center for suspension from ½ and ⅝-in. hanger studs. This splicer is part of the large line of electric railway material made by the Central Union Brass Co., St. Louis. The Central Electric Co., Chicago, is selling agent and maintains an excellent stock.

THE FIRST ANNIVERSARY.

It is just a year since the Chicago, Milwaukee & St. Paul road inaugurated its celebrated Pioneer Limited passenger train service between Chicago, Milwaukee, St. Paul and Minneapolis. This service marked a new era in the railway world in the line of passenger accommodations. At a cost of a quarter of a million dollars that progressive company furnished the traveling public, in its Pioneer Limited train, comforts and facilities the best ever produced. This train has been described many times in newspapers and magazines, but should be seen and examined to be appreciated. In beauty of finish, richness and elegance of furnishing nothing equal to it has ever been attempted by any other road. The car builders were nearly a year in completing the Pioneer Limited trains (there are two—one leaving Chicago for the West and the other leaving the Twin Cities for the East every evening in the year) and they stand today a monument to the builder's art. No regular passenger train service in America is as well known as the Pioneer Limited. From the standpoint of passenger traffic the past twelve months have been the most successful in the history of the St. Paul road, made so very largely by the Pioneer Limited. The patronage of this service is a striking illustration of the fact that the public appreciates a good thing.

The Terre Haute (Ind.) Electric Co., which bought the street railway in that city, has increased wages from 14 cents to 15 cents per hour.

ECHOES FROM THE TRADE

THE JOSEPH DIXON CRUCIBLE CO. again enlightens the public on the history of graphite and lead pencils in "Graphite" for July, Vol. 1, No. 8.

THE WAGENHALS MANUFACTURING CO., Cincinnati, O., has just filled an order from the Cape Town (S. A.) Tramways for two of its slow feed controller handles.

J. G. WHITE & CO. have been appointed consulting engineers for the Elizabeth Street Railway Co. and the Elizabeth City Horse Railroad Co. The work to be done includes about eight miles of track and overhead work together with cars, trucks and equipments.

THE CREAGHEAD ENGINEERING CO., Cincinnati, is building the overhead work for the Dayton (O.), Springfield & Urbana Electric Ry., about 25 miles, and for the Dayton (O.) & Xenia Traction Co., about 20 miles; it also has several other important contracts in hand.

THE GARTON-DANIELS ELECTRIC CO., of Keokuk, Ia., has, since Jan. 1, 1899 shipped its lighting arresters into every state in the Union and also made over 50 shipments abroad. The company advises us that the sales of these devices for the first half of 1899 equal the sales of any preceding year.

THE ST. LOUIS CAR CO. has received an order from the Chicago City Ry. for 60 vestibuled closed cars exactly similar to those recently built for that road by the Stephenson Co. The cars are to be mounted on Moore trucks, which the St. Louis Car Co. will build, the Chicago City furnishing the castings.

THE CENTRAL ELECTRIC CO., Chicago, carries a large line of the favorably-known "Bound Brook" graphite bushings which are reported as being most highly recommended by all railway men who have used them. A bushing is a bearing, and just as friction in the bearings is reduced the earnings are increased.

THE H. W. JOHNS MANUFACTURING CO. has placed its western business in charge of the Manville Covering Co., 173 Randolph St., Chicago, and H. A. Reeves, who has so long represented the Johns company, has sole charge of the railway department. Mr. Reeves is prepared to fill orders promptly from the Chicago stock.

THE BROWNELL CAR CO., St. Louis, has nearly completed an order of 20 cars for the Metropolitan of Kansas City, and has just received a second order from the same company for 50 more. The many friends of Mr. Brownell will be greatly pleased to learn that he is steadily bringing the company's affairs into good condition.

THE CONSOLIDATED TRACTION CO., of Pittsburg, Pa., has recently received 40 new summer cars, 20 of which are used on the Manchester Division and the remainder on the Second Ave. Division. These cars were built at the Laclede works at St. Louis, are 36 ft. in length, and are equipped with storm protectors of the latest design.

THE BULLOCK ELECTRIC MANUFACTURING CO., of Cincinnati, has sent out a handsome card calendar for July with the great days of last July marked in a conspicuous manner and in the border a list of the regiments participating in the battles of San Juan Hill, El Caney and Santiago, and the warships most prominent in the naval fight of July 3d.

THE ELECTRIC STORAGE BATTERY CO., of Philadelphia, on June 14th secured an interlocutory order of injunction against the Quincy & Boston Street Ry. requiring it to refrain from using the Hatch storage battery installed at its South Braintree power house from and after August 1st. It is claimed the Hatch battery infringes Brush patents held by the plaintiff company.

THE PITTSBURG OIL CO., 133-5 W. Harrison St., Chicago, is the maker of "Imperial" boiler compounds and greases and "Premium Franklin" lubricating oils. The motor greases are highly recommended for either summer or winter use and its lubricating oils are well and favorably known. The "Imperial" boiler compound is prepared either as a liquid or as a powder, to suit customers.

MESSRS. SALCEDO & CO., of Gomez Palacio, Mexico, advise us that they are going to build an electric railway between Lerdo, in the state of Durango, and Torreon, in the state of Coahuila, a distance of about 10 miles, and request that the makers of electrical railway equipment will send them catalogs. They would also like to enter into correspondence with engineers who can advise them as to all details.

A. L. IDE & SONS, of Springfield, Ill., makers of the well-known "Ideal" engine, have recently issued a handsomely illustrated catalog of their automatic cut-off engines and special appliances. Among the latter are throttle valves, steam separators, reducing motions, power transmitters and belt tighteners. In addition the catalog contains descriptions of some of the principal details, methods of lubrication, etc.

THE CHARLES MUNSON BELTING CO., of Chicago, which was recently organized, announces that it is now in a position to supply all its patrons with the best belting in the market. For 33 years the Munson belting has had a very high reputation among American makers and the company assures the trade that the same careful workmanship and high grade of leather will always be found in its goods.

THE BETHLEHEM STEEL CO. on June 26th formally took over all the property, etc., of the Bethlehem Iron Co. under a lease. The officers of the Bethlehem Steel Co. are: Robert P. Linderman, president; Edward M. McIlvain, vice-president; Abraham S. Schropp, secretary; C. O. Brunner, treasurer; R. W. Davenport, general superintendent; Owen F. Leibert, chief engineer; Charles P. Coleman, purchasing agent.

WILSON & CO. will be the name of the new concern succeeding to the business of Wilson, Thomson & Co., the members of the latter firm having dissolved partnership by mutual consent, Mr. Thomson retiring. All obligations of the old firm have been assumed by Wilson & Co. This company makes the Wilson patent trolley pole catcher, and is sole agent for the United States and Canada for the Frank Ridlow Co., of Boston.

THE STAR LUBRICATING OIL CO., of Cleveland, O., is the maker of high grade lubricants for all purposes, including oils, gear, curve and motor greases and belt dressings. Besides lubricants, the company handles the "Excelsior" boiler compounds and has had great success in this line. The compounds are prepared after making an analysis of the boiler water used; this analysis is made without extra charge. The company will send samples free on application.

THE FALK CO., of Milwaukee, as announced in our June issue, last month suffered the loss of its blacksmith and special work shops by fire. The company was at that time building extensive additions to its plant and will be in position to care for all orders promptly. The new buildings now in course of erection on an eight-acre lot near the old plant comprise a machine shop 100 x 200 ft., a foundry 100 x 200 ft., a power house 40 x 60 ft. and an office building 40 x 60 ft.

THE WESTERN ELECTRIC CO., Chicago, has recently issued two new circulars; Bulletin No. 104 describes the "S. K. C." alternating current lightning arrester, and Bulletin No. 7002 is descriptive of arc lamps and their manufacture. Among late orders and contracts taken by the company are for the equipment of the building of Fortune Bros., 225 Des Plaines St., Chicago; for wiring 5,000 lights in the Williamson Bldg., Chicago; two 100-light W. E. arc machines and 220 W. E. open arc lamps for the city of Winnipeg, Manitoba.

THE JOYCE-CRIDLAND CO., the well-known maker of jacks of Dayton, O., reports a very good trade among the street railways. This company makes a specialty of jacks suitable for railway work both in car houses and on the track. It claims that its No. 176 jack for track work has many advantages over others on the market. This jack has a rise of ¼ in. for each stroke of the lever; the capacity is 5 tons. A special feature is that the lifting toe is at right angles to the lever so that when placed under a rail the lever lies lengthwise of the track instead of crosswise of it.

THE MILLER-KNOBLOCK CO., of South Bend, Ind., has recently completed a sprinkling car for the St. Charles Railroad Co., of New Orleans, in which city there is an ordinance requiring the street car companies to sprinkle the streets through which their cars run. This sprinkler is of the latest improved type built by the Miller-Knoblock Co. and it will carry 2,500 gallons of water. It will also sprinkle from either end of the car, or, if desired, from both ends at once. The railway company announces that the new sprinkler will be put into operation immediately upon its arrival in the city.

THE NORTHERN PACIFIC RY. has recently completed a new branch line from Spokane to Lewiston, the chief city of northern Idaho, situated at the junction of the Snake and Clearwater Rivers. From this point the Northern Pacific is rapidly building two other branches directly into the heart of the agricultural and mining districts. This section is known as the Buffalo Hump country, which has been recently found to be very rich in mineral and agricultural products, and the Northern Pacific has just published an interesting folder describing the Hump mining regions to which their new extensions are the only railway connections.

ELMER P. MORRIS, 15 Cortlandt St., New York, advises us that Henry L. Prather, New England Bldg., Cleveland, and the Miller Electrical Maintenance Co., Pittsburg, have been appointed agents for his material. The first of the new one-piece Morris bonds were turned out the first week in July. Business is reported as very good in wire, iron poles, brackets, car wheels, etc., shipments having been made to Genoa, Italy; England, Africa, Cuba, South America and Trinidad during June. On July 10th all the business assets and liabilities of Mr. Morris were transferred to the Morris Electric Co., of which Mr. Morris is treasurer.

THE WESTERN ELECTRICAL SUPPLY CO., of St. Louis, states that its street railway department has been doing a most gratifying business. It is especially pleased with the excellent sales of the Kalamazoo trolley wheel, for which it is general agent. It has sold this wheel to nearly all the roads throughout the South and West and has yet to find where it has not given most satisfactory service and done all that was claimed. This wheel has in every instance been most heartily endorsed by the superintendents and master mechanics of roads that have used it, and the company thinks it has in this wheel the best thing of the kind on the market.

THE MICA INSULATOR CO., of New York, Chicago and London, reports a very heavy increase in the volume of business during the last two months. The company's insulating materials, "Micanite" plates, segments, rings, etc., "Empire" insulating cloths and papers, and M. I. C. compound, are being used very extensively by the leading builders of electrical machinery throughout the United States and Europe, and "Micanite" segments are now in use by nearly all the large builders of generators and motors. Parties having had no experience in the use of "Micanite" will do

well to correspond direct with the company at New York, Chicago or London.

THE DORNER TRUCK & MANUFACTURING CO. advises us that it has closed a contract with the Logansport Commercial & Manufacturing Association by which the latter will erect for it a large foundry and machine and truck shop at Logansport, Ind. The Dorner company will also receive a cash bonus to locate in Logansport. Chicago capital has been interested and the company will soon be in position to carry on the foundry and truck business on a large scale. The company's office and warehouse will be continued at the corner of Mason and Belden Sts., Cleveland, and it will also have offices in Chicago and New York. There are numerous orders on hand and as the merits of the company's trucks are being recognized by managers, new orders are being taken.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING CO. has received an order from the Sioux City (Ia.) Traction Co. for a new generator of 550 h. p., "engine type," 550 volts; it will be direct connected to a steam engine running at 90 r. p. m. This generator will work in multiple with the other machines already installed and will serve to greatly increase the efficiency of the system. Since the recent consolidation of the street railways the service has been much improved; the Sioux City Traction Co. has found it advisable to add a number of new cars and has bought several Westinghouse quadruple equipments of 125 h. p. each. These motors will be attached to each one of the axles so that the cars will have 100 h. p. which will enable them to maintain their speed on the steeper grades.

WESTINGHOUSE, CHURCH, KERR & CO., Chicago, are making an important addition to the electrical power house of the Detroit & Pontiac Railway Co. This contract was received after inspection of the railroad recently equipped for the Detroit, Ypsilanti & Ann Arbor Railway Co. by Westinghouse, Church, Kerr & Co. and so successfully operated. They are erecting 500-h. p water tube boilers, furnished with Roney mechanical stokers. In place of the horizontal engines which have been in use for sometime, the plant, when remodeled, will include two Westinghouse steam engines of 400 h. p. each. A number of new cars will be added, each of them driven by Westinghouse electric motors. The operation of the Detroit, Ypsilanti & Ann Arbor has been so highly satisfactory in every respect, that the directors of the Detroit & Pontiac desire to have, as near as possible, a fac simile.

THE CHISHOLM & MOORE MANUFACTURING CO., of Cleveland, O., has recently acquired the business of the Rail Joint & Manufacturing Co., which name will be abandoned and the joint will be known as the American Standard Rail Joint in the future. This company is one of the largest manufacturers of chain hoists and cranes in the United States, and has an extensive factory in Cleveland. In addition to its already very large works, it is now building a malleable iron works, 100 x 318 ft., a building for the annealing and shipping department 60 x 190 ft. and a machine shop 60 x 180 ft. The company has increased its capital stock from $100,000 to $300,000. The business of the American Rail Joint Co. has increased steadily, and had become so large that it necessitated it owning works. Col. W. E. Ludlow, the well-known manager of the American Rail Joint Co., will continue to act as manager for this department for the company.

THE FAMOUS FILTER CO., of 314 N. Main St., St. Louis, has during the past month made 28 sales of its well-known "Famous" waste oil refiner and purifier. Among the purchasers were: Tiffin (O.), Fostoria & Eastern Electric Ry.; St. Louis & Belleville Electric Ry.; St. Louis, Belleville & Suburban Ry.; Ripley (Tenn.) Electric Light Co.; Lebanon (Ill.) Electric Light Co.; the Merchant Mills, Mobile, Ala.; Newbern (Tenn.) Electric Light Co.; Berlinger & Son, New York City. Berlinger & Son got 1 No. 5, 3 No. 6 and 12 No. 7 filters. The "Famous" was described and illustrated in the "Review" for March, page 187; those interested in the subject may obtain detailed information concerning the experience of those who have used the apparatus by addressing the company and asking for a copy of "Advanced Modern Engineering Practice." The company will also send free to street railway power plants a limited number of clean oil testing outfits.

THE CREAGHEAD ENGINEERING CO., of Cincinnati, O., has just issued its Catalog No. 15, which comprises 90 pages, profusely illustrated, descriptive of railway line material. The design of this company's material is the result of experience in the building of railways and the devices made by it have been thoroughly tested and approved by many of the best railway engineers and superintendents. As far as is consistent with good practice the devices are made light in weight; they are carefully designed to place the material where needed and to present a neat and pleasing appearance. Convenience in attachment and repair is a point the company has always kept in mind and this has often secured the preference over goods in which cheapness of manufacture seemed to be the principal object sought. New designs are placed on the market from time to time, and the company is always pleased to receive suggestions along this line. Copies of this catalog may be had on application to the company.

THE UNION BOILER TUBE CLEANER CO., of 262 Penn Ave., Pittsburg, was organized in 1895 for the purpose of engaging in an entirely new business, that of removing the scale from the interior of the tubes of water tube boilers, and it is said to be at the present time the only concern making a special business of such work. The company has its specially designed machinery, which was briefly described in the "Review" for June, page 382; and is able to make contracts for cleaning all types of water tube boilers under heavy penalty for non-fulfillment. The company also sells and leases its apparatus, which is protected by patents both here and abroad. The users of boilers have fully appreciated the value of the company's devices and the resulting demand has compelled frequent enlargements of the manufacturing plant, since it started in May, 1895; quite recently the working force has been more than doubled in an attempt to keep up with orders. The flexible shaft used for boilers having curved tubes was designed by this company, other flexible shafts having proved unable to withstand the wear and tear.

THE B. F. STURTEVANT CO. presents an example of how the development of a large business leads to the manufacture of certain types of machines. Beginning back in the early 60's to make fan blowers, the necessity of building attached engines became more and more apparent as the demand for large, independently driven fans increased. During the 70's the "steam fan" thus became an important product, and from the building of vertical engines it was but a step to the design of the horizontal type for driving large fans. The work was continuous and exacting, demanding the utmost care in design and construction. With the advent of electricity as a motive power, the Sturtevant Co. immediately began the design and manufacture of its own motors for direct attachment to its fans, so that the electric fan now stands as a rival of the steam fan. Having thus become manufacturers both of high speed engines and of electric motors, it was but another step, and a natural one, to the union of these two elements, the latter in the form of a dynamo, and the production of a high grade generating set. With an exceptionally complete line of small and medium sized engines in various types, and an equally extensive equipment of dynamo patterns, it is thus possible to make up almost any desired combination. Thus has this company become not only manufacturers of fans, but also of engines, motors and dynamos and their combined resultants, electric generating sets. The company has just issued a pamphlet entitled "2,500 Witnesses," which is a handsome bit of typographical work. It is a list of buildings and steamships where the Sturtevant system of apparatus is installed for ventilating and heating.

NEW PUBLICATIONS.

DERRAH'S STREET RAILWAY GUIDE for Eastern Massachusetts and Rhode Island has reached its fourth edition which has just been issued and contains a number of features not to be found in the previous editions. The book contains a fine map of all the street railway lines in eastern Massachusetts, southern New Hampshire and eastern Rhode Island, all of which country is covered by a network of more than 1,500 miles of electric railway, all of which is in direct connection with the city of Boston. The Guide contains handsomely illustrated descriptions of a number of trolley rides on various lines, also special features such as night cars in Boston, route and rates of fare, distances, running time, time-tables, and in fact full information for reaching every point on the electric line radiating from Boston. Mr. Robert H. Derrah, by whom the work is compiled, has made a study of these lines for many years and is in the street railway excursion business at 113 Devonshire St., Boston. The Guide bears the official endorsement of the Massachusetts Street Railway Association.

THE UNIVERSITY OF MINNESOTA has issued a new Bulletin giving a general statement of the university courses, the requirements for admission, the courses of instruction, etc. The college of engineering is treated in a supplement published with the Bulletin. The University considers it desirable that engineering students taking the technical courses should have a more liberal education than can be obtained in a four years' course. This has led to the establishment of a five years' course in science and technology in which the usual course is supplemented by more English and general culture studies.

AMERICAN STREET RAILWAY INVESTMENTS for 1899, better known perhaps as the "Red Book," has lately been issued from the press. This manual of the street railway properties of the United States and Canada is the oldest, largest and most complete of the financial publications treating exclusively of street railways and by reason of accuracy of its data has become a recognized authority among investors.

The present edition contains 300 pages of solid brevier matter, each page 13½ x 10½ in. It includes reports of about 1,400 companies, giving in each case the history of organization, exact financial description of securities issued, four and five years comparisons of receipts, expenditures, assets, liabilities, etc., description of the plant and equipment, names of officers and references to detailed descriptions of the properties which have from time to time appeared in the Street Railway Journal to which the Red Book is a supplement. The comparison of assets and liabilities is a new feature; another new feature is that of giving the names of brokers handling the securities of the principal companies. The present edition contains 34 maps of important properties.

Published by the Street Railway Publishing Co., 120 Liberty St., New York. Price, $5.00.

DUNCAN'S MANUAL OF TRAMWAYS, OMNIBUSES AND ELECTRIC RAILWAYS, published by T. J. Whitney & Sons, Ltd., of London, has now reached its twenty-second edition which has just been published for the year 1899. This work contains the financial reports and statistics of the tramway and omnibus companies of the United Kingdom and all of the colonial and foreign companies that are registered in English, also giving the dates of their incorporation, and, where fixed and ascertainable, the dates at which their leases or concessions terminate. The present edition contains 428 pages which are divided into the following complete sections, viz.: Metropolitan, Provincial, Scotch, Irish, municipal and foreign lines, each section being arranged in alphabetical order. This edition also contains the fullest information possible to be obtained of the tramway lines owned by municipal authorities.

The work gives the names of the directors and officers of each company, the company's main offices, its capital account and reserve fund and, where sufficient data are given, an analysis of its revenue account. The accounts are all brought down to the year ending Dec. 31, 1898, showing the exact financial status of each of the companies. A comparison is also given of the accounts for the half-year ending June 30, 1898, with those of the half year ending Dec. 31, 1898.

The work contains a complete index in which the tramway lines are alphabetically arranged under each of the different sections given above.

The book is bound in cloth. Price 3s. 6d.

THE ENGINEERS' YEAR BOOK for 1899 has come to hand. This is the publication issued by the Society of Engineers of the University of Wisconsin, and the present issue is Vol. VII. The contents comprise: "Methods of Transmitting Intelligence," by Prof. Geo. D. Shepardson; "The Strength of Gear Teeth," by J. T. Flather; "A Rotary Converter," by Geo. F. Adams; "Theory of Flexture of a Circular Plate or Ring, Loaded Symmetrically About Its Center," by H. T. Eddy; "Western Practice for Determination of the True Meridian," by C. E. Van Barneweld; "Inspection of Erection of Steel Bridges," by G. A. Cassidy; "Some Gold in Peru," by Geo. A. Pratt; "Laboratory Work in the Electrical Engineering Course at the University of Wisconsin," by Frank W. Springer; "The 'Boston & Montana' System of Surveying," by P. B. McIntosh; "Engineering and Finance," by Morgan Brooks; "Water Works for Small Cities and Towns," by C. F. Loweth. Price, 50 cents per number; post paid, 60 cents.

NEW TERRE HAUTE CO.

The property of the Terre Haute Electric Railway Co. was last month sold to Lee Higginson & Co. and Stone & Webster, of Boston, and a new company has been organized to operate the business. The new company is known as the Terre Haute Electric Co., the directors are W. R. McKeen, Demas Deming, J. G. McNutt, John E. Lamb and John T. Beasley, all of Terre Haute. Guy E. Tripp is general manager and M. F. Burke, superintendent.

OMNIBUS AND TRAM SERVICE IN PARIS.

In answer to a Chicago correspondent Consul-General Gowdy at Paris has secured data concerning the omnibus and tram service in that city which were published in the U. S. Consular Reports. There are three tramway lines serving Paris and the suburbs and omnibuses are generally used in the city; the Compagnie Generale des Omnibus owns one of these lines and practically controls the other two. This company's concession expires in 1910.

The passengers carried in 1896 were as follows:

33 lines of omnibuses (26 to 30 places).....	50,030,034
14 lines of omnibuses (40 places)	79,349,631
3 lines of steam tramways	12,862,990
23 lines of horse tramways.....	87,092,926
4 lines compressed air and electricity.....	10,705,340
Total	240,040,291

In 1897 the company had 16,017 horses and the maximum number of vehicles working in one day was 1,130.

The fare on the top of an omnibus is 15 centimes (nearly 3 cents); inside and on platform, 30 centimes (nearly 6 cents). The payment of the last-mentioned fare entitles the passenger to a "correspondence" or transfer ticket to another connecting or intersecting line. No passengers are taken on when the places are filled, either at a station or en route. At the starting points, numbered tickets are handed to the passengers, and when there are more than enough to fill one conveyance the precedence is given to those holding the first numbers. The next omnibus or car starting begins with the number last uncalled on the previous vehicle. The same system prevails at the fixed stations en route for vacant places. No standing in the aisle is allowed. The distance traversed by the various lines varies from two to four miles.

The bonds of the company bear 4 per cent interest and are quoted at about 101; the stock is quoted at about 348.

ELECTRIC FANS IN SLEEPING CARS.

Monon Route sleepers for Indianapolis and Cincinnati leaving Chicago at 2:45 a. m. have been equipped with electric fans. These sleepers are set in Dearborn station for occupancy at 9:30 p. m., and the electric fans will make them cool and pleasant during the summer months. Get tickets at No. 232 Clark St.

NEWS NOTES.

ATLANTA, GA.—The Collins Park & Belt Railroad Co. has in view extensive improvements which will necessitate the enlargement of its power house. J. C. Simmonds, president.

BAY CITY, MICH.—The Bay City, Tuscola & Huron Railway Co., which was organized to build an electric railway from Bay City to Tuscola and Huron Counties, has disposed of its franchises and contracts for rights of way to Benjamin Boutell, of this city, as trustee.

BETHLEHEM, PA.—The Bethlehem & Bath Street Railway Co., has been incorporated with $36,000 capital stock to construct a line between Bethlehem and Bath. Joseph J. McKee, president.

BRIDGETON, N. J.—The Bridgeton & Millville Traction Co.'s line, including the lines to Millville, Cedarville and Tumbling Dam Park, are said to have been sold to a Philadelphia syndicate. The present stockholders will retire.

BROCKTON, MASS.—The Brockton, Canton & Dedham Street Railway Co. has been organized with a capital stock of $200,000 to build an electric line between the cities named in the title. John J. Whipple, Fred C. Hinds and Chas. T. Field, all of Boston, are interested.

BUTLER, PA.—A charter has been granted to the Butler Passenger Railway Co. to construct a street railway in the borough of Butler, to be about eight miles in length; capital stock $50,000. The directors are A. L. Reiber, president; K. V. Ritts, John Berg, James B. McJunkin and Charles Duffy, all of Butler.

CATLETTSBURGH, KY.—Surveys are being made for an electric line between Catlettsburgh and Central City. It is understood that the road will also be extended to Kenova and Ceredo, W. Va.

CINCINNATI, O.—The stockholders of the Cincinnati, Lawrenceburg & Aurora Street Railway Co. have announced an agreement to increase the capital stock from $35,000 to $750,000.

CLEVELAND, O.—The Cleveland & Eastern Railway Co., with a capital stock of $1,000,000, has been incorporated to build an electric line from Cleveland to Burton, with a branch extension from Fullerton to Chadron. The incorporators are H. Clark Ford, Harrison B. McGraw, John Wilson Hart, Frederick A. Henry and S. P. Baldwin.

CLINTON, MASS.—The Clinton & Hudson Street Railway Co. has been organized here, with Alexander S. Paton, Leominster, Mass.; W. R. Dame, Clinton; Wm. H. Tybee, Worcester, Mass., and others as directors.

COLUMBIA, S. C.—A deal to purchase the Columbia Street Ry. and Electric Power Co. has been closed by several Baltimore capitalists, some of whom own the Charleston electric railroad. The price is $257,000.

COLUMBUS, O.—It is reported that the Columbus Central Street Railway Co. is to be consolidated with the Columbus Street Ry. in a very short time. The union of the two lines will doubtless result in a number of improvements being made. E. K. Stewart, general manager.

DETROIT, MICH.—The Wolverine Construction Co. has awarded the contract for constructing 22 miles of track to B. F. Sullivan & Co. The track is to be constructed between Sand Hill and Farmington, and Farmington Junction and Orchard Lake, connecting the Sylvan Lake road with the Grand River electric.

EUREKA SPRINGS, ARK.—The Citizens Street Railway Co., which heretofore derived its power from the Citizens' Electric Co., has been absorbed by the latter. Owing to a friction between the two companies for many months cars have stood idle in the sheds. Operations have now been resumed.

THE
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The Brooklyn and New York street railway strikes were both flat failures, for which there were two principal reasons—the men had no real grievances and the police suppressed disorder with great firmness.

A Detroit man has become possessed of a wonderful new idea. It is that street car fares are a commodity and should be governed by the market price. The only trouble with this theory is that it is never heard of except when advocating three or four-cent fares. No one outside of a street railway office has ever been known to even think of such a thing at times when the company is spending six cents to carry a five-cent passenger.

Wisconsin has an anti-pass law which makes it an offense for any state, city or county official to ride free on any common carrier. Under this law many street railways have refused to carry policemen free, and during the strike last week in Eau Claire, the mayor refused to permit his police force to officer the cars and protect the new men, as the officers would be riding free. Under this interpretation any fugitive from justice will find the street cars of Eau Claire the safest place of escape, if only he can have charge of the controller handle.

We think that it is in order to congratulate our British cousins upon the fact that the electric railway industry has so grown as to feel the need of an association which shall be representative of it, such an organization having been formed in June last under the title of the Tramway & Light Railways Association. The members are to be operating companies or corporations (local authorities) and individuals; the official organ of the Association is our esteemed contemporary, the Railway World, whose editor, Mr. A. M. Willcox, is honorary secretary.

The new association has our best wishes for success, which in view of the encouragement recently given to electric railways in the British Isles seems certain.

Two months from the date of this issue the advance guards of the Street Railway Convention of 1899 will be pouring into Chicago. Every indication points to a phenominally large attendance, and delegates who have not already made their hotel reservations should do so while there is yet time to secure choice locations. The hotel facilities of the city are ample, but are always in demand during October, hence intending visitors will secure better accommodations if they will only speak a little in advance. The local committee is hard at work and the results will be apparent during convention week.

Practically no space is left in the exhibit hall, and a reallotment has been necessary, reducing the size of the larger applications, in order to take care of everybody. While the floor space is the largest ever provided at any convention, it will all be occupied, and the display alone will well be worth a trip across the continent. Chicago has a royal welcome waiting, and wants at least one representative from every street railway in the country and as many more as can come.

The action of the Hartford Traction Co. in voluntarily reducing its rates by extending the limits of the 5-cent fare on several lines is in accord with the position taken many times by this paper. We have always maintained that street railway managements are liberally inclined and are following broad gaged, progressive policies. But the management alone is in position to know when it is possible to do this. Some time since a committee visited the Legislature and petitioned for an act reducing rates on certain lines of this same road. The request was rejected after careful examination, on the grounds that the existing rates were fair and reasonable. Since that time the business of the company, by good administration, has increased to a point where the management felt justified in reducing its rates by extending the ride, and not only did so on the route previously requested, but on several others for which no concession was asked or expected.

To the casual rider who happens to travel at an hour when the cars are always crowded morning and night, a certain line may appear to be a small Klondike, but as likely as not there are 14 hours in the day when it is running at a loss. Taking all things into consideration the American street car ride gives more for the money than anything we know.

The saving in the cost of operation which can be effected by substituting electric traction or self contained "composite" motor cars for the ordinary steam locomotives for handling passenger traffic on branch lines of steam railroads, is causing the managers of such roads in all parts of the world to give the subject much attention. The ordinary

two car train requires five men to operate it, engineer, fireman, baggageman, conductor and brakeman; a two car train operated by electricity or a "composite" motor car would require but two, or perhaps three men, thus effecting a saving of from 40 to 60 per cent in the item of trainmen's wages.

The length of the steam railroad spur lines and the light passenger traffic over them will doubtless in many cases prohibit the expenditure for copper necessary for operation on the overhead trolley system. For such lines the steam railroads, and in some instances what would be called street railways, have turned to the autocar. We have described several steam, air and gasoline motor cars in the past few years, and at present the demand for them appears to be steadily, though slowly, growing; the greatest demand is by steam railroads, however.

It is extremely difficult to keep in touch with the street railway controversy in Detroit because the current literature on the subject is so very voluminous. On another page is a brief summary of what has happened since our last issue; we venture no predictions for the future.

The Chamber of Commerce, prominent citizens, Governor Pingree, Mayor Maybury, officers of the company and others, have been indulging in much talk and nearly everybody's motives have been impeached. Mr. Pingree attempts to reach the public through proclamations printed on handbills and at least 13 of these have been issued by him, beginning with No. 1, which we reprinted last month.

The 3-cent fare will not be given a trial just now, which is possibly a misfortune. The belief that it is possible to operate a street railway system on 3-cent fares is firmly fixed in the minds of a great many persons, and perhaps the best way to determine whether it is correct is to make a trial. Detroit, for the present, at least, has refused to play dog and let the trial be made. As we do not believe it possible to make a success of street railroading on a 3-cent basis, we congratulate Detroit and condole with the street railway interests which would reap the benefit of a costly object lesson.

Atlanta has a chance to buy the lines of the Consolidated, by paying par for $2,000,000 of stock and assuming the bonded indebtedness of $2,250,000. The property paid four per cent net in 1898. To avail itself of this offer the city is to grant at once, certain franchises now asked for by the company and the latter is to enjoy a practical monopoly in the line of future grants as against another company which threatens to parallel the best lines of the Consolidated. The city in return is to share in any profits over three, four and five per cent for 1900, 1901 and 1902, respectively, and after, with the privilege of purchase at any time it is ready.

The interesting feature of the situation is the timidity which all of a sudden seems to have seized the very people who thought they were thoroughly inoculated with the municipal ownership idea. Now it actually confronts them and they realize that interest must be paid, not only on the present liability, but the cost of future extensions and betterments as well, and that a failure to do business at a profit does not mean a receiver but increased taxation to supply the deficiency, it radically changes the rosy hues of "millions in it," to the risk which continually confronts every business man and corporation. The proposition begins to assume faint outlines of a white elephant to people who all the time considered it an easy matter to run a street railway and pay big dividends.

When the Street Railway Accountants' Association of America was organized in March, 1897, it was recognized that probably the greatest work which the Association could undertake would be the standardization of street railway accounts. Mr. C. N. Duffy presented a paper on the subject designed to elicit a full discussion as to the objects of such a system and the best means of reaching them. The immediate result was the appointment of a committee consisting of C. N. Duffy, secretary and treasurer of the Citizens Street Railway Co., St. Louis; W. F. Ham, secretary of the Nassau Electric Railroad Co., Brooklyn, and John F. Calderwood, auditor of the Twin City Rapid Transit Co., Minneapolis, with instruction to prepare a report.

The committee presented an elaborate report at Niagara Falls in October, 1897, which was approved by the Association. At that time H. L. Wilson, auditor of the West End Street Railway Co., Boston, and H. J. Davies, assistant secretary and treasurer of the Cleveland Electric Railway Co., Cleveland, were added to the committee and the committee made a permanent one. This committee made a second and more extended report at Boston in September, 1898, which was adopted.

When the first report was discussed a question was raised, we believe, as to the wisdom of this Association adopting and recommending a system of accounts without first getting the approval of the Boards of Railroad Commissioners of the various states, since the Commissioners have in many states, the final decision as to what system should be used by the companies reporting to them. The permanent committee endeavored during the following year to have meet with it the Railroad Commissioners of the states which exercise any control over the accounts of street railways, but arrangements could not be made before the Boston convention, and the report as adopted was that of the street railway accountants only. How well the work was done is shown by the report of Mr. Seymour to the National Association of the State Railroad Commissioners and the report of Mr. Duffy to President Calderwood, which are printed on another page. Conference with representatives of the two other associations mentioned in the reports showed that only a few changes were suggested, all of minor importance, and all such as were readily agreed to by Mr. Duffy and Mr. Ham.

It is indeed, a high compliment to the committee which prepared the "Standard System" and to the Association to have Mr. Seymour's committee recommend it in this language:

> It was found that the form prepared by the street railway accountants was so much more advanced in its preparation, so complete and full in its details, and so well adapted for its purpose, owing to the familiarity of those who prepared it with street railway accounting, that we deemed it wise to abandon the work which we had commenced, and advise the endorsement and adoption of the form prepared by them.

We extend congratulations on this praise from such a source, and with a feeling of pride remember that the "Review" was to some small extent instrumental in forming the Street Railway Accountants' Association.

We have had occasion during the past few months to mention a large number of street railway companies in connection with increases in the rates of wages paid, and this

we take it is an indication of the correctness of a statement we have frequently made, that the men at the heads of our street railways have the welfare of their employes at heart. There are at least two reasons why a manager ought to pay his men just as high wages as the company can afford; the company gets better service when the men know their work is appreciated, and, as an individual, the manager is happier, as the condition of the men with whom he works is bettered.

On another page we note that the Columbus (O.) Street Railway Co. has decided to hereafter pay to its employes a dividend upon the wages earned since the preceding dividend day, at the same rate that holders of the company's stock receive. The wording of the resolution indicates that this is regarded by the company as an increase in wages to be determined in amount by the ability of the company to pay, rather than a sharing of profits with employes, and we find it difficult to reconcile the scheme adopted here, with some of the generally accepted economic theories respecting the relations of capital and labor.

In a lecture before the State Convention of Illinois Municipalities, held at Peoria, Ill., in March last, Mr. Allen R. Foote defined interest as the wage of capital, and wage as the interest of labor, and further said: "Wage is a guaranteed payment for the use of capital, and of labor, without risk of loss or right to share in the profit." This latter definition of wage is probably an acceptable one, but in the short statement, "wage is the interest of labor," accuracy has been sacrificed to brevity. To take that statement literally, would be to assume that the value of the service rendered by labor is a certain sum, say twenty (interest at five per cent) times, the annual wages earned by the laborer; it would be nearer the truth to say that wage is composed of interest on labor and a sinking fund payment (or insurance premium). Mr. Foote's theory of profit sharing is that after cost has been properly computed (cost includes interest on the capital invested) any profit should be divided between the capital and labor which have jointly produced it by paying dividends to the capitalist on his money invested, and to the laborer on his wages earned at the same rate per cent. This theory of dividing profits appears to carry with it an admission that wage is not the "interest of labor," because were that so the amount of the capitalist's interest and the laborer's wages should constitute the basis of the division of profits.

According to the more generally accepted theory, wage is paid to purchase labor, as any other commodity is bought, and the wage would therefore be a measure of the value of the service rendered. Waiving all question as to why labor should share in the profit if it is a commodity, and admitting that profits ought to be shared between capital and labor, would not the equitable basis of division be to pay the labor a dividend (at the same rate that the capital receives in excess of interest) on one-half the amount of wages earned? The capital has been invested during the whole of the dividend period, while the labor has been invested from day to day and the average time of the "investment" is but one-half the dividend period.

The suggestions are made in order to call attention to the fact that the increase in wages granted by the Columbus Street Railway is really such, and is much more than the men would receive were distribution made on an equitable profit-sharing basis. In the plan adopted at Columbus no payment of interest on the capital stock is made before the profits are divided; four per cent per annum is surely a very low rate of interest on capital invested in a street railway, so that in fact the Columbus employes receive all the "profit" that is distributed, stockholders getting only a reasonable interest.

THE SITUATION IN DETROIT.

There have been a number of very sudden shifts in the Detroit street railway situation during the past month. On July 14th, all of the street railways in Detroit started to run on a straight 3-cent fare basis, selling five tickets for 15 cents and giving universal transfers.

On July 18th, the city council met and reconsidered its passage of the security franchise, upon which depended the sale of the entire Detroit street railway properties to a company representing the city, and from this action the present owners declared all negotiations at an end. Three days later the Citizens Street Ry. and the Fort Wayne & Belle Isle Ry. stopped the sale of 3-cent tickets and instead of resuming the rate that has been in force for 20 years, six tickets for 25 cents, the rate of 5 cents and no tickets, was established on all lines controlled by these two companies. The Detroit Ry., a 3-cent line, has not increased its service to meet the demand and a resolution is now before the council asking that company to put a two-minute service on all of its lines. The city council states that it will refuse all favors to the street railway people pending a return to the old rates of fares.

Mayor Maybury, who is opposed to "municipal ownership," has had prepared an ordinance which he proposes to try and enforce by law and thereby compel the 5-cent lines in Detroit to reduce their rates of fare, as well as grant transfers. This ordinance, as approved by the council, August 8th, reads:

"It is hereby ordained by the people of the city of Detroit: That the said Citizens' Street Railway Co., its successors and assigns, shall keep on sale on its cars in service at all times tickets to be sold in strips or packages of eight tickets for 25 cents, each of which tickets shall be accepted by said railway company, its successors or assigns, for a single ride for any distance in either direction, over the lines or route operated by the said railway company, its successors or assigns, on a car on which it is presented; and any passenger presenting such ticket or upon payment of one single fare charged by said company, shall be entitled to a transfer ticket good for a continuous ride over any other line or route operated by said company, provided such ticket is presented on the next regular car of the company within 15 minutes after such passenger leaves the car on which he receives such transfer ticket. This ordinance shall not be construed to affect any lines or routes of street railways now owned by the Detroit Railway Company.

"This ordinance shall take immediate effect."

Immediately after the street railway companies refuse to comply with the provisions of this ordinance, as Vice-President Hutchins is certain they will, a new fight in the courts will start in Detroit. Under present franchises the companies affected have the right to charge 5 cents for every ride.

This is the street railway situation in Detroit as we go to press. But it should not be supposed that Governor Pingree and his associates have abandoned the municipal ownership proposition. The governor proudly states that the people can blame only themselves for the present 5-cent

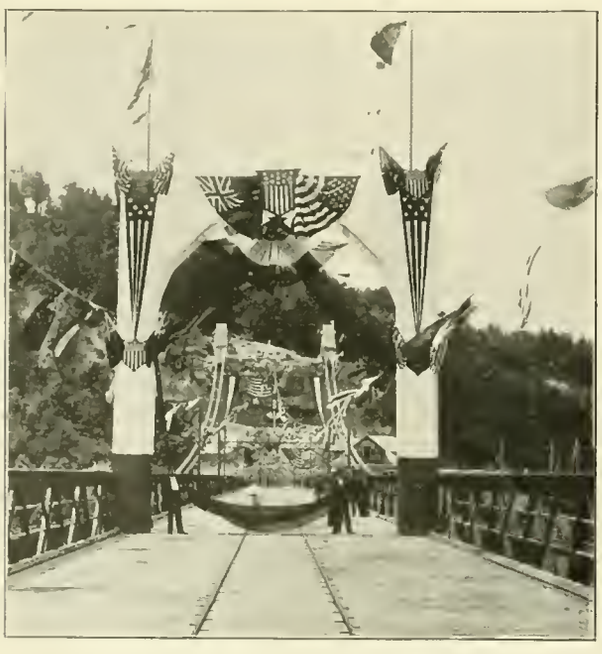
cash fares and, further, that he will keep up the fight until after the election this fall, and if then the voters come to the front, electing a city council favorable to his ideas, that municipal ownership will yet become an assured fact.

In addition to its other street railway troubles Detroit has been threatened with a strike. Vice-President Hutchins and General Manager du Pont made a number of concessions in the matter of rearranging schedules so that the 10 hours work of the men would be within 11 hours, instead of 12, as formerly; also the rate for "tripper" men making less than four hours per day was increased.

The employes' union started out to demand a general increase in wages from 20 and 21 cents an hour, to 23 and 24 cents, and at a general meeting on the night of August 1st, it was agreed to offer to compromise at 21 cents for the first nine months men were in the employ of the company, and 22 cents an hour thereafter. This proposition was submitted to the company's officials and refused, Mr. Hutchins stating that it was impossible at this time to grant a general increase in wages, and he also stated that the question of granting an increase in wages would not be submitted to arbitration, but that all other questions in dispute would be submitted to such a board.

OPENING OF NEW NIAGARA BRIDGE.

On Friday, July 21st, the International Traction Co. formally opened its new suspension bridge across the Niagara gorge a short distance above the villages of Lewiston, N. Y., and Queenston, Ont. This bridge was built by the Lewiston Connecting Bridge Co. and the Queenston Heights Bridge Co., but is now the property of the International Traction Co. The bridge has been fully described



OPENING OF THE NEW NIAGARA BRIDGE.

in these columns. It will be recalled that it has a cable span of 1,040 ft. and that the suspended span is 800 ft. in length. The floor of the structure is 25 ft. wide, and through the center there has been laid a single track for electric cars, the bridge being designed as one of the connecting links in a belt line trolley service about the beautiful gorge.

The bridge was gaily decorated from end to end and presented a very beautiful sight. Hon. W. Caryl Ely, president of the International Traction Co., had sent out handsome invitations to prominent people in the United States and Canada, expressing a desire to have them present at

THE FIRST CAR.

the opening; enclosed in the same envelope was a card entitling the holder to free transportation over all the company's lines on July 21st and July 22d.

The guests assembled at the two ends of the bridge, and shortly after 1 o'clock walked to the center, where the 74th regiment band, of Buffalo, was stationed. After a general handshaking, the officers of the International Traction Co. receiving congratulations from all, the party proceeded to Queenston Heights, where luncheon was served in tents erected in the shadow of Brock's Monument. Numerous speches were made, Mr. Ely presiding as toastmaster.

KILLED BY A RAILWAY CURRENT.

On July 24th, William Crites, 18 years old, was killed by the railway current while assisting a lineman at work for the Union Traction Co., in Marion, Ind.

The lineman was on the pole lengthening out the span wires with a view to setting the poles back farther in the street so as to permit of paving the street farther out. The lineman states that he instructed Crites, who had only been working for the company a short time, to watch the coil of wire which he left on the ground, carrying the end up with him, and not let anybody touch it; but it seems that the wire came in contact with the old span wire, which was charged with electric current on account of leakage at the bell, and transmitted current to the ground, and that Crites for some reason had hold of or touched the wire, thus receiving the full force of the current, and was instantly killed. It is said that the young man had been afflicted with heart disease.

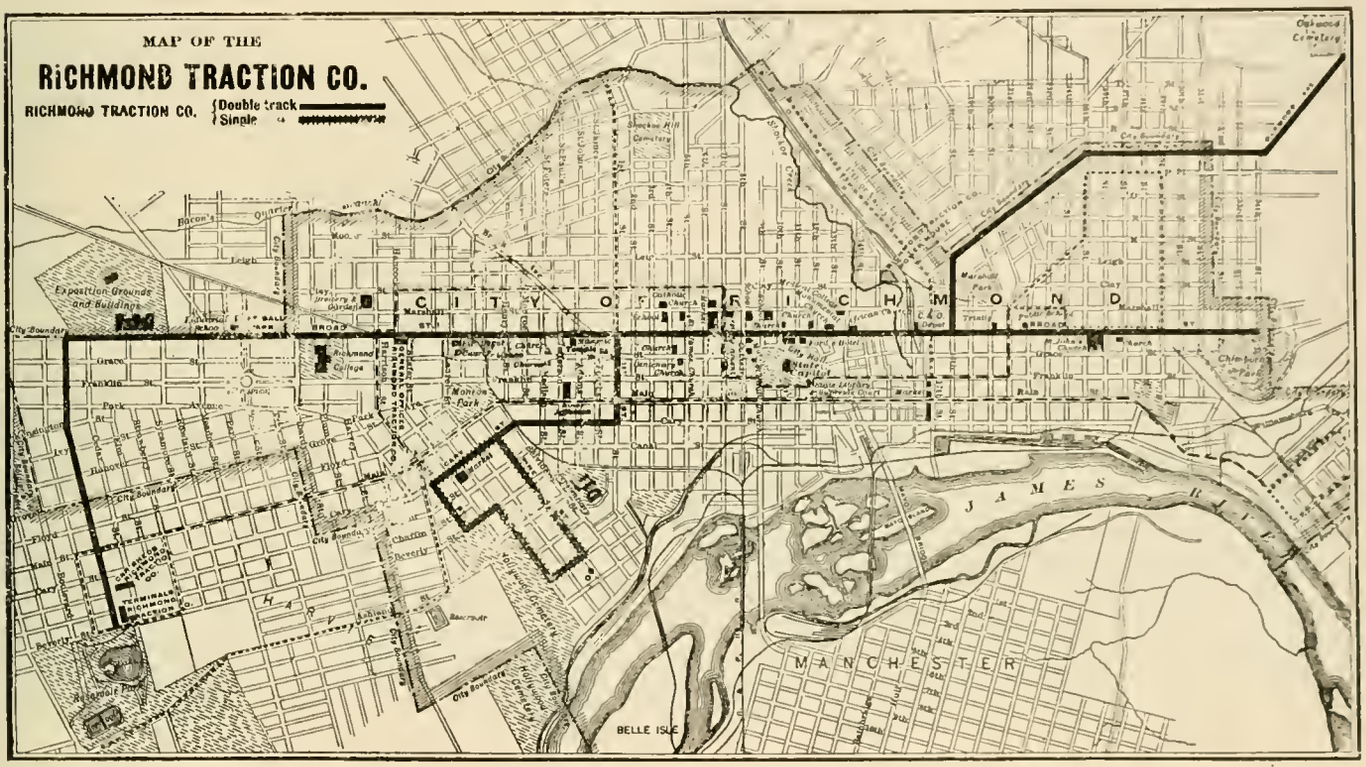
The Chicago Consolidated Traction Co. has been fined $50 for violation of the smoke ordinance.

The Richmond Traction Co., Richmond, Va.

The city of Richmond, Va., which has the distinction of being the pioneer city in the use of the single trolley system has had its street railway facilities increased by a new road, which embodies the latest improvements in this method of traction. The Richmond Traction Co. now owns a system of street car lines comprising 16.04 miles of track, which are shown upon the accompanying map in heavy black lines. The main line of the road passes through Broad St., which is the principal thoroughfare of the city, for a distance of four miles without a curve. Beginning at Chimborazo Park, a beautiful and elevated plateau having a magnificent view of the James River for many miles, this line extends westward to the Exposition Grounds, situated near the western boundary of the city. Along this route or immediately contiguous to it are situated nearly all of the public buildings, markets, churches and places of amusement, among which may be mentioned the State House and grounds containing many historic statues, the City Hall, Masonic Temple, Armories, Base Ball Park, Richmond College, State Library, Soldiers' Home and Lee Monument and two railroad depots, those of the Chesapeake & Ohio and the Richmond, Fredericksburg & Potomac.

From the Exposition Grounds the line turns south following Robinson St. to the Reservoir Park, the most frequented summer resort in the city. From 18th and Broad Sts. a double track branch line extends northeastwardly to Oakwood Cemetery, the burial place of thousands of soldiers, which has been heretofore entirely without street car facilities, and another branch beginning at First and Broad Sts. extends southwestwardly via Cary St. to the picturesque Hollywood Cemetery, which contains many historic tombs, including those of several of the former Presidents of the United States. This section of the road passes through a thickly settled district from which a large amount of traffic is drawn.

The lines are double track throughout the whole system with the exception of the Cary St. loop, which is a single track, and the construction of the road is of the highest order. The tracks in the city are laid with 95-lb. grooved steel girder rails, type 218, of the Loraine Steel Co., while in the suburbs there is one mile of double track on Robinson St. and ½ mile on Oakwood Ave. laid with 60-lb. T-rails. The roadbed consists of white oak ties in a concrete bed, the concrete being 6 in. thick below the ties, extending 6 in. beyond the ends of the ties, and also filling the spaces between the ties, leaving them completely embedded in concrete. This construction has not been found entirely satisfactory to the company, but was forced upon it by the city authorities. Two important objections to this construction have developed which seem impossible to be remedied, while the city enforces this style of construction. One of these is the unyielding nature of the roadbed, which, on account of having no cushion, causes the bolts and bonds at the rail joints to be hammered loose by the action of the cars. The other objection to this construction is the premature destruction of the ties, due to the lack of drainage. The concrete practically forms a series of troughs in which the ties set and from which there is no way to drain off the water which settles around and rots them. Again it is very difficult and extremely expensive to renew the ties, as the only way to remove and put in new ones is by chopping out all the concrete around them. Outside the city limits stone ballast has been used, which entirely obviates both of these troubles.



The overhead construction is neat and substantial. On one portion of Broad St. center poles of steel are used, the poles weighing about 1,000 lb., and carrying cross-arms,

upon which the feeders are run. The remainder of the lines are equipped with steel side poles weighing 700 lb. and span wires. The feeders are all carried overhead and a No. 0 trolley wire is used. The overhead fittings and all the electrical apparatus of this system are of the General Electric type.

The company has a total of 74 cars, 31 of which are open summer cars and the remainder closed cars and trailers. There is also one snow sweeper. The cars are of several different makes including the American Car Co., Jackson & Sharpe Co., and Stevenson & Co. They are supplied with double equipments of G. E. 1,000 motors and Peckham double extension trucks. Each car is provided with two registers, one a cash register of the New Haven Cash Register Co., and the other a transfer register, built by the Sterling Supply & Manufacturing Co. Fenders of the Consolidated Car Fender Co. are placed on both ends of the cars

of this building 32 ft. are partitioned off, which space is used for the machine and repair shop. This building faces on Robinson St. and at the right hand side just beyond the entrance is a large inspection pit, 30 ft. in length and its width covering three parallel tracks. A certain number of cars are brought over this pit and inspected each day and a record of these inspections is kept by a special method which will be explained below. The rest of this barn is for car storage.

The repair shop in the rear of the bar covers a space of 32 ft. x 84 ft., at one end of which is the repair pit shown in the illustration. The machines included in this shop are a drill press, a lathe of 20 in. swing and 8 ft. bed, a Gould & Eberhardt shaper, a Norton emery grinder, an armature rack, water rheostat, and a pivoted crane, whose travel covers this pit, lathe, armature rack and drill press. On one side of this shop is a large board upon which all the shop

RESERVOIR PARK TERMINAL.
REPAIR PIT.

POWER HOUSE.

CAR HOUSE AND SHOPS.
INTERIOR OF POWER HOUSE.

to avoid the trouble and delay of changing them at the terminal points.

The use of these fenders has been attended with great success and the company has avoided several fatal accidents by picking up a number of children at different times who ran directly in front of the cars and who would have undoubtedly have been killed but for this protection. On one occasion three men were walking on the track in a very dark night and were not perceived by the motorman of an approaching car until the car was almost upon them. The car struck them while running at a good speed, and all three were picked up by the fender and carried some distance before the car could be stopped. When the car was brought to a standstill the men on the fender were found to be unhurt in any way.

The car barn is situated one block from the reservoir Park terminus and is a large building constructed of steel columns filled in with brick, steel arches and a corrugated iron roof. It is 84 ft. in width and 224 ft. long and contains 8 parallel tracks, 10 ft. between centers and 192 ft. long. In the rear

tools are hung. Upon this board is shadowed in black paint every tool which belongs upon it, so that in replacing the tools each one always occupies its own place. This board also enables the foreman to see at a glance if all the tools have been replaced at night, and if not, just what ones are missing. The machines are all run by a 15-h. p. Crocker-Wheeler motor standing on an elevated platform at one end of the machine shop.

The repair pit shown in the illustration is arranged so that the portion of the tracks under the wheel base of the car can be entirely removed, and the weight of the car is carried upon four screws running vertically through lugs on the four ends of the stationary track. A truck runs upon a track at the bottom of this pit and this truck contains a carrier which can be screwed up vertically under the car to receive the motors, wheels, etc., when they are disconnected from the car truck. They are then lowered and rolled out into the side extension of the pit, where they are picked up by the crane and transferred to the shop floor or to the machines.

A very convenient method of baking newly wound armatures and fields by electricity is in use in this shop, which was devised by Mr. O. G. Cosby, the master mechanic of the company. It consists of a water rheostat in series with the 500-volt railway current, and in the case of an armature two sections on opposite sides are left disconnected from the commutator and these are connected to the rheostat circuit which allows at first a small and afterwards a gradually increasing current to flow through the armature until the insulation is thoroughly dried out. An ammeter is placed in the circuit by means of which the amount of current supplied at any time is shown. This process, while probably not an economical one where a large number of armatures are being rewound, is extremely convenient and much cleaner than an oven, and where the rewinding of an armature is only an occasional occurrence as in this shop this method of drying is very advantageous.

The company maintains a very methodical and systematic inspection of all its cars, one-sixth of which are inspected each day so that the whole number of cars are inspected each week. A monthly record is posted in the repair shop upon a card containing the number of each car upon one side, and a space for each day of the month opposite each car number. When a car is inspected its condition is entered upon the card for the day of the month on which the inspection occurs, so that the master mechanic and motorman can see at a glance the condition of every car. Those cars marked "bad" are taken into the shop and repaired and this is entered on the card so that these cars are marked "good" on the date of their repair.

In the rear of the machine shop and separated from it by about 15 ft. is a paint shop built of corrugated iron capable of holding two cars. This is entered by means of the track, which runs over the repair pit, and the two parallel tracks in the paint shop are connected by means of a transfer table. Another small corrugated iron building in the rear of the machine shop and to one side of the paint shop is used for a store room for the shop supplies and car materials. It is divided into three rooms in which the stores are systematically arranged. Between the store room and the machine shop is a water tank and pump for supplying buildings with water, as city water is not available at this point. An isolated wooden building near the car barn is used for the line wagon, and also for the storage of the track and overhead material; the superintendent's office is situated in a building on Robinson St., directly opposite the car barn.

The present power house of this road is situated at the corner of 15th and Clay Sts., on the bank of a small stream called Shockoe Creek, but this plant will probably only be used for a short time, as the same interests which own the railway have organized a company for the general supply of electric power whose plant is now in course of construction. As soon as this plant is completed the railway power plant, which is now considerably overloaded, will be abandoned and the road will take its power from the new company's plant.

The power house now in use is a handsome and substantial building of brick and granite, which is partly shown in the accompanying illustration. It is divided into an engine room and a boiler room by a fireproof partition extending through the center of the building between the two roof arches. The roof is constructed of iron trusses covered with slate; the building has a frontage of 212 ft. and is 268 ft. deep. The engine room is equipped with two Hamilton-Corliss tandem compound condensing engines, made by the Hooven, Owens & Rentschler Co.; the cylinder dimensions are 16 in. and 30 in. by 42 in. stroke, rated at 450 h. p., and running at a speed of 102 r. p. m. Each engine is direct connected to a 300-kw. 6-pole G. E. generator. The engines are equipped with Cochran separators, and an auxiliary Chapman gate valve is placed in the steam pipe to each engine for use in case of emergency. The oil cups throughout the plant are fed from a tank placed near the ceiling on the partition wall, from which the oil is piped to all the machinery. After passing through the bearings it is carried to two filters in the basement by means of a system of pipes, and after filtering it is pumped back to the supply tank.

The switchboard is of the standard G. E. type, containing 2 machine panels, 1 station panel and 9 feeder panels. A lightning arrester is placed on the back of each panel in addition to its usual equipment, and instead of a negative panel the return circuits are brought in upon a bus across the back of the two machine panels. Alongside of the switchboard is a daily bulletin to be filled out by each of the three watches during the day. The items entered are the amount of coal

AUDITORIUM, RICHMOND TRACTION CO.

fired, water fed, water per lb. of coal, steam per kw. hour and coal per kw. hour, giving a complete record of the day's run. Each engine has a J. B. Davis & Sons feed water heater and a Dean condenser using water from Shockoe Creek.

The boiler room, which is about 10 ft. below the level of the engine room floor, contains two water tube boilers rated at 300 h. p. each, which have to be forced considerably to equal the engine capacity. The boilers use city water, which is particularly bad and has to be carried into a tank outside the boiler room and purified with boiler compound before using in the boilers. The boilers are fed by two Worthington feed pumps, measuring 7½ x 4½ in. by 10 in. and there is also an auxiliary heater in the boiler room, besides those mentioned above, into which the feed pumps and condenser pumps exhaust.

In front of the boilers is a track upon which a coal car runs from which the boilers are fired. There are scales at the boiler room door where the coal is delivered and each car load of coal is weighed here before being taken to the boilers, where it is fired by hand. Soft coal is used. The boilers are connected to a steel self-supporting stack 125 ft. in height. The room is lighted with two incandescent arc lights and there are three in the engine room, all being run in series on the railway circuit. Gas is also supplied for use during the time the engines are shut down.

Appreciating the value of amusement resorts as feeders to the traffic of its road, the company controls the large auditorium illustrated herewith located upon the line of its road. The building has a seating capacity for 12,000 people and is rented for convention purposes, etc. It is also used for vaudeville performances and other amusements.

The officers of the company are: E. R. Williams, president; W. M. Habliston, vice-president; R. L. Williams, treasurer; Jos. L. Young, jr., auditor, who succeeds J. A. Cook, just resigned, and S. P. Cowardin, superintendent. The road started in operation upon part of its line on June 20, 1896. The construction was in the hands of Mr. A. Langstaff Johnston, consulting engineer, and Mr. S. P. Cowardin, first assistant engineer. Mr. Cowardin then took charge of the building of the electric roads of Norfolk, Va., which are owned by the same interests and returned to take active charge of the Richmond road on Feb. 1, 1899. His management of the road has met with marked success, its operating expenses amounting to a little less than 49 per cent of its gross receipts.

E. C. HATHAWAY.

The organization of the Lexington (Ky.) Railway Co. by a Baltimore syndicate represented by Mr. R. Lancaster Williams, which was noted in the June issue of the "Review," has been followed by the appointment of Mr. E. C. Hathaway as general manager of the company's properties purchased from the Belt Electric Line Co., which operated the electric railway; the Central Electric Co. running the

E. C. HATHAWAY.

lighting plant; the Hercules Ice Co., and the Passenger & Belt Co.

Mr. Hathaway has had an extended experience in the construction and operation of electric lighting, steam and gas plants, and has been employed in the capacity of consulting engineer in the installation of several street railways. He was born in Southboro, Mass., Dec. 1, 1861, and was educated at Lynn, Mass. His first employment was with the Boston & Hingham Steamboat Co., after which he successively filled prominent positions with the Highland Street Railway Co., of Boston; the Boston & Albany Railroad Co.; the Chesapeake Gas Co., of Baltimore, Md., and the Washington Gas Light Co., of Washington, D. C. He was then associated with Prof. T. S. C. Lowe in the building of the Mt. Wilson Ry., of Pasadena, Cal., after which he was employed in the construction of the Colorado Springs Gas & Electric Light Co. He also rebuilt the plant of the Capital Gas & Electric Light Co., of Frankfort, Ky.

Mr. Hathaway was next employed with the Charlotte Consolidated Construction Co., of Charlotte, N. C., which connection he severed to assume his present position as general manager of the Lexington Railway Co., to which he brings a wide and varied experience of the different interests under his charge, which assures their successful management.

MAINTENANCE AND REPAIR OF ROLLING STOCK.

BY J. W. GREER, GENERAL MANAGER YOAKUM (TEX.) IMPROVEMENT CO.

PART IV.

Eternal vigilance is the price of satisfactory work from all classes of machinery and particularly in the case of electric street railway motors. No machinery is operated under more unfavorable conditions than is the street car motor; it is placed within a few inches of the ground, the dust, slush or mud of the street surrounding it, covering it and often penetrating it; its duties consist largely of quick starts, hard pulls, and sudden stops; it is too often controlled by one who has no more idea of its construction or weakness than a 10 year old child has of anatomy. Bearing these things in mind, is it any wonder that in the early days motors would sometimes play out and cars have to be "towed in." The astonishing feature to those who fully realized the conditions was that the apparatus could be made to work at all.

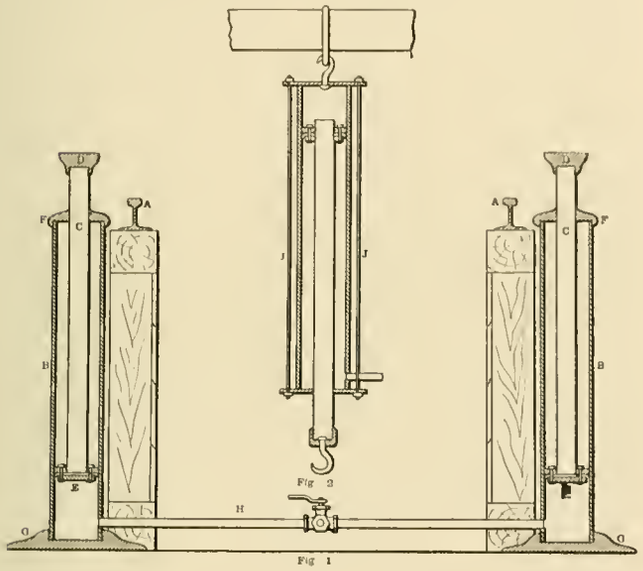
The motors of the present day are vastly superior to their forerunners and give extremely satisfactory service; this is due to the energy of the great electric companies and their willingness to spend money like water in making experiments.

When the writer looks back to the days when he saw Van Depoele with a cheese-box motor on the front platform of a horse car without trucks, geared with a sprocket chain to the front axle, and the car counterbalanced with switch frogs, brake shoes and scrap iron placed under the rear platform to keep the car from tilting up, or to the days and nights (mostly nights) when Sprague tried to make a single 7½-h. p. motor climb a 10 per cent grade with a 12-ft. car, aided and abetted by Crosby, Greene and others, he feels that the names of these men should of right be remembered for all time as the creators of electric railroading.

But speaking as one of the humbler "experts" who helped to work out the first problems of installation and operation, when installation and engineering meant to take a road and, single handed, change everything from the track construction to the office methods, adopt every appliance to fit the local conditions, break in every employe from the steam engineer to the track greaser and from motorman to bookkeeper, and required great assurance and versatility, the writer wishes to record his opinion that the magnificent courage of the capitalists who invested in such unpromising enterprises deserves to rank with the inventors and experimenters. If ever a blessing to man was conceived by accident, born of experiment and nurtured by wealth, it is the electric car motor.

This digression has proceeded far enough, and it is time to return to the immediate subject, maintenance and repair of rolling stock. The motor equipment must be kept clean, and the cleanings, daily, semi-weekly or weekly, according to the conditions, may be rapidly and effectively done by means of compressed air and a hose. But for thorough overhauling, complete examination, and perfect cleaning, the car body should be lifted from the trucks, the trucks rolled out and the motor cases opened, and everything blown out in the most thorough manner, after which a careful wiping with waste or towels (the latter preferred) is in order. With the aid of a pneumatic lift one man can remove the truck from a car or replace it in twenty minutes, and the ease and facility with which the work of cleaning and repairs can be made with the trucks and motors separated from the car as compared with the time required to do the same work with the motors under the car, is not comparable.

A simple and inexpensive lift may be made in your own shop, as illustrated in the accompanying sketches.



AIR HOISTS.

Fig. 1 is an end view of a repair pit fitted with pneumatic hoists for lifting the car bodies off the trucks. In constructing this hoist four air jacks are used, only two of which show in the end view. A, A are the rails of the tracks on which the car stands. The jacks are placed just outside the rails and pit frame, far enough, however, to allow the journal boxes or other projecting parts of a truck to pass when the pistons of the jacks are raised. The construction of each jack is as follows: B is 4-ft., length of extra heavy wrought pipe 8 in. in diameter. This pipe is threaded on both ends with a cap F over the top and a floor plate G at the bottom. C is a piece of pipe 4 ft. 3 in. long and 2½ in. in diameter which forms the piston rod. It is threaded on both ends with a cap D at the top end. The piston E is made of two pieces of iron with a leather cup between them. The top plate of the piston is a 2½ in. flange screwed onto the rod and just filling the pipe B. The bottom plate of E is a solid piece of iron ¼ in. less in diameter than B, and is bolted to its mate as shown; between the two is placed a piece of heavy leather having its edges turned down to form a cup. The air coming into the jack through the pipe H automatically sets out the leather cup against the sides of the cylinder and makes an air tight joint. The hole in the cap F through which the piston rod C passes need to be only a comfortable fit, and not a stuffing box, as no air passes above the piston E.

Each of these jacks will lift 3,000 lb. with an air pressure of 70 lb. or the hoist complete will raise a car body weighing 12,000 lb. The air pipes are arranged in the bottom of the pit and connected in such a way that the air is admitted to all four jacks simultaneously by a single, stop and waste lever valve, in the supply pipe. An extra valve at each jack can be put in the air pipes if desired. The cylinder being 4 ft. long and the intended lift not to exceed 3 ft., 1 ft. is left for bracing purposes between the cap F and the piston E, when the latter has been forced up 3 ft.

When the jacks are not in use the bearings D, D stand level with the top of the rails and completely out of the way. In raising a car body a piece of timber is laid across the sills underneath the car and on D, D. After the jacks are set, they need never be removed, and can therefore be built in the brick or cement floor permanently, or filled round with earth. There is nothing to wear out except the leather cup which packs the piston, and this is replaced when necessary by unscrewing F and pulling the piston out of the cylinder.

Each of these jacks costs less than $25 to build, as follows:

4 ft. extra heavy pipe, 8-in., @ $1.60	$6.40
4½ ft. extra heavy pipe, 2½-in., @ 20 cents	.90
Cap F	2.00
Flange G	3.00
Bearing D	1.50
Flange E	1.50
Plate E	1.00
4 bolts, .20, leather, .50	.70
Labor of assembling	5.00
	$22.00

To form the leather cup for packing the piston of an 8-in. jack, cut a round piece from sole or heavy harness leather, to a diameter of 10 in., place it over the end of an 8-in. pipe and drive a wooden plug (slightly tapered) into the pipe over the leather. The piece of leather should first be soaked in water until pliable; leave the plug in the pipe till the water dries out of the leather, and the latter will retain its cup shape. The wooden plug is, of course, the thickness of the leather smaller than the pipe. Of course the lift can be used for many purposes besides lifting car bodies from the trucks.

In addition to the lift described, a single cylinder or jack, inverted, and hung to a truss or joist overhead should be provided as shown in Fig. 2. As this hoist will lift 3,000 lb., motors can be picked up with it, wheels and axles lifted, one end of a car raised to take out wheels, motors dropped, motor cases opened and closed with it, etc. It is a quick and handy tool, which saves much labor and consequent expense. Instead of screwing the cap F, and floor plate G, onto B, as in Fig. 1, it is better to put a flat plate of wrought iron 10 in. in diameter, over the ends of B, drill a series of holes around and close to the edge of the plates, and connect the two heads together with long rods or bolts J, as shown in Fig. 2.

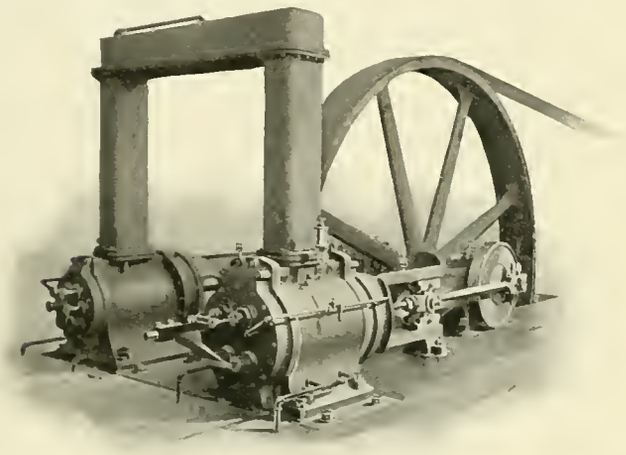
Besides the lifts described, the writer strongly recommends two other pneumatic tools for the maintenance and

repair department of a street railway; these are a reversible boring machine or compressed air drill and a pneumatic hammer.

If one has a pneumatic wood boring machine such, for example, as that made by the Chicago Pneumatic Tool Co., which weighs only 10 lb., almost any of the boring or drilling of a car or repair shop can be done. It will work in any position and in the most out of the way places; holes in places that cannot be reached by a brace and bit can be readily bored or drilled with this apparatus.

After you have used it for boring all the holes or drilling all the iron on a car, you can pass it to the engineer and he will find that a round wire brush on a long rod inserted in the boring machine is the finest flue cleaner he has ever tried. The wire brush is revolved rapidly through the flue and the machine reversed in bringing it back, straightens out the brush for another bout.

The other machine is a pneumatic hammer for the blacksmith shop. This machine, while operated by compressed air, is virtually the same thing as a steam hammer on a



RAND AIR COMPRESSOR.

small scale. The pneumatic hammer used by the writer is made by the Rand Drill Co., 100 Broadway, N. Y.

A simple feed handle regulates the length of stroke, or the force of the blow, and the operation is easily effected by the use of the operating handle, which is so arranged that one man can handle his work and the machine at the same time.

In this connection it may be stated that the air compressor in the writer's shop, and described in a previous article, is of the type illustrated made by the Rand company. This compressor, as stated, has cylinders 12 x 12 in. and 6½ x 12 in., a speed of 110 r. p. m., and compresses 174 cu. ft. of free air per minute, delivering it at 135 lb. pressure.

The writer does not believe in a street railway company embarking in the manufacture of electrical supplies, or in maintaining a complete foundry, machine shop or car building establishment. The trouble with a great number of small street railways is that they have too much machinery and too many men in the shops. The facilities for doing things, and the necessity of keeping the machinery in use, leads to the wildest extravagance, and the small amount saved in making the various supplies "in our shops," is absorbed many times over by the new parts used, where the old could be used longer if the men did not "have to be kept busy at something."

Contrive always to keep just a little more work ahead then can possibly be done by the force you keep. Every man will do his best to catch up, and your road will get value received for the wages paid, which should always be a shade higher than paid by others for the same class of work. Result: contented men, anxious to please, and desirous of holding their jobs.

Five men and two boys (apprentices) are sufficient to do all the work of maintenance and repair of one hundred electric cars, provided they understand their business and are furnished proper tools and machinery. Utility, and not quantity, is what is meant by proper tools and machinery.

The labor should be distributed as follows:

1 machinist and 1 apprentice to repair and clean motors.
1 armature winder to do all electric work.
1 painter and apprentice.
1 carbuilder or woodworker.
1 blacksmith.

The blacksmith must be willing to help both the machinist and the carbuilder, as he will not have enough to do in his own line to keep him fully employed, and both of the others will at times need help such as he can give. Mechanics who are only willing to do one thing are of very little use around the repair shops of a street railway.

In addition to the pneumatic tools already described, the machinery should comprise:

A pneumatic spraying machine for the paint shop with which the painter can rapidly and evenly apply all the first or rough coats of paint.

A hydraulic wheel press of 60 tons capacity fitted with the necessary tools for pressing on and off not only car wheels, but pinions, gears, etc., as well.

A lathe with an 8-ft. bed and a swing of 36 in., geared direct to a motor.

A band saw, a drill press, a grinding machine (emery wheel on one end of the mandril and a grindstone on the other).

An air pipe to the furnace of the blacksmith, and one in the armature room for blowing out fields, armature, etc.

This is all the machinery that is needed in the repair shops of a one hundred car road, and is sufficient to enable the number of men before mentioned to do the work with ease. But there must be at all times for the shop force ten cars out of that number, as follows:

Painter, four cars.
Carbuilder, two cars.
Machinist, two cars.
Car washers, two cars.

The painter should have in his shop always two cars which are being painted from start to finish, and the two cars which are being retouched and varnished. Cars properly varnished and retouched twice a year do not need repainting oftener than once every two years. A painter with less than four cars in the shop is compelled either not to do a day's work or to make a poor job by crowding.

The carbuilder must have continually one car in his shop which is receiving a general overhauling, and another which is receiving the daily repairs incident to the business.

The machinist must have one car in his shop which has the trucks removed and the motors being thoroughly overhauled, while he has another receiving the temporary cleaning and minor repairs.

The car cleaner should have one car cleaned and ready to go out, while he is working on a second car; thus he requires two cars.

Most roads nowadays have a double equipment of cars, but I am sorry to say few of them seem to be able to keep the equipment in shape to do the work intended, hence you continually hear the complaint from passengers, "this road runs box cars all summer and open cars all winter." Men cannot do work unles they have something to work on, so keep the work ahead of them in the systematic way pointed out, and never let a shortage of cars for a special occasion cause you to rob the shops. You might make a few dollars on that day, but you disarrange the shop system, and in the long run it costs you many times the profit made.

SECOND STRIKE AT CLEVELAND.

The strike on the Cleveland Electric Ry. which was begun June 10th and lasted till June 25th was settled, so it was thought, by an agreement reached on the latter date. The substance of this agreement covered five points as given in the "Review" for July, page 490. One of the articles provided that the non-union men employed by the company during that strike were to be retained and not subject to annoyance by the union men who were to be taken back and given 80 per cent of the runs.

The union men acted in bad faith and it was soon discovered that a car with a non-union crew would be stoned and the men assaulted. To prevent this the runs of the cars in charge of non-union men were not posted on the bulletin boards at the barns, so that the "sympathizers" could not be advised of what cars to stone.

The refusal to again post the runs of non-union crews was one of the grievances alleged by the men when a second strike was begun at 4.15 a. m. on July 17th. The immediate cause was the discharge of 10 union men who refused to go out on cars having a non-union man in the crew.

Cars were sent out about 8 o'clock on two lines and were mobbed, the crews being severely beaten. The violence increased and culminated in the blowing up of a car (by placing dynamite on the track) on the evening of the 20th. Later the same night a dynamite bomb was exploded at one of the car barns in an attempt to injure non-union men quartered there. The riots increased in frequency and violence and the state militia was called out to cope with the disorderly elements.

Five hundred troops arrived on the 21st and 500 more were ordered to Cleveland on the 24th. More cars were wrecked by explosives on the 22d and 23d. The first fatality was the shooting of one of the rioters by a non-union motorman.

By the 27th Mayor Farley had reached the conclusion that the time for diplomacy was past and when the city council, which proposed to appoint a committee to investigate the cause of the strike, he made a pertinent speech saying that "now is a good time for everyone to mind his own business." Soldiers were quartered in the school houses against the protest of the school trustees.

The strikers declared a boycott on the street cars, and everybody who rides on them, and on the soldiers, from which much was expected. It was to extend even to persons who sold goods to persons who rode on the cars; naturally this was too sweeping to last.

On the 22d the press committee of the strikers gave out a lengthy statement advocating violence, which was in part as follows:

"Let every man abide by arbitration, if such method of adjudication does not bear the unmistakable evidence of partiality.

"We believe that force can be applied in many instances, and that it is absolutely essential in the present case. Government protects life and property, but does not regard labor in any light whatever. We are lacking a principle in government because we cannot employ the forces of the government to enforce the demands of labor. Government runs the street cars and threatens to shoot the men who dare interfere.

"Therefore the power of the laborers is nullified by the very government which says the laboring man has a right to toil. When any form of despotism arrays itself against the struggling masses, it cannot be successfully coped with by common law. When great aggregations of capital defy law and wipe out competition, thereby diminishing the demand for labor, they must be met by an element strong enough to render their organization futile.

"This is the power the union men wield today. It is a power for great good in the community. It protects the poor from the oppression of the fabulously rich and keeps before the public eye the various stages of progress along the lines of economic development."

Dynamite outrages continued, nearly every day a car was reported having been injured by explosives.

The citizens of Cleveland are growing heartily tired of the violence which has attended this strike, and the press reports of August 9th contain the following paragraph:

"At an enthusiastic meeting of more than 200 business men this afternoon a fund of $10,000 was started for the suppression of lawlessness in connection with the street railway strike. Many speakers denounced the strikers and perpetrators of violence. As a result of the meeting a demand will be made for the establishment of a regular army post in Cleveland. Steps were also taken to increase the police force of the city. The appointment of a committee of five was authorized to take steps to lift the boycott. The meeting resulted from the blowing up of a Wade Park Ave. car with dynamite early this morning."

INDIANAPOLIS RAILWAY CAR PLANT.

The Indianapolis Street Railway Co. is erecting and equipping a plant for the manufacture of all its own street cars. Ground has been broken for the shop building and much of the machinery has been ordered. The building will adjoin the present car barns in West Washington St.; it will have a frontage of 200 ft. and be 200 ft. deep. Mr. Charles Remelius, who was connected with the Detroit car shops, has been appointed master mechanic of the Indianapolis shops now building. The plant, it is announced, will be as well equipped as any in the country, and will employ about 100 men at the start.

It is the company's intention to start building its cars as soon as possible and it is thought that some of the new cars built at home will be in operation by November 1st. For the first three months closed cars only will be built, and then Mr. Remelius will turn his attention to building open cars for service next season. The company expects within a year to build at least 300 new cars in addition to those remodeled. The new cars will each accommodate 50 persons comfortably. When the plant is fully equipped it will have a capacity of a new car a day. The bodies of the closed cars will be 22 ft. in length, with large platforms in the rear, upon which a smoking compartment will be built. The paint shop is designed to hold 20 cars.

The power plant of the company in West Washington St. is being enlarged and a complete new equipment of motive power has been ordered. It consists of a 2,000-h. p. engine, a 1,200-kw. generator, and three new boilers. The contract requires that this plant shall be in operation within six months. The old plant will be used as a reserve. The engine room and boiler room are being enlarged. The company has secured ground for building tracks and switches and will soon be able to land its coal and materials at the plant and shops by rail.

The company has also let a contract for a new car barn in Louisiana St., 100 x 180 ft. It will have a capacity of 50 cars, and will be finished, it is announced, by October 1st. The McLean Place barns will be enlarged, so as to accommodate 200 cars.

A large amount of reconstruction of track is being carried on, and about 25 miles will be rebuilt this year. All the reconstructed track is being laid with welded joints and eventually it is intended to weld all of the tracks of the system.

A new baggage car, built by the Cedar Rapids (Ia.) and Marion Street Railway Co. was put into service on that road on July 22d.

In the second trial of the suit of the City of Toledo against the Water Street Ry. last month, the city was awarded $8,860, which is $42,000 less than the verdict returned at the first trial. Both sides are dissatisfied and have asked for a new trial, the city claiming the damages incommensurate, and the railway company considering them excessive.

TRAFFIC ON CHICAGO ELEVATED ROADS.

All of the elevated roads in Chicago have shown marked gains in their traffic. During the first six months of 1899 the Metropolitan is reported to have carried 2,200,000 passengers more than in the corresponding period of 1898, the gain being about 19 per cent; for July the gain was about 26 per cent. The company does not make public information, but the talk of the stock brokers is to the effect that it has earned a dividend every month since the new company began operating.

The South Side for the first half of the year shows a gain of 17½ per cent in gross receipts, and the belief is current that its stock will soon be put on a 4 per cent basis.

Figures for the Lake Street are not at hand, but the increase is said to be very encouraging.

TERRIBLE DISASTER NEAR BRIDGEPORT, CONN.

The most appalling street railway accident of recent years was that near Bridgeport, Conn., on Sunday, August 6th, in which nearly twice as many lives were lost as in the terrible Cleveland bridge accident Nov. 16, 1895.

The Stratford extension of the Milford (Conn.) Street Ry., forming the last section of an electric line from Bridgeport to Ansonia, was opened for traffic on August 3d, having just been completed. About midway between Bridgeport and Shelton the road crosses Peck's Pond on a long bridge which is approached from the south end by an earth embankment descending on a 3 per cent grade for 250 ft. The rails used are 5½ in. deep and on the bridge are 6 x 10-in. guard timbers bolted to the ties. A section of the trestle near the scene of the accident is shown in one of the engravings.

On Sunday the traffic was heavy, it being the first holiday since the line was opened. A car left Bridgeport at 2 p. m. and when passing Stratford, which is two miles from the trestle, had 42 passengers on board. At this writing it is not known whether there were others taken on later or not. When the approach to the bridge was reached the car commenced to rock violently, and finally jumped the track just after passing the first pier. It ran over the ties for a distance of 85 ft., and then left the structure. The car, which was an open one, turned over, spilling all the passengers, who fell into the marsh, some 50 feet below, the car falling on top of them. This fact accounts for the great number of persons killed. Twenty-nine were killed and 12 seriously injured. Watches found on two of the bodies show the time of the accident to have been 3:23.

One man jumped from the front platform of the car when it left the track escaped without serious injury, having landed in soft mud. The motorman also jumped, striking the ties and thence falling into the marsh; he suffered only bruises.

VIEWS OF THE WRECKED CAR.

A NEW RAILWAY FOR STEUBENVILLE, O.

The city of Steubenville, O., is about to grant a franchise for a street railway for which bids have been advertised by the city clerk. The route, which is called the Steubenville and Mingo Route, commences at Ross and Third Sts. and continues in a southwestwardly direction to the city limits of Steubenville. Bids were called for with reference to the terms and conditions contained in an ordinance passed July 11, 1899. All bidders were obliged to specify the lowest rates of fare for which passengers would be carried over the proposed route, viz.: Single cash fare, number of tickets for one dollar, number of tickets for 50 cents and number of tickets for 25 cents.

Only one bid was received from a company known as the Wheeling Co., which gave bonds of $10,000 with the Baltimore Guarantee Co. as sureties. The Wheeling Co. offers to carry passengers at the following rates: Single cash fare, 5 cents; 22 commutation tickets for $1, 11 for 50 cents. 5 for 25 cents; children under 6 years accompanied by adult person, free.

Soon after the accident a force of men was at work removing the dead and injured, the greater number of whom were pinned under the car.

On the next day the coroner's jury examined the scene of the wreck. The car, which had sunk in the mud beneath the bridge, was removed and carefully examined. The wheel flanges were found to be in perfect condition. The brake and brake rod also were uninjured. The location of the controller handle showed that at the time the car left the bridge the current was turned completely off. Bridge experts who accompanied the jury, said that a car running rapidly over the earth approach would acquire a springy, swaying motion, because of the elastic properties of the earth. If a car traveled down the approach at a high rate of speed, they said, it would, at the time the trestle was reached, be swaying considerably. So long as it remained on the earthen foundation there would be little danger of leaving the irons, but when the bridge was reached the elasticity of the foundation immediately would be removed, the bridge being rigid and the tendency would be for the car to spring up from the rails.

George Hamilton, the motorman of the ill-fated car, was arraigned in the Stratford justice court charged with manslaughter.

BRIDGE OVER PECK'S POND.

He pleaded not guilty and the case was continued for one week. The prisoner's bail was fixed at $2,000, which he furnished.

Engineer W. W. Starr, who superintended the building of the bridge, said that the bridge was perfectly safe in every respect. In his opinion, after a thorough examination, the motorman became bewildered as the car commenced to travel fast down the incline and finding himself in a dangerous situation lost his head and turned the current on instead of reducing it.

Since the accident two other cars have jumped the track at other points on the road, no one being injured in either case.

Under the common law there was no civil action sounding in damages for the wrongful killing of a person; pain and suffering, cost of medical attendance, loss of wages, etc., being the elements of damage, no action would lie where death was instantaneous. This rule has been modified by statute in most of our states, but the Connecticut law is rather peculiar in that the damages recoverable where death was instantaneous are limited to $100. The important question in the suits which will doubtless be brought against the company, will be whether falling through a distance of 50 ft. or more is a cause of physical or mental suffering, as no less than 23 of the passengers were killed on striking the ground.

A CHAPTER OF LESSER ACCIDENTS.

July 29th a car on the Montgomery (Pa.) & Chester electric line left the track in Phoenixville and ran into a building. The car was wrecked and a number of persons hurt, but none seriously.

Two cars belonging to the Wilmington & Chester Traction Co. collided on July 8th near Bellevue and 14 persons were injured. The injured were promptly cared for by the company and those who were not able to be taken home were sent to the Delaware Hospital. The safety signal had been tampered with and the cars met on a grade where it was impossible to stop them.

July 30th there was a collision between a passenger car and an express car on the Winchester Avenue road of New Haven, Conn., near Woodmont. It is stated that the accident was due to the motorman of the express car trying to "steal" a switch; he was seriously hurt, being the only one on either car injured.

A slight collision occurred at the junction of 59th St. and Eighth Ave., N. Y. City on July 21st, caused by the stopping of a 59th St. car too suddenly when signalled by the flagman. Three cars were running very close to each other, and when the first made a sudden stop the second and third cars crashed together. Two passengers who stood up to see why the car stopped were knocked down, but not seriously hurt.

An electric car was wrecked on a curve between Joplin and Galena on the evening of July 16th. The car was slightly behind time and was running around the curve at a speed of about twenty miles an hour and its derailment is thought to have been due to a broken wheel flange. After bumping along the ties for 100 ft. the car left the roadbed and plunged down an embankment on one side.

There were about 40 passengers on the car when it left the rails, but none sustained any more serious injury than a thorough shaking up or slight bruises.

July 23d a collision occurred on the Bradford (Pa.) Electric Street Ry. which resulted in the death of one person, a passenger, the severe injury of one of the motormen and lesser injuries to nine others. One car was proceeding up a rather steep grade, followed at a distance of a block or more by a special car going after a funeral party. The motorman of the first car saw the car that he had expected to meet at the next passing point, approaching, and therefore shifted his trolley and started back to make another switch. The special car which had been following was concealed from view because of a curve and the two collided with the result stated.

A serious collision occurred at South Dighton, Mass., on the Summerset & Swansea road on July 17th. At the Gushee hill turnout the motorman of the regular from Summerset car failed to notify the motorman of the down car that specials were following him. The car from Taunton at once proceeded, but had not gone 500 ft. beyond the turnout when the first special came into view through the fog, and before the motorman could put on the brakes the cars came together with a terrible crash, and the second special, coming along, collided with the other two. The motorman of the Taunton car jumped and fell into the river, but was rescued with slight injuries.

A serious collision occurred on the Fort Rouge line of the Winnipeg Electric Street Railway Co. on a curve in River Park, July 12th. One car was returning to the city from the terminus of the park line and had the right of way over the single track as far as the first siding where the car in the opposite direction should have been passed. The first car it is alleged passed the siding without stopping, contrary to orders. The second car which was loaded with passengers going to the park approached the curve at a good speed when it came in sight of the other car. The conductor of the first car succeeded in stopping and even reversing his car when the impact occurred, but the loaded car which was an old one had its vestibule completely wrecked, severely wounding the motorman and several passengers.

During a terrific thunder storm on the afternoon of July 7th, a head end collision occurred on the Akron, Bedford & Cleveland Ry., in which one passenger was killed, three fatally wounded and nine others injured. The collision occurred between a passenger car and a construction train near Season's switch, about three miles from the power house of the suburban road.

Shortly after 1 o'clock in the afternoon a motorman was dispatched from the power house to Northfield to bring back a stone car which had been used in construction work. He received orders from the train dispatcher not to proceed back to the power house before he received orders to do so. After finding the stone car fully loaded the motorman coupled the car onto his motor and waited for orders to move.

While waiting, the heavy storm came on and he could not reach

the train dispatcher by telephone. Believing that the telephone wires were disarranged by the storm and that he might be expected to move, he concluded to pass the Cleveland-bound car at Season's switch.

The northbound car passed Season's switch as per order and proceeded at full speed to the next switch. Some distance from Season's switch the two cars came together on a curve. The stone car cut its way almost through the passenger motor car. There were fully 20 passengers in the car at the time.

Two trolley cars collided at right angles in Brooklyn on July 8th at the crossing of Myrtle and Nostrand Aves. The Myrtle Ave. car was uninjured and proceeded on its way, but the Nostrand Ave. car was thrown across the track, blocking the line for half an hour. The latter car contained about 100 passengers, mostly women and children, several of whom were slightly injured.

PRESS COMMENTS ON THE CLEVELAND STRIKE.

It is the sort of a strike that some so-called labor leaders love to be mixed up with. It means bitterness and bloodshed, death and dynamite, and after it is all over the cause of labor in the city of Cleveland will be worse off than it was before. It cannot be otherwise.—Binghampton (N. Y.) Herald.

It remains to be seen how long the people will submit to the bullying of a mob which has had the effrontery to justify the use of dynamite, and which is now resorting to a vindictive and cowardly boycott. It is the duty of Cleveland to protect every man in the right to work if he chooses; to protect every man who chooses to ride on the cars, and it is equally the city's duty to protect the right of every merchant and shopkeeper to trade with whomsoever he pleases, and whenever and wherever he likes. No quarrel between employer and employed justifies the taking away of these elementary rights. Life and property must be protected whenever or however assailed.

The discharged employe who strives against the supremacy of the law makes a fatal mistake. As the Courier-Journal has repeatedly observed, the law is the poor man's best friend. The law is all that protects the weak and the poor from the strong and the rich, and whenever the law is assailed the poor man deprives himself of his only and most powerful protector.—Louisville Courier-Journal.

A Cleveland physician gave two boycotters an answer that they will not forget in a hurry. Yesterday afternoon he received a call to quickly attend a little girl, who is one of his patients who is at death's door. He started for the child's home. Her father is a motorman on one of the Big Consolidated cars. The physician had proceeded some distance when he was accosted by two men.

"I would advise you," said one of the men, "not to visit that—— scab's house. We know you have been going there, and thought you would be glad of a little friendly warning."

The physician regarded them contemptuously and answered: "Don't boycott me," he said, "although I have visited this child and shall continue to do so. Boycott God, for the child will not live long. Tell God that He must not allow her to enter heaven. Should he insist on doing so, boycott him by refusing to patronize heaven yourself."—Cleveland Leader.

The application of the boycott has assumed such a phase as to show the utter inhumanity of the men who enjoy it. When a doctor is warned by boycotters not to attend a dying girl because her father is a "scab," the heartlessness manifested is suggestive that the men who use it are not entitled to consideration as human beings. Such heartlessness robs the men resorting to such methods of all sympathy, and strikes and strikers are alike classed as relics of a past barbarous age. The term strike has lost its original significance, and now means little less than organized resistance to society and its laws, an organized denial of the right of one man to work unless under prescribed rules, and of another to hire outside of a self-constituted autocracy called a union. Until organized labor modifies its methods in this respect it will never receive the sympathy of the millions of men who are outside it, and the better class inside. In all these unions the strikes are originated, promulgated and managed by the least reputable elements, while the better class submit to a dictation they know to be unwise and unjust. The Review has thorough sympathy with the organization of labor for its own advancement and protection. But such an organization should be on lines that embrace the rights of others as well.—Elkhart Review.

WORK ON THE CHICAGO NORTHWESTERN ELEVATED.

Work has been resumed on the construction of the Chicago Northwestern Elevated R. R., which was organized in 1893 by Mr. Chas. T. Yerkes, and parts of which were built previous to 1896. The building of the road was let to the Columbia Construction Co., which consisted of the same people as those interested in the Northwestern Elevated. Owing to financial difficulties the work was stopped in 1896 until the present year, when a loan of $4,500,000 was made through Blair & Co., of New York, for the completion of the road. To secure the loan the entire capital stock and the bond issue were deposited with the Illinois Trust & Savings Bank. The contract with the Columbia Construction Co. was rescinded and the work is now carried on by the Northwestern.

The company commenced the work on this road last month at Dayton and Halsted Sts., and will push forward rapidly the completion of the section from Dayton St. to one square south of Cleveland Ave., a distance of nine squares. There are gaps between Hudson and Orleans Sts., and between Division and Hill Sts., for which the steel has not yet been rolled. The material is on the ground for the construction of the section from Orleans St., south of Division St., and the section between Hill St. and Institute Place. The material for the line from Institute Place to Michigan St. is at the mills ready for shipment.

The contract has been let for the building of the terminal station at Wilson Ave. This building is to be constructed of brick and steel, and will be 400 x 65 ft. in size. It will have a capacity for housing 40 motor cars, which will be put in operation when the line is open for traffic. The work on the viaduct at Wells St. will be completed in about three weeks.

In all, there will be 25.45 miles of track, of which 23.92 miles will be used for running trains, and the rest for car storage.

From Institute Place to Wilson Ave., a distance of a little more than 5½ miles, the road will be four-track, and it will be two-track from Institute Place to its connection with the Union Loop at Fifth Ave. and Lake St. Express trains will be run, which will make stops only once in each mile between Wilson Ave. and Institute Place. These trains will run from Wilson Ave. into the heart of the business district in a little more than 25 minutes.

The walls of the power house at Fullerton and Southport Aves. are completed, ready for putting in place a part of the trusses for the roof. The stack has been finished.

The present expectation is to have the road in operation by the last of March, 1900. Delay in the turning out of the structural steel by the mills has made it impossible to complete the road and have it in operation as early as was first expected.

Fifty out of a total of 147 cars have been completed and are ready for the track. The present plans include a connection with the Chicago & North Shore Street Ry., which will be made by means of an inclined plane, landing passengers on the station of the elevated road.

Several cars on the East St. Louis Ry. lines were placed at the disposal of the Ladies' Auxiliary of the Protestant Hospital Association on Saturday, July 22d. The cars were officered by a number of the prominent ladies of the city from 6 a. m. until midnight, and a considerable sum in fares was collected by the lady conductors for the benefit of the hospital.

The Missouri state board of equalization has recently made an important increase in franchise assessments of nearly $15,000,000. Of this increase $10,294,355 was upon the street railway systems of the city of St. Louis. Of the balance, $1,500,000 was upon the Kansas City street railways, and $500,000 upon the property of the Western Union Telegraph Co. in the state. The increase of assessment will increase the tax receipts $222,000.

AN ADVERTISING CIRCULAR.

The accompanying illustration and the matter quoted are from a small circular issued by the Rapid Railway Co., Detroit, Mich., for which Milton Carmichael is excursion agent. The advertisement strikes us as being an excellent one and it will doubtless interest the managers of other interurban lines. The reading matter is in part as follows:

INTERIOR VIEW OF RAPID RAILWAY PARTY CAR.

JUST A LITTLE HINT TO CLUBS AND SOCIETIES.

The time of the year has now arrived when it is pleasant to have social gatherings away from home—away from halls and the conventionalities of the winter.

Did you ever think of trying the trolley car diversity?

When the Rapid Railway party car turns out it is as neat as a parlor, cozy and comfortable, so that the occupants cannot help but have a good time. A number of conveniently arranged tables fix it just right for the serving of refreshments or for a card party.

Arrangements easily made at Mt. Clemens for dancing and other socialties.

PATERSON RAILWAYS SOLD.

Negotiations have been concluded for the sale of the lines of the Paterson Railway Co. to the Shanley syndicate, which controls the North Jersey Traction Co. The Paterson company's lines were practically the only ones in the northern section of the state which were not either owned or controlled by the syndicate, of which Mr. B. M. Shanley is the head.

The syndicate has for a long time been desirous of securing the Paterson lines and for some time past there have been heavy sales of the stock, a large number of shares changing hands. As was the case when the syndicate secured control of the North Hudson County Railway Co., and later the New Jersey Electric Railway Co., there will probably be no change in the directory of the Paterson Railway Co. for some time, as sufficient stock will be retained to entitle the present directors to continue to act as such. The control of the road, however, is now in the hands of the syndicate, and it is reported that the stock was purchased at its par value.

ELECTRICAL CONGRESS IN VIENNA.

The Electrotechnical Congress held in Vienna June 15-17, 1899, proved to be a great success, there being nearly 400 delegates and engineers in attendance. The papers and discussions dealt with electric railroads, lighting stations, and telephone and telegraph systems. Numerous excursions to notable electrical installations and other points of interest were made after the business sessions of the congress were over and on the second evening a banquet was held.

PRIZES FOR DIAGRAMS OF OVERHEAD WIRING.

We feel sure that all street railway men who are called upon to design or erect overhead wires on complicated crossings or curves would be interested in knowing of some of the problems that have been met in different cities and the ways in which they were solved.

In order to get information concerning a number of such overhead installations, the "Street Railway Review" offers two prizes for suitable drawings, the necessary description to accompany them. It is understood that we shall be at liberty to use all of the diagrams submitted.

First. A prize of $15 for the best example of overhead work at crossings or curves actually installed where all the overhead wires belong to one company, and there is no necessity for insulating the different lines from each other.

The points on which the award will be based are: a. Difficulty of the problem, such as number and location of switches, crossovers, etc. b. Excellence of the design, which includes the location of the poles, the arrangement of the span wires, pull-off wires, hangers, cars, etc. c. The neatness of the drawings will be considered in making the award.

Second. A prize of $15 for the best example of overhead wires at crossings or curves actually installed where the lines belong to different companies and it is necessary to insulate the different systems from each other. The basis of the award will be the same as in the first class.

RECONSTRUCTION AT MACON, GA.

The Consolidated Street Railway Co., of Macon, Ga., is reconstructing its entire roadbed, putting in 70-lb. T-rails. This makes the third time that the greater part of this road has been rebuilt. It was originally laid with 30-lb. rails, which were afterwards replaced with rails weighing 45 lb., which at the time were considered sufficiently heavy to last indefinitely, but experience has shown that the life of light rails on electric railways is very short.

Through the business districts of the city, where the traffic is heaviest, brick paving is used and a special brick is used next to the rail similar to the pavement of the South Bend (Ind.) Street Ry.

The accompanying illustration shows a "dinky" car which is used on some of the outlying lines of the Macon Consolidated. Many roads in the country are running large cars through thinly populated districts, where not more than seven or eight passengers

"DINKY" CAR, MACON, GA.

are picked up on a trip. Mr. E. E. Winters, superintendent of this company, has several such runs on his lines for which he has utilized cars 10 ft. in length. They were formerly mule cars which have been remodeled and equipped with a single 35-h. p. motor. Each of these cars is run by one man only, and they make such good speed that they have become very popular. The result of their use has been satisfactory to both the company and to its patrons.

The handling of the soldiers which were in camp at Macon during the winter greatly increased the winter's receipts.

ATLANTA ROADS OFFERED TO THE CITY.

As a Result of a Hot Franchise Fight Joel Hurt Makes a Proposition to Sell to the City.

The state of Georgia, on the petition of certain citizens of Atlanta, some time since began proceedings against the Atlanta Consolidated Street Ry. and the Atlanta Ry. to prevent a consolidation of the roads; it is urged that a consolidation would be in violation of a state law, as tending to prevent competition. As we understand the situation, the Trust Company of Georgia, of which Mr. Joel Hurt, formerly president of the Atlanta Consolidated, is president, purchased the stock and bonds of the Atlanta Railway Co. and the stock of the Atlanta Consolidated with the intention of effecting a consolidation, the operation in future to be conducted by the Atlanta Railway & Power Co. The plan to consolidate was abandoned as illegal, but the two roads being owned by the same parties, the officers of the Consolidated were chosen to similar position in the Atlanta Railway Co., and the operation put practically under one management.

The ostensible cause for instituting the legal proceedings was the declared intention of the Atlanta Ry. to take up its tracks in one of the streets, but the railway people contend that the suit is really brought by the Georgia Electric Light Co., which fears the Atlanta Railway & Power Co. would hurt its business.

Mr. H. M. Atkinson, of the Collins Park & Belt Railroad Co., and president of the Georgia Electric Light Co., made applications for street railway franchises covering the city and paralleling the Railway & Power company's lines.

On July 26th, Mr. Hurt addressed the following communication to the council:

"To the Committee on Electric and Other Railways of the City of Atlanta. Gentlemen: I herewith suggest the following propositions to the city government which, if acceptable, I will recommend and endeavor to have promptly accepted by the Atlanta Railway & Power Co. and the Atlanta Railway Co:

"The recent financing of these companies provides for a bonded stock issue of $2,000,000 and a bonded indebtedness of $5,000,000, of which there is reserved for future extensions and improvements $750,000. The bonds in reserve will build a new power and lighting station of sufficient capacity to light the city's streets and to supply power and lights for domestic and manufacturing purposes. It is estimated that after building a lighting station there will be left in reserve a large amount of bonds, which will be used for future extensions of the lines. A proper sinking fund is to be provided for the bond issue. The bonds will all bear 5 per cent, except $225,000 of the bonds of the old Atlanta Street Railway Co., which will bear 6 per cent.

"I propose that out of the annual earnings, commencing January, 1900, the dividends on the capital stock will be the first year 4 per cent; for the year 1901, 5 per cent, and thereafter 6 per cent. All dividends above 6 per cent will be divided one-fourth to the stockholders and three-fourths to the city for improving the streets and for public schools.

"The companies, acting with the city, to lay out and build all extensions of lines which may be needed, and in the event of any disagreement, the same to be determined by a commission to be established by the state legislature.

"The city to have the right at any time, after twelve months' notice to the companies, to purchase the properties by paying par for the stock, after any dividend period, and assuming the bonded indebtedness.

"In order for the city to receive the benefits of such an arrangement and to avoid a constitutional objection, if any, the companies' franchises to be amended in accordance with this agreement.

"If at any time the city of Atlanta should deem it advisable, the arrangement entered into can be terminated at its option, and the present rights of the company be reinstated.

"By this arrangement the companies will continue to pay their taxes, but the paving laws to be so amended as to relieve the companies from paving, except to restore paving which it may remove.

"In order to secure good service to the public, all complaints and criticisms to be left to an officer to be selected by the city, who shall have authority to adjust the same with the companies, and failing, to make complaint to a commission to be established for the purpose.

"The entire matter to be considered and so arranged as to secure to the companies and stockholders their rights and to secure for the public and to the city a proper discharge of the obligations of the public carrier.

"I am moved to suggest this proposition by a consideration of the fact that the franchises which have been granted and have for years proven unprofitable to the owners of the street railway companies, have now grown to a value on account of the increased population of the city, which merits a consideration of the advisability of the city's securing, if possible, a fair interest in the future growth of the property, and the further consideration that the owners of a large majority of the stock of the companies are Atlanta citizens, who will be satisfied with a reasonable return for their investment, and who, it is believed, would be willing to so adjust these public utilities as to secure to the city great benefits in the future, which might otherwise be enjoyed by foreign investors in the stocks of the companies, and which could not be reclaimed until the expiration of the present franchises, running from forty to fifty years.

"It is believed further that by this method the city of Atlanta can now secure and hold in reserve the right to own the properties which may in the near future be deemed advisable. Respectfully,

"JOEL HURT."

Two days later Mr. Hurt modified this proposition by limiting the dividends on the $2,000,000 of stock to 3 per cent for 1900; 4 per cent in 1901, and 5 per cent annually thereafter; all dividends to be paid out of net earnings. After 1902 all dividends in excess of 5 per cent to be paid one-fourth to the stockholders and three-fourths to the city.

As in Detroit many citizens who have supposed they were in favor of municipal ownership, are not so sure of their own mind when brought face to face with the actual proposition; and when they consider the responsibilities to be assumed and the political power involved are unwilling to recommend the deal.

The Atlanta situation has been growing more difficult for several weeks, until Mr. Hurt evidently concluded to make a grand charge on the enemy. A council committee has been appointed to study into the proposition and report.

CARBONDALE TRACTION SOLD.

The controlling interest in the Carbondale (Pa.) Traction Co. has been sold to stockholders of the Scranton (Pa.) Railway Co. and the new officers were chosen on August 1st. The Carbondale Traction Co. is the successor to Lackawanna Valley Rapid Transit Co. and the old Carbondale company, and operates 20 miles of electric railway. It is expected that the road will eventually be consolidated with the Scranton and Wilkesbarre systems, and one of the first things to be done is the changing of the gage from its present width to standard.

Upon the transfer of stock being made E. E. Hendrick, president, and R. A. Jawdin, secretary and treasurer, resigned and the following officers elected: President, Clarence M. Clark, of Philadelphia; vice-president, Frank Silliman, jr., of Scranton; secretary and treasurer, R. A. Jadwin, of Carbondale, who was re-elected.

Mr. Clark is president of the Scranton Ry. and Mr. Silliman is manager.

Mr. C. E. Flynn has been manager of the Carbondale road for several years, and it is largely due to his efforts that the property has been brought up to a condition where it was a desirable purchase. Mr. Flynn will continue as general manager.

MR. LOWRY'S PRIVATE CAR.

A new car built for the use of Mr. Lowry and other officers of the Twin City Rapid Transit Co., and their friends, was placed in service a few days since. It is equipped with a toilet room, buffet, card room, large wicker arm-chairs replete with cushions, carpeted floor, hand-painted panels and ceiling, and all the luxuries which taste could suggest for a parlor on wheels.

The car will be placed at the disposal of President McKinley when he visits Minneapolis.

THE OLDHAM, ASHTON & HYDE TRAMWAY.

The Oldham, Ashton & Hyde (England) tramway, power for which is furnished from the electrical works of the Ashton Corporation, was completed on May 25th last and favorably opened for traffic on June 12th. This road and the Corporation plant are the subjects of an interesting article in the Electrical Review, London, from which the following details have been gathered. The road runs through residential and manufacturing districts, connecting the three cities named; along the route are many sharp curves and

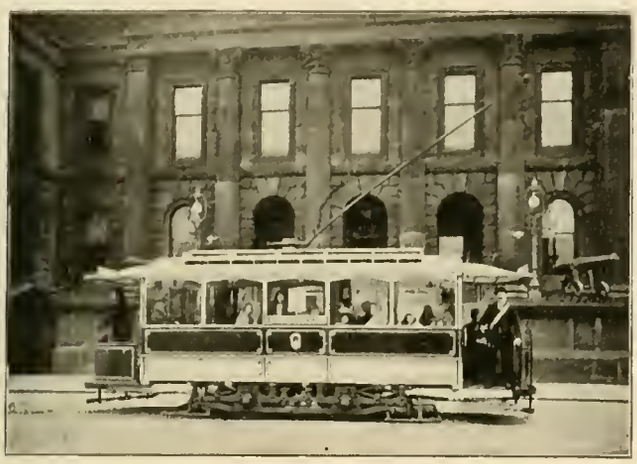


FIG. 1—CAR AND LINE IN ASHTON.

grades, the steepest being about 9 per cent. The line at present consists of eight miles of single track with turnouts, but important extensions are in contemplation. The equipment is of the overhead single trolley type.

Fig. 1 shows the style of cars used on this road of which there are 26 motor cars and 12 trailers with closed bodies mounted upon single trucks of the Peckham cantilever type having a wheel base of 5 ft. 6 in. The cars are 26 ft. long over all with a seating capacity of 26 passengers inside and 2 on each platform. Each car is fitted with two 27-h. p. G. E. motors. The trolleys are of the Boston pivoted type with Dawson swivel heads but these are to be changed in accordance with the recommendations of the Board of

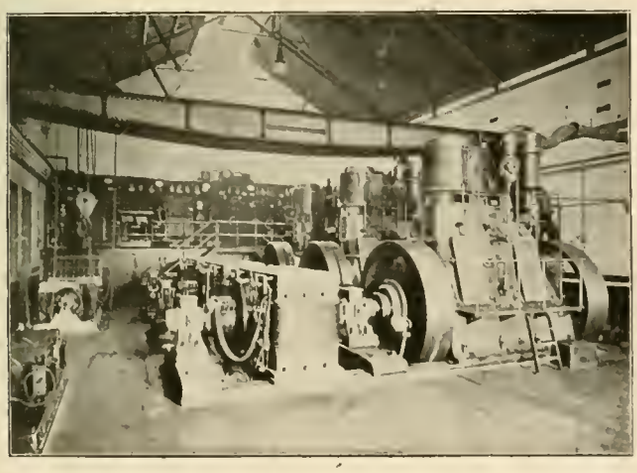


FIG. 2—GENERAL VIEW OF ENGINE ROOM.

Trade to the straight under-running type with detachable heads so that if the trolley jumps off the line and strikes the overhead wires the head will be pulled off without injuring the line work. The K 10 series parallel controllers which are in use at present are to be superseded shortly by the B 13 type, with Westinghouse electrical brakes, one of which is already in use. The trailers as well as the motor cars will be supplied with electric brakes so that the whole control will be in the hands of one motorman.

The road is built to standard gage with 94 lb. girder rails which are machined at the ends for Dick, Kerr & Co.'s patent fishplates. These are 20 in. long and, as will be seen from the illustration, are designed to give a continuous running surface over the joints. The rails are tied to gage every 8 ft. with tie bars and are laid on a 6 in. bed of concrete except where the ground is very soft. At such points the rails are laid on 6 x 12 in. stringers set on a concrete foundation. The rails are bonded with two Chicago bonds at each joint with cross bonds at frequent intervals.

The overhead work is carried principally on iron side poles with span wires, although a few poles with brackets are used in certain narrow streets. Some of the poles carry arc lamps on top. The trolley wire is No. 0 B. & S. of hard drawn copper and is double throughout to avoid overhead switches. Guard wires are also used.

The feeder cables, of which there are 25 miles in all, are lead covered with paper insulation, and are laid directly in the ground without further protection except in the made ground where wooden troughs are used filled with a bituminous compound.

STATION.

The electric station of the Ashton Corporation is a combined lighting, railway and destructor plant and is essentially up to-date, the whole of the pumps and accessories being electrically driven.

The engine room contains three 650 h. p. units each consisting

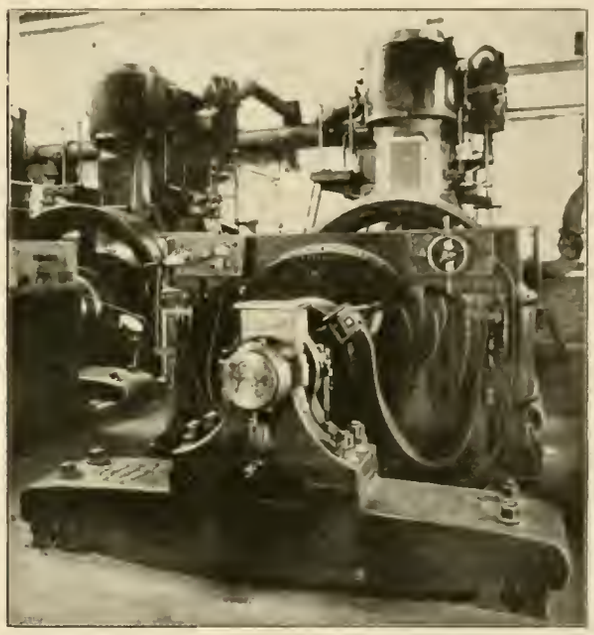
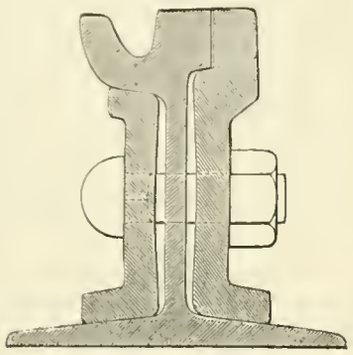


FIG. 3—END VIEW OF GENERATOR.

of a Browell—Lindley compound engine direct connected to a 2-pole dynamo made by P. R. Jackson & Co., Ltd. The engines are enclosed with casings and are equipped with Westinghouse and Rite's patent central valve. They are supplied with steam at 140 lb. pressure; the cylinder dimensions are 16½ and 31 x 17 in. The governors are of the Begtrap automatic fly-wheel type which act on both cylinders and are regulated by a sliding weight which can be adjusted to govern at 190 r. p. m. for lighting and 210 r. p. m. for traction. A general view of the engine room is given in Fig. 2 which shows the two fly-wheels on each engine, one between the engine and dynamo 8 ft. in diameter and weighing 3 tons, and the other on the outside of the engine. The latter contains the governor. Forced lubrication is provided for all the moving parts by two sets of oil pumps to each engine, one of which is held in reserve, and the oil is supplied under 25 lbs. pressure. Each engine is supplied with a steam separator, blow-through valves for warming up the cylinders and a water circulation around the slides which is used chiefly for emergencies. "United States" metallic packing is used throughout. The normal capacity of each engine is 500 h. p. non-condensing and 650 h. p. condensing.

A general view of the dynamos is shown in Fig. 2 and a more detailed view in Fig. 3. These are provided with a special winding designed to give 550 amperes at 550 volts for traction purposes, and

680 amperes at 400 volts for lighting. At the left hand side of the pole piece in Fig. 3 will be seen a two-way switch. This is used to cut out the series winding when the dynamos are used for lighting, and on the right hand side is an equalizing switch for running in parallel with the compound winding. The armatures are wound on the Jackson-Sayers patent system, with Lewis and Howitts patent polar extensions. The efficiency of the machines is said to be such that the full load may be switched on or off, with either the shunt



RAIL JOINT.

or compound excitation, without causing sparking, while the brushes need not be shifted under any change of load. The field magnets are of cast steel and the shunt winding is outside the series coils. The armature is 44 in. in diameter and 36 in. long, with a toothed core and wound with copper bars with evolute end connections. The armature core is ventilated and the shaft is hollow, being provided with Lewis's oil throwers which lift the oil from a reservoir and throw it into catchers whence it flows into the bearings. The brushes are staggered, the middle one of "Boudreaux" white metal foil being set a little ahead of the other two which are of copper. The coupling is insulated with ebonite and rubber bushings around the pins and the fields and bearings are magnetically insulated from the bed plate by heavy zinc separators.

There are two smaller machines in the engine room shown at the left of Fig. 2. One of these is a motor generator consisting of a 75-kw. compound generator and shunt motor. The series winding is used when the machine is transferring power from the lighting to

FIG. 4—DESTRUCTOR AND PART OF BOILER HOUSE.

the traction mains but may be switched out when the machine is running on the traction mains to assist the lighting. It is also used for carrying the day lighting load or for charging the storage batteries from either sets of mains. The other small machine is a balancer for regulating the lighting system which is on the 3-wire plan. The two small machines are nearly alike and are in general similar to the large dynamos.

A battery of 240 Plante cells is contained in the engine room back of the switchboard. This has a capacity of 50 amperes for 9 hours or 110 amperes for a short time.

The switchboard partly shown in Fig. 2 contains 9 panels. The first three on the left are dynamo panels, each containing a double pole main switch, voltmeter, ammeter, double pole fuses, shunt switch interlocking with main switch, and shunt rheostat, also a small switch which cuts out with a small reverse current. The latter is used instead of a minimum current cut-out for, as the dynamos are used for traction as well as lighting, if all the cars stopped at once a minimum current cut-out would cut out the line. The fourth panel contains + and — voltmeters, a neutral ammeter and plug bars for four feeders, one for balancing distributor and one for traction. Also on the back of this panel are seven plug bars, four for dynamos, two for motor generator and one for battery discharge. The fifth is the station panel with main switch and circuit breaker, lightning arrester, total ammeter and Thomson wattmeter. The next panel is for the motor-generator and contains two volt meters, two ammeters, current direction indicators and a complicated set of interlocking switches for operating the motor generator. Panel No. 7 is the storage battery panel, No. 8 is the balance panel and the last three are feeder panels fitted with the usual apparatus.

The station supplies public arc lights up to midnight and each lamp post is provided with two incandescent lamps which are used instead of the arcs after midnight. These are changed over by a 2-way switch.

The boiler room, partly shown in Fig. 4, contains three tubular boilers of the Lancashire type, each 28 ft. long by 8 ft. in diameter. The heating surface is 990 sq. ft. and the grate area 44 sq. ft. Green economizers are used consisting of 280 9-ft. tubes, the scrapers being driven by a motor. The feed pump is a 3-throw ram pump delivering 4,000 gallons of water per hour against a pressure of 140 lb. An independent injector feed is also supplied. The feed pump is driven by a motor from the 440-volt mains but arrangements are being made to run it at a lower speed on 220 volts.

A separate Ledward ejector condenser is placed in the exhaust pipe close to each engine and fed with a head of 20 ft. of water from a tank over the pump room. From the hot well the water is pumped through a Ledward cooling tower by a centrifugal pump driven by a 22-h. p. motor. A similar pump afterwards raises the water from the cooling tower to the tank above the pump room.

The destructor, Fig. 4, situated at one side of the boiler house, consists of six cells. The gases from the cells are led through two multitubular boilers, each 11 ft. long by 8 ft. in diameter which contain 106 tubes 3½ in. in diameter. The draft passes around the sides and underneath the boilers. The heating surface of the tubes is 1,065 sq. ft. and of the shell plates 154 sq. ft. A small tramway runs around the destructor for the removal of clinker to a mortar mill where it is mixed with lime and sold for building purposes.

MAY NOT CARRY FREIGHT IN DETROIT.

July 27th, Judge Lillibridge of the Wayne Circuit Court enjoined the Detroit street railway companies from hauling freight through the streets of the city. The suit was instituted over a year ago and the decision is based on the fact that there is no city ordinance providing for carrying freight. The injunction is against "carrying, handling, or transporting upon cars over the lines of its railways, within the limits of the city of Detroit, slag, cobblestones, sand, or other material or heavy freight, except that which is necessary to be used by the company in the construction and repair of its tracks and roadbed."

Nearly all of the interurban electric lines about Detroit will be affected by this ruling, as the freight traffic was increasing and promised to soon become profitable.

Later advices state that hauling freight has not been stopped, notwithstanding the order of the court, as the merchants and business men generally demand that it be continued. If the Supreme Court affirms this decision it is almost certain that the suburban lines will be given freight franchises.

The number of passengers last year on the electric railways in Canada was 100,000,000, an increase of over 19 per cent compared with the previous year, when the number was 83,811,306. This is a most satisfactory showing, but the present year will be still more favorable, as there is a steady expansion of electric railway systems in Canada.

INTEREST ON CASH DEPOSITS.

The Cincinnati Street Railway Co. has effected what we believe is a very happy solution of the bond and deposit question which in many instances has provoked hurtful controversy between companies and their employes. Mr. James A. Collins, secretary and assistant general manager, has sent us copies of the resolutions adopted by the directors; they are as follows:

"Whereas, The Cincinnati Street Railway Co. has endeavored to provide a method for bonding its conductors, motormen and grip men by a reliable surety company and at such time to refund to said employes the amounts of their respective deposits, but has been unable to make arrangements satisfactory to a majority of the employes thus interested; and further, it desires to place the said employes with respect to their deposits upon an equal footing with the stockholders of the company; therefore it is,

"Resolved, That a dividend of 5 per centum per annum be and the same is hereby declared upon the deposits of all conductors, motormen and gripmen for the fiscal year ending June 30, 1899, payable on the 15th day of July, 1899 and that annually thereafter on the first day of July succeeding, an annual dividend at the same rate paid stockholders shall be paid to all conductors, motormen and gripmen upon their respective deposits."

On a request from some of the collectors to be permitted to deposit money in lieu of giving bond, the following was unanimously adopted:

"Resolved, That any employe who is required to furnish a bond for faithful performance of duty, etc., may at his option deposit with the treasurer of the company money to the amount of the required bond, upon which said deposit dividends will be paid annually on July 1st succeeding, at the same rate paid to stockholders; same to prevail until further orders."

AMERICAN TROLLEYS FOR PARIS EXPOSITION.

One of the exhibits for the Paris Exposition of 1900 which has been planned by the management is an electric road upon which will be run model cars made by the different manufacturers of the United States. It is expected that each plant will be represented by at least one car. Awards will be made by the Exposition authorities. The over-head trolley system will be used, and the road will be a mile long, connecting the Seine with Vincennes Park, where the overflow exhibits of the Exposition will be placed.

Vincennes Park is six miles from the main Exposition grounds, and it is proposed to make an American line of transportation between the two, consisting of boats on the river for five miles of the distance and the electric road for the remaining distance. Although outside of the grounds this line will be considered a part of the American exhibit.

It is stated that another novelty of the Exposition will be a gigantic umbrella that has been invented by R. E. Sherman of Chicago. It is a steel structure about 350 feet in height. To each rib of the umbrella a car capable of seating 50 people will be attached, and these cars will be lifted from the earth to a point even with the top of the structure, where they will be suspended in mid-air long enough to give a magnificent bird's eye view of the grounds and the city beyond.

WIRE THIEVES CAPTURED.

The Pennsylvania Traction Co., of Lancaster, Pa., has been much annoyed by the cutting and stealing of the copper ground wire connecting its tracks. At 7 o'clock in the morning, on July 5th three men were caught with a large quantity of the wire in their possession, and it is thought with their capture the trouble will cease. The three colored men arrested drove to a junk shop with two bags filled with copper wire, the weight being close to 300 lb. Mr. Miller, the proprietor, thought the wire looked suspiciously like the kind used by the Traction company, and to verify his suspicion, he telephoned to Alderman Cummings, advising him of the affair, and the alderman told him to keep the men in conversation, first buying the wire, paying for the same with a check, the payment on which, of course, could be stopped. Alderman Cummings telephoned the police station, and two officers went to Miller's establishment and took the three men into custody.

CANADIAN ELECTRICAL ASSOCIATION.

An annual meeting of the Canadian Electrical Association was held at Hamilton, Ont., last month for the election of officers for the ensuing year, at which the following officers were elected: President, A. A. Dion, Ottawa; vice-presidents, E. E. Cary, St. Catharines, P. G. Gossler, Montreal; executive committee, J. J. Wright, Toronto; O. Higman, Ottawa; Geo. Black, Hamilton; John Carroll, Montreal; A. B. Smith, Toronto; J. Street, Ottawa; W. H. Browne, Montreal; A. Sangster, Sherbrooke; H. R. F. Wise, Brantford; B. F. Reesor, Lindsay.

The next meeting will be held at Ottawa.

PENNSYLVANIA STREET RAILWAY ASSOCIATION.

At a meeting of the executive committee of the Pennsylvania Street Railway Association, held recently, it was decided to postpone the eighth annual meeting of the association from the first week in September, to Wednesday and Thursday, October 4th and 5th.

The meeting will be held at the Stevens House, in the city of Lancaster. Papers and addresses of interest to members of the association will be read and delivered at the first day's session, while the second day will be occupied with a series of entertainments of interest and attraction to members and visitors in attendance at the meeting.

Announcement of the program and exercises for the meeting will be made in the next issue of this paper.

S. P. LIGHT,
Secretary.

AN ENGLISH STREET RAILWAY ASSOCIATION.

The Tramways & Light Railways Association has been incorporated in Great Britain under the companies' acts, for the purpose of promoting the welfare of the various tramways and light railways in that kingdom. The members of the association may be individuals, who shall pay annual dues of $5, or corporations or companies, who shall pay annual dues of $25. Individuals have one vote and companies five votes. The governing body comprises the president and vice-president and a council of not more than 18 members; the following gentlemen have been appointed councilors by the signatories of the articles of association:

George Richardson, chairman of North Metropolitan Tramways Co., Belfast Street Tramways Co., Blackpool & Fleetword Tramroad Co., etc.

George F. Fry, of the Tramways Committee of Dover, chairman of the London Street Tramways Co., etc.

Emile Garcke, managing director of the British Electric Traction Co., chairman of the Potteries Electric Traction Co., Swansea Improvements & Tramways Co., etc.

J. Barber Gleen, managing director of Provisional Tramways Co., secretary of the Belfast Street Tramways Co., Isle of Thanet Light Railway Electric Co., etc.

W. M. Murphy, chairman Dublin United Tramways Co., etc.

Stephen Selton, parliamentary engineer British Electric Traction Co., etc.

A. M. Willcox, editor of the Railway World, has been chosen honorary secretary of the association and that journal made its official organ.

THE PHILADELPHIA EXPOSITION.

Good progress is being made on the buildings for the National Export Exposition to be opened at Philadelphia, Sept. 14, 1899.

The contractors in charge of the work on the exposition buildings are rushing it with all possible speed. Already the work is two weeks ahead of time, such has been the haste with which it has been pushed forward. Work on the esplanade is being hurried forward with all possible despatch. From plans and descriptions it can be seen that it will be a beautiful place, rivaling, if not surpassing, the famous Court of Honor at the World's Fair in Chicago in 1893.

LICENSE FEES FOR STREET RAILWAY PARKS.

In compliance with an inquiry from the Derby (Conn.) Street Railway Co. in regard to the license charges made by cities for parks and amusement resorts operated by street railway companies, we have addressed letters to a number of roads, from which the following information has been received:

Holyoke Street Railway Co., Holyoke, Mass.; population 45,000; 10 cents admission to park; 5 cents for use of chairs; $1 per season license fee.

Lewiston, Brunswick & Bath Street Ry., Lewiston, Me.; population of the three cities 52,000; no admission fee to park and no license fee paid to city.

Middletown Street Railway Co., Middletown, Conn.; population of 20,000; 5 and 10 cents for admission to park; no license.

Duluth Street Railway Co., Duluth, Minn.; population 60,000; no admission fee to park; admission to theater 10 cents to 35 cents; license fee paid by lessee.

Ottawa Electric Railway Co., Ottawa, Can.; population 55,000; admission fees to park 10, 20 and 30 cents; no license fee.

Lynchburg & Rivermont Street Ry., Lynchburg, Va.; population 30,000; no admission fee to park; 10 cents for seats on pavilion only; no license fee paid.

Central Railway & Electric Co., New Britain, Conn.; population 25,000; no admission fee; 5 cents for seats; no license fee paid to city.

Terre Haute Electric Co., Terre Haute, Ind.; population 38,000; no admission fee to park; no license fee paid city.

Hot Springs Railroad Co., Hot Springs, Ark.; population 17,000; 10 cents admission to park, reserved seats 20 cents; park outside city; county license fee $27 per year.

Allentown & Lehigh Valley Traction Co., Allentown, Pa.; population (Allentown and Bethlehem) 61,000; no admission fee to park, reserved seats 10 cents; $10 license fee paid to city.

Binghamton Railroad Co., Binghamton, N. Y.; has two parks; admission charged to one, the other free; no license fee paid to city.

Schenectady Railway Co., Schenectady, N. Y.; population 29,000; no admission except when park is rented; no license fee paid city.

Easton Transit Co., Easton, Pa.; population 30,000; no admission fee to park and pays no license fee to city.

Birmingham Railway & Electric Co., Birmingham, Ala.; population 80,000; admission to park free, to pavilion 10 cents; park outside city; state license $25 per year.

Cleveland City Railway Co., Cleveland, O.; population 400,000; generally free admission to park, holidays 5 cents; park outside city; no license fee.

Atchison Railway, Light & Power Co., Atchison, Kan.; population 17,000; 10 and 20 cents for admission to shows in pavilion; no license fees.

Jamestown Street Railway Co., Jamestown, N. Y.; population 28,000; admission to park free; no license paid to city.

Fort Wayne Consolidated Railway Co., Fort Wayne, Ind.; population 50,000; admission to park 10 and 15 cents; no city license fee.

Tri City Railway Co., Davenport, Rock Island and Moline; population of three cities 75,000; no admission fee to park, 10 cents to theater; no license fee paid to city.

Consolidated Street Railway Co., Grand Rapids, Mich.; population 100,000; no admission fee to park, 10 cents for reserved seats; license fee to city $10 per year.

Meadville Traction Co., Meadville, Pa.; population 12,000; no admission fee to park; no license fee.

Ashland & Cattlesburg Street Railway Co., Ashland, Ky.; population both cities 10,000; no admission fee to passengers, 10 cents to others in park; no license fee.

St. Thomas Street Railway Co., St. Thomas, Ont.; population 12,000; no admission fee to passengers to park, 5 cents to others, chairs at theater 5 cents; no license fee.

Norwich Street Railway Co., Norwich, Conn.; population 24,000; 5 cents admission fee to passengers to park, 10 cents to others; no license fee.

Manistee, Filer City & East Lake Railway Co., Manistee, Mich.; population 25,000; park free to passengers, 10 cents admission fee to casino; no license fee.

Bridgeport Traction Co., Bridgeport, Conn.; population 65,000; park is rented to picnic parties, etc., who fix their own admission fee; no license fee.

Lowell & Suburban Street Railway Co., Lowell, Mass.; population of city 90,000; no admission fee to park, theater 5, 10 and 20 cents; no license fee.

Geneva, Waterloo, Seneca Falls & Cayuga Lake Traction Co., Seneca Falls, N. Y.; population of these cities 23,000; park free to passengers, admission fee to others 10 cents; no license fee.

Dartmouth & Westport Ry., running from Fall River to New Bedford, Mass.; population of two cities 170,000; no admission fee charged to park; license fee to city $100.

Manchester Street Railway, Manchester, N. H.; population 60,000; 5 cents admission fee to park; no license fee.

Southwest Missouri Electric Railway Co., Webb City, Mo.; population 5,000; no admission fee to park; no license fee; park out of city.

Loraine & Cleveland Railway Co., Cleveland, O.; population 375,000; no admission fee; park 20 miles from city; no license fee.

Denison Street & Electric Railway Co., Denison, Tex.; population 15,000; admission fee to park 10 to 25 cents; no license fee for free show, nominal license fee for pavilion.

New Orleans City Railroad Co., New Orleans, La.; population 300,000; no admission fee to amusement park, except 15 cents fare for round trip on cars; no license fee, but company keeps hotel, pavilion, platform, pier and revetment levee in good condition as per contract with city.

Leavenworth Electric Railroad Co., Leavenworth, Kan.; population 23,000; no admission fee to park; no license fee.

Other replies have been received from roads which do not own or control the parks upon their lines and as these do not bear upon the subject under discussion we have refrained from quoting them.

DIVIDENDS ON WAGES AT COLUMBUS.

Mr. Robert E. Sheldon, president of the Columbus (O.) Street Railway Co., has favored us with a copy of a resolution recently passed providing for the payment to employes of dividends on wages earned. This resolution reads:

"Whereas, The directors of the Columbus Street Railway Co. desire to show their appreciation of the loyalty and efficiency of its employes, and as an incentive to continued faithfulness, be it

"Resolved, That until further ordered by the board, on dates when dividends are declared payable to the stockholders of the company, there shall also be paid to regular employes of this company, additional compensation, the amount of which shall be ascertained by multiplying the total sum of each employe's wages during the preceding three months by such figure as will produce the rate of dividend as is paid to stockholders. To entitle an officer or employe of the Columbus Street Railway Co. to receive such additional compensation, the following conditions must obtain in each instance:

"First, the employe must have been in the employ of the Columbus Street Railway Co. for six months preceding the three months for which extra compensation may be awarded.

"Second, should an employe quit of his own accord, or be discharged from the service of the company, he shall not be entitled to the extra award for the fraction of the three month period."

The company pays regular quarterly dividends of 1 per cent.

The first payment to employes in accordance with this resolution was made August 1st, and the secretary of the company, Mr. P. V. Burington, writing under date of August 4th, states that the company has already received many evidences from the recipients of their great appreciation.

MORE TROLLEY WIRE STOLEN.

On the night of July 18th thieves cut down and carried away 600 ft. of trolley wire on the Buffalo & Hamburg (N. Y.) road. The work was done before midnight, and one of the late cars was laid out, passengers having to walk three miles and take a steam train to get home.

On Sunday, July 16th, electric cars superseded cable cars on the State St. line of the Chicago City Ry.

FUNERAL SERVICE ON THE CALUMET, CHICAGO.

Ever since the Calumet Electric Street Ry. was opened for traffic it has furnished funeral trains to parties desiring them, and the service has been extensively used.

Mr. H. M. Sloan, general manager, informs us that from Jan. 1, 1899, to July 22, 1899, he has furnished 90 funeral trains, aggregating 90 motor cars and 66 trailers. The number of funerals over the road is often as high as four per day. The charges for cars are $8 for a motor car and $3 each for as many trailers as may be desired. This charge is extremely reasonable, two cars replacing 15 carriages and the hearse.

No special funeral cars are owned by the company. The back is removed from one seat of a motor car and a place thus provided for a coffin. While a specially finished and handsomely upholstered car would be appreciated, a single such car would be insufficient for this traffic and probably would excite ill feeling because all could not use it, and the cost of several such cars would be too great.

ELECTRIC ROAD IN MEXICO.

The city of Mexico will soon have an electric railway, good progress having been made in the equipment of the Guadalupe and San Angel lines for electric traction. Mr. C. F. Beames writing in Modern Mexico gives some details concerning the work and we reproduce the illustrations. There yet remains some work in the heart of the city replacing light weight rails with 85-lb. 60-ft. girders.

The power plant is located in Colonia, Indianilla, south of the city and comprises three buildings, engine room, boiler house and coal storage, with steel frames; the walls are of stone and "tepetate" and were erected after the frame and roof were up and most of the machinery in place.

The equipment includes three batteries of Babcock & Wilcox water-tube high-pressure boilers, supplying steam to two McIntosh & Seymour cross-compound condensing engines, each direct connected to one General Electric 425-kw. 550-volt generator operating at 100 r. p. m. There is also a single cylinder McIntosh & Seymour engine direct connected to a 25-kw. G. E. generator for lighting. There is a 25-ton traveling crane in the engine room.

The J. G. Brill Co. will furnish 35 cars, 18-ft. bodies and 27 ft. over all, with cross seats, and large windows to make them "convertible." The cars will be mounted on Brill trucks, equipped with two 35-h. p. G. E. motors.

The work has been under the general supervision of Mr. A. E. Worswick, vice-president and resident engineer of the railway company. Mr. J. Pereira, representing the Babcock & Wilcox Co. in Mexico, engineers from the engine builders, and of the Mexican General Electric Co., installed the apparatus. Mr. H. P. Bradford is president of the railway company.

1—LAYING 60-FT. GIRDERS—TEMPORARY TRACK AT LEFT. 2—POWER HOUSE. 3—INTERIOR OF POWER HOUSE DURING ERECTION OF MACHINERY.

The Birmingham Railway & Electric Co., of Birmingham, Ala., has published a time table of its street railway lines which is embellished by numerous illustrations of the pleasure resorts to which its cars run. This company has two handsomely fitted trolley cars for the accommodation of trolley parties.

THE PENNSYLVANIA CONSOLIDATION.

One of the largest consolidations of electric lighting and street railway properties of which so many have recently been effected, is that of the United Power & Transportation Co., of Philadelphia. In the "Review," May, 1899, page, 353, was an announcement of the incorporation of this company under the laws of New Jersey, and that it had obtained control through the purchase of stock, of three large railway systems in Pennsylvania.

Other properties have been secured from time to time and now the company controls the following:

Wilkes-Barre & Wyoming Valley Traction Co.
Wilkes-Barre, Dallas & Harvey's Lake Railway Co.
Lebanon Valley Street Railway Co.
Trenton Street Railway Co.
Wilmington & Chester Traction Co.
Wilmington City Railway Co.
Chester Traction Co.
Delaware County & Philadelphia Electric Railway Co.
Holmesburg, Tacony & Frankford Electric Railway Co.
Roxborough, Chestnut Hill & Norristown Railway Co.
United Traction Co., of Reading.
Wilmington City Electric Co.
Citizens' Electric Light & Power Co., of Delaware County.
Edison Electric Illuminating Co., of Lebanon, Pa.

The street railways in this list have an aggregate of over 300 miles.

The officers of the United Power & Transportation Co. are: President, John A. Rigg; vice-president, R. N. Carson; secretary, E. J. Moore.

ANNUAL REPORT OF THE GLASGOW TRAMWAYS.

The results of the year's working ending June 1, 1899, shows that the revenue of the Glasgow Corporation tramways amounted to £439,224 1s. 8d. and the working expenses to £318,105 18s. 1d., leaving a gross balance of £121,118 3s. 7d. The gross balance for the preceding year was £100,538 14s. 11d. The years gross balance has been applied in meeting interest, sinking fund, rent of Govan and Ibrox tramways, payment to common good fund, depreciation written off capital, in all amounting to £67,345 12s. 7d., leaving a net balance of £53,772 11s. 0d., which has been transferred to the general reserve fund.

The chief point of interest in connection with this report is the inauguration of the overhead trolley system during the past year and the resolution to adopt it for the whole system. In anticipation of this change a scheme for numerous and important extensions both inside and outside the city, measuring in all 19 miles of double track, has been approved during the past year.

From the list of lost articles found in the cars of the Glasgow corporation it is to be inferred that the inhabitants of that city are particularly absent-minded, especially in regard to umbrellas. No less than 1,123 of these were found on the cars last year, and 1,153 during the previous year. Bags come next, with a record of 742 for the year, and the bundles of clothing number 718. There were 576 purses found, and the total of all articles numbered 6,716, of which 3,490 were claimed.

IN THE POWER HOUSE.

This department is devoted to the construction and operation of electric railway power houses. Correspondence from practical men is specially invited. Both the users and makers of power house appliances are expected to give their views and experiences on subjects within the range of the department.

Mr. H. J. Termohlen, electrician of the Rockford (Ill.) Railway, Light & Power Co., writes us concerning the armature of a D-62 machine, used as a street railway generator, which has had a long life. He wound the armature in June, 1894, and it was put in service July 19, 1894. It burned out July 1, 1899, having been run from 6 a. m. to 11 p. m. every day during the five years, except during two weeks when the engine driving it was being repaired and a new commutator put on the generator.

Who has a better record?

TESTING RHEOSTATS FOR HEAVY CURRENTS.

Mention has been made in these columns of the manner in which the Calumet Electric Railway Co., Chicago, utilizes the swampy land surrounding its power station for a rheostat when testing with heavy currents. The track rails served as one terminal and one or more pipes driven into the ground as the other. Recently General Manager Sloan wished to calibrate his wattmeters and needed a rheostat for heavy currents which could be more readily adjusted.

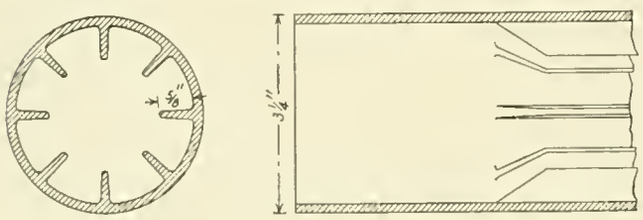
A short distance from the power house are four shallow parallel trenches, each about 10 ft. long, which stand full of water; four sections of old rail were suspended from a wooden frame supported on poles set outside the trenches, and a wire brought from the switchboard and connected to these rails.

The current which this rheostat will carry depends on the surface of the rails submerged, and the number of rails used is accordingly varied to suit the demands. Close regulation is secured by resting one end only of the rail in the trench and raising or lowering the other end. For extra heavy currents two other rails, one 60 ft. long and one 30 ft. long, lying permanently submerged in the wet ground are also connected to the positive terminal.

Currents of over 2,700 amperes have been easily handled with this apparatus.

RELATIVE CONDUCTIVITY OF BOILER TUBES.

Tests made at the University of Illinois in connection with a thesis by Mr. Frank H. Armstrong, of the mechanical engineering class of 1899, show interesting results on the conductivity of boiler tubes. The tubes tested were locomotive boiler tubes about 8 ft. long. The test tube was placed centrally in a 10-in. pipe which was filled with water, an inlet pipe being placed at one end and an outlet at the other. To provide heat a gas burner was placed at one end of the test tube; the burner was supplied with gas and air, each under pressure which was kept constant so that uniform conditions of "firing" could be maintained.



"SERVE" TUBE.

Comparisons between a clean tube 2 in. outside diameter and one covered with 3-32 in. of hard scale, showed 13.8 per cent less heat transmitted because of the presence of the scale.

Comparisons between a plain tube 2¾ in. outside diameter and a "Serve" tube of the same diameter with eight projecting ribs on the fire side, as shown in the sketch, gave 51 per cent more heat transmitted with the "Serve" than with the plain tube. The relative surfaces exposed to the hot gases in these two types of tubes are as 8.9 to 18.0.

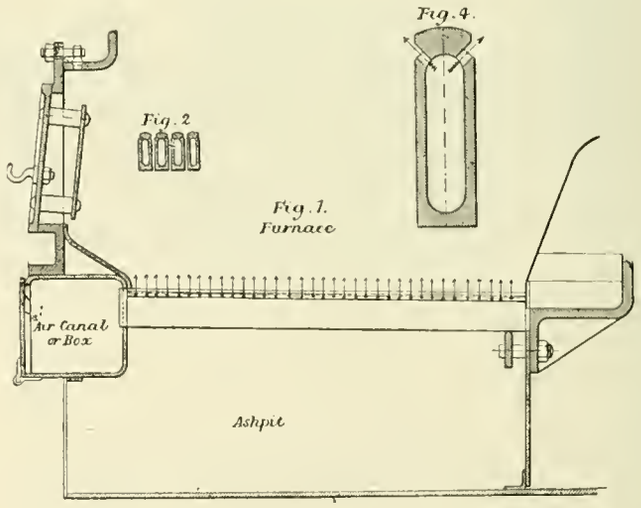
Individual tests under similar conditions varied from 2 to 4 per cent.

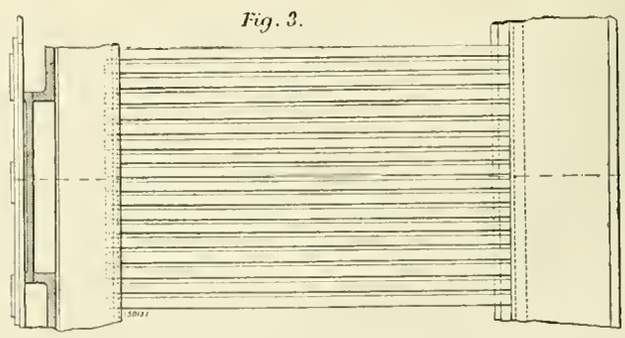
A NEW METHOD OF FORCED DRAFT.

A paper read before the Institution of Naval Architects (England) by Mr. Nelson Foley.

The writer has called the system about to be described new, believing it to be original, and, up to the present, untried, except by himself; but he is naturally open to correction, should such not prove to be the case.

The fundamental principle of the system is that the firebars themselves are utilized as a means of forcing the air into the fire. In order to accomplish this, the bars are made hollow, and are perforated with a row of small holes along each side near the upper surface, the holes being placed at such an angle that the air is forced in jets into the fire through the ordinary spaces between the bars. The front ends of the bars are inserted into a box or canal under the fire door, which is in communication with a fan, as shown in Figs. 1 and 3.





GRATE FOR FORCED DRAFT.

Fig. 2 shows a section of some bars as designed for an experimental trial. It will be observed that the holes are at such an angle as not only to direct the air up among the fuel, but also to induce,

COST OF POWER FOR ELECTRIC RAILWAYS.

Output Measured by Wattmeter in Each Case.

Station.	Month, 1899.	Monthly Output, Kilowatt-Hours.	Cost of Electrical Output per Kilowatt-Hour—Cents.						Gals. Cylinder Oil per 10,000 k. w. h.	Gals. Lubric't-ing Oil per 10,000 k. w. h.	Lbs. Water per Lb. Coal.	Lbs. Fuel per k.w.h.	Price of Fuel per Ton of 2,000 Lbs.	Kind of Fuel
			Fuel.	Labor.	Supplies, Oil, Waste, etc.	Water.	Re-pairs.	Total.						
1.....	Apr.	1,413,517	.270	.165	.041	.034	.042	.552	4.56	1.06	12.13	2.57	...	Bituminous
5. Metropolitan Elevated, Chicago.	"	1,088,885	.377	.227	.026	.027	.031	.688	.9	.53	6.69	4.46	...	"
8.....	"	492,645	.431	.255	.022	.031	.007	746	...	...	...	...	...	"
9.....	"	768,702	.555	.270	.029	.050	.006	.911	...	...	...	...	...	"

by means of the jets, a draught from the ashpits. The top part of the bar is made umbrella fashion, so that the holes may have protection as far as possible from ash, dust, or scoria. Fig. 4 is an enlarged section, showing this feature.

Without being sanguine of a satisfactory result, it was thought that the benefits to be gained in leaving both stokeholds and ashpits open were sufficient to justify some experiments being made on a small stationary water tube boiler. The results have been so far beyond expectation that the subject appears to the writer to be of sufficient interest and importance to warrant his bringing it under the notice of the institution; in fact, it seems to him to bid fair to cause some revolution in forced combustion. The results of these experiments are appended at the end of the paper.

Up to the present only short bars have been experimented with, but a sample bar up to 4 ft. in length has been cast without difficulty; at the same time, where it is possible to have an air box at each end of the grate, the bars need never exceed the moderate length of, say, 3 ft. A method of uniting them in the center has also been devised for such cases as when the front only is available for an air box, and a long grate is desired. It should be noted, however, that it is thought preferable, in order to give facilities for good, stoking, cleaning fires, and keeping the fires in good order, to work always with short grates, and use a high rate of combustion.

It has been observed during the experiments that little refuse falls into the ash pits, that the bars keep perfectly cool, and that the clinker does not adhere to them; in fact, from time to time, the clinker can be removed from the fire without drawing the same.

It has also been noticed that during forced draft the bars do not suffer at all, although it is only fair to say that on one occasion the ends of some bars were burnt because the bridge at the back was not in order, a space being left between it and the bar ends.

It is intended, in adopting this system, that the full advantage should be taken, making the grates moderate in length, and running with forced combustion as a normal condition. In this manner the destruction of fire bars would be reduced to a minimum, and the fires could be regulated to a nicety.

The fire can be regulated also, so that it is a matter of indifference whether the fire-door is open or shut; but, of course, it cannot be overlooked that, at very high rates of combustion, especially with ordinary cylindrical boilers, the fire-door must be kept shut, as with the ordinary ash-pit draft.

RESULTS.

Experiment.	Air Pressure.	Coal, Pounds per Hour per Square Foot of Grate.	Jet Holes.		Bars.		Observations.
			Diameter.	Pitch.	Length.	Surface.	
	in.		in.	in.	ft. in.	sq. ft.	
1	1.38	29	5-32	11-16	2 7½	7	Evaporative trial, careful firing.
2	1.45	32	5-32	11-16	2 7½	7	Evaporative trial, careful firing.
3	1.25	41	5-32	11-16	2 7½	7	For combustion only.
4	1.73	40	5-32	11-16	2 7½	7	Evaporative trial, careful firing.
5	3.15	72	3-16	11-16	1 3½	3.22	For combustion only.
6	3.15	53	3-16	11-16	2 7½	7	Evaporative trial, careful firing.

Presuming a long life for the individual bars, the cost of production need not, it seems to the writer, be considered a serious matter; for the foundry in Naples it comes to about 10 centimes per kilogramme.

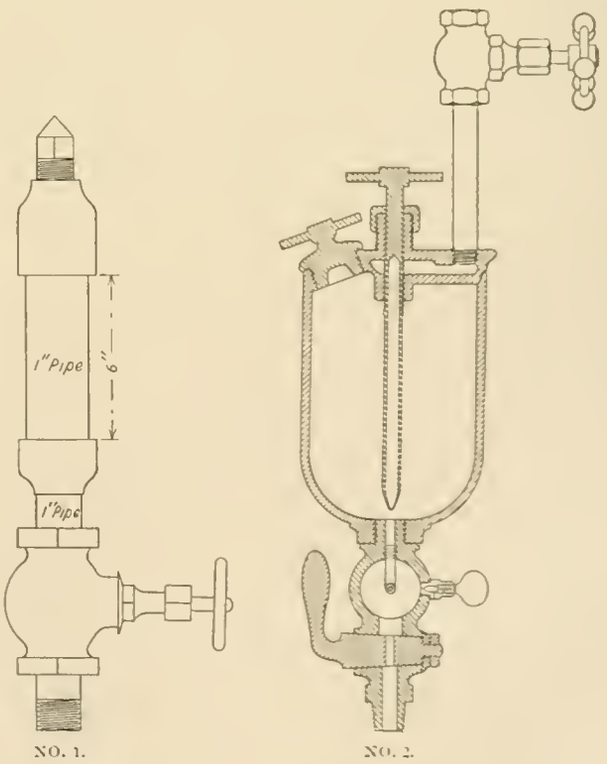
The experimental grate was 2 ft. 7½ in. long and 2 ft. 7½ in. wide, composed of bars of section as shown in Fig. 4; in the case of Experiment 5, however, half the length was bricked over. The air pressure was obtained from a smithy blast, the strength of which was never more than 80 millimeters (3 1-5 in.). Coal, Cardiff of good quality. Height of funnel from bar level, 17 ft. 6 in.

During trial 6 it was thought that for this rate of combustion the passages to the funnel were too contracted. On measuring same they were found to be collectively between 1-6 and 1-7 of the grate area, whereas the funnel area itself was 1-5.

[This arrangement is quite similar to that employed in the Cornelius smokeless furnace described in the "Review" for June, page 381, and the paper is of interest as showing that this type of grate bar is practicable either for forcing the boilers or as a smoke preventing device.—Ed.]

GRAPHITE LUBRICATORS.

The current number of Graphite, published by the Joseph Dixon Crucible Co., contains the following information concerning lubricators for introducing graphite into engine cylinders.



NO. 1. NO. 2.

No. 1 is a home made device constructed of pipe fittings and is screwed into the steam chest; the nipple just above the valve has a brass plug driven into it and a 1-16-in. hole drilled through the

plug. One of these devices, the writer states, placed on the high-pressure steam chest serves to supply flake lubricating graphite to both cylinders of the engine and to the air pump. The lubricator is filled once in three days. The cylinder oil consumption was reduced one-half by using graphite.

The Dixon Co. states that it uses a small hand oil pump of the type often used for supplying oil to small engines, a teaspoonful of graphite being put in before each half-day run.

The Lunkenheimer Co. makes a sight-feed lubricator which it claims will feed graphite automatically and continuously, so that it is unnecessary to provide a sight-feed oil lubricator, though an oil pump is recommended for occasional use, especially when starting the engine. This is No. 2 in the illustration.

CHICAGO CITY COAL HANDLING PLANT.

The Chicago City Ry. has recently installed some coal handling machinery at its power station at 51st St. and Wabash Ave., which has effected a great economy in handling the fuel. At this point there are two stations, one at the old cable plant built in 1886 with two 500-h. p. engines and porcupine boilers of 350 nominal h. p. each, and the other an electric plant installed in 1893 which comprises five pairs of 24 x 48-in. Wheelock engines, improved pattern, each pair driving two 500-kw. Westinghouse generators, and 19 horizontal tubular boilers 72 in. by 20 ft. The boilers in the cable house are fitted with Roney stokers and those in the electric plant with Murphy smokeless furnaces and mechanical stokers. It will doubtless be remembered that for some years the cable engines in this station have been idle, the cable machinery being driven by an electric motor taking current from the electric station.

Prior to February last the coal for this plant was loaded into small cars with a capacity for 1,600 to 1,700 lb. each, which were lifted on an elevator and then wheeled onto a truck running overhead in the two boiler rooms, where the coal was dumped into bins and chutes whence it fed to the stokers by gravity.

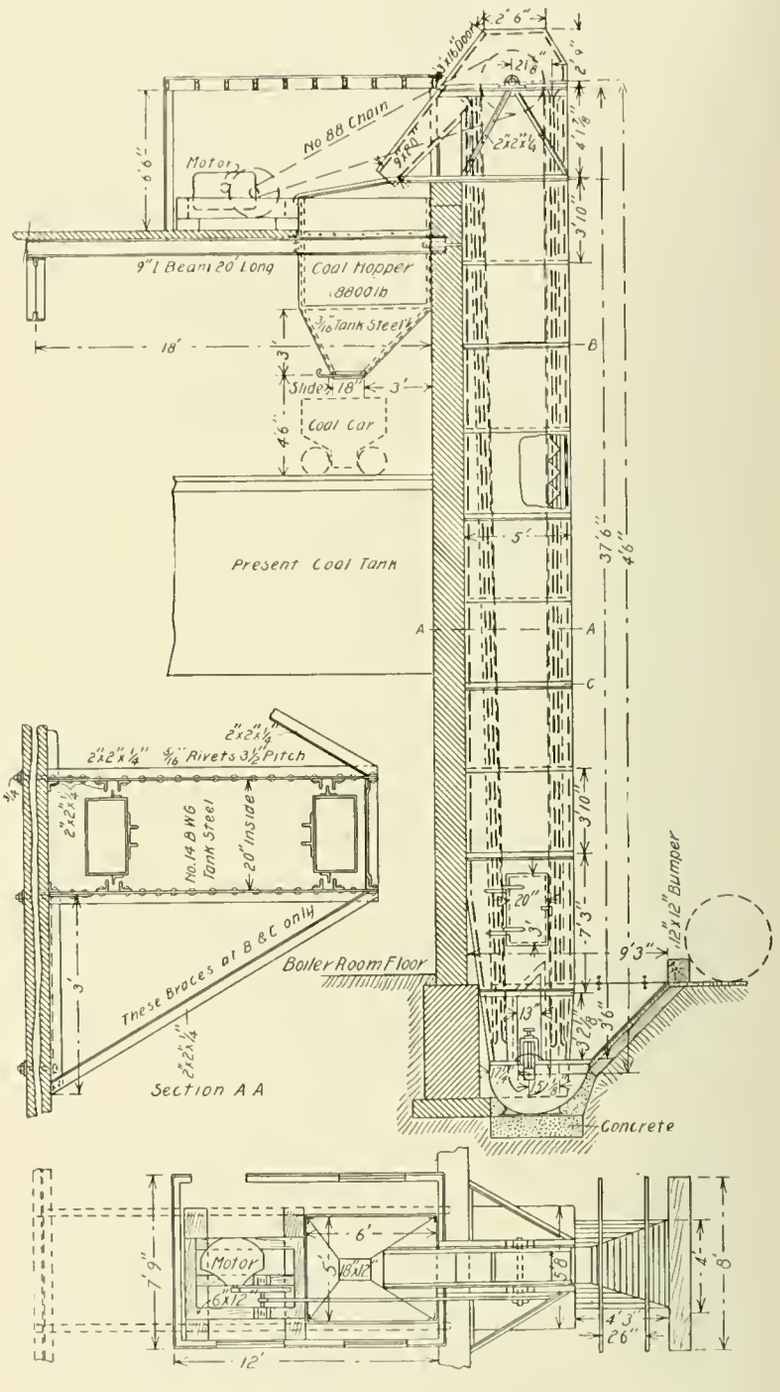
The coal consumption varies from 125 to 200 tons per day and under the old system of handling it two cars and six men were regularly employed, with two extra men about one-third of the time, the cost for labor being about $10 per day. In addition a 25-h. p. engine driving the elevator was run 24 hours per day.

The present coal handling and storage plant was designed by Mr. C. J. Reilly, superintendent of motive power of the company, and the elevator was built by the Link Belt Machinery Co., which used its standard machinery adapted to Mr. Reilly's design, and it has been in operation since Feb. 15, 1899. A 5-h. p. electric motor drives the elevating machinery and one man distributes it to the bins; the total cost for labor is $2 per day. It is seen that the saving of labor alone effected by the installation amounts to $2,920 per year, and the saving due to substituting a 5-h. p. motor for the 25-h. p. steam engine is amply sufficient to cover depreciation on the coal elevator. The total cost of installing the coal handling apparatus was less than $1,200.

The elevator is placed within a rectangular steel shaft on the outside of the south wall of the building; the arrangement of the pits, hoppers, etc., is very well shown by the drawings. The coal bin in the boiler room extends the entire length of the building and has a capacity of 250 tons. It is 180 ft. long, 10 ft. wide and 9 ft. deep, being supported on a row of columns placed 9 ft. apart and 4 ft. in front of the boilers and further braced at the sides by rods suspended from the roof trusses. This bin is covered with planking save between the rails of a 26-in. gage track running over the center of the bin. A hopper shaped car, the body of which is 3 x 5 ft. at the top and 2 x 3 ft. at the bottom and 3 ft. deep, holding about 1,600 lb. of coal, carried on four 19-in. wheels, carries the coal from the upper receiving hopper to the desired point over the bin. As the track is level one man can easily push the car about and thus can distribute from 125 to 200 tons into the bin in 10 hours.

The car is run under a chute from the upper elevator hopper, a slide drawn out, and the car loaded with coal in an instant. When pushed to the unloading point it is dumped by dropping the bottom. This is a much cheaper way of distributing the coal along the bins than to employ a horizontal conveyor; the conveyor would require the attention of one man all the time, whereas now the man alone does the work.

In addition to the 250 tons storage capacity in the electrical boiler house, the bins in the cable boiler house hold 150 tons, and a shed at the south end of the latter 1,000 tons more. All the coal for this station is hauled from two or three miles in wagons, being delivered by the contractors to the shed or to the vertical conveyor. When coal is taken from the storage shed it is loaded into the small



COAL HANDLING MACHINERY—CHICAGO CITY RY.

cars which dump into the receiving hopper of the vertical conveyor. A track is laid from the shed to the hoppers; the rails of this track are shown in the drawing.

The Columbus (O.) Street Railway Co. reports earnings for the week ending July 14th at $15,412, and for the corresponding week in 1898, $12,649. The total increase in July over the same month in 1898 is $9,718.

A movement is under way to eventually secure the conduit system for the street railways of Cleveland, Ohio. A franchise has been sought for a new line out Lake and Hamilton Sts. and over Doane and Woodland Hills Aves. to Newburg, which if granted will be with the provision that the conduit system be used.

THE ARRANGEMENT OF STEAM AND OTHER PIPES, AND THEIR FITTINGS.

A paper read before the Municipal Electrical Association (England) by J. E. Edgcome, Borough Electrical Engineer, Kingston-upon-Thames.

The subject of steam and other piping is one of the greatest importance to engineers of central stations, and indeed to all who have to deal with steam plant. It is a subject upon which volumes might be written and still leave much unsaid. The author does not pretend to advance any especially new or original information, but rather a series of notes based on some little experience, in the hope of eliciting what should prove to be a most interesting discussion, and a discussion from which every member may be able to carry away some useful suggestion, to be put into practice when laying down a new generating station, or when carrying out the inevitable extension of his present works. The arrangement of piping referred to in this paper is proposed for small or for moderate-sized stations, which form the majority, rather than for those very large stations to be found in a few of the big cities, and where, possibly, special arrangements are necessary.

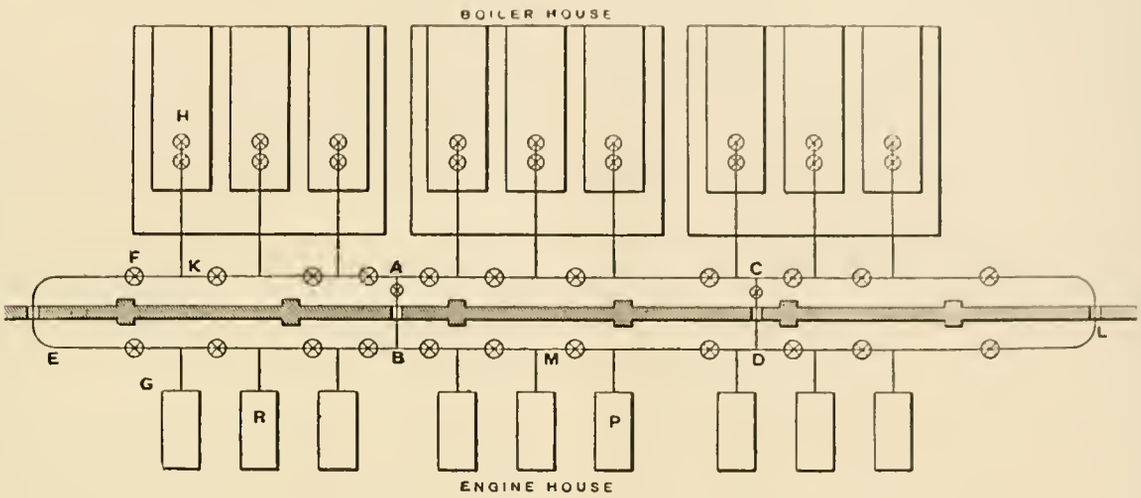


FIG. 1.

STEAM PIPES.

The author is of opinion that in the majority of cases, the best and most favorable arrangement of steam piping is in the form of a steam ring, running from the boiler house through the engine house and returning to the boiler house as shown in Fig 1. It is advisable that the ring should be cross connected at two or more places, as shown at A B and C D, so that in the event of repairs being necessary to any pipe, say at E, the closing of the valves F G does not necessitate, in case boiler H is under steam, that the steam should pass to the engines, say P or R, by the long route K A L M, but by the shorter route K A B M. This arrangement will also allow of considerable lengths of steam pipe being cut out when the engines and boilers upon them are not in use, and will be found to give greater flexibility to the ring system.

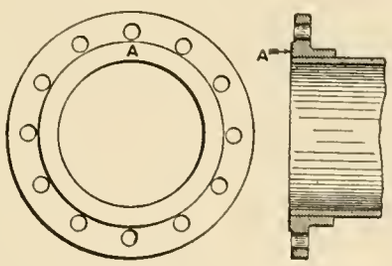


FIG. 2.

In most cases, particularly when the engine house and boiler house are approximately on the same level, it is usually more convenient to carry the steam piping overhead, and where a single line of boilers is installed backing towards the dividing wall, and similarly a single line of engines is laid down with the engines abutting towards the same wall, it is extremely simple to carry out a steam ring system. Where a double row of engines is installed the system becomes a little more complicated, and it is usually advisable to form a second loop of steam piping in parallel with the main ring within the engine house, feeding the engines on either side, the engines in that case facing one another, with the machines outward.

Serviceable and reliable steam pipes may be made up of lap welded mild steel, with heavy wrought iron flanges, the flanges being screwed on hot, and the ends brazed. The flanges must, of course, be faced up to enable good joints to be made. In larger sized steam pipes it will be found that joints can be kept tighter by having the flanges made with a slight boss, which is faced up for the joint, instead of the whole of the flange being faced up for that purpose, as shown at A in Fig. 2; from 1-16 in. to ⅛ in. is sufficient thickness for the thickness of the boss. Steam pipes, where supported on brackets or columns, should be carried on rollers to allow of free contraction and expansion.

JOINTS.

With the higher steam pressures now in use, care and discrimination are required in making and keeping good sound joints. There are innumerable makes of jointing material on the market. Rubber prepared with plumbago makes a good sound joint, which requires taking up when steam is admitted to the pipe, as the material softens with the heat, although it sets into a hard permanent joint when tightened up. An admirable and reliable join is one made with corrugated brass rings, painted with thin red lead.

DRAINAGE.

One of the most prolific causes of trouble with steam piping is that from accumulation of water, and too much care cannot be taken in the thorough draining of the pipes. For this purpose a number of separators should be fitted in the ring on the boiler side to collect the water from the steam where it leaves the boilers, and, in the author's opinion, it is certainly advisable that every engine should be fitted with its own separator, to deal with any water which may be carried over from the main steam pipe.

To deal, however, with the water which will, notwishstanding, collect in the main steam ring in the engine house, it is advisable to connect the ring in several places to steam traps, similar traps being connected to the separators of the engines. The author has found from experience that to permanently connect the engine separators to steam traps, deals more effectually with the water trouble than to constantly blow out the water from the separators as it collects there, especially in view of the difficulty experienced in ascertaining the quantity of water in the separators, except by the use of gage glasses, which are a source of constant trouble owing to the difficulty of getting glasses to withstand the pressure when there is any variation of temperature or when they are subjected to sudden cold draughts.

The connecting pipes from the boilers to the main steam pipe, and from the main steam pipe to the engines, should be preferably of copper, with full swan neck bends to keep the water back as much as possible, and to allow of expansion.

STEAM TRAPS.

These are most necessary adjuncts to the steam pipes; but, although there are some very good steam traps on the market, probably most engineers will agree that an ideal trap has yet to be discovered. All steam traps require a certain amount of attention, and should be fitted with a reliable class of stop valve to enable them to be shut off from the live steam main for inspection and for the renewal of the valves and seatings when necessary. Most of the modern traps will discharge at a considerable height, depending, of course, upon the steam pressure, and it will be found that a quantity of excellent feed water may be collected by this means. When discharging to a height each trap should be fitted with a non-return valve to prevent the column of condensed water in the pipe returning to the trap. It will be found convenient to group the discharge pipes from a number of steam traps into a small tank, having an overflow pipe to the hot well. This will enable the discharge of every trap to be inspected, which is a necessary precaution to ensure that each is in proper working order.

VALVES.

Valves are a very important part of a steam system, and care should be taken to select a class of valve suitable for the work which it has to perform. Full-way valves possess so many advantages over other types that in the most modern plants these are almost wholly used for high pressure steam work, and can be obtained from the smallest to the largest size. The large valves on the main steam ring should each be provided with a small by-pass valve to enable a length of cold steam pipe to be warmed up, and the pressure balanced before the main valve is opened. This will prevent the straining of the joints caused by sudden expansion, and likewise accidents due to water hammer.

When erecting new steam pipes, attention should be given to the thorough cleaning of the pipes, as otherwise fine particles of grit, driven by the steam into the faces of the valves, cut into the seats, causing considerable trouble and expense. The author was informed by one large firm of valve makers that, owing to the trouble they had experienced from this cause, and the expense to which they had been put, due to the necessity of taking down and refacing valves fitted in this manner on new pipes, they intended in future to include in their estimates a certain sum to cover such cost. Where, as is almost universally the case, boilers run in parallel, it is advisable to fit a self-acting valve between the steam ring and the main stop valve on each boiler, the self-acting valve being placed immediately after the stop valve. There are various types of this valve, the usual form being a ball working on an inclined plane. The object in all cases is to provide a valve which shall close automatically when the pressure on the boiler it controls falls below that in the steam ring, as this enables that particular boiler, when thus isolated, to recover itself and to get up a full head of steam upon which the automatic valve reopens and again connects the boiler to the steam main.

BLOW-OFF VALVES.

Where the boiler blow-off valves discharge into one common pipe, as is usually the case, it is very necessary that the blow-off value should be of some type in which the handle shall be practically locked when open. This will prevent the blow-off from a live boiler being forced into a boiler which is standing off for the purpose of being cleaned. Want of attention to this precaution has been the cause of many accidents, frequently involving the death of the men working in the boilers. This locking arrangement is usually carried out by the use of some special form of key, in which the key is held locked in the valve as long as the valve is open, and can only be withdrawn when the valve is shut; and as long as one key only is available it is, of course, impossible for two valves to be open simultaneously. As, however, a key is supplied with every valve, the spare keys, which it is advisable to keep in case of breakage, should be locked up, in charge of one of the engineers, and should not be available in the works. The author remembers seeing on a battery of boilers, which had been carefully fitted with this class of valves, two of the blow-off valves open at one time with, of course, a key to each valve, entirely doing away with the element of safety, and further causing this false feeling of security to become an added danger.

Where the blow-off from the flooding valves of superheaters are led into the same blow-off pipe, and when, as is usual, a type of two-way valve is used which cannot be fitted with a locked key, possibilities of accident are averted by making a stringent rule that the flooding valves must not be opened unless the key of the boiler blow-off valves is hanging within sight.

CHECK VALVES.

The check valves of boiler feed pipes are more convenient, for the purpose of inspection, when fitted with an arrangement which allows the valve and setting to be inspected while the boiler is under steam, and the author would also suggest the convenience of fitting every feed branch with a plug-cock, having a removable handle, to enable each check valve to be shut off for inspection both from its own boiler and from the feed main. A plug cock with removable handle is recommended in place of an ordinary wheel valve, as the latter may be accidentally closed, whereas the handle would be fitted to the former only for the specific purpose of examining the check valve or for completely cutting off the water supply from a boiler when standing off. The feed supply would, of course, in all cases be regulated by means of the check valves themselves.

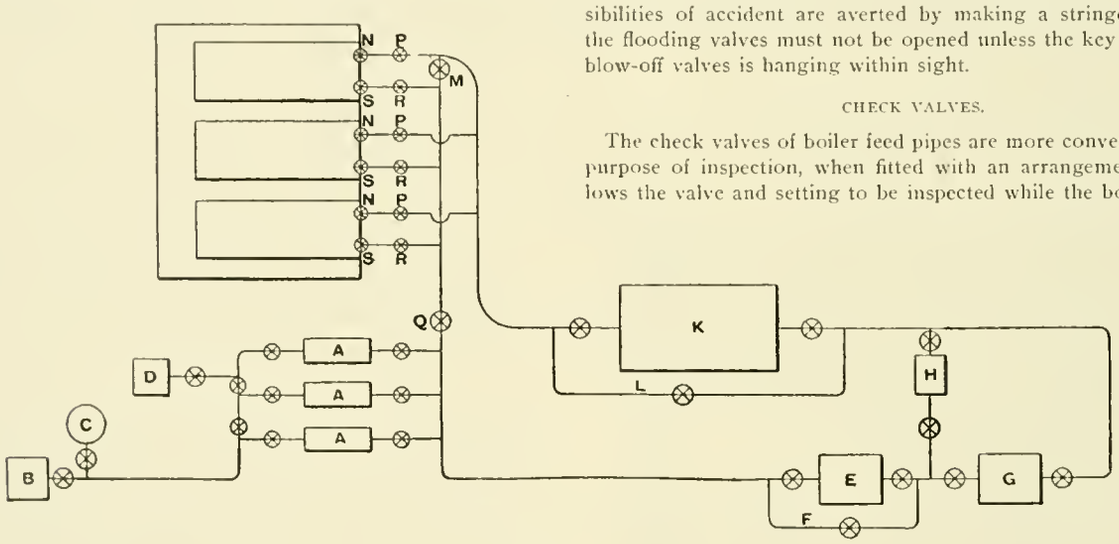


FIG. 3.

Perhaps the author may be permitted to say a few words on the subject of feed water supply. A convenient arrangement is to connect the pump suctions through suitable pipes and valves to the hot well, the cold well, and also to a third supply in case of emergency, and to connect the discharge pipes from the pumps to a double line of piping supplying the feed water either through the filters and one or more economizers, or, if required, direct to the boilers.

In the accompanying diagram, Fig. 3, AAA are the feed pumps, B the hot well, C the cold well, D the tank connected to a third supply, E is a cloth filter with by-pass F; G a sawdust filter fitted in series with E, with a by-pass sawdust filter H, the by-passes being used when the main filters are being cleaned. This arrangement has given excellent results, leaving the boilers clear of all traces of oil, which formerly proved a source of considerable trouble and anxiety. The condition of the sawdust in G and H is a good indication of the condition of filter E, and proves whether or not it is doing its work properly. K is the economizer with the by-pass

L, to enable it to be inspected and cleaned without passing the feed direct to the boilers via Q, which would entail cutting the filters out of circuit. The arrangement of the branches from the hot and cold feed enables the boilers to be fed either with hot or cold water through the stop cocks and check valves pn or rs, and by opening valve m, cold water can be fed through the hot feed check valves, or the reverse should any of the branch pipes or check valves be out of order.

PIPE COVERINGS.

A few words must be said with reference to the various coverings in use for preventing radiation of heat from steam pipes. It is most necessary that all pipes carrying steam should be enclosed in a covering of some non-conducting material. Endless varieties of pipe coverings exist which may be divided into two classes, permanent coverings, and removable coverings.

The former, which are generally wrapped with some description of linen or canvas, have a good finished appearance when colored and varnished, but suffer from disadvantage that the covering is destroyed when it is necessary to remove it from the pipe at any point, and the appearance of the whole length of pipe is spoilt in consequence. Removable coverings are, on the other hand, as their name implies, specially made for the purpose of allowing free inspection of the pipe, but in appearance they are usually clumsy, and do not lend themselves to the neat finish of permanent coverings. It is also questionable whether, as a rule, they are such efficient non-conductors of heat as are permanent coverings.

It would take up too much time to attempt to describe the many varieties of covering on the market. They are all manufactured from some good non-conducting material such as asbestos, magnesia, slag-wool, or felt, and are put on either wet or dry. There are also numbers of coverings which depend principally for their non-conducting properties upon an air space being left around the pipe. Probably every engineer has been induced at some time to try various coverings, and, like the author, has possibly found a few good, many indifferent, and some distinctly bad.

There is no doubt that to obtain an efficient steam supply with a minimum of condensation, every portion of steam-carrying metal must be covered with a thoroughly good non-conductor, and where practicable all valves and flanges should be treated in the same manner. This applies equally to the drain pipes, or, at any rate, to that portion connecting the steam traps. For the sake of keeping down the temperature in the engine house it is generally advisable also to cover the exhaust pipes with some non-conducting material.

Much more might be said on the subject of pipe work, but the author trusts that what he has advanced will fulfil his expectations, namely, to produce a useful and exhaustive discussion on what he ventures to think is a most important portion of central station equipment.

NEW WISCONSIN LINE OPENED.

The Waupaca & Chain o' Lakes Electric Railway Co., a new Wisconsin road, commenced operation of its cars on July 4th. Messrs. W. B. Baker and Irving P. Lord, of Waupaca, have devoted a great deal of time during the past two years to the furtherance of this project, and on the day the cars were started their efforts were well rewarded by the very large patronage given to the road, and interest manifested by the citizens of Waupaca and surrounding country.

The Electrical Installation Co., of Chicago, was awarded the contract for the complete construction and equipment of this road on May 18th last. The work of grading was commenced on May 26th, and the five miles of road completed ready for operation within 32 working days. During the progress of the work a record was made in track laying, 23,000 ft. of track being laid, lined and surfaced within 60 working hours. The contractors had a most complete and efficient organization, working like a piece of well-oiled machinery which made it possible to finish the work within the time required by the railway company. Standard construction was used throughout; cedar ties, 50-lb. T-rail, "Crown" bonds and No. 00 trolley wire.

The Chain o' Lakes is one of Wisconsin's most beautiful resorts, and the patronage already bestowed on the road has demonstrated to the management that they have made no mistake in its construction.

A RAILWAY RESORT FOR CHATTANOOGA, TENN.

Elaborate plans are being prepared to connect the lines of the Chattanooga Electric Railway Co. with Glenwood Park, which is owned by the Glenwood Land Co. This tract surrounds Indian Springs between Avondale and Highland Park and the railway company desires to secure control of this land and gain certain concessions from the Glenwood Land Co.

If the deal is consummated the railway company proposes to make a number of additions to and changes in their present track system. Indian Springs will be made the main entrance to the park and a new line will be built to this point and a number of other lines will be built inside the park property.

The matter concerning the building of a lake covering an area of 25 acres, bath houses, etc., will be drawn up and set forth in a written proposition, to be approved by the directors of the Chattanooga Electric Railway Co., and will then be sent to the officers and directors of the Glenwood Land Co. for their consideration.

The Glenwood Land Co. is said to be quite favorably disposed toward this scheme.

ELECTRICITY ON AUSTRALIAN RAILROADS.

The practicability and economy of substituting electricity for steam motive power on the branch lines of the railways in the colony of Victoria, Australia, are now under discussion and Mr. C. E. Norman, engineer for existing lines (what we call engineer of maintenance of way) is making an inspection of the railroads of America and Europe, giving particular attention to the equipment and operation of electric roads. While it cannot be said that it is probable that the railways of Victoria, which are owned and operated by the Government, will soon be equipped with electricity, yet it is interesting to note that the question is under consideration.

The colony of Victoria has an area of 87,884 sq. miles, with a population of 1,169,000, and has 3,123 miles of railroads, which have been built at a total cost of £38,600,000. In the year ending June, 1898, there were over 43,000,000 passengers carried and 2,408,000 long tons of freight. The ratio of working expenses to earnings was 63.09 per cent, and the percentage of net earnings to capital invested, 2.49.

ELECTRICAL INDUSTRY IN JAPAN.

An interesting clipping from the Japan Times, relating to the electrical industry has been forwarded by Consul General Gowey. Electroplating dates back to about 1887, when a workshop was first started in Mita, Tokyo. The plated articles now turned out are not much different in finish from those coming from abroad. There are about 200 shops now in the city of Tokyo doing electroplating, but most of them are on a very small scale.

The manufacture of telephone apparatus has so far advanced in Japan that, with the exception of springs, for the supply of which foreign aid is still depended upon, all other necessary paraphernalia can be made at home at about one-half the cost of foreign goods. At present, therefore, only a very small portion of telephone apparatus is being imported. Foreign instruments are used in such places as Tokyo and Osaka, where the telephone connections are in brisk demand. The manufacture is carried on both in Government and private shops.

The electromotors made for the Kawasaki Electric Tramway at the Shibaura Engineering Works are the first of the kind made at home, those heretofore used by the Kyoto, Nagoya, and other tramway companies having been obtained from abroad. The Kawasaki Tramway is highly satisfied, we are told, with the Shibaura dynamos; for it has found them, so far as its experience goes, just as good as those of foregn make employed by other establishments. It is said that the Shibaura works have since secured orders to construct a number of the same apparatus for the Hoshu Electric Tramway Co. Of the materials required for their construction, the Shibaura works can obtain at home everything but wheels and springs, which have to be imported.

The loss of traffic due to the Brooklyn strike is estimated at $150,000.

THE ELECTRIC RAILWAY IN COREA.

In the "Review" for July were quoted press dispatches from Seoul, Corea, briefly telling of the riots excited by the electric cars in that city and of the fate which promptly overtook a score of the ringleaders. Two letters from Mr. H. Collbran, recently published in the Railway Age, give interesting accounts of the opening of this road and of the troubles which followed soon after, and we reprint, by permission, the substances of Mr. Collbran's letters. Under date of May 15, 1899, he writes:

"The opening of an electric railway in Seoul, the capital of Corea, on the 1st instant, caused great excitement throughout the country, many Coreans coming from a distance to be present on the occasion.

"It was difficult to ascertain what were the expectations of the people, as they imagined all sorts of things, but it seemed that the majority expected the overhead trolley wire would pull the cars along. One very gratifying feature, however, was the entire absence of all superstition, forming a marked contrast to the fears of the Chinese a few years back when railways were first introduced in that country.

"When the machinery was set in motion at the power house the scene was truly a gay one. All of the cabinet ministers, many officials of the emperor's household department, military and civil officers, city officials of all kinds, etc., were present, and formed a typical oriental picture, in their rich and handsome silken costumes, all eager to participate in the introduction of a 'progressive step' so great as an electric railway.

"Outside the railway yards were thousands upon thousands of Coreans occupying every space where it seemed possible to sit or stand, and there they had been waiting for many hours to see what would happen. Among all the officials none was more prominent or more active than the Hon. Yecha Yun, ex-governor of the city, who, after some four years' residence in Washington, did much toward introducing western improvements into Corea, and who deserves great praise for building such streets in Seoul as have rendered the construction of an electric railway feasible. For nearly 4,000 years the only means of travel enjoyed by Corean gentlemen have been by the use of chairs or litters carried by laborers, and a jump direct from the Sedan chair to an electric railway is certainly an event in eastern life worthy of notice.

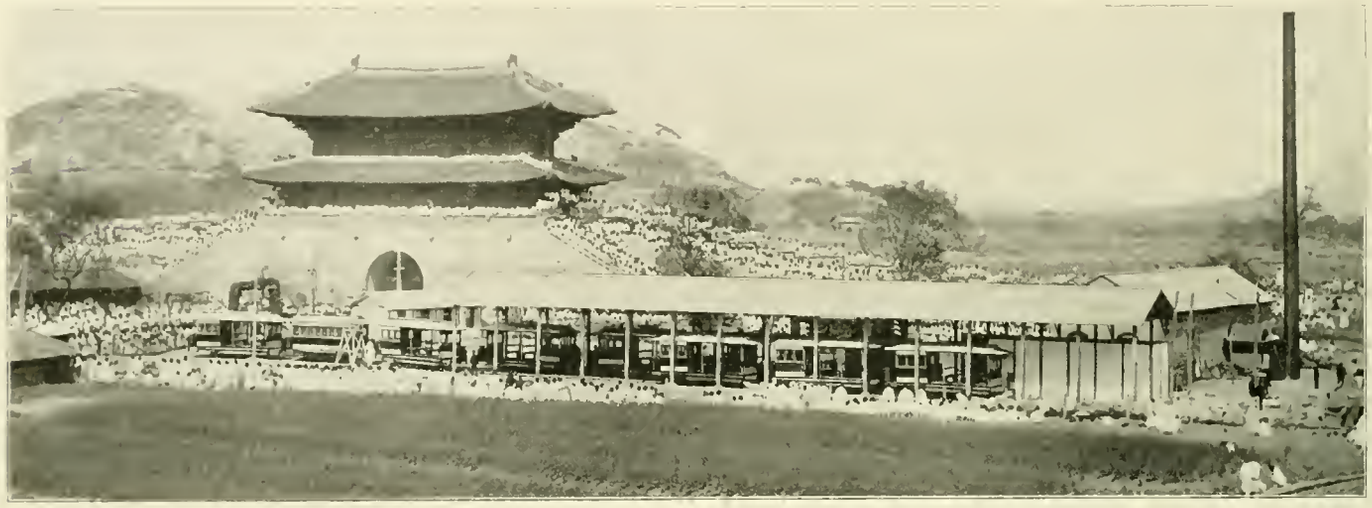


FIG. 1—THE OPENING OF THE ELECTRIC RAILWAY IN SEOUL—POWER HOUSE AT THE EAST GATE.

FIG. 2—GATE OF SEOUL.

FIG. 3—CAR WITH LEADING STOCKHOLDERS.

"When the time came for the first cars to start there was no hesitation on the part of the Corean officials about showing their confidence and all of them quickly found seats. The streets had been lined with soldiers, but notwithstanding these precautions the greatest care was necessary owing to the enormous throngs of people.

An average speed of five miles per hour was maintained, except in one instance, where the track was well guarded, and it was impossible to resist the temptation of discomfiting the police, a number of whom had been instructed to run ahead of the cars: a rate of 12 miles was made for a short distance, quickly leaving the worthy policemen in the rear, to their great consternation and the indignation of their chief, who was riding in the car. No mishap of any kind occurred and after returning to the power house a messenger arrived from the emperor requesting that a special trip be made in order to afford him and his suite, and the crown prince and his suite an opportunity of inspecting the cars. This was promptly complied with. His majesty and the court generally looked on the scene from the palace gates, near the United States legation, and the emperor expressed his pleasure and approval of the new enterprise and its successful introduction. Prince Ye Chai Toon, the head of the household department, a little later on toasted the electric company and said many nice things concerning America and its people.

FIG. 4—A NATIVE CONDUCTOR.

"Some of the rules established for the operation of the railway are curious. For instance, it is not considered necessary in America

to announce that females may ride as well as males; but this forms the subject of the first rule in the schedule issued by the Seoul Electric Co. Can it be possible that so practical a thing as a street car will eventually lead to the destruction of the custom, centuries old, of secluding women, and permit them to travel in open carriages instead of being shut in a closed chair, little else than a closed box?

FIG. 5.

"Again, the company, like others we have heard of in Europe and America, has been confronted with the 'hat' difficulty. This time it is in regard to the men and not women. For ages past men in Corea have worn huge straw hats when in mourning for the loss of a relative. These hats are truly of enormous size—at least as large as a bushel basket—and the Coreans have drifted into the custom of wearing them as sunbonnets. But it now appears that another of their ancient practices is in jeopardy; for the bushel basket must go or treble rates must be charged the wearers.

"The fares vary, according to distance, from 2 to 15 cents. This creates surprise, because the people cannot understand why it costs less to ride so rapidly in a beautiful carriage than in a sedan chair, which can only be carried by coolies.

"In order to accustom the citizens of Seoul to the new method of traveling, and to facilitate the operations of the company afterward, the opening celebrations were practically continued for a full week, until it became possible to run cars quite as crowded as a Chicago State Street car, at a high rate of speed, and the sum

FIG. 6—WHAT WAS LEFT.

total of accidents amounted to breaking the leg of a dog, who was rather indifferent about getting out of the way. This fortunate result was largely contributed to by the aid of the officials of the United States legation, who were indefatigable in securing arrangements that assisted in preventing accidents.

"All the details of arranging the safe opening and accompanying celebrations were under the care of Mr. H. R. Bostwick, of San Francisco—a task involving much anxiety, when the fact is remembered that the Coreans knew nothing of railways or of electricity, and that in Cairo, Egypt, about 60 people were killed during the first week of the street cars in that city. He well earned the comment of a Corean coolie, who, when the cars were being finally turned in, shouted, 'Me Kook Sa Ram Mar-ni Chosse,' which, being interpreted, says, 'The Americans, they are all right.'"

"Extracts from a letter under date of June 6, 1899, are as follows:

"Considerable rain usually falls in Corea during the month of April and is of immense value to the rice and other crops, but this year no rain had fallen since early in January. The country was suffering from a serious drought. Sacrifices were offered to the heavens by the emperor, but all in vain. Early in May the electric railway opened for public service, and although well patronized it was generally stated that the rain did not come because the railway house rested on the rain dragon's back and he was consequently prevented from doing his usual work.

"The common people, believing this, became clamorous for the destruction of the railway, which by that time had been some 10 days in successful operation.

"Just then the first fatal accident occurred. A child ran safely across the track a few yards in front of the car, but was called back by its father, and running right under the wheels, was instantly killed. It needed only the action of the father in holding up the body of the child to the gaze of the mob to excite violence. A rush was immediately made upon the car, the employes were com

FIG. 7.

pelled to fly for their lives and the mob quickly set fire to and destroyed the first car and almost equally destroyed the one following it.

"The excited people then made ready to go and destroy the power house, where the lightning was stored, but by this time the representatives of the company had arrived upon the scene and soon gained control of the situation. They cleared the track and succeeded in running cars through the city again within some two hours after the trouble arose.

"The government authorities have issued instructions to both the military and the police that they are expected to prevent any similar trouble occurring again, but as ill luck would have it, the long-delayed rains commenced to fall about 48 hours after the people had stopped the railway, thereby strengthening the belief that the company had stolen the lightning from the clouds and left little or none for rain and thunder storms, without which the people cannot grow rice and must starve to death."

Fig. 4 is an excellent likeness of the first Corean electric railway conductor. His expression of self-satisfaction is doubtless due to the combined influences of a nice new uniform and a salary of $7.50 per month.

Fig. 5 represents one of the street cars in Seoul in operation under normal conditions. This illustration is also of interest as emphasizing the bushel-basket-hat difficulty referred to in the previous account.

Fig. 6 shows the remains of the first car attacked, the photographs having been taken just after the mob was driven back. Fig. 7 is the second car, with workmen engaged in removing it from the track for the passage of the first car after the trouble was quieted.

TAUNTON SNOW PLOWS.

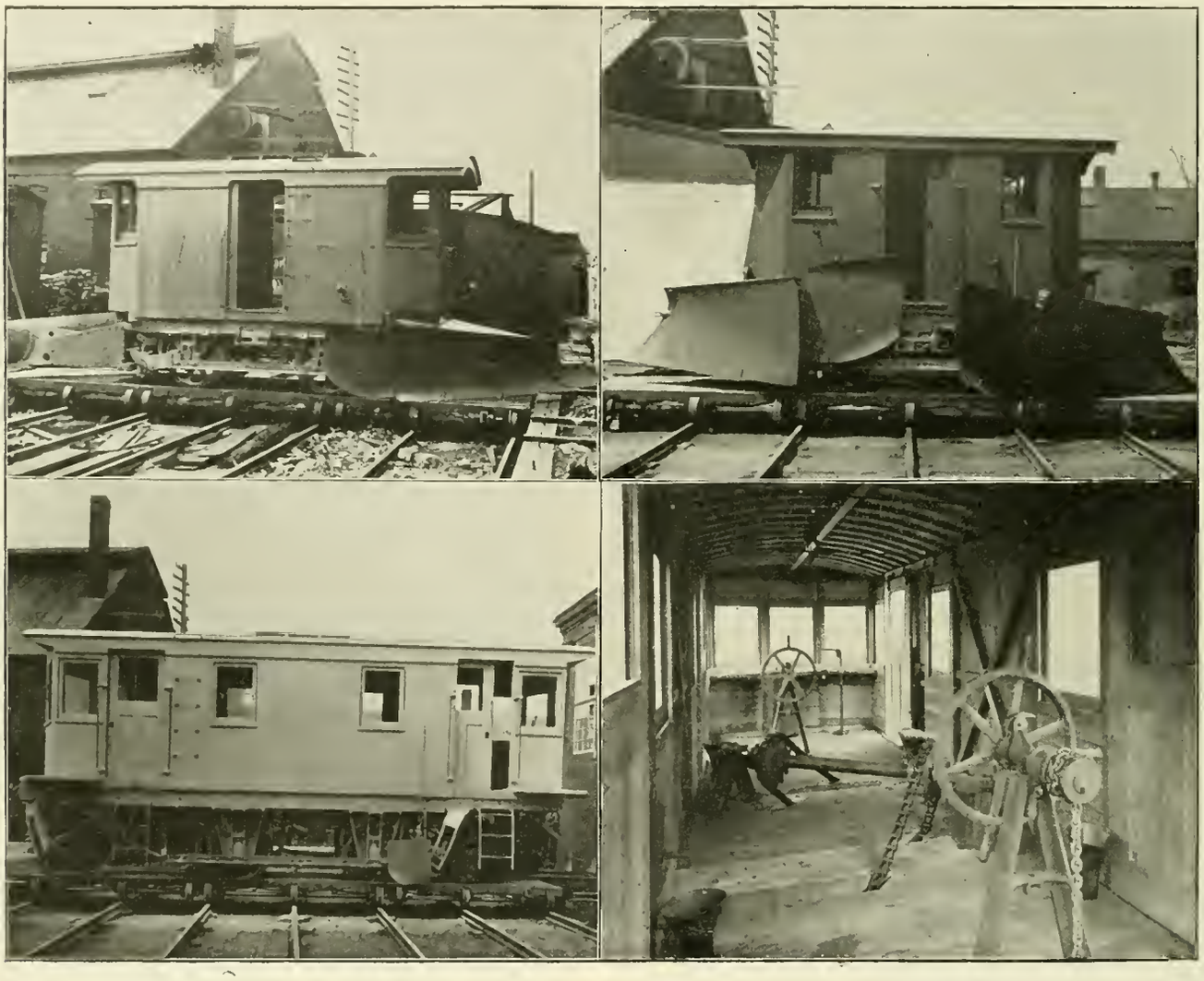
Those managers who will need to purchase snow plows and sweepers for use during the coming winter should now begin to place their orders if they wish to avoid all vexatious delays when the winter season comes. The first snow storm last fall came several weeks before it was expected and for that reason there were a great many roads which were closely blockaded, the plows not being in readiness; it is safe to say that those roads will not be caught in the same predicament again.

Some of the most successful and widely used snow plows and sweepers for electric railway work are those made by the Taunton Locomotive Manufacturing Co., of Taunton, Mass., and the accompanying engravings show the nose and share types of plow and the sweeper of this company.

The double track share plow for double track work in cities weighs 9 tons without motors, and has a share 39 in. high with a spread of 7 ft.; the spread is increased to 9 ft. 3½ in. by wings, and still further increased to 10 ft. 3½ in. by the extension share. The share is carried in front of all the wheels and thus room is obtained to place the motors on the axles. The extension girder, which with its lifting mechanism solves one of the most difficult problems in snow plow construction, is to all intents and purposes entirely of steel, as the castings used fill only a secondary place in the construction. The digger which was originally designed for the Taunton nose plow is now applied to all the company's snow handling apparatus.

The connection can be made for either the overhead or the underground trolley, and for the excellence of the machine as a whole the company refers to the work done during the last two winters in Boston, New York, Brooklyn and Lowell.

The standard nose plow weighs 9 tons without motors and has the following dimensions: Height of nose, 48 in.; spread of nose, 8 ft. 3 in.; spread of nose and wings, 11 ft. 8 in. The main framing of the plows of this type is of hard pine, but the nose framing is of oak and covered with steel plates. Access to the motors is readily had through large trap doors in the floor. Among the desirable points in the design and construction are these: The noses work easily and independently; the wings are pulled in by a kick of the foot and are fastened automatically; the noses and wings are shaped to roll away the snow and not simply to butt it; the operating parts of the plow are all at the ends of the house or cab and the floor is clear; the braking gear is quick and powerful in action.



TAUNTON STANDARD NOSE PLOW.
TAUNTON SWEEPER.

TAUNTON DOUBLE TRACK SHARE PLOW.
INTERIOR OF CAB.

The sweeper illustrated weighs about 25,000 lb. without the motors and has dimensions as below:

Length over sills	27 ft. 4 in.
Length over house	27 ft. 1 in.
Height of rail to top of trolley plank	12 ft. 4 in.
Height of rail to under side of sill	3 ft. 8½ in.
Diameter of brooms	36 in.
Dimensions of sills	11 x 4½ in.
Dimensions of cross sills	8 x 4½ in.
Wheel base	6 ft. 6 in.
Size and weight of wheels	33 in. 425 lb.
Diameter of axles	4 in.
Tread and flange of wheel	2¼ in. and ¾ in.
Greatest width with wings closed	9 ft. 8 in.

The large size of the main and cross sills indicates the substantial construction which is carried throughout the sweeper. The brooms are of a new and improved pattern such that the rattan cannot come out of the broom until it is absolutely

worn out; there is no chance to strew the roadside with broom material by reason of any failure on the part of glue or nails to hold the rattan in place. The brooms are run by an independent motor mounted in the cab; this allows the operator to run the broom at any desired speed with reference to the speed of the machine, that is to say, the machine may be run at a speed not exceeding 1½ miles per hour, while the broom may be run at full speed. This combination is of great advantage in drift work. In this machine the brooms extend clear across both rails in front of the machine so that a path nearly 3 ft. wider than the body of the machine is cleaned absolutely at the front. In addition to the thorough cleaning by the brooms, the sweeper has what it is claimed no other sweeper in the market possesses, namely, a first class digger which will remove ice from the rails in advance of the wheels.

In addition to the broom and diggers there may be put on each side a wing or leveler which breaks down the pile of snow which the broom throws on one side of the track. These wings are operated by counterbalance weights from the interior of the cab, and are quick and positive in action.

The sweeper is propelled by motors on the axles as a car or snow plow is propelled, and the brooms in the front of the machine only are run, the rear brooms in each case being easily raised up, thrown out of gear and held there by a simple and effective lifting device.

The cab is built something like a baggage car, but with vestibule ends and the doors are so placed that all the convenience of an open platform is secured without its exposure. The digger lever is directly over the head of the broom operator and the sand spouts are supplied with large pipes conveniently located. There are four sand boxes in the cab. The sweeper is not mounted on an independent truck, but the running gear is attached directly on to the main frame. This gives a simple and substantial form of construction with great strength. The mechanism is simple and everything is made with reference to easy handling in a storm.

MOB RULE IN LONDON, ONT.

The trouble which had been brewing between the London, (Ont.) St. Ry. Co. and the Street Railway Employes' Union for several weeks culminated on July 8th in a serious riot, during which the troops were called out and the city put under martial law. The strike, which has been in progress for some time, has resulted in the employment of non-union men by the company, and all the morning before the riot rumors were freely circulated that the non-union men were dissatisfied with the treatment they were receiving from the company, and that they were going to run their cars into the barn at 2 o'clock because of a reduction in wages. The rumor was entirely groundless, but as it spread among the union strikers they commenced to congregate near the car barns to witness the strike of their non-union successors. As no strike took place, however, the crowd which was being rapidly augmented, grew ugly, and after two or three cars which had been run into the barn by mistake were again put out on the road, acts of lawlessness were commenced. There seems to be no room for doubt that the mob was an organized affair, as some evidence on this point is already in the hands of the police. The appearance of a violent mob at just this time was also peculiar, as negotiations leading to a settlement had just been commenced between the company and the striking union men. A committee of the city council and of prominent citizens had been waiting for several days for a list of grievances against the company of which the strikers complained, which were to be arbitrated. This list, which was promised several days previous to the riot on Saturday, was not yet completed, but was expected by the following Tuesday, and it is rather inexplicable why Saturday should have been chosen for an onslaught upon the company's men and property, as it was reasonable to suppose that the citizens' committee would reach some decision which would terminate the strike amicably.

When cars 56 and 88, which were put into the barn by mistake, were brought out again to continue their trip, the trouble began. The non-union men were jeered and hissed and some of the mob untied the trolley rope of one car and threw the trolley off the wire. While a constable, who was on the car, climbed upon the roof with the motorman to adjust the trolley, a shower of stones were hurled at the car demolishing the windows and narrowly missing the men on the roof. At this juncture the chief of detectives arrested a man who was throwing stones, but the man was rescued by the mob. A special detective was also set upon by the crowd about this time and after being pelted with stones and eggs was struck on the back of the head by a striker, inflicting a severe scalp wound. The other car which left the barn ran to the end of the route and returned with three lady passengers, but no damage was inflicted upon it.

About 3 o'clock Mayor Wilson, Alderman Parnell and others addressed the mob urging them to disperse and promising to help the sitrikers adjust their difficulties as soon as their grievances were made known, but this had but little effect. After the mayor drove away, the police were unable to clear the street thoroughly, many of the crowd waiting for the appearance of the cars again. After two hours car 88 made its appearance, closely followed by cars 62 and 96. Each was pelted with rocks more freely than the preceding one and most of the glass was broken. No. 86 was next sent up to the barn, and the crowd made a tremendous onslaught upon it. The motorman dropped on his knees in the vestibule to avoid personal injury and the conductor ran into the car and laid down between the seats. The switch point was turned so that the car, instead of running into the barn, continued along to the loop at the end of the line. Here the crew deserted it and it was entirely demolished by the mob. The next car, No. 66, was taken into the barn by the county constable, although every window was smashed. Car No. 58 was similarly treated.

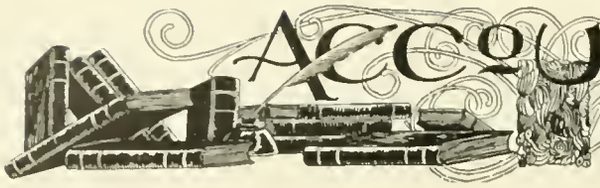
The most vicious attack of the day was made upon car 60, which was about a block behind car 58. The motorman and conductor barely escaped with their lives. A dozen stones crashed through the windows of the vestibule and the motorman sank to the floor with a broken nose, his forehead badly cut, a scalp wound and an injury in the neighborhood of the heart. He was in a semi-conscious condition when with the conductor he was taken from the car and placed in safety by the police. Cars 94, 80, 82 and 84 were similarly treated by the mob, which was now utterly beyond control of the police. An attempt to burn one car by saturating it with coal oil was with difficulty prevented by the police.

The mayor, accompanied by the crown attorney, again drove to the scene of the rioting and after addressing the crowd got their promise not to molest the remaining six cars on the line if they were taken into the barn by the police. The mayor was deceived, however, as when the first two cars coupled together and manned by the police approached the mob they met the same treatment as the previous ones, the two policemen both being hurt with stones, making it evidently unwise to attempt to bring in the other four cars.

Seeing that no more cars were coming the enraged mob started down town to demolish the last four cars stalled there. They were met by the mayor, who read the riot act in the thick of the crowd, but with little effect. Not until the soldiers, who were called out, advanced upon the mob with fixed bayonets would they disperse. The cars were then returned to the barn under military escort at 1:20 o'clock at night. Considerable damage was done to the store windows along the route and the list of the injured is a long one.

The city was put under martial law. In addition to the troops in the city, which numbered only 30 soldiers, 150 more were contributed by neighboring cities. The First Hussars and the regular force at the Toronto barracks were ordered to be in readiness at any time to go to London.

For several days following but few cars were run at night, while those in the daytime were under the military protection. On July 11th the strikers submitted their grievances in writing to the committee appointed by the council to effect a settlement of the difficulty. The committee, after going carefully over the list, came to the conclusion that no real grievance existed, and that it was merely a struggle for the recognition of the union. The company has offered to take back as many of the strikers as it has places for and to submit any real grievances to arbitration. It has, however, refused to be governed by the strikers' union, so under the circumstances no settlement could be made. On July 20th the company had all the positions filled with new men and cars have since been running on schedule time, but under police protection at night. The strikers maintained a bus line for a time, but this service was soon cut down so that it amounted to only a few trips a day. Business has been seriously affected in all branches by the strike, which has now been of several months duration.



CHANGES IN STANDARD ACCOUNTS.

The following report made by Mr. C. N. Duffy, chairman of the permanent committee on standardizing street railway accounts, to President Calderwood of the Street Railway Accountants' Association of America, will explain itself:

[In order that persons not having copies of the report of the 1898 committee in the pamphlet form, to which the references by page and line in the accompanying report refer, may note the changes, we have placed additional references to the "Street Railway Review" of September, 1898, in parenthesis.—Ed.]

REPORT.

St. Louis, July 21, 1899.

An invitation was received from Mr. Wm. O. Seymour, of the Board of Railroad Commissioners of Connecticut, to attend a meeting at the Manhattan Hotel, New York City, on July 11, 1899, to confer with the committee representing the Convention of Railroad Commissioners, and the committee representing the Association of American Railway Accounting Officers, for a general discussion upon the subject of a "Classification of Construction and Operating Expenses of Electric Roads," and I beg to report that Mr. Wm. F. Ham and myself attended this meeting, representing the Street Railway Accountants' Association of America.

The following gentlemen were present at the meeting: Wm. O. Seymour, member of the Board of Railroad Commissioners of Connecticut, and chairman of Committee on Classification of Construction and Operating Expenses for Street Railways; Ashley W. Cole, chairman, Board of Railroad Commissioners of State of New York, and a member of Mr. Seymour's committee; H. M. Kochersperger, comptroller, New York, New Haven & Hartford Railroad Co., and a member of the committee representing the Association of American Railway Accounting Officers; J. D. Greene, auditor of disbursements, Pennsylvania Railroad Co., and a member of the committee representing American Railway Accounting Officers; Wm. F. Ham and C. N. Duffy, representing the Street Railway Accountants' Association of America; H. T. Billings, clerk of the Board of Railroad Commissioners of Connecticut.

After a morning and an afternoon session, in which the report of the committee on "A Standard System of Street Railway Accounting," Covering the Classification of Construction and Equipment Accounts, Classification and Operating Expense Accounts, and Forms of Monthly and Annual Reports, made to the Street Railway Accountants' Association of America, at its second annual convention, held in Boston, Sept. 6, 1898, was discussed, the following modifications and changes were unanimously agreed to by all the gentlemen present:

1. The title of the sub-heading "Car Service," which includes Operating Expense Accounts Nos. 16 to 24, inclusive, and is the second sub-heading under the main heading "Transportation," was changed from "Car Service" to "Operation of Cars." This will necessitate a change in the printed report, as it appears on page 16. (St. Ry. Rev., Sept. 1898, p. 654.)

2. Account No. 8 "Maintenance of Miscellaneous Equipment." The second paragraph explaining what is to be charged to this account, which now reads: "Repairs and renewals of all harness, should be charged to this account," should be changed to read: "Repairs and renewals of all harness should be charged to this account. The cost of replacing horses lost by death or worn out in service, and the depreciation in the value of horses, should be charged to this account." This will necessitate a change in the printed report as it appears on page 25. (Ib., p. 656.)

3. Account No. 30, "Stable Expenses." The first paragraph explaining what is to be charged to this account, which now reads: "Charge to this account the cost of feed, keep and shoeing of horses, replacing horses lost by death or worn out in service, depreciation in value of horses, and all other stable expenses," should be changed to read: "Charge to this account the cost of feed, keep and shoeing of horses, and all other stable expenses." (Ib., p. 658.)

A new additional paragraph should be inserted, which will be the fourth paragraph, to read: "The cost of replacing horses lost by death or worn out in service, and the depreciation in the value of horses, should be charged to Account No. 8." This will necessitate a change in the printed report as it appears on page 35.

4. The number of Operating Expense Accounts is to be 38, Nos. 1 to 38 inclusive, Account No. 39, "Taxes," to be eliminated from Operating Expense Accounts, and classified as a "Deduction from Income." This will necessitate a change in the printed report, as it appears on page 17 (Ib., p. 654), as "39, Taxes," should be stricken out. This will also necessitate a change in the printed report as it appears on page 38 (Ib., p. 659), as it will be necessary to strike out the following: "Account No. 39, Taxes." "Charge to this account taxes on real and personal property used in the operation of the road, track taxes, franchise taxes, taxes upon capital stock, taxes upon gross earnings, car licenses and other vehicle licenses."

Page 15, line 30 (Ib., p. 654, 5th line from bottom of first column), insert the word "and" after 37 and preceding 38; insert a comma after 38. Page 15, line 31, strike out "and 39." "Page 15, line 33, insert the word "and" after "Terminals" and preceding "Insurance"; insert a comma after "Insurance"; strike out "and Taxes."

5. Monthly Report under "Deductions from Income" (Ib., p. 659), the first item is to be "Taxes." This will necessitate a change in the printed report as it appears on page 40, as it will be necessary under the heading "Deductions from Income" to insert as the first item "Taxes."

6. Annual Report under "Deductions from Income" (Ib., p. 659), the first item is to be "Taxes." This will necessitate a change in the printed report as it appears on page 41, as it will be necessary under the heading "Deductions from Income" to insert as the first item "Taxes."

It will also be necessary to change the form of printed report as it appears on page 39. Page 39, line 6, second paragraph, insert the word "and" after 37 and proceding 38; insert a comma after 38; strike out the words "and 39" (Ib., p. 659, third paragraph). Page 39, line 9, second paragraph, insert the word "and" after "terminals" and preceding "insurance"; strike out the words "and Taxes" (Ib., p. 659, third paragraph). Page 39, insert a new paragraph to be the third paragraph and read as follows: "Taxes include taxes on real and personal property used in the operation of the road, track taxes, franchise taxes, taxes upon capital stock, taxes upon gross earnings, car licenses and other vehicle licenses."

It will also be necessary to make the following changes in the printed report in the alphabetical list of items chargeable to Operating Expense Accounts:

Page 49, line 8 (Ib., p. 661), "Depreciation of Horses," "30," should read "8."

Page 53, line 9 (Ib., p. 661), "Horses, depreciation of," "30," should read "8."

Page 53, line 10, "Horses, replacement of," "30," should read "8."

Page 55 (Ib., p. 662), strike out 16th, 17th and 18th lines, "Licenses," etc.

Page 60, line 15 (Ib., p. 663), "Replacing horses," "30," should read 8."

Page 62, line 37 (Ib., p. 663), "Subscriptions other than to attractions," "33," should read "32."

Page 63 (Id., p. 663), strike out 14th, 15th, 16th, 17th, 18th, 19th, 20th, 21st and 22d lines, "Taxes, etc."

After the modifications and changes referred to above were unanimously agreed to by the gentlemen present, Mr. Seymour, chairman of the committee representing the Convention of Railroad Commissioners, announced, that at the annual meeting of his association, to be held in Denver, Aug. 10, 1899, his committee would make a report to the convention, recommending the adoption and use of the Standard System of Street Railway Accounting adopted by the Street Railway Accountants'

Association of America, with the modifications and changes agreed upon, which he would have embodied in his report, and that he was confident that his association would unanimously adopt the report as presented. Mr. Seymour stated that he would have at least 200 copies of the "Standard System of Street Railway Accounting" printed, containing the modifications and changes as agreed upon. Mr. Seymour also stated that he would have blank reports printed to conform with the Standard System of Street Railway Accounting, and that he would have the street railways of Connecticut make their annual reports for the fiscal year beginning in 1900, on these new forms.

Mr. Kochersperger and Mr. Greene, representing the Association of American Railway Accounting Officers, stated that they would report to their association, at its next annual convention to be held in May, 1900, the result of their conference with the committees from the Convention of Railroad Commissioners and the Street Railway Accountants' Association of America, and that as a committee, they would recommend the adoption and use of the Standard System of Street Railway Accounting adopted by the Street Railway Accountants' Association of America, with the modifications and changes as agreed upon embodied into the system.

Mr. Ham and myself, on behalf of the committee representing the Street Railway Accountants' Association of America, agreed to all the modifications and changes that were made, and stated to the gentlemen representing the other two associations, that we would present a report at the next annual convention of our association to be held in Chicago, in October, 1899, that we would embody what was agreed upon, and assured the gentlemen that we were confident that our association would sustain us in what we had done and unanimously recommend the adoption and use of the Standard System of Street Railway Accounting, as modified and changed.

Through the co-operation of the Convention of Railroad Commissioners, and the Association of American Railway Accounting Officers, with the Street Railway Accountants' Association of America, which will certainly be brought about by the action of the committees representing their respective associations, as, unquestionably, the action of those committees will be sustained by the associations, and in view of what the Street Railway Accountants' Association of America has already accomplished in the matter of bringing the Standard System of Street Railway Accounting into general use among street railway companies who are members of that association, Mr. Ham and myself are satisfied that the Standard System of Street Railway Accounting will be used by all of the street railway companies of the United States, and that a uniformity of methods and results, which has been so much desired, and for which we have so earnestly labored, will now be attained.

In explanation of the modifications and changes agreed to, I beg to submit the following:

1. Changing the title of the sub-heading "Car Service" from "Car Service" to "Operation of Cars." Mr. Kochersperger and Mr. Greene stated that the title "Car Service" would conflict with a technical term used in the operation of steam railroads, and with an account that steam railroads carried on their books, which represents a car-mileage account, as I understand it. In addition, it was suggested by these gentlemen that the title of the sub-heading "Operation of Cars" was preferable to "Car Service," and was in uniformity with the title of the first sub-heading under "Transportation," "Operation of Power Plant." Mr. Ham and myself readily agreed to this suggestion, and we both considered not only the objection to the other title well founded, but the name of the new title an improvement over the old.

2. Transferring from Account No. 30, "Stable Expenses," to Account No. 8, "Maintenance of Miscellaneous Equipment," the cost of replacing horses lost by death or worn out in service, and the depreciation in the value of horses. Mr. Kochersperger and Mr. Greene criticised the action of our committee in classifying this item under Account No. 30, "Stable Expenses," a "General Expense" Account, for the reason that they thought that the cost of maintaining horses was a maintenance charge, and should be classified under the same account that carried the cost of maintaining the wagons and horses. They pointed out that the wagons, harness and horses were one, in the sense that the wagons and harness were useless without the horses, and that in their opinion, Account No. 8 should carry the cost of maintaining wagons, harness and horses, in order to have the classification consistent. In this Mr. Ham and myself thought that unquestionably they were correct.

3. Eliminating Account No. 39, "Taxes," from Operating Expense Accounts and classifying it as a "Deduction from Income." In view of the fact that under the Inter-State Commerce Classification of Accounts, the universal standard followed by steam railroads, and the position taken by all of the boards of railroad commissioners throughout the United States that exercise any supervision over the books and accounts of street railways, to consider "Taxes" as a "Deduction from Income," and not as an "Operating Expense Account," and for the sake of bringing about a uniformity of methods and secure the co-operation of the Convention of Railroad Commissioners and the Association of American Railway Accounting Officers, all of the gentlemen representing these two associations being of the same opinion as to the disposition of "Taxes," and in addition being firmly fixed in their opinion that "Taxes" should not be a part of the operating expenses of a road, Mr. Ham and myself agreed to change our classification of Operating Expense Accounts, taking therefrom Account No. 39, "Taxes," and treating "Taxes" as a "Deduction from Income," making it the first item under that heading in monthly reports and annual reports.

A copy of that report will be sent to each of the gentlemen who attended the meeting at the Manhattan Hotel, New York City, July 11, 1899, to the two members of the committee of the Street Railway Accountants' Association, besides yourself, who were not present at the meeting, to the secretary of our association, and also to the two honorary members of our association, Mr. H. H. Windsor, editor of the "Street Railway Review," Chicago, and Mr. E. E. Higgins, of the Street Railway Journal, New York, as both of these gentlemen are deeply interested in the subject, and will, no doubt, give our association the benefit of the columns of their papers to further the work of our committee.

I trust that what was accomplished at the meeting and the action taken by Mr. Ham and myself will be endorsed and approved by the other members of our committee, as well as ratified and confirmed by our association, at the next annual convention to be held in Chicago, in October, 1899.

I shall write Mr Seymour and request him to have printed 300 additional copies of the report that his committee will present to his association at the annual convention in Denver, our association, of course, to pay the cost of printing these 300 extra copies.

C. N. DUFFY, Chairman.

To John F. Calderwood, Esq., President, Street Railway Accountants' Association of America.

The report which Mr. Seymour's committee made to the Convention of Railroad Commissioners at its meeting in Denver, August 10th, contains the most hearty endorsement of the "Standard System of Street Railway Accounting" that could be made, and is a high compliment to the Street Railway Accountants' Association and to its members which prepared the reports. Mr. Seymour's report is as follows:

To the Eleventh Annual Convention of Railroad Commissioners:

At the ninth annual convention of Railroad Commissioners, held in St. Louis in May, 1897, the following resolution was passed:

"Resolved, That a special committee of three be appointed by this convention to prepare a form of classification of the construction expenses and operating expenses of electric roads, to correspond as far as practicable with the forms approved by this convention, and adopted by the Interstate Commerce Commission for steam roads, and that said committee be authorized to invite the co-operation and assistance of the Association of American Railway Accounting Officers; also of the American Street Railway Association, or any other persons possessing expert knowledge appertaining to the subject, and to report the result of these proceedings to the next annual convention of this body."

The persons appointed to carry out the purposes of this resolution were: Wm. O. Seymour, of Connecticut; Ashley W. Cole, of New York, and R. S. Kayler, of Ohio. The committee appointed by the Association of American Railway Accounting Officers to co-operate with the foregoing committee were:

H. M. Kochersperger, comptroller of the New York, New Haven & Hartford Railroad Co.; M. Riebenack, assistant comp-

troller of the Pennsylvania Railroad Co.; H. D. Bulkley, comptroller of the Baltimore & Ohio Railroad Co. The committee as thus constituted met in New York City in April, 1898, and mapped out its work, closely modeled after the forms of the classification of the constitution and operating expenses of steam roads, but the items chargeable under each head of the various accounts were not completed, and we found it impossible to perfect it in time to present to the tenth annual convention, held in Washington in May, 1898. We therefore reported progress, and asked for an extension of time for the completion of the work, which the convention readily granted. At the time of this meeting in New York City it was learned that an organization was in existence known as the Street Railway Accountants' Association of America, which had been engaged for two years in preparing such a classification as we had been instructed to prepare. In accordance with the terms of the resolution appointing us, we sought and obtained the co-operation and assistance of this organization, to which we are indebted for the form herein presented for your consideration and adoption. It was found that the form prepared by the street railway accountants was so much more advanced in its preparation, so complete and full in its details, and so well adapted for its purpose, owing to the familiarity of those who prepared it with street railway accounting, that we deemed it wise to abandon the work which we had commenced, and advised the endorsement and adoption of the form prepared by them. Several slight modifications in the form have been made at the suggestion of the Railway Accounting Officers, and as it is now presented it is unanimously approved and recommended to this convention by your committee and the Railway Accounting Officers associated with us. Emanating from their own accounting officers, the form is more likely to be universally adopted and used by the street railway companies than if prepared and submitted by those entirely outside of their organization, especially if they are assured by our action that it will be accepted and approved by the various state commissions to which they are required to make annual reports. Your committee desire to publicly express their sincere thanks to the committee of the Street Railway Accountants' Association of America, who are the authors of this classification, and whose name, position and address are prefixed to this report, for the cordial and generous manner in which they have contributed the results of their laborious and extended deliberations for our consideration and adoption; also for the valuable assistance rendered by Mr. J. D. Green, auditor of disbursements of the Pennsylvania Railroad Co., who represented Mr. Riebenack upon the committee; to Col. N. H. Heft, superintendent of the electrical construction of the New York, New Haven & Hartford Railroad Co., who kindly gave us the benefit of his expert knowledge of electrical matters; to Col. Charles R. DeFreest, recently clerk of the Railroad Commissioners of the New York, whose assistance and advice was much appreciated; to Henry F. Billings, clerk of the Railroad Commission of Connecticut, and, finally to the committee of the Association of American Railway Accounting Officers, who were associated with us, without whose advice and assistance no good thing can be accomplished in devising correct methods of railway accounting. Respectfully submitted for the committee.

Wm. O. Seymour, Chairman.

WHALOM PARK, FITCHBURG & LEOMINSTER ROAD.

Mr. W. W. Sargent, superintendent of the Fitchburg (Mass.) & Leominster Street Railway Co., sends us a handsomely illustrated pamphlet descriptive of Whalom Lake and Park, the pleasure resort of this company. The park was first opened in 1893 and has become more popular each year, being at the present time a favorite picnic resort for the territory within a large radius; it comprises 60 acres, mostly wooded, on the shores of Whalom Lake. During the summer the Boston Opera Comique Co. has sung to large audiences; the program sent us occupies about a page in a 36-page pamphlet, otherwise filled with advertisements, so that we judge that there are a great many people to be reached through this medium.

The employes of the Washington (Pa.) Electric Street Railway have asked for an increase in their wages from 12½ cents an hour to 15 cents.

ST. LOUIS UNITED RAILWAYS.

The United Railways Co., of St. Louis, Mo., has been organized following the purchase of the St. Louis lines by Brown Bros & Co., of New York. This company will own and control every street railway in the city with the exception of the St. Louis & Suburban line, and it is generally expected that the latter road will eventually become one of the consolidation. The first purchase made by Brown Bros. & Co. in this city was the Lindell system, which also included the Missouri system, the latter having been absorbed by the former some time before. The Central Traction franchise was next purchased. Attention was then turned to the Union Depot system, and it was only a short time before that was taken in. The People's Ry. came next. The last purchase was consummated only a few weeks ago, and took in the National system and the Southern Electric line.

The capitalization of the new company is to be $45,000,000. An issue of stock to this amount is to be authorized. It is said that half will be in common and half in preferred stock. A meeting of the stockholders of the company has been called to be held Wednesday, September 20, for the purpose of voting upon a proposition to issue the company's bonds to the amount of $45,000,000, and there is no question but that this proposition will be carried. While these bond and stock issues are to be authorized, the entire issue will not be placed upon the market. A sufficient amount of the bonds and stocks will be reserved in the treasury of the company to be used for the redemption of all the outstanding bonds of the various companies taken in by the United Railways Company. As these old bonds fall due, they will be redeemed by the new ones and by stock reserved for that purpose. A sufficient amount will also be reserved to meet all outstanding floating indebtedness of the various companies, as well as for the purchase of other lines, franchises, property, etc., that may be desired by the consolidated company. The building of extensions and branches will also be provided for in this manner.

The following officers of the new company have been elected: Edwards Whittaker, president; Murray Carlton, vice-president; Jilson J. Coleman, general manager, and George W. Hunter, Robert McCulloch, George W. Baumhoff and James F. Davidson, division managers.

PICTURES SPEAK LOUDER THAN WORDS.

The almost invariable tendency of female street car passengers to alight from the cars in the wrong direction has been greatly checked on the Staten Island railway lines by a pictoral warning in the shape of a poster with which the cars are decorated.

The accompanying illustration is from one of the signs sent us by the New York & Staten Island Electric Co., West New Brighton, N. Y. The original is 16 x 9 in. and is printed in five colors.

A severe storm which passed over Washington, D. C., on July 16th, occasioned considerable delay upon some of the roads which are supplied with power from the Potomac Electric Power Co. Four poles were blown down at one point on the Georgetown and Tenallytown line, and as these poles carried the feeders, the whole system was crippled. Three cars were also burned out on the Great Falls road.

ENGLISH ELECTRIC LOCOMOTIVES.

Through the courtesy of Messrs. Crompton & Co., of London, we are able to present to our readers some illustrations and details of the electric locomotives which have been built by that company for the City & South London Ry. This road, which was described in the February, 1898, issue of the "Review," was the pioneer underground railway in the city of London. An important extension to this line has been under construction for some time but,

FIG. 1—CITY & SOUTH LONDON LOCOMOTIVE.

although advertised to be completed in July, will not be finished for two or three months yet, owing to the engineering difficulties met with in course of construction. The new line includes a tunnel under the Thames and will be operated from a new power station. Ten new locomotives have been ordered for this road to supplement the 20 others of various makes already in use. The new locomotives are all being built by Crompton & Co., and their general appearance is shown in Fig. 1. They have approximately the following dimensions:

Height	8 ft.	5½	in.
Total length over all	14 ft.	2	in.
Total width over all	6 ft.	10	in.
Length of wheel base	5 ft.	6	in.
Diameter of wheels	2 ft.	7	in.
Gage of track	4 ft.	8½	in.

Each locomotive is fitted with two motors, one of which is shown in Fig. 2. The armatures are built directly upon the axles so that there is no gearing whatever.

FIG. 2—MOTOR.

Each locomotive gives 150 lb. draw-bar pull at 150 amperes, and the maximum speed usually attained is 26 miles per hour. A view of the armatures mounted upon the axles is shown in Fig. 3. The locomotives are built with teak doors and polished plate glass windows. The cabs have wooden floors fitted in sections so as to be easily removable, and the interiors are neatly panelled with polished teak, each cab being provided with two seats and a locker.

The wheels have cast steel centers with tires 3 in. thick and 4¾ in. wide; the motors are suspended from brackets fixed underneath the cab at the four corners by means of bolts and springs. The locomotive is provided with a powerful hand brake, in addition to which there is also a Westinghouse air brake. For the use of the air brake there are two air storage reservoirs of about 18 cu. ft. capacity. These air reservoirs are charged by an air compressor in the cab which is direct driven by an electric motor so that the charging may take place while the train is in motion. Standpipes are situated at the station for charging the compressed air cylinders while the train is at rest.

Each locomotive is wired for two complete lightning circuits, each

FIG. 3—ARMATURES.

consisting of five 16-c. p. lamps in series. Two lamps are used for general lighting of the cab, one lamp is fixed over each commutator and the remaining lamp is used for a portable. The locomotive is also provided with two lamps with red, white and dark slides which are arranged for burning oil.

The controllers used are series-parallel controllers which were specially designed to meet the requirements of this railway by Mr. McMahon, chief engineer of the road. A tachometer reading "miles per hour," is located inside the cab, and is driven from one of the axles. The complete locomotive weighs about 13 tons.

EAST BOSTON TUNNEL ENJOINED.

The supreme court has decided that the Boston Transit Commission is not authorized to proceed with the construction of the East Boston tunnel provided for under the statute of 1897. A previous act authorized the Transit Commission to construct a tunnel connecting Hanover St., Boston, with the surface railways of East Boston and the amendment of 1897 requires the tunnel to be extended so as to connect with the present subway, an additional distance of nearly 2,000 ft. In the opinion of the corporation council the Commission by these acts was granted permission to do one of two things; to construct a tunnel to East Boston either from the surface at or near Hanover St., or from any subway which was already built. This opinion required the Commission to construct the tunnel as soon as the Elevated Railway Co., for whose tracks the tunnel was to be built, should be authorized to begin the construction of its railroad over the route applied for.

Estimates were made on nine different routes for the tunnel and one was chosen by the Commission which would come to the surface somewhere near North Sq. which would be at least 1,500 ft. from the nearest point of the subway and much farther than that from any car entrance to the subway. From the terminus of the tunnel it was proposed to run surface tracks to connect with the subway. This route was chosen because the estimate for it was within the amount of the appropriation, while to connect the tunnel with the existing subway would have considerably exceeded it.

Proceedings were brought by Causten Browne and others against the Commission, and to restrain the City Treasurer from issuing bonds for the cost of the tunnel, the petitioners contending that the connection between the subway and the tunnel must be an actual physical connection, and that a connection by means of several hun-

dred feet of street railway surface track was not such a connection as the statute called for.

In its decision the court says: "It is to be observed that the connection is to be made by the commission, and we can see no sound reason for making a distinction as to that duty at the different ends of the tunnel. As at the easterly end the tunnel must be extended far enough to make a physical connection with the surface tracks, so at the westerly end it must go far enough to make a physical connection with the subway, and as at the easterly end there must be no intervening link between the tunnel side and the surface track side of the point of connection, so at the westerly end there must be no intervening link between the tunnel side and the subway side of the point of connection."

In regard to the cost of construction the opinion states: "But the respondents urge that no such tunnel as is called for under this construction of the statute can or ever could be built with the sum already appropriated, while the tunnel which the commission has voted can be built within the appropriation. This fact does not seem to us of much weight. It is a matter of common knowledge that the actual cost of a public work frequently exceeds the estimate, and appropriations are made from time to time as needed, especially where considerable time is to be taken in its construction."

On these grounds the court has ordered the construction of the tunnel under the present plans to stop.

IMPROVED SERVICE ON THE LAKE STREET ELEVATED, CHICAGO, TO AND FROM OAK PARK.

Mr. Frank Hedley, general superintendent of the Lake Street Elevated Railroad Co., Chicago, advises us that on Monday, July 24th, the company put in effect a schedule giving nearly three times as many trains as heretofore. The improvement can best be appreciated by reference to the table showing the former and the present headway at different hours of the day.

Time.	Old Headway.	New Headway.
12:00 to 1:30 a. m.	45 min.	45 min.
1:30 a. m. to 4:30 a. m.	60 "	60 "
5:54 a. m. to 8:15 a. m.	10 "	6 "
8:15 a. m. to 4:30 p. m.	20 "	7 "
4:30 p. m. to 7:45 p. m.	7 "	6 "
7:45 p. m. to 11:00 p. m.	20 "	7 "
11:00 p. m. to 12:00 m. n.	20 "	10 "

The western terminus of this road is now at Wisconsin Ave. and Randolph St., in Oak Park, 9 miles from the northwest corner of the Union Loop. The total distance on the elevated structure is 7 miles, the last 2½ miles being over surface tracks; the incline connecting the surface and the elevated tracks is about 800 ft. long and lies between West 52d St. and Willow Ave., Austin.

In May last the Lake Street Elevated inaugurated a special express service to the Harlem Race Track, which has been continued since that date, and is greatly appreciated by patrons. The races at Harlem occur during each alternate two weeks, and during the races eight special trains leave from the corner of State and Randolph Sts., at intervals of 7 minutes, the first one leaving at 1:48 p. m., and run to the race track without any stops save at five of the Union Loop stations. The other stopping points on the Loop are at Madison and Wabash, State and Van Buren, Pacific and Van Buren, Madison and Fifth Ave. and Randolph and Fifth Ave.; from this last station to Harlem is 9 miles and the run is made in 25 minutes. Between the Loop and Cuyler Ave. it is necessary to pass regular trains at various points and the schedules are so arranged that the meetings occur where there are cross-overs and sections of third track; the regular trains are shunted to the third track, giving the main line to the race specials. From Cuyler Ave. to the race track the trains run over the lines of the Suburban Railroad Co. The saving in time by the express trains is about 14 minutes.

When the Lake Street road was built it was designed with the idea of laying a third track between the two main tracks, and at various points sections of the third track have been built and are used for switching purposes. The company has under consideration the completion of the third track between Campbell Ave. and W. 52d St., which will enable it to give an express service, the express trains making no stops between these points.

TRAMWAYS IN MILAN.

The following description of the tramways of Milan, Italy, is furnished by U. S. Consul W. Jarvis:

The transit service in Milan is electrical. All the tram lines excepting three start from the Piazza del Duomo (the Cathedral square) and run either to the various railroad stations or through the gates to points beyond the city limits. The lines above excepted are one from the Central Railroad Station that runs past the Northern Railroad Station to the Porta Ticinese Station, another that encircles the city, and a third from Porta Volta to the Musocco Cemetery.

The line that encircles the city is divided into five sections, and the fare on each section is 10 centesimi (2 cents), or 50 centesimi (10 cents) for the round trip. The line that runs from the Central Railroad Station past the Northern Railroad Station to the Porta Ticinese Station is divided into two sections, and the fare on each section is 10 centesimi (2 cents); 20 centesimi (4 cents) for the whole trip. The fare on the line from Porta Volta to the Musocco Cemetery is 15 centesimi (3 cents). The fare on each of the lines starting from the Piazza del Duomo is 10 centesimi (2 cents). But for the benefit of the working and the poorer classes, the fare is 5 centesimi (1 cent) on each line from the Piazza del Duomo and on each section of the other lines before 8 a. m. in the summer and 9 a. m. in the winter.

The total development of track system owned by the commune is 66 miles. But, as some of the trams run over the same track for certain distances at various points, the actual length of track is 42 miles. The contract which the Societa Generale Edison di Electricta has with the municipality of Milan for the management of the city's tramways lasts for twenty years. The commune provided at its own expense the laying down of the tracks, which were transferred to the above society on the payment of 4,500 lire ($868.50) for each kilometer (0.62137 mile, or 3,280 feet 10 inches) of single track.

The commune pays to the above society 25½ centesimi (5.1 cents) for each car per kilometer. From the total yearly receipts are deducted the amounts paid by the society to the commune and by the commune to the society, and the remainder is divided between the society and the commune in the proportion of 40 per cent to the former and 60 per cent to the latter.

The regulations permit of cars carrying more passengers than there are seats, but, to prevent overcrowding, the gates are often closed. Only one gate is opened on each car—which will seat about 18 passengers—and this is always on the opposite side of the car from the parallel track, so there is no danger of stepping off in front of an approaching train. There were 44,559,888 passengers carried in 1898, against 39,736,091 in 1897.

The tram service in Milan is excellent; the cars are run with care and skill, and, when it is possible, at a fair rate of speed. There are very few accidents, although there is a perfect network of tracks in the Piazza del Duomo, and many of the streets through which the trams run are very narrow. The conductors are polite and obliging.

WAGES INCREASED.

Among street railway companies which have found it possible to increase the wages paid to all of their employes are the Union Traction Co., Muncie, Ind., which made an increase ranging from 10 to 15 per cent according to the length of service; the La Crosse (Wis.) City Railway Co., which increased the pay of its conductors and motormen $2 per month and made a rate of 15 cents per hour for overtime, and the Columbus (O.) Street Railway Co., which increased the wages of its laborers 20 per cent; the Lexington (Ky.) Railway Co., which increased the pay of conductors $1 per week, with the promise of another increase; the Glen Oak & Prospect Heights Railway Co., which increased the wages of its conductors 50 cents and of its motormen $1 per week, and the Milwaukee Electric Railway & Light Co., which on July 25th made the rate 20 cents per hour instead of 19 cents.

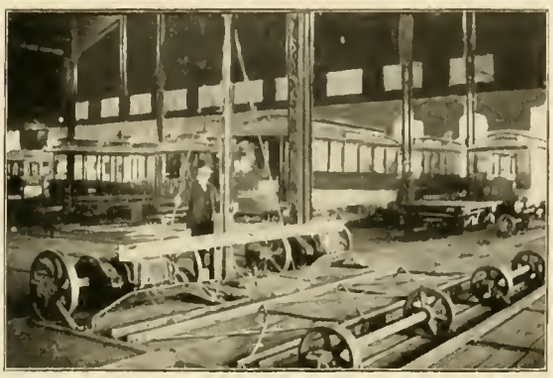
The Columbus (O.) Street Railway Co. also increased the wages of its employes by arranging for a dividend on wages earned.

The Portland (Me.) Street Railway Co. has just put a new system of transfers into operation upon its new lines in the Forest City.

MECHANICAL DEPARTMENT

A NEW TRANSFER TABLE.

The accompanying illustration shows a new transfer table recently installed in one of the car barns of the New Orleans City Railroad Co. There was found to be insufficient track entrances to this barn and to facilitate the movement of cars in this barn the

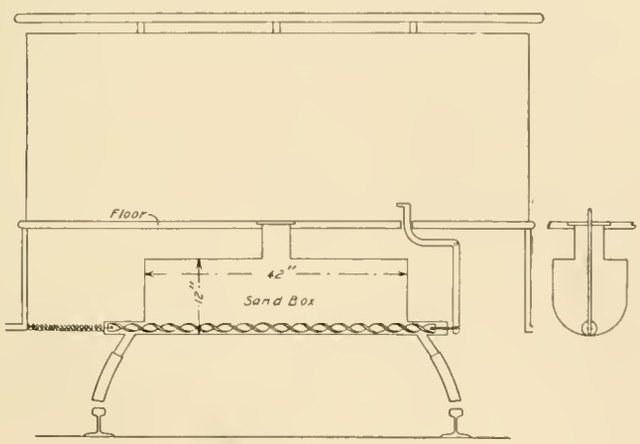


TRANSFER TABLE, NEW ORLEANS CITY R. R.

transfer table shown was constructed. The general arrangement of the table is very well shown in the illustration. It is equipped with two 30-h. p. motors and a K2 controller. An old W. P. rheostat controller is used for the K2 controller. The table was made of an extra length to accommodate the double truck cars used by this company, and since its installation has proved a great success in facilitating the movement of cars about the barn.

PLATFORM SAND BOX.

Mr. Thomas Elliott, chief engineer of the Atlanta (Ga.) Consolidated Street Railway Co. and of the Atlanta Railway Co., has recently designed a platform sand box for sanding both track rails,



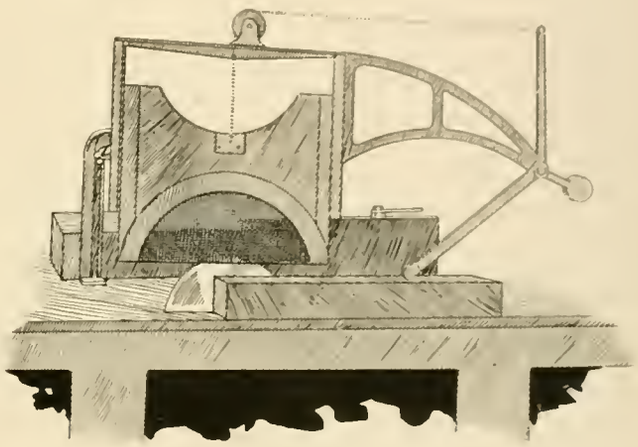
SAND BOX, ATLANTA, GA.

which is shown diagrammatically in the accompanying sketches. The box is 42 in. long and 12 in. deep, with a capacity of 3 cu. ft.; it is placed transversely under the front platform of the car and is filled through a hole cut in the platform and covered by a hinged lid. A pipe extends from each end, terminating over the rail. For manipulating the sand a treadle on the platform is connected to a bar of ¼ x 1½ iron, twisted, extending through the box; on the other end is a spring. When the treadle is pressed down by the motorman the twisted bar is drawn to the right and forces sand out on one rail; when the treadle is released the spring pulls the twisted bar back and forces sand out on the other. In new boxes now under construction a door is placed in the bottom for removing stones or such matter as may inadvertently get in with the sand.

The box is placed so far in front of the wheels that the spouts do not cover the track rails at curves, which is considered an advantage, as it prevents the use of sand at these points which should be kept greased.

SAW GUARD.

In a recent number of Engineering, London, was published a brief description of the circular saw guard shown in the accompanying sketch. It is in use at shops of the London & Northwestern Ry. As seen it consists of a counter balanced cover for the



SAW GUARD.

saw blade which is raised to the proper height to clear the work by the lower arm of the bell-crank lever; this arm has a friction roller at the end which bears on the work.

DOES PAINTING PAY.

BY J. L. J.

There is little doubt but that this question presents itself many times and in many forms, to the management and officials of street railways. The paint shop, if it is a luxury, is a very expensive one indeed, but if it be a standing necessity, it surely is something which demands careful thought. Provided that it is placed under proper system and control, it should then be considered at least one of the best paying investments which any road can make. There are very many reasons why this assertion can be made. Let us study a few of them. The life of a street car is very dependent on the painting, and is very materially lengthened if the body of paint and varnish is kept in good condition, that is, each exposed part so covered by the oily film called paint. Iron parts are not exposed to the elements, and consequently do not rust. If the wood is shielded so that no moisture can enter it, scarcely any expansion or contraction takes place, and there is no opening of the fibers or loosening of joints or tenons, except as they may be wrenched or forced by hard usage. It can easily be seen that with

the expansion which would be caused by rains and contraction from heat, that a car would soon be falling to pieces from what might very justly be called premature decay. It would probably be quite safe to say that one-half of the life of a car is added by its being protected by paint.

Still, in the face of these important facts, the paint shop seems to be regarded in some cases as an extravagance, a sort of necessary evil that must be tolerated. However, strange this may seem, it is true. This feeling comes from a lack of study on the part of the official in charge. There is little doubt but that his mind is taken up by matters of deep and live interest which thrust themselves to the front. But paint and painting should not be put in the background. The reader of this article may urge that it is written by a painter and from a painter's standpoint. The responsive question immediately comes: From what point of view can painting be considered as intelligently as from that of a painter's? Or, who is so well qualified to judge, or knows as much about painting as the man who has spent his lifetime studying that subject?

To illustrate: Some time ago the writer attended a painters' convention, and from all sides criticism was heard on the color of the cars in the city and the lack of harmony in the general effect of striping and ornamenting. More than twice as much money had been used than would have been necessary to give the cars a very pretty and pleasing general effect. But, instead, they had an unkept, blank, repulsive appearance to the eyes of the painters assembled. Some inquisitive party took the trouble to ask who was the designer of the painting on the cars, and learned that some official on the road had conceived the idea and "so ordered it."

To say the least, the man responsible did not consult a painter or even the taste of any lady, or he would have learned that contrast must be had to bring harmony, and vice versa. A disregard of harmony in contrast makes the result tame and flat or glaring and vulgar. No doubt the query is very often made: Does it pay to put on a good finish and also to ornament a street car on the outside? We say, decidedly yes. A company must do so, to a certain limit. Beyond that limit, no. That limit may be found very easily by getting the pulse of the people or watching the dress and taste of the masses and striking an average, thereby getting the happy medium between the flights of fashion on the one hand and the hard, tasteless finish which appears to say "we want the earth," on the other. It must be poor policy to have a car painted in such a manner that it gives an impression of disregard for the sentiments of the people. They who would win from the public must cater, in some measure, to its wishes. It is plainly noticeable that buildings that are built and painted in an inviting and tastful style are more readily taken by tenants than those built with a disregard of taste. There is a class of the traveling public who are almost compelled to ride in any kind of a car that is presented. But there are many who ride for pleasure, and a car so painted that it gives a pleasing effect is a drawing card and leads the thoughts to diversion and rest. There can be no reasonable doubt but that many rides are taken in street cars because they have taken the attention and pleased the eye; which would not have been done if the cars had not been painted in a way that brought a sense of pleasure to the parties who ride in them.

SOME SHOP HINTS.

By courtesy of Mr. H. M. Sloan, general manager, and Mr. W. A. Harding, master mechanic, we are able to describe some rather interesting tools and methods used in the shops of the Calumet Electric Street Railway Co., Chicago.

FIELD COIL FORMER.

Fig. 1 shows an iron former for winding fields which was made to obviate the annoyance resulting from wooden formers breaking and wearing out. It is made to suit the field coils to be wound on it and consists of a former casting and a cover plate. The cover plate has a piece of wood bolted to it and to this is glued a strip of leather where the wire comes in contact with it; this arrangement was the outgrowth of experience, it having been found that either iron or wood would abrade the insulation on the wire. Four slots are cut in the sloping flange of the former and opposite these in the parallel portion are shallow grooves; these permit the insertion of straps or the application of mallet to remove the coil from the former. The shank projecting from the back is held in the jaws of a lathe chuck when winding a coil.

SPECIAL CHUCKS.

For turning bearings special chucks shown in Fig. 2 are used. There are now three sizes used in the shops for W. P. 50 and G. E. 800 armature bearings. The sketches show all the necessary di-

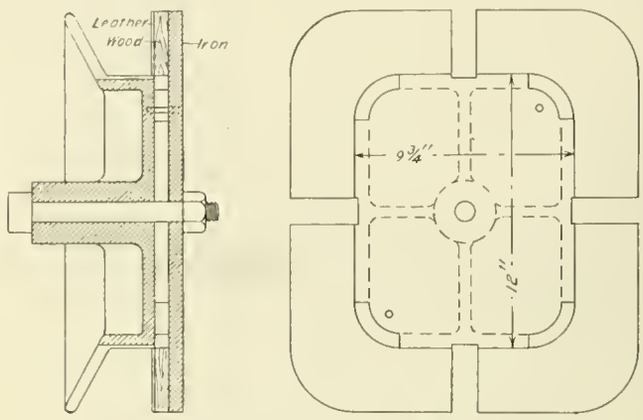


FIG. 1—FIELD COIL FORMER.

mensions. Fig. 2 is used for two styles of bearings, the channel opposite the split side of the chuck being cut to give room for the feather or key, which is on the outside of one type of bearing shell; the other type of shell is round with no projections.

Fig. 3 is a chuck for G. E. 800 armature bearings. For a modified armature bearing which has been designed in the shop for

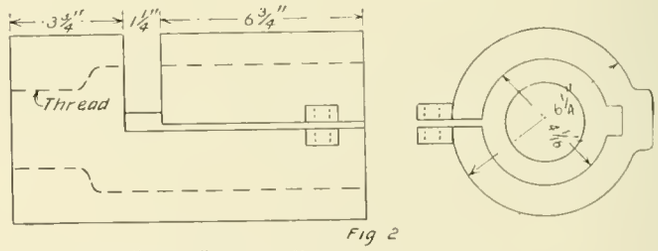


Fig 2

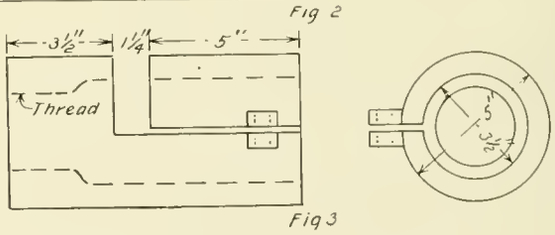


Fig 3

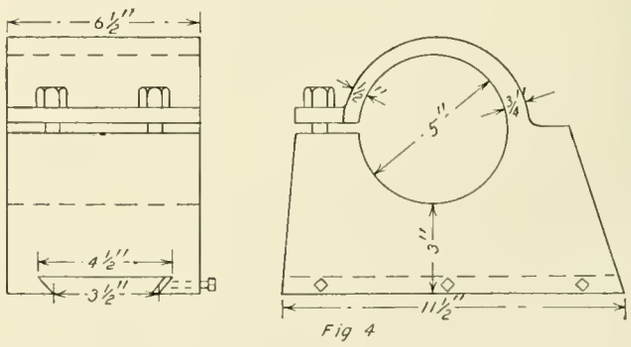


Fig 4

SPECIAL CHUCKS.

W. P. 50 motors there is a third chuck of the same dimensions as Fig. 3, except that the internal diameter is 3¾ in.

These chucks are split along one side and the bearing clamped by a single bolt through the lugs shown. Half the chuck is cut away for a distance of 1¼ in., this being done with a three-fold object; it makes the clamp more flexible, it provides a place for turnings and chips to escape, and it gives the workman a better

opportunity to examine his work and to caliper it at both ends without removing the chuck.

As it has been found that so-called standard bearings are very seldom uniform either in diameter or length, it is not the practice to keep the supply of babbitted bearings turned to these standards, but when a new bearing is used the armature shaft is measured off to give the proper end play. The rough babbitted bearings are of course kept in stock.

Fig. 4 is a special device used for turning the brass axle motor bearings; these are not babbitted. The bearing is solid and clamped in the holder which is placed on the apron of the lathe replacing the tool holder. A boring bar with two tools, one to give the roughing and one the finishing cut, is mounted between the centers and the shell very quickly finished.

PIPE BENDING.

Just before the Fourth of July there was a call for 10 pairs of car side gates which were needed in a great hurry. It was found that extra heavy ½-in. pipe would fit the hooks on the cars, and side gates were made by bending pipes about a former and riveting three cross bars in them. The former is a piece of heavy oak plank shaped at the corners as shown in Fig. 5; the bending tool is a forged fork with an iron pulley mounted near the crotch, the ends of the fork being pivoted to the former. Small iron plates are let into the wood to form bearings for the pivot bolt. The rounded corners of the former protrude in order to allow the bending fork to carry the pipe beyond a right angle, the permanent set always being less than the maximum deflection.

A similar simple former was used in turning out some complicated shapes in bent piping used for making single piece fenders.

CAR SIGNS.

The company starts cars for several divisions from the same terminal and this makes it necessary that each one be provided with a sign indicating the route or destination, of such design that it can be clearly read at a considerable distance. For some years the cars on different routes have been given sign boards of distinctive colors which enable the patrons to tell the destination of an approaching car in the day time. These boards are 12 x 24 in. and were hung on the dasher by a strap-iron hook fastened on one end of the sign board. The boards were painted with the proper route color and on this background the name of the destination was painted in large letters. The signs were reversible, each side bearing the name of one of the two termini of the route. These signs answered admirably during the daytime, but at night the motormen found that on certain portions of the line it was necessary to come to nearly a full stop at every street intersection in order to let persons who might be waiting see whether this was the car they wanted to take. This resulted in a serious loss of

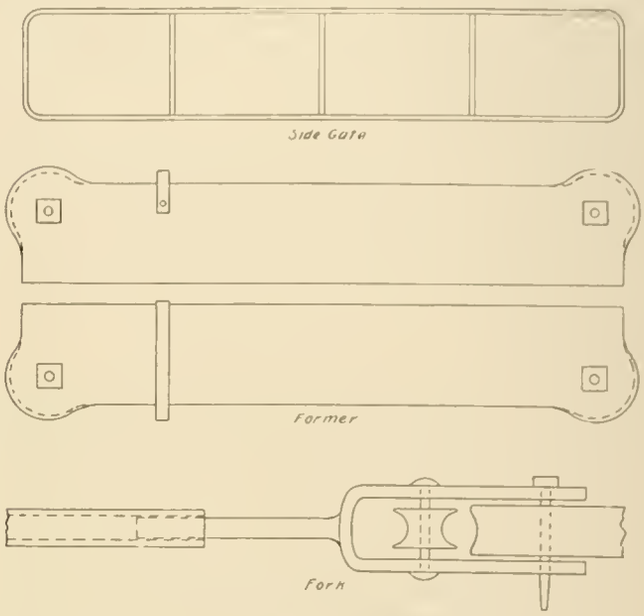


FIG. 5—FORMERS FOR BENDING PIPING.

time and it was decided by the management that a sign which would serve by night as well as by day must be provided.

The first condition laid down by Mr. Sloan was that in daylight the sign must show letters on a background of the route color, and at night show illuminated letters of the route color, the background at night of course being black. A plan in which this condition is successfully met for all routes except those whose color is white or brown, was worked out a few months ago by Mr. Harding.

The route colors are: Red for the Roby division; brown for West Pullman; white for Auburn Park; green for Pullman; yellow for Manhattan Beach, and purple for one of the cross lines.

Experiments showed that the best location for the illuminated signs was at the upper part of the dasher at the motorman's right. Placing the signs on the hoods was considered, but abandoned because of the danger of the trolley rope catching on the box of the sign at the rear end; the location chosen is sufficiently far from the headlight and, as will be explained later, the box is to a considerable extent protected from injury through the carelessness of passengers by the brake staff and the forging bracing the upper end of the staff.

Cars so far equipped with the signs are of two patterns, those with wood dashers and those with iron dashers. For the latter a wooden box 11½ in. high, 24 in. long and 4 in. deep was bolted on the outside of the dasher; this box had a slanting top to shed water. If it is necessary to place any more boxes outside of the iron dash-

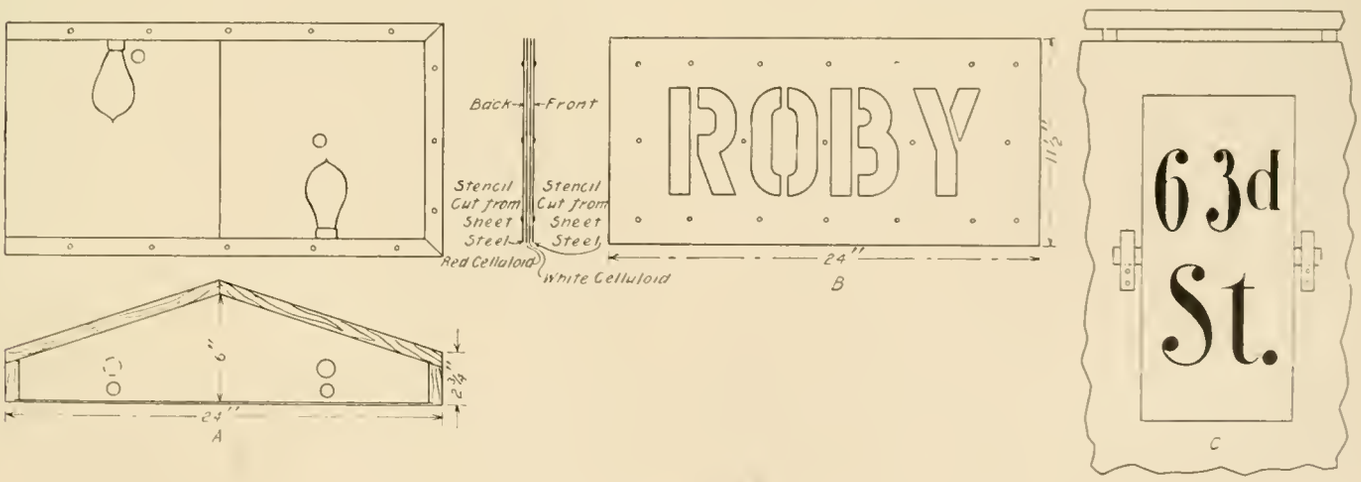


FIG. 6—CAR SIGNS.

ers a malleable iron box without any back will be riveted to the dasher. The standard construction, however, is that used on the wooden dash cars and is as shown in the sketch; the sign board, lamps, etc., are the same for both kinds of cars.

A hole is cut in the dasher near the top and a light wooden box

of the shape and dimensions shown at A in the sketch inserted. This box must be able to stand a little rough usage because passengers will persist in piling or resting packages on it as it projects into the vestibule, but by placing it behind the brake staff and under the braces supporting the latter at the top it is well protected. Strap irons are fastened to the front of the dasher to make the grooves in which the sign slides. Two incandescent lamps are placed in the box as indicated at A. For ventilation there are four holes cut in the box, two in the bottom near the front edge, and two in the back above the lamps.

The sign itself consists of two sheets of thin steel, in which the proper letters have been cut, making a stencil, and two sheets of celluloid, the four being fastened together with small copper rivets. These signs are 11½ in. high and 24 in. long; sheet celluloid is made 20 x 28 in., hence in designing signs, this size should be borne in mind to avoid waste in cutting.

The Roby sign shown at B in the sketch has in front a steel stencil showing the word "Roby," next a sheet of very thin white celluloid, next a sheet of red celluloid, and at the back a steel stencil exactly similar to the front one. Before assembling, the steel sheets are painted on both sides to prevent the inner side rusting when the celluloid is cleaned with a sponge and water.

Some of the divisions have the names of both termini cut in the stencil plates. It is found that the best green is got by using blue celluloid for the color sheet, instead of green.

Exceptions were noted in the complete consistency of the color scheme on the two routes. West Pullman cars by day show white letters on a brown background; only white celluloid is used in the sign and it shows white illuminated letters at night. The Auburn Park line is indicated during the day by black letters on a white background; the sign is a thick sheet of white celluloid on which are painted black letters; at night it shows black letters on a white ground. Special cars are almost always run in the daytime only and the signs used on them have the word "Special" in silver letters on a black ground; this is the sign used on funeral trains.

The signs being removable, cars may be changed from one division to another without causing confusion.

Two of the signs are placed on the car, one at each end, the two lamps in each box and a fifth one which is in the conductor's end, being in series. The cost of equipping a car with these signs is about $10, distributed as follows:

4 steel stencils @ 90 cents	$3.60
4 quarter-sheets celluloid @ 60 cents per sheet	.60
rivets and labor	.20
paintings and labor	.20
2 boxes @ 75 cents	1.50
5 lamp sockets @ 7½ cents	.38
5 lamps @ 18 cents	.90
wire	.40
labor of placing boxes, wiring, etc	1.75
Total	$9.53

Next year Mr. Sloan hopes to have all his motor cars fitted and in the meantime has made a change in the way of hanging the old sign board carried on the dasher so as to prevent them from swinging and scratching the paint. A piece of strap iron is fastened across the middle of the board with the ends projecting about 2 in. to form lugs at the sides. Two pieces of strap iron riveted to the dasher receive these lugs and hold the board in position, as shown at C in the sketch.

SOUTH KNOXVILLE, TENN., LINE OPENED.

On July 3d the first car of the Knoxville Traction Co. crossed the Tennessee River bridge into South Knoxville, carrying some of the prominent citizens as guests, and on July 4th the regular schedule was put into effect. On this day the company's highest previous record of passengers carried was beaten by 7,000. Everyone of the company's cars was put in service and about 35,000 passengers were carried. In consideration of the hard and faithful work done by the employes, Manager Howell gave every man in the employ of the company, motormen, conductors, shopmen, power-house men, etc., $2 extra for the day's work, to show that their efforts were appreciated by the road.

VESTIBULES IN NEW HAMPSHIRE.

The New Hampshire Legislature at its last session passed an act authorizing the Board of Railroad Commissioners to act on the question of vestibules for street cars, its order to be sanctioned by a penalty of $50 per day. On July 20th the board issued its order, which, after reciting the act, proceeded as follows:

With a view to an intelligent discharge of the duties imposed upon it by this act the board has made such investigations as it could by public hearings in Manchester and Concord, to which all street railway managers and others interested were invited, by inquiry among motormen and conductors, and by correspondence with persons in other states, and having weighed all the information and opinions it has been able to obtain, finds:

The electric vestibule is of comparatively recent origin and is still in an experimental state as regards patterns and methods of construction. The objections to it are that it obstructs somewhat the view of motormen and conductors, thereby increasing the liability to accidents, and that its doors interfere with the free and safe ingress and egress of passengers, and these objections outweigh it advantages in cities of more than 55,000 population, where the streets are protected from the wind by high buildings and the volume of traffic is so large as to require frequent stops and almost constant use of the platforms and doors.

That it is not much needed upon lines in cities where the trips are very short, and car men and passengers are exposed to the elements but a few minutes at a time, is obvious.

It is admitted that in outlying and sparsely settled districts vestibules not only protect car men from the inclemency of the weather, but conduce to the comfort of passengers without putting any one in jeopardy, or to serious inconvenience, and no instance can be learned where, when once adopted, they have been discarded.

In New Hampshire all closed cars in use upon the Springfield, Chester & Derry, Exeter, Hampton & Amesbury and Portsmouth roads, and upon the Penacook lines in Concord, and the Hudson Lowell lines in Nashua, which reach into country districts, have been provided with vestibules, and the testimony of managers and car men who have had experience with them is unanimous in their favor.

In Massachusetts they are required by law upon all new cars for use in cities having 55,000 population or more, and similar legislation has been obtained in several other states.

That they will, in the near future, be deemed to be necessary upon all winter cars in cities of less than 75,000 people, and in all towns, we think is certain.

The question which presents itself to us is, whether they shall be had at once in this state, or secured gradually as cars are repaired, replaced or multiplied.

The evident purpose of the Legislature in passing the act quoted was to require them, wherever they are needed, and as all our lines of any considerable length extend into suburban and country districts where this protection is as desirable as upon those on which it is conceded to be necessary, and has already been provided by the voluntary act of the managers, we are unable to find good reason for exempting any of them.

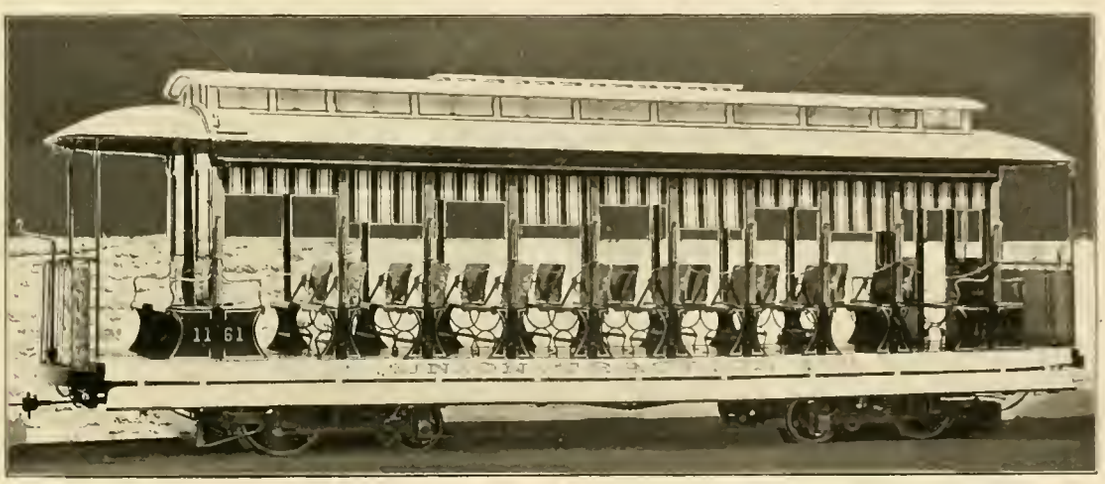
It is, therefore, ordered that all closed electric passenger cars run regularly in this state in the months of December, January, February and March, except those used in cities on lines so short that the schedule time for round trips does not exceed 15 minutes, shall be provided with vestibules of patterns approved by the railroad commission, it being understood that this requirement does not apply to cars run only on special occasions or in emergencies, or to take the place temporarily of those that are being repaired.

The Kansas City Street Railway Co., which, a little more than a year ago, gave $11,000 to the Kansas City convention hall project, has now given $5,000 to the fund, by the offer of which Kansas City hopes to secure the meeting of the next democratic national convention.

An attempt is being made to abolish the grade crossings of the Detroit street railways with the Lake Shore and the Nickel Plate railroads. It is proposed to tunnel beneath the former and bridge over the latter. The city engineer estimates the cost of the work at $179,000.

OPEN CARS WITH CENTER AISLES.

The Union Traction Co., of Philadelphia, has become thoroughly convinced of the value of large cars for the accommodation of its traffic. As has been noted before in these columns, it has been extensively rebuilding its four-wheeled cars, adding to the length and mounting them on maximum traction trucks. Up to the present time no attempt has been made to remodel the open cars, and such a scheme would hardly be considered possible in view of the number of different styles of open cars which the company has in operation. It has, however, ordered a large number of a new type of open cars from the J. G. Brill Co., the first delivery of which was made recently. These are 12-bench open cars with a central aisle. From the passenger's standpoint, they are among the most desirable of all the various types of open cars, as each seat has space for two persons and no more; and when a passenger steps upon the car, no matter at what point, he is sure of obtaining any available seat, no matter where it may be found. Women, children and persons of short stature can enter by the platform steps without difficulty and reach a seat with perfect ease. The platform step has the usual height instead of the 18 in. necessary to reach the step of the open car. During inclement weather, when the curtains are down, neither the conductor nor passengers are exposed, and there is no need of guessing at what seat behind the curtain is empty, and no getting into the car at a point where seats are full and then being obliged to stand with empty seats unavailable except by going out in the rain again. In case of crowding, which in America is accepted as a normal condition at the rush hours, those standing are in the aisle and do not incommode persons who have secured seats. The loss of seating capacity amounts theoretically to one for each cross seat. As a matter of fact, five full-sized people on an ordinary cross seat open car are all of them inconvenienced to a considerable degree, and four really represents the maximum number which can be seated with comfort.



BRILL OPEN CAR WITH CENTER AISLE—UNION TRACTION CO., PHILADELPHIA.

The length over crown pieces is 33 ft. 3 in.; length over all, 34 ft. 3½ in.; width at sills, 7 ft. 1 in.; width at posts, 7 ft. 7 in. The platform is 4 ft. long; to the under side of the sill is 26 in. This gives for the running board a height of 18 in. with a 15-in. riser. Each end of the car is provided with an ordinary platform and a low step 14 in. from the head of the rail, with a 12-in. riser to the floor of the platform. The cars are mounted upon "Eureka" maximum traction trucks with 30-in. drivers and 20-in. pony wheels. Sixteen of the seats are reversible and eight are stationary, giving a total capacity of 58. The reversible back seats are spaced 2 ft. 7 in. between centers. The inside finish is ash, the head lining being three-ply veneer. The Philadelphia system of using brass chains between the posts on the side where passengers are not allowed to enter is followed in this case. These cars are capable when loaded of passing round a curve of as short a radius as 33 ft.; when light they can make even shorter curves. The Philadelphia gage is 5 ft. 2¼ in. The cars are equipped with two Westinghouse No. 38 B nose-suspension motors.

THE BROOKLYN STRIKE.

During the early part of July there was the most persistent talk of a strike of the employes of the Brooklyn Rapid Transit Co., but as more or less strike talk had been heard for so long, many regarded it as merely an effort to influence the market value of the traction stocks. On July 15th a committee waited on President Rossiter to present grievances. After this interview Mr. Rossiter issued the following statement:

"A committee of five Brooklyn Heights Railroad employes, two from the Brooklyn Elevated and eight from the Nassau Railroad called on me this morning. I first received its chairman, Mr. Mackenzie, whose statement I took, and who filed with me a statement on behalf of the other members of the committee. I asked him if he had anything further to state, and upon him replying in the negative he retired, and the remainder of the committee were then called in and stated their individual grievances. There was considerable desultory talk, some specific grievances being pointed out, which I promised to inquire into and, if the facts were as stated, to correct any injustice that might have been unintentionally done.

"The men finally stated they were here for me to sign the agreement, which their chairman had left. I told them I had not looked at it as yet. At their request I took up the different parts of the agreement, as follows:

"'1. That the time tables be arranged upon all lines so as to comply with the ten hour law work day.'

"I informed them that this was being done on every line on the company's system.

"'2. That the prevailing rate of wages shall be $2 for each full day's work, and trips and overtime be paid at 20 cents per hour.'

"Our rate of wages is $2 per day on every line in the system. All overtime over 30 minutes is being paid for, and had been paid for for over a year past at the rate of 20 cents per hour.

"'3. That two-thirds of the cars shall be full day runs.'

"On the existing time tables today 62 per cent of the total runs on the Brooklyn Heights lines are full day cars, receiving $2 per day each, and 55 per cent on the Nassau lines are full day runs, receiving $2 per day.

"That as to the balance of the runs on the entire system our time tables are so arranged that no man receives less than $1.50 per day, while on the Nassau lines when the time tables were turned over and before we commenced active operation it was found that over 50 per cent of the men received less than $1.50 for the day's work, and that 30 per cent received less than $1.25 for the regular day's work.

"'4. That the company shall receive committees of their employes representing the men; that no employ shall be discriminated against for acting on such committee.'

"This has been the practice of the company ever since I assumed charge, and certainly will be continued.

"'5. That no man shall be discharged without just and sufficient cause, and only after he has had an impartial hearing.'

"I stated as to this that no man had ever been discharged from the company and no one would be without good and sufficient reason, and that if any case of injustice was brought to my attention it had always received and would receive immediate attention.

"'6. Extra brakemen on the main line; first—Fifteen to report for work at 4:40 a. m. Balance at 5:30 a. m. All brakemen to be paid from 15 minutes after their reporting time when marked up for runs. When extra brakemen be held for Rockaway or Coney Island runs that they be paid for all time over one hour. That all brakemen, agents, gatemen and platform men be paid 20 cents per hour or any fraction thereof.'

"I merely dismissed this and stated that in view of the present condition I could not consent to any increase of wages, but that the matter of arranging time tables would be looked into, with a view of remedying any reasonable cause for complaint that now exists.

"I am sorry to say that the attitude of the committee impressed me as being the attitude of men looking for a grievance. When individuals on the committee tried to address me at length, as I was glad to have them, the leaders attempted to deter them, and the efforts of the leaders seemed to produce trouble.

"This attitude, however, will make no difference in the feelings or attitude of the company. We have the true interests of our employes at heart, and we will willingly allow no condition to exist which will give rise to a reasonable complaint. We are willing and desirous of hearing genuine complaints, and I think our men generally think so, as indicated by the loyalty of the great majority who have been with us for four years or more.

"I do not believe that the committee which called upon me this morning represents anything more than a small body of malcontents who are influenced not by their conditions or of their fellow fellow employes, but by outsiders who have selfish interests in promoting trouble."

The strike was declared at 4:30 a. m. on Sunday, July 16th, but less than 1,000 went "out," nearly all of them being on the Nassau line. Sunday traffic to Coney Island was light and no cars were running after 8 p. m. By Monday night the strike was claimed to be broken, there being at least 75 per cent of the cars running.

Early Sunday morning the rioting, which usually attends strikes, was begun, but Chief Devery of the Greater New York police force, placed 3,000 men in Brooklyn and effectually protected the company's property. By Monday night fully half of this force was withdrawn. The most serious act of violence was the explosion of two dynamite charges under columns of the elevated road; the damage done in this case was quickly repaired.

Schedules were completely restored by the 22d, and a few days later the men were asking to be reinstated.

During the strike the trainmen who remained loyal were provided with meals at the company's expense, and the rate of pay doubled. Mr. Rossiter believes in keeping men who may be called upon to fight well fed.

A sympathetic strike on the Metropolitan lines in New York was attempted, being called on the morning of July 19th. Less than 200 out of the 3,500 employes quit work, and no trouble caused except on the Second Avenue lines, where some scenes of violence were enacted. By the 21st all Metropolitan cars were running on the regular schedules.

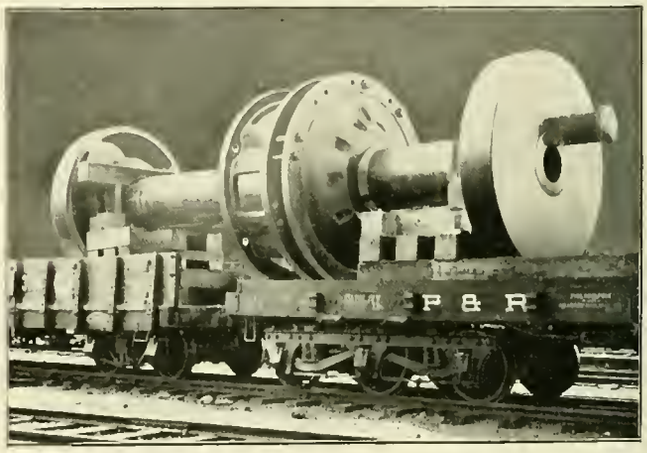
In some quarters it was charged that Mr. Albert L. Johnson, formerly president of the Nassau system, was fomenting the trouble, and it is known that he championed the cause of the strikers and made a donation of $500 to their fund. When the explosion under the elevated became known to Mr. Rossiter he is said to have made a remark to the effect that he could not keep track of all Johnson's men did. This so incensed Mr. Johnson that he caused Mr. Rossiter's arrest on the charge of criminal libel. Mr. Rossiter denied having uttered the words complained of and the case was dropped.

The United States Court has appointed Michael P. Heraty, of Philadelphia, and John C. Weadock, of Bay City, Mich., receivers of the Bay Cities Consolidated Street Railway Co. There was no objection to the petition, which was presented by the Philadelphia Securities Co., trustee for the stockholders, who are the bondholders also. The company has $470,292 in bonds outstanding, on which no interest has been paid for several years.

LARGE SHAFT FOR BOSTON ELEVATED.

What is believed to be the second largest shipment ever made in this country, the Krupp gun sent over the Pennsylvania to the World's Fair being the largest, was made from the works of the Bethlehem Steel Co., South Bethlehem, Pa., on June 9th. The illustration shows the shipment referred to. It is a shaft with crank disks and generator fly-wheel hub assembled on it, all finished complete. This shaft was made for an engine built by the Corliss Steam Engine Co., of Providence, R. I., for the Boston Elevated Ry. The total weight of the shipment was 170,400 lb., and in order to transport it to Boston, the Philadelphia & Reading Railway Co. furnished two cars of 100,000 and 80,000 lb. capacity, respectively, and blocked the shaft so that 60 per cent of the weight was supported on the stronger car and 40 per cent on the other.

The shipment was made over the New Jersey Central, the Delaware & Hudson Canal and the Boston & Albany. This shaft is the first of three for the Boston Elevated Railway Co. It is of fluid compressed nickel steel, hydraulically forged hollow on a mandrel, oil tempered and annealed. It is 37 in. in diameter in the center with



LARGE SHAFT FOR BOSTON ELEVATED.

a 17-in. hole through its axis and is 27 ft. 10 in. long. The metal of which it was made showed tests of 50,000 lb. elastic limit and 18 per cent elongation in test pieces 1 in. diameter and 10 in. long. Shipments approximating this size will frequently have to be made by railroads in the future.

The Bethlehem Steel Co. has in hand orders from the Edward P. Allis Co., Milwaukee, for the Metropolitan Street Railway Co., of New York City, 11 shafts of exactly the same size; also from the Westinghouse Machine Co., Pittsburg, Pa., orders for 16 similar shafts for the Third Avenue R. R., New York City, and two for the Brooklyn Edison Illuminating Co.; also from the Westinghouse Electric & Manufacturing Co. orders for 15 shafts a little smaller in size for the water power plant at Messina Springs, N. Y. The power plants for which these shafts are intended are designed to be equipped with engines of 8,000 h. p. capacity. In all probability even larger units than this will be called for in the future, as the tendency toward centralization of power is in that direction. We have heard that the engines for the power plant made necessary by the change from steam to electricity by the Manhattan Elevated, New York, are to have a maximum capacity of 12,000 h. p. The shafts for these engines will of course be considerably larger than that shown in the illustration.

REAR END LIGHTS FOR TROLLEY CARS.

An ordinance is to be introduced in the Philadelphia Council as soon as that body shall convene in the fall, requiring rear end lights to be carried on trolley cars which run into the city suburbs or along country roads within the county of Philadelphia. The measure will specify that the illuminant shall be oil or other fluid independent of the electric current used in operating the cars and is to be similar in power and construction to the "'bull's eye" lamps in use on steam railroads on the rear of the cars.

RECENT STREET RAILWAY DECISIONS.

EDITED BY J. L. ROSENBERGER, ATTORNEY AT LAW, CHICAGO.

DRIVING TEAM PARTIALLY BEYOND CONTROL UPON EXPOSED TRACK.

Farmer v. Findlay Street Railway Co. (O.), 53 N. E. Rep. 447. Mar. 14, 1899.

Although one driving a team of horses upon a public street has knowledge that a street railway company has negligently removed the pavement from its tracks and conducting wires, the supreme court of Ohio holds that he is not to be charged with negligence if he drives upon the exposed track and wire, not voluntarily, but because his horses are partially beyond his control.

DUTY AS TO LOOKING TO SEE HOW MANY ARE TO GET ON CAR.

Sexton v. Metropolitan Street Railway Company (N. Y.), 57 N. Y. Supp. 577. April 18, 1899.

The second appellate division of the supreme court of New York declares that it is not inclined to admit the proposition that, as a matter of law, where one person is seeking to get upon a car, either stopped or slowed down for the purpose, there is no duty imposed upon the servants of the company in charge of the car to look and see if any one else is following and seeking to take advantage of the car being stopped to board it. That question, it adds, is generally one of fact, depending on the circumstances of the particular case.

MUST BE ALERT TO DISCOVER APPROACH OF CAR FROM THE REAR.

Bossert v. Nassau Electric Railroad Co. (N. Y.), 57 N. Y. Supp. 896. May 2, 1899.

The second appellate division of the supreme court of New York says that it is committed to the doctrine that while it is not negligence, as matter of law, for one driving a wagon at night in the track of a surface railroad to fail to look backward to see an approaching car, yet he may not rely wholly upon the supposition that the railroad's servants will see him in time to give warning, and that he must be on the alert to discover in some manner and by some exercise of his senses the approach of a car from the rear.

SLACKENING OF SPEED NOT TO BE ASSUMED TO BE FOR PERSON ON STREET.

Reidy v. Metropolitan Street Railway Co. (N. Y.), 58 N. Y. Supp. 326. May 24, 1899.

Where, for aught that appeared, the slackening of the speed of a car while passing a crossing might have been due to a cause other than the signal of a person who wanted to get on board, the appellate term of the supreme court of New York holds that, in the absence of proof that such reduction of speed was made in response to such person's efforts to attract attention, he had no ground for assuming that such change in the speed of the car was made for his benefit or convenience, and that he was guilty of contributory negligence in running towards the car and attempting to get aboard it below the crossing.

NO PARAMOUNT RIGHT OF WAY AT CROSSINGS.

Atlantic Coast Electric Railroad Co. v. Rennard (N. J.), 42 Atl. Rep. 1041. Apr. 10, 1899.

The court of errors and appeals of New Jersey holds that the driver of a vehicle upon a road used by the public at large, which crosses the track of an electric railway, must exercise reasonable care to avoid collision, and that the same duty rests upon the motorman of a trolley car in approaching the crossing of such a road, whether the crossing is in the country or in a town; and, in case of accident, the question whether either or both of said parties failed in such duty is one to be determined by the jury, when the proofs on the subject of negligence leave the question in doubt. Neither party at such a crossing, it declares, has a paramount right of way.

NOT RESPONSIBLE FOR NEGLIGENCE OF CONTRACTOR'S EMPLOYE.

Hauser v. Metropolitan Street Railway Co. (N. Y.), 58 N. Y. Supp. 286. May 24, 1899.

This action was brought to recover for injuries done to a horse by falling through the earth between the pavement and a bridge placed over an opening in a public street, opened under a permit from the department of highways for railway improvements for the defendant company, for which a contractor did the work. The plaintiff obtained a judgment. But this is reversed by the appellate term of the supreme court of New York. It holds that for that injury, action did not lie against the street railway company, but only against the workman whose personal act or omission caused the damage, and against the contractor who selected and controlled him.

GOING OUT ONTO PLATFORM BEFORE REACHING DESTINATION.

North Chicago Street Railroad Co. v. Bauer (Ill.), 53 N. E. Rep. 568. April 17, 1899.

Where it did not appear that there was any regulation of the street railway company prohibiting passengers from riding on the platform, but, on the other hand, it did appear that other passengers rode on the platform without objection on the part of those in charge of the car, the supreme court of Illinois holds that it was not negligence, as matter of law, for a passenger to leave his seat in a cable car while a block from his destination and go out onto the rear platform for the purpose of alighting when it reached his stopping place, the question of negligence in such case, it says, being one of fact for the jury to determine from all the circumstances.

LIABLE AS JOINT OPERATORS OF LINE.

Messenger v. St. Paul City Railway Company (Minn.), 79 N. W. Rep. 583. June 14, 1899.

Notwithstanding the contention that they were each operating its part of the line merely as a connecting carrier, but, on the evidence, which was not only that each collected a fare on its portion of the line, but that they owned the cars jointly, employed the same conductors and motormen, each paid half of the wages, had all cars marked with names of both cities, and on the front, "Interurban," the supreme court of Minnesota holds that the St. Paul City Railway Co. and the Minneapolis Street Railway Co. were jointly operating the interurban line, partly owned by each, and connecting the two cities, and that each one is liable for the acts and omissions of the other in operating the same.

BOY AT PLAY TAKES RISK OF RUNNING IN FRONT OF CAR.

Brady v. Consolidated Traction Co. (N. J.), 42 Atl. Rep. 1054. Feb. 27, 1899.

A boy, 9½ years of age, while playing in the street, ran in front of a trolley car which he saw approaching, and was struck by the further corner of the fender. The supreme court of New Jersey holds that there was no element of danger which he did not perceive, or which a boy of his years was not capable of fully appreciating, and that, therefore he took the risk of failing in the attempt which he designedly made.

PILING RAILS IN THE STREET.

Thomas v. Consolidated Traction Co. (N. J.), 42 Atl. Rep. 1061. Mar. 1, 1899.

While a street railway company has the right to place a pile of rails upon the street, temporarily, for its use in reconstructing or repairing its track, yet, the supreme court of New Jersey holds, it is bound to the duty to exercise reasonable care to guard the public

using the street against the danger arising from the rails so placed upon the street, and in the night time to place a guard or signal of warning to persons using the street; and this duty exists whether the pile of rails be placed in the gutter of the street or in some other portion thereof.

DUTY OF DRIVER SEEING PASSENGERS ABOUT TO LEAVE CAR.

Louisville Railway Co. v. Rammacker (Ky.), 51 S. W. Rep. 175. May 23, 1899.

Where a car has stopped, as for example to take on a passenger, signals to stop are unnecessary for a passenger wishing to alight, if the driver, there being no conductor, sees this latter passenger leaving the car, and knows, or, as a prudent man, ought to know, she intends to get off, and, the court of appeals of Kentucky holds, the driver has not only all the notice that the law requires, under any case, for a passenger to give, but he owes to her all the duty that he would if she told him she wanted to get off at that point. But if he does not see her, then she must give notice of her intention to get off.

The court further holds that there was no error in refusing, in this case, where it affirms a judgment of $6,000 for the party suing, to permit the driver to prove that it was usual for persons to leave the car while in motion, without giving notice to the driver. That it is usual or customary for passengers to disregard their own safety, and get off the car while in motion, it declares, will not justify or excuse an act of negligence in starting a car before a passenger has alighted, by reason of which the passenger is injured.

TIME NOT COME FOR RETROGRADE MOVEMENT IN AVOIDING GRADE CROSSING.

Pittsburgh Junction Railroad Co. v. Ft. Pitt Street Passenger Railway Co. (Pa.), 43 Atl. Rep. 352. May 24, 1899.

The time has not yet come, declares the supreme court of Pennsylvania, for any retrograde movement in the work of preventing and avoiding grade crossings either in cities, towns, or country. The act of June 19, 1871, conferring equitable jurisdiction on certain courts as to railroad crossings and providing that, "if in the judgment of such court, it is reasonably practicable to avoid a grade crossing, they shall by their process prevent a crossing at grade," the supreme court goes on to say it is its settled conviction should be liberally construed and rigidly enforced, whenever cases fairly within its letter and spirit are presented. That there are other grade crossings where more trains pass, it does not consider any argument in favor of sanctioning the maintenance of additional death traps. However, in considering the elements of danger necessarily involved in the crossing, the court holds that the fact that the plaintiff company had been using the street for the purpose of shifting its cars was properly eliminated on the trial, as that was clearly a wrong use of the street anyway.

WHEN DUTY TO TRANSFER PASSENGER MAY BE ENFORCED BY MANDAMUS.

Richmond Railway & Electric Co. v. Brown (Va.), 32 S. E. Rep. 775. Mar. 23, 1899.

While mandamus does not lie to enforce mere contractural duties, the supreme court of appeals of Virginia holds that, where the duty to transfer a passenger is made incumbent by law, it may be enforced by mandamus. In such a case, it says it is manifest that a suit at law for damage for a failure to perform the duty is not an adequate remedy, the wrong suffered being a constantly recurring and continual one. Furthermore, it holds that the duty is of the latter character and enforceable by mandamus, where such duty is imposed by order of the county court by virtue of statutory authority contained in the act under which the company is incorporated. It also holds that where a company is required to give transfers under an order which provides that when transferred the passengers shall have all the rights and privileges of any passenger on the line to which they are so transferred, that includes the right to a further transfer from the later line, if regular passengers on that line are given a transfer from it, though this may practically amount to two transfers in the same direction.

WHERE CHILD LEAVES CURB AND GOES IN FRONT OF CAR.

Weitzman v. Nassau Electric Railroad Co. (N. Y.), 57 N. Y. Supp. 1120. May 8, 1899.

A judgment for the plaintiff, an administrator, is reversed in this case, by the second appellate division of the supreme court of New York, because of a refusal to instruct the jury that if they believed that the car of the defendant was running at a moderate and proper rate of speed, and if, at the time the deceased left the curb to cross the tracks, the car was so close to the place deceased was struck that it was impossible for the car, under any circumstances, to be stopped before running over the child, then the verdict must be for the defendant. It is plain, says the court, that, if the jury found such a state of facts to exist, it was incumbent upon them to exonorate the defendant from liability, and that the defendant was entitled to have them so instructed.

NO RIGHT TO CHANGE FROM ONE CAR TO ANOTHER.

Lasker v. Third Avenue Railroad Co. (N. Y.), 57 N. Y. Supp. 395. Mar. 29, 1899.

The plaintiff voluntarily took passage in one of the open cars of the defendant. Subsequently, because of a cold, and of a sudden change in the weather, he left the open car, and boarded a closed car—one immediately in the rear of the open car, and attached thereto. The conductor of the closed car then demanded from the plaintiff his fare, which he refused, for the reason that he had already paid a fare to the conductor in charge of the first, or open, car. Because of this refusal, he was ejected from the last car; and hence this action.

On appeal, the general of the city court of New York affirms a judgment for the defendant company. It says that the demand of the conductor in charge of the closed car for the plaintiff's fare was just and reasonable. The plaintiff had voluntarily chosen to take passage in the open car. If, for reasons satisfactory to himself, and for his own interest, he subsequently wished to take passage in one of the defendant's closed cars, he thus made himself a new passenger, and the defendant had the right to require him to pay the usual fare, and his refusal to pay such fare entitled the company's servant to use necessary physical force to eject him from the car.

LIABILITY FOR FAILURE OF MOTORMAN TO SET BRAKES.

Hoover v. Carbon County Electric Railway Co. (Pa.), 43 Atl. Rep. 74. Apr. 24, 1899.

A failure of a motorman to properly adjust the ratchet to the teeth of the wheel so as to secure the brakes, before he left his car on a turn-out, when he went to help put a derailed truck on the track, the supreme court of Pennsylvania holds, was the negligence of a fellow servant, for which the company could not be held responsible, in an action for damages brought by a conductor on another car for injuries sustained by the first car running down onto the main track, and colliding with his car. Nor does it think that the situation was changed by the fact that a superintendent had said, "Give us a hand to put on the truck." No name was mentioned, and the court says that if the men in charge of the car understood the call as directed to them, they could not have understood it as an order for all of them to leave the car, without properly adjusting the brakes. If the superintendent had directed them first to secure the car, and then to come to his assistance, the court goes on to say, there would have been no negligence in giving such an order; and he might assume that they would act with ordinary prudence in a matter in which their duty was so manifest. An entirely different question, it adds, would, however, have arisen if a passenger had been injured, or if the injury had been to some one not connected with the road as an employe.

NOT REQUIRED TO REFLOOR BRIDGE.

City of Cedar Rapids v. Cedar Rapids & Marion City Railway Co. (Ia.), 79 N. W. Rep. 125. May 16, 1899.

An ordinance imposing upon a street railway company operating thereunder the duty of keeping in repair "such streets and highways as are now paved," and to "pave on all streets and avenues which

may at any time be paved or ordered to be paved" the "portion of the streets included between the rails and one foot outside of the same," the supreme court of Iowa holds, cannot be fairly construed to obligate the company to repave a bridge with oak plank three inches thick laid diagonally on said bridge. In the first place, the court maintains that the bridge is no part of the streets, avenues and highways, within the meaning of such an ordinance, and that the duty to pave or to repair pavement in the street, avenues, and highways does not include such reflooring as stated. It is true, continues the court, that for certain purposes, as for travel, bridges are made part of the streets, avenues, and highways, but in common acceptation, they are recognized as different from that part of the streets, avenues, and highways which are made directly upon the earth's surface. Moreover, it holds that the term "pave," as applied to streets, avenues, and highways, refers to the laying of some hard substance upon the earth, so as to make a convenient surface for travel, and such, it maintains, was undoubtedly the sense in which the language was used in this ordinance.

LIABILITY FOR CONDUCTOR TRYING TO GET ON CROWDED PLATFORM.

Gray v. Metropolitan Street Railway Co. (N. Y.), 57 N. Y. Supp. 587. Apr. 7, 1899.

Any act of a servant of a street railway company which caused the crowd upon the platform of a street car to sway and jostle a passenger, so as to cause him to fall off the car, the first appellate division to the supreme court of New York holds, would be evidence tending to show negligence on the part of the company. Nor does it consider it necessary for the passenger to prove direct contact between such servant and himself, which caused him to fall or be thrown from the car. To sustain a finding of negligence, it holds it sufficient to prove a state of facts from which the inference can be drawn that the act of a conductor in forcing himself upon the front platform while the car was in motion was such as would entirely tend to, and which as a matter of fact did, throw the passenger from the car. The fall of the passenger occurring at the moment the conductor attempted to force his way upon the platform, and there being no other cause for the passenger to fall, the court holds that the jury certainly had a right to infer that the cause of the passenger's falling from the car was this act of the conductor. And in accepting a transfer ticket from a person, while he was upon a crowded platform, the court holds that the conductor assented to his riding in the position in which he was at the time the transfer was taken. In that position, it adds, the passenger was entitled to presume that the company's agent would commit no act which would expose him to unnecessary danger.

DEMAND THAT MUST BE MADE BEFORE BRINGING ACTION TO ANNUL LEASE.

Flynn v. Brooklyn City Railroad Co. and another (N. Y.), 53 N. E. Rep. 520. Apr. 18, 1899.

This was an action brought by the plaintiff, as a stockholder of the Brooklyn City Railroad Company, to set aside a lease made by it to the Brooklyn Heights Railroad Company, to compel the retransfer of all the property that passed under the lease, and for an accounting by the lessee to the lessor.

Now, when a contract founded in fraud is executed by the directors with a third party, upon the express approval of a required number of stockholders, with the intention on the part of all concerned to defraud the non-assenting stockholders, and the scheme will naturally result in serious injury to them or to the corporation, the court of appeals of New York holds that a court of equity will set aside the fraudulent transaction, and compel the delinquent parties to account. Such, as it interprets the complaint, it says, was this case.

The right of action, however, the court goes on to state, belongs to the corporation, and should be brought by it as plaintiff; but, when it will not bring the suit itself, an aggrieved stockholder, after due demand, and a refusal or unreasonable neglect to proceed, may bring it in his own name, upon making the corporation a party defendant. Such an action is not for the benefit of the plaintiff alone, but is representative in character, and for the benefit of himself and all other stockholders similarly situated.

Here, the plaintiff's demand was either of a payment to himself of what he deemed he was entitled to, or of a distribution among of the stockholders of what he deemed they were entitled to. This, the court holds, did not meet the requirements of the situation, because no demand was made that the corporation bring an action to annul the lease. In other words, it says that the plaintiff was not entitled to what he demanded, and that he made no demand of what he was entitled to. And because it deems the demand made insufficient to meet the requirements of the law, for the reason stated, it affirms a judgment sustaining an order dismissing the complaint.

RISKS ASSUMED BY SWITCH TENDER.

Thompson v. Citizens' Street Railroad Co. (Ind.), 53 N. E. Rep. 462. Apr. 20, 1899.

A boy 16 years of age, and of average size and intelligence for a boy of that age, was employed at a street crossing turning switch tongues. One day he threw the switch tongue for a motor car and trailer. Right back of the latter, was a car drawn by horses. These horses were frightened, and prancing about. Believing that he was in danger of being injured by them, after throwing the switch tongue, the boy stepped back further than usual, and was struck by a car on another track.

The proximate cause of the accident and injury to the boy, the supreme court of Indiana thinks, was the threatening appearance of the horses. And the danger of such an occurrence, it holds, was one of the risks of the employment assumed by the boy.

Furthermore, without evidence of the fact, the court says that it can not assume that the body of a trailer car, running at so moderate a rate as 8 or 10 miles per hour would "sway" or rock upon its trucks to such an extent as to strike a person occupying a position near the track, but far enough away from it to escape collision with a car passing at a slower rate of speed.

Upon the question whether a motorman on an electric car and a switch tender working on the same line and for the same company are co-employes, the court states that it entertains no doubt that they sustain that relation to each other.

FRANCHISES AS CONTRACTS.

Dern v. Salt Lake City Railroad Co. (Utah), 56 Pac. Rep. 556. Mar. 14, 1899.

The supreme court of Utah says that a franchise is a contract between the state, or other body granting the franchise, and the party accepting and acting upon it. It is governed by the general rules applicable to contracts, and either party may waive any breach of the conditions of a franshise; and anything which would constitute a waiver of a breach of a contract constitutes a waiver of a breach of the conditions of a franchise.

The waiver of a breach, which, if insisted upon, would forfeit the franchise, or some special right under it, leaves the party in default free to enjoy the privileges granted until the state moves in the matter, and a forfeiture has been judicially declared.

The defendant company having been in operation for a period of about 27 years, and no proceedings having been instituted by either state or city to forfeit any of the rights granted by the franchises to the defendant company, and additional franchises having been repeatedly granted, the court goes on to say that all defaults on the part of the defendant company up to the date of the last franchise (March 18, 1894) have been waived; and the plaintiffs, being strangers to the contract, have no right in the premises.

The act authorizing the city to grant a franchise to the defendant company having imposed no restrictions, except as to the time for which the franchise should be granted, the court holds that no rights could be forfeited, therefore, except for the causes and in the mode prescribed in the franchise.

CARE REQUIRED ON APPROACHING PRIVATE CROSSING.

Duncan v. Union Railway Co. (N. Y.), 57 N. Y. Supp. 326. April 7, 1899.

If the driver of a street car approaching a private crossing has reason to believe that persons are in the habit of coming upon the highway at the time when he is approaching, the first appellate division of the supreme court of New York holds, he is bound to use

towards those persons the same care that he would be bound to use with regard to other persons crossing the street at any regular crossing.

At all times, the court goes on to say, he is bound to run his car in such a manner that he may give warning of the approach of his car to persons having occasion to cross the highway, and that he may be able, like the driver of any other vehicle (having in view the greater difficulty of regulating his car), to avoid running upon people who are attempting to cross the highway, or who have occasion to go across the track in turning their wagons around or turning out to avoid other vehicles.

On the other hand, the plaintiff, the court holds, was not called upon, as matter of law, to watch and listen for the approach of a car using the highway, as he would have been called upon to watch and listen at a country crossing of a railroad company going upon its own tracks, where it had an exclusive right, but it was proper for him to take into consideration the duty of the defendant in running along the highway, and to suppose that that duty would be performed.

Even if the plaintiff had seen the car coming, at a rapid rate of speed, 150 or 200 feet away from the place where he was approaching the highway, as the defendant claimed he might have done, the court holds that he would have had the right to assume that the driver of the car would so reduce its speed when he approached the entrance to the private driveway in which the plaintiff was that persons coming out upon the highway might have an opportunity to avoid him.

RIGHT OF PEOPLE TO CROSS TRACKS BETWEEN CROSSINGS.

Lawson v. Metropolitan Street Railway Co. (N. Y.), 57 N. Y. Supp. 997. May 5, 1899.

The streets, says the first appellate division of the supreme court of New York, are yet intended for every citizen who has occasion to use them. He may come upon foot or in vehicles, up and down the street, as his pleasure or his business requires, and he may cross the street backward and forward in his vehicle, so far as his convenience or business incline him to do so. In doing so, however, he must not needlessly or recklessly or willfully obstruct the street cars in their route, and he must use reasonable care to keep out of their way. But he is not called upon to avoid the use of the street or to delay crossing it because a street car happens to be in sight coming towards him. What he must do, is to endeavor, in crossing the street, so to regulate his act that he shall use the care of a reasonably prudent man to keep out of the way of the cars, and not unduly delay them in their passage.

On the other hand, the driver of a street car is bound, also, to use reasonable care so to regulate the passage of his car as not unnecessarily to collide with persons who have occasion to use the street in front of him. As he can only do that by regulating the speed of the car, it is his duty to use reasonable care to regulate the speed to attain those ends. When one attempts to cross the track of a street car, and has approached the track at such a distance from an approaching car that he has reasonable ground to suppose that he will be able to cross the track, it is the duty of the street car driver to give him a reasonable opportunity to cross, and if, for that purpose, it is necessary for him to check the speed of his car, or even to stop the car entirely for a short space, it is his duty to do it, and the person crossing the track has the right, without being charged with contributory negligence, to assume that that duty will be performed.

Furthermore, the court points out that there is a vast difference between lawfully doing an act, the effect of which may be to momentarily obstruct the passage of a street car, and to put oneself on the track of the car in an endeavor to obstruct it. The latter is a penal offense; the first is not.

PROPER PLACE FOR PASSENGERS IS INSIDE OF CAR.

Thane v. Scranton Traction Co. (Pa.), 43 Atl. Rep. 136. May 1, 1899.

The proper and assigned place for passengers, says the supreme court of Pennsylvania, is inside the car. And it holds that, unless he shows some valid reason to excuse him, a passenger is bound to put himself in the appointed place; and, if he does not, he takes the risk of his location elsewhere.

In discussing the matter of standing on the platform of cars, the supreme court says that it is the long-settled rule that standing on the platform of a moving railroad train is negligence of itself, while, on the other hand, the Pennsylvania cases have practically established that standing on the platform of an ordinary horse car is not negligence of itself, but raises a question for the jury. The electric trolley, it suggests, occupies a position between these two, in respect to this subject.

The principle at the foundation of the rules is, and always has been, the court goes on to say, the same, though in the development of methods of travel the circumstances and conditions have changed. The increased speed upon passenger railway lines, with its resultant danger, now approximates to that of steam railroads, and, indeed, in many cases exceeds the speed of the fastest trains at a time not too remote to be within the memory of every judge on this bench—a time at which the rule as to steam cars was first established. The reasons which were potent in the establishment of that rule then are equally potent in its application now. Therefore, the supreme court holds that where there is room to be seated in the passenger's proper place, and no special and sufficient reason is shown why he should not avail himself of it, it is negligence of itself to remain on the platform of a moving trolley car.

Cases where the car is crowded, and no seat is available, the court adds, rest on a different basis. There the traveler, if he is to get on at all, must stand on the platform, with its rods, etc., to hold by, or inside, with a strap for that purpose. He is presented with a choice of evils, and his action must be judged by the jury—while, on the other hand, the carrier, by receiving him, undertakes and gives him assurance that it will take care of him, and guard him against accident as far as the circumstances permit.

In this particular case, it was undisputed that there were vacant seats in the car, one of which the plaintiff could and should have taken. He chose, instead, to stay on the platform. In so doing, the supreme court holds, he took all the risks incident to that position. The injury he received by being thrown against the dasher, it goes on to say, was the direct consequence of his position, and would not have been received had he been inside. Whether he would have received some other injury, equal or greater, it pronounces conjectural and irrelevant. Besides, it declares that the distinction sought to be made between injury from ordinary risks of the road, and from a collision the result of negligence of the carrier, is not sound. What the passenger took himself, it repeats by way of emphasis, was the risk of his position from any cause.

Judgment reversing judgment for the plaintiff affirmed.

CLAIMS WHICH HAVE PREFERENCE OVER MORTGAGES.

McCornack v. Salem Consolidated Street Railway Co. (Or.), 56 Pac. Rep. 815. Mar. 27, 1899. Rehearing denied April 24, 1899; 56 Pac. Rep. 1022.

It has become a settled principle under the authorities that, where a mortgage is taken upon the property, and even upon the earnings of such a corporation as a street railway company, it is implied, from the nature of the business in which the concern is engaged, and the usual and ordinary management and conduct of such business, that the current earnings of the enterprise shall be first applied to the payment of the current operating expenses, such as for labor and supplies, and for necessary equipments and improvements of the mortgaged property, and that the balance, only, usually termed the " net earnings," shall be applied in payment of the mortgage indebtedness.

This doctrine rests upon the ground that the maintenance of the road and the prosecution of its business are essential to the preservation of the mortgage security. The primary object is to keep the enterprise a going concern, from considerations of both public and private interest. And the management of such a concern, whether in the hands of its promoters or in those of a receiver, is charged with the duty of so marshalling the funds arising from current earnings as to apply them in accordance with the relative equities of the preferred creditors and the mortgagee; and if, through regard for mere convenience, something is taken from the fund and paid to the mortgage creditor, when as of right it belongs to and should have been paid to the preferred creditor, it is not considered inequitable, unless the claim has become stale, to require that the preferred creditor shall be paid from the future current re-

ceipts, or from the proceeds of the sale of the mortgaged property. It is from considerations of this nature that the courts are induced to require, as a condition of the appointment of a receiver, that the mortgagee shall consent to the payment of such equitable demands as are outstanding against the company, which have accrued within a reasonable space of time prior to the receivership, and, even in cases where the condition is not primarily imposed, to require that the receiver shall adjust the current receipt fund in accordance with the equities thus to be ascertained, and under certain conditions, reimburse the preferred creditor from the body of the estate, and to that extent displace the mortgage.

It is often a difficult matter, the supreme court of Oregon goes on to say, to determine what are preferred claims and what are not, depending to a large extent upon the particular circumstances of each case. However, it thinks it clear from the authorities that claims cannot be included which may arise on account of additional equipments provided, and valuable and lasting improvements made. And in no sense can such claims be extended to the inclusion of those of general creditors.

Measured by the understanding thus to be gathered touching the nature of the claims or demands which are entitled to preference over a mortgage, the court holds that two heaters, purifiers and condensers complete, and one water tank, first ingrafted as an experiment, but finally constituted a new and additional improvement, were outside the rule, not being required to keep the enterprise a going concern, though they enhanced the value of the mortgage security and saved fuel, enough, in time, to pay for themselves.

TITLE TO RAILS PASSES WITH ANNEXATION.

Clemons Electrical Manufacturing Co. v. Walton (Mass.), 53 N. E. Rep. 820. May 17, 1899.

After a construction company employed to build four miles of street railway had laid and finished over three miles thereof, except the overhead work, for which the necessary materials were lying upon the ground, the street railway company, apparently wishing to withdraw from its bargain, notified the construction company that it declined to accept the construction, and the construction company accepted the refusal, voting to sell all the material and other property lying on said line of street railway to another company, to be paid for by the indorsed notes of the latter, and agreeing to credit the first company with all sums received on the notes.

This action was brought to recover against the indorser of those notes. He set up that the maker had received no consideration, or if it had received one, that it was illegal. Particularly, was reliance placed upon section 56 of chapter 113 of the Public Statutes of Massachusetts, forbidding a street railway company to sell or lease its road.

Now, if the sale was a sale of personal property only, and of personal property the title to which never had passed to the first-mentioned street railway company, the supreme judicial court of Massachusetts holds that it was no less good if that company refused to accept the title in order that the sale might be made, and because it doubted whether it could make a sale after it became the owner. But suppose that it was understood by all the directors at the time of passing their several votes that what was really intended was a transfer of that company's location to the other street railway company, and that the vote was put in the form which it took to conceal that purpose; if that was the real understanding and bargain between the directors, the court holds that the fact that it was not expressed in their vote would not save the corporate action from illegality. In other words, it says that if in the minds of the movers of the corporations the sale was a means to the abandonment of the road by one company, and its occupation and use by the other, the law would not be blinded to the character of the act because they had wit enough not to betray their scheme in a vote.

The votes of both companies, the court goes on to say, were meant, and were construed by conduct to mean, the tracks which had been laid, as well as the loose material. As to these, it adds that it was all very well for the first company to refuse to accept them; but, it holds, the title had passed as soon as the rails were annexed to the freehold. The construction company had no franchise or easement there. The first street railway company had. And it is not necessary, says the court, to consider whether the rails became real estate, and followed the easement. When laid down, they became part of the first company's road, within the meaning of the statute, whether they were realty or personalty. Only as part of that company's road had they a right to be where they were. The company had no more right to sell its rails for the purpose of removal, with the intent that its road for those four miles should be abandoned, than it had to sell them to be kept where they were, and to be used along with the franchise by the buyer.

For these reasons, and in order that, on a new trial, evidence might be admitted of any conversations or understandings between the directors of the several companies at the time when they were all together, and when the votes were passed, tending to show an illegal scheme, such as it supposed, the court sustained the exceptions of the defendant indorser to rulings for the plaintiff. And if the color of the facts be not changed, it suggests that the defendant will be entitled to a ruling that the first street railway company had acquired a title to the rails which had been laid, and could not lawfully become a party to a transaction by which, in substance, it sold that part of its road.

BICYCLE RIDING BETWEEN TRACKS.

Nein v. La Crosse City Railway Co. (U. S. C. C. A.), 92 Fed. Rep. 85. Feb. 23, 1899.

A man riding a bicycle crossed one of two parallel street railway tracks and continued down the smoothly paved space, four feet wide, between them. He testified that he looked around at the time, but did not see any car. All that he apparently thought of, however, was to reach that space, relying upon his speed to afterwards keep out of the way of any car. But, as a matter of fact, there was a car approaching at not more than 30 to 50 feet away when he crossed into the space between the tracks. He was extremely deaf, and riding at a speed of from 10 to 12 miles an hour, while the car was variously estimated to be going at from 10 to 18 miles an hour, and was permitted a speed of 20 miles an hour by the city ordinance.

It is plain as noonday, says the United States circuit court of appeals, that the conduct of the man was grossly negligent, amounting to recklessness. The space between the tracks is a dangerous place in which to drive a bicycle. It is recklessness to ride there while a car is passing. To ride there relying upon the warning of the gong in order to make timely escape from collision with a coming car is more or less negligent. And a person deprived of hearing is bound to greater diligence, in the exercise of the sense of sight, to ascertain the danger which he knows is probable and likely to come upon him.

After making these statements, the court declares that it is difficult to find language to fittingly characterize the recklessness of this man's conduct. Beyond any question, as matter of law upon undisputed facts, it holds he was guilty of gross negligence.

It is possible, perhaps probable, continues the court, that rapid passage through the air causes exhilaration to a degree that begets indifference to and disregard of danger, or possibly a desire to incur it; but whether such perversion of judgment or aberration of the intellect results from voluntary intoxication caused by the inhalation of ozone, or from the imbibing of spirituous liquors, the law does not excuse the want of ordinary care which one should take to guard one's personal safety.

Nor does the court consider that it was the duty of the motorman to do more than to turn off the current while the bicycler was crossing the track, and not to decrease the speed of the car immediately upon sounding the gong, as that would impose upon these public carriers the duty of the highest diligence, and not the duty of ordinary care, which the law requires. He had the right to presume that the man, upon the sounding of the gong, would timely leave his position of danger. Hence, a judgment on a verdict directed for the defendant is affirmed.

Twenty-five citizens of Lancaster, O., made the round trip to Zanesville, O., at the invitation of the Fairfield Traction Co. last month on a handsome new motor car just put in service. The trip occupied two hours each way. The traction company officials had everything on board for the comfort and pleasure of their guests and the only casualty reported was the loss of President Peters' hat in a gale of wind.

NEW YORK-BROOKLYN RAILWAY TUNNELS.

It seems to be fully settled now that the cities of New York and Brooklyn will be connected by two tunnels under the East River, one of which will be the long talked of terminal for the Long Island R. R. and the other a tunnel connecting the Metropolitan Street Ry. of New York with the Brooklyn Rapid Transit roads. These two tunnels will form the most extensive and costly railway tunnels in the United States, and from present appearances the work upon them will be commenced at an early date.

A tunnel for connecting the Long Island R. R. with New York City was projected years ago, but for various reasons has never been exploited. At the 1899 session of the Legislature three bills were passed in reference to this project. The first bill repealed the provision of the city charter limiting city franchises to 25 years in the case of tunnel railways underneath the streets and authorized the Municipal Council to grant a 50-year franchise, with the privilege of renewal for 25 years more. The second bill provided for the proposed tunnel under the East River, and the third bill provided for the removal of the Long Island R. R. tracks from the surface of Atlantic Ave., Brooklyn, with the additional provision that where a company depresses its tracks it shall not lose its rights to the surface of the streets, but may operate another road by electricity or any other motive power except steam. By the terms of the bill the city will share equally with the railroad company in removing the tracks from the surface of the street. This bill was signed by the Mayor of New York, which leaves the road in a position to begin actual construction at once, and the officials of the Long Island R. R. have announced their intentions to push the work as rapidly as possible. In connection with this there is a plan to have the transatlantic steamers of the American Steamship Co. land at Montauk Point, thus saving 120 miles of steaming, and if this plan is carried out steamship passengers will come into New York over the L. I. R. R. through a tunnel under the East River, and be landed at a depot in the heart of the city at a point near where a number of the large railroad systems terminate.

Where the surface tracks are removed on Atlantic Ave. they will be substituted partly by subway and partly by elevated structure. All the branch lines of the L. I. R. R. connect with the main line at Jamaica, and the Atlantic Ave. line running west from this junction crosses the borough line of Brooklyn near Atkins Ave., where there is a summit in Atlantic Ave., and from this summit the elevated structure will rise so as to clear the next cross street, continuing to Manhattan Crossing, where the road again touches the surface. From Manhattan Crossing to Ralph Ave. the line is underground, where it changes to elevated, continuing as far as Nostrand Ave. From this point on it continues underground to the present terminus at Flatbush Ave., where the station will be depresed to the depth of 18 ft., which will be reached by stairways and elevators. This is the end of the change in the present line in which the city bears part of the expense, and the underground portions will be large enough to accommodate standard cars and locomotives. The tunnel line will leave this station passing under Flatbush Ave., Fulton and Pineapple Sts. to East River, and under Maiden Lane and Cortlandt St., Manhattan, terminating near the line of the west side elevated roads. From this terminus it is expected to continue a Hudson River tunnel at some future date.

The depth of the tunnel under the bed of the river will be 30 ft. and the section under the river will consist of two circular twin tunnels 14 ft. 6 in. in diameter, and the cross section of the land portion will be 22 ft. 8 in. in width with an elliptical roof arch. These sections will not be built for standard, but for special cars, the distance between centers of tracks in the double portion of the tunnel being 10 ft. 9 in. The trains from the Flatbush Ave. station to the Manhattan terminal will be operated by electricity. The estimated cost of the tunnel is $6,000,000.

The other tunnel projected between the boroughs of Manhattan and Brooklyn is the outcome of a proposed combination between the Brooklyn Rapid Transit Co. and the Metropolitan Street Railway Co.

At the corner of Ann St. and Park Row the tunnel will start and proceed under Nassau St. and other streets at a gradually increasing grade until at Fulton Market it will be 100 ft. below the street. There is to be a station there, and passengers will ascend and descend by elevators. It will pass over 50 ft. below the rock bottom of the river, and about 146 ft. below the surface of the water. It rises and reappears at the City Hall in Brooklyn. Under the terms of the resolution the "New York & Brooklyn R. R." is authorized to construct a double track in the tunnel.

The plans of this tunnel have not yet been made public.

GREATER AMERICA EXPOSITION.

It is quite evident that all of that fearless courage and energy which conquered the Great American Desert of our fathers' time and made it blossom like a garden, has not ceased to exist. Omaha has attempted what no other city ever undertook, and is now holding its second exposition the next year after having made the Trans-Mississippi Exposition such a success in 1898. The results of the Spanish war have given the Greater America Exposition a reason for being and it will really prove of great educational value in making the people of this country acquainted with the peoples and countries which have been brought, temporarily or permanently, under our flag.

What are for the present (in the absence of a declared policy on the part of Congress) called the colonial exhibits, are very instructive and highly interesting. The Colonial Building is, of course, occupied with exhibits showing more particularly the natural and manufactured products of these countries. These are supplemented by the Filipino village, the Hawaiian, and the West Indian amusement sections in the "Midway," which prove even more interesting because there are found the people among their natural surroundings.

On August 4th, the Chicago, Milwaukee & St. Paul Ry. extended the courtesies of the road and provided a special car for a delegation from the Chicago Trade Press Association. Two days were spent at the exposition grounds, the management doing everything in its power to make the visit a pleasant one. Most people attend such expositions as this one either for instruction or pleasure and both classes are well provided for at Omaha. The Court of Honor, about which the buildings of the Exposition proper are all grouped, is a surprise to the unwarned visitor; by day it rivals that celebrated section of the same name at the Columbian Exposition, and at night when illuminated, the effect surpasses that attained in 1893. The same may be said of the amusement feature—the "Midway."

The success of this second Omaha fair is assured and is due largely to the untiring efforts of Dr. Geo. L. Miller, president of the Exposition. He has overcome bitter local opposition which for a time threatened to prove a serious handicap and now has the satisfaction of seeing another crown added to his laurels. The Trade Press Association, of which this paper is a member, is particularly indebted to President Miller and Mr. J. W. Cutright, superintendent of the department of publicity, for courtesies shown while in Omaha.

ELECTRIC LINE FOR MARSEILLES, FRANCE.

The Compagnie Generale Francaise de Tramways, of Paris, has a concession to operate an electric street railway in Marseilles and is now engaged in installing an overhead trolley system to replace the horse cars and omnibuses. The concession expires Dec. 31, 1950.

At the present time the fares vary from 2 cents to 8 cents according to the distance, but under the new system a uniform rate of 2 cents will be charged. The company is to pay the city $19,300 per annum for the use of the streets and after the gross receipts exceed 7,000,000 fr. additional payments of 4 per cent on the eighth, 5 per cent on the ninth, and 6 per cent on the tenth and succeeding millions. The state will become the owner of the tracks and appurtenances at the expiration of the concession, and has the right to purchase at any time upon the payment to the company of an annuity to equal the average net receipts for the five best of the seven next preceding years.

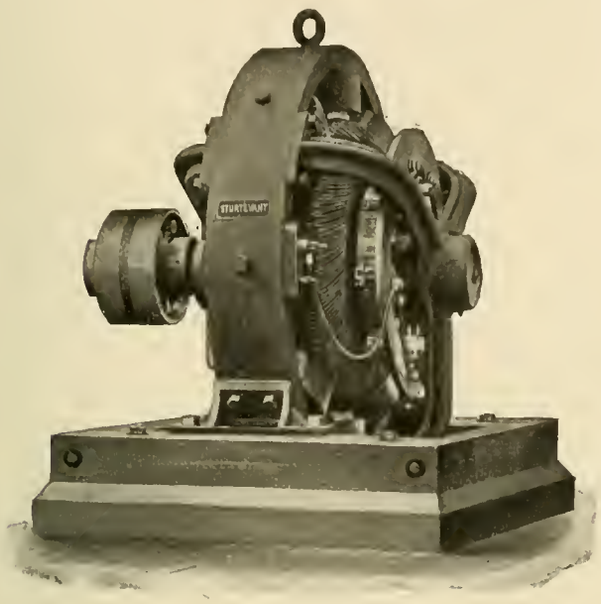
Trolley day was set apart in Vincennes, Ind., for the collection of a sum of money for charity. Free use of the Vincennes Citizens Street Ry. was tendered by the company and ladies served as conductors and collected the fares. There was $566.91 collected. Prizes were given to the amateur conductors who collected the largest amount in fares.

A NEW TYPE OF 8-POLE GENERATOR AND MOTOR.

The accompanying illustration shows a new type of 8-pole machine, which has been brought out by the B. F. Sturtevant Co., of Boston, Mass., and, as indicated by the coupling, is primarily designed for direct connection to a shaft, usually the shaft of a fan.

The field ring, which constitutes the frame of this machine, is made of wrought iron, cast steel or cast iron, according to the size, the sizes ranging from 3 to 138 h. p. in motors, or from a 3 to a 110 kw. in generators.

Wrought iron field cores are used, and a special type of cast iron pole shoe, which by its peculiar shape and size, is one of the principal elements in rendering this machine capable of extreme



STURTEVANT 8-POLE MOTOR AND GENERATOR.

variation of load without sparking of the brushes, or any shifting or adjustment whatever.

The field coils are machine wound, and have large radiating surfaces and good ventilation. The armature cores are built up of laminated, slotted discs, mounted upon a cast iron spider, having a hub projection for the reception of the commutator. These armatures are of the coil wound drum type, and usually have the two circuit winding, although in some cases a multiple winding is used. The special feature of this type of winding lies in the fact that as few as two sets of brushes can be used. The commutator is of large diameter, with pure rolled or drop forged copper segments, supported in a cast iron shell of spider construction, thoroughly insulated with mica and micanite. Reaction brushes of carbon are generally used. Tripod bearing yokes support the shaft, and the bearings are provided with sleeves which in the larger sizes are self-aligning; ring oilers are used.

A GAS AUTOMOBILE FIRE ENGINE.

As a fire engine operates in cities and always upon solid ground in the streets over which it passes, it suggests to the automobile enthusiast the use of an automobile for this purpose, and it is astonishing that the problem has not sooner received practical attention. An automobile of this description known as the Porteu-Cambier engine is described by G. Espitallier, in La Nature, which it is stated has proved very satisfactory in practical use. The motive power is supplied by an oil engine which is placed at the rear end of the carriage symmetrically with respect to the longitudinal axis of the vehicle. It is of from 20 to 22 h. p. in capacity; the ignition is electrical, and the carburretters are of the Longuemare type. The crank shafts are assembled in two couples which act upon two cranks 180° apart, driving a shaft which corresponds to the central axis of the vehicle. This shaft drives by bevel gears an intermediate shaft carrying a set of pulleys. This intermediate shaft is provided with two sets of connections, one of which drives the pumps by means of a train of gear wheels, and the other drives the wheels of the vehicle by means of a belted connection to a counter shaft, the latter being connected by pocket chains to the rear axle. The belted connection between the two transverse shafts is supplied with two sets of fixed and loose pulleys which correspond respectively to two speeds of 15 and 8 km. per hour of the vehicle. Crossed belts are used on these pulleys which are shifted from the fixed to the loose sets by levers, and an extra set of pulleys with a straight belt are also used upon the intermediate axle which permit the vehicle to be run backward. All the belts are enclosed in a sheet iron casing to protect them from the water of the pumps. The disengagement of the running gear and the connection of the pump gear at the intermediate shaft is made instantaneously and automatically, so that the action of the pump commences at the moment the vehicle stops at the scene of the fire.

The suggestion has often been made, and it appears to be entirely feasible, to equip fire engines with electrically driven pumps, for use in cities where overhead trolley lines or power supply circuits are pretty generally distributed. Connections could easily be made between the trolley line and track of a railway without disturbing the street car service. Such an arrangement would furnish a sufficient and unfailing source of power where the necessary agreement could be made between the fire department and the electrical supply company or railway.

In the early days of electric railways an enterprising agent of a prominent electrical company had nearly succeeded in selling a railway plant in a small town when unexpected opposition to the use of the overhead trolley wires was suddenly urged by the newly organized fire department of the town which nearly caused the electric railway scheme to fall through. Seeing that his only chance to sell the road lay in conciliating the fire department, the agent, who was of an inventive turn of mind, wrote an article on the advantages of electrically operated fire engines connected to overhead railway systems which appeared in the daily papers and which appealed so strongly to the fire department as to enlist its sympathy with the trolley scheme. The franchise was granted and the road built, but up to the present time the electric fire engine has not been put in service.

STEAM AND TROLLEY TO UNITE.

The combination of electric railway interests in the state of Connecticut which has recently attracted considerable attention now appears to be much more important than was at first supposed, and evidence lends to the conviction that the combination will include the steam as well as the electric railway interests of the state.

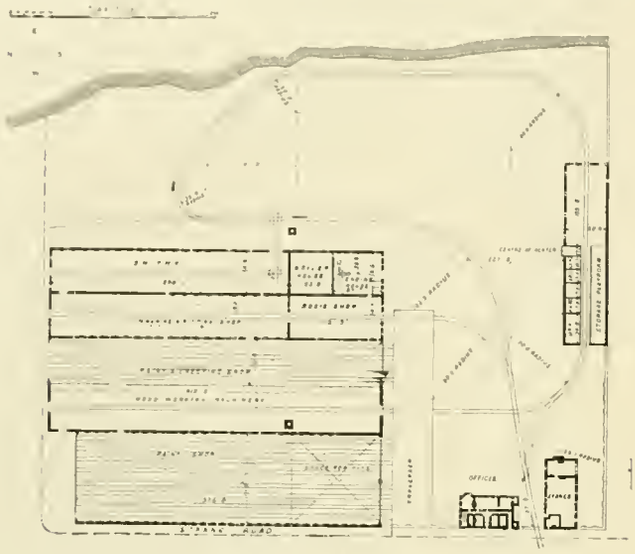
The combine will do business under the name of the Connecticut Light & Power Co., and within a few weeks it has purchased the Waterbury Traction Co. Other railroad and lighting companies are to be absorbed as soon as the necessary arrangements can be made. From the fact that the struggle between the steam and electric railways, which has been a prominent feature in the state legislature for several years, was strikingly absent during the last session it is to be inferred that an understanding has been reached between these interests, and this belief is further strengthened by the fact that the new Colonial Trust Co., of Waterbury, which it is expected will finance the trolley combine contains in its directorate the names of a number of well-known men who are closely identified with the steam and trolley railway interests of the state.

TRANSFER TICKET FRAUDS.

The Waterloo & Cedar Falls (Ia.) Rapid Transit Co. caused the dismissal or arrest of all but two or three of its conductors last month. Three of the men arrested are charged with conspiracy and defrauding the company out of a large sum of money. The plan of operations, it is alleged, was to issue bunches of properly punched transfer checks to each other and to turn them in with their daily reports, pocketing the cash represented by the slips. More than two months ago the leakage in receipts was suspected by the railway people and detectives were employed to ferret the matter out. Various charges, but none of a criminal nature, are made against the other men discharged by the company.

THE ELECTRIC RAILWAY & TRAMWAY CARRIAGE WORKS, PRESTON, ENG.

The Electric Railway & Tramway Carriage Works, Ltd., situated at Preston, England, is the newest and by far the largest street car building concern in Great Britain, and has already demonstrated that its promoters, Messrs. Dick, Kerr & Co., correctly understood the electric railway (or, as our English brethren would say, tramway) situation. As we have heretofore pointed out the short-time



PLAN OF WORKS.

purchase clause in the Tramways Act of 1870 acted to smother enterprise in street locomotion, and this in turn caused stagnation in the manufacture of tramway supplies. The Light Railways Act gave more encouragement to investors in tramway properties and in the last few years there has been a growth in this field that is quite remarkable. The tramway companies found that it was next to impossible to secure early delivery of cars ordered from home shops because all the builders catered principally to the steam railways, and tramcar orders were of secondary consideration.

The new works at Preston owe their being to men who were not only interested in electric traction, but could see farther in advance than others, hence this car building company is first in the field, and with the brightest of prospects.

The works are close to the Albert Edward Docks, and the River Ribble, and have sidings into them from the London & North Western and the Lancashire & Yorkshire Railways. There is every facility for the receiving and dispatching of materials and goods, whether by sea or land. The old buildings on the site have been entirely re-arranged and put into good condition. The buildings, new and old together, are so extensive that of the thirteen acres to which the property extends, from four to five acres are under cover. System and orderly sequence, resulting in efficiency and economy, form the key-notes of the whole plant.

The ground plan gives a good idea of the extent and arrangement of the works. To the right of the entrance are general stores; to the left, the offices of the company; at the south end of the ground, a building for cutting and storing timber and lumber; at the north end of the ground, boiler and engine rooms, bogie fitting, machine, and smiths' shops, carpentry and erecting shops, paint shop, and pit shop where the numerous pits between the tracks admit of the motors being fitted to the electric cars. The experimental track in the grounds is also a prominent feature.

It will be convenient first to refer to the power appliances, and then to deal with the various departments in the order obtained by tracing the progress of materials from the time they enter the works till they emerge as finished cars ready for immediate service.

The power plant comprises two Galloway boilers 28 ft. by 7 ft. 6 in., furnishing steam at 120 lb. to a 14 and 25 by 24-in. horizontal engine direct connected to a Mather & Platt multipolar dynamo of about 250 kw. capacity. This plant is now being duplicated. The machinery in the shops is driven by electric motors and a storage battery of 140 chloride cells, 440 ampere-hours, is used as a regulator and for furnishing light and power when it is desired to run a portion of the shops at night. The larger tools have individual motors and the smaller ones one motor to several machines. In the works there are 25 motors; they are all of 10, 25 or 40 h. p. capacity.

In connection with the power plant, a Green's economizer and a Klein's cooling tower have been provided. The coal store is in front of the boiler house, and the coal is unloaded direct from the railway wagons—which are brought into the works on the railway tracks—into the store. Thence it passes through bunker holes direct to the firing floor. Close beside the latter, and adjoining the coal store, is a storage reservoir for rain water; connections have also been made with the city water mains, so that the public supply can be utilized.

When timber is brought into the works on the railway wagons it is conveyed by the tracks to the building on the right of the plan, which is a plain brick structure 225 ft. long by 50 ft. wide, and one story high, the railway track running right through the building. At the east end is a log band saw mill which can deal with logs up to 48 in. in diameter, and from 30 ft. to 40 ft. long. Storage space for an ample stock of timber is provided, and a large portion of it is occupied with selected and seasoned timber of the highest grade.

The sawn timber is conveyed from the storage shed on the railway track direct into the wood-working machinery and erecting shops, which occupy the two central bays of the main building. All the bays are very long and spacious, the dimensions being shown on the plan. The shops now referred to have light iron truss roofs, are well lighted, and have a concrete floor between each railway track. They are equipped with machines of the latest and best type, which have been obtained from America.

ELECTRIC RAILWAY & TRAMWAY CARRIAGE WORKS, PRESTON, ENG.

Iron and steel materials which have to be forged go around, on coming into the works, to the east side of the buildings and are passed on the railway wagons into the smithy. In the smiths' and bogie shops the construction of the trucks—a most important part of an electric car—is carried on. While the company makes trucks for electric cars, it is also prepared to supply and fit to the car bodies the trucks of the noted American makers. When the trucks which are built on the premises are finished, they are brought out in front of the bogie shop and taken along by a transverser, which runs along the front of all the shops, to the pits at the end of the paint shop where they are fitted to the car bodies. The other ironwork of the cars is worked northward to completion, and is then passed across to the paint shop and fitted in place. In the iron-fitting shop two large galleries run the entire length of the building, where the lighter machines are placed.

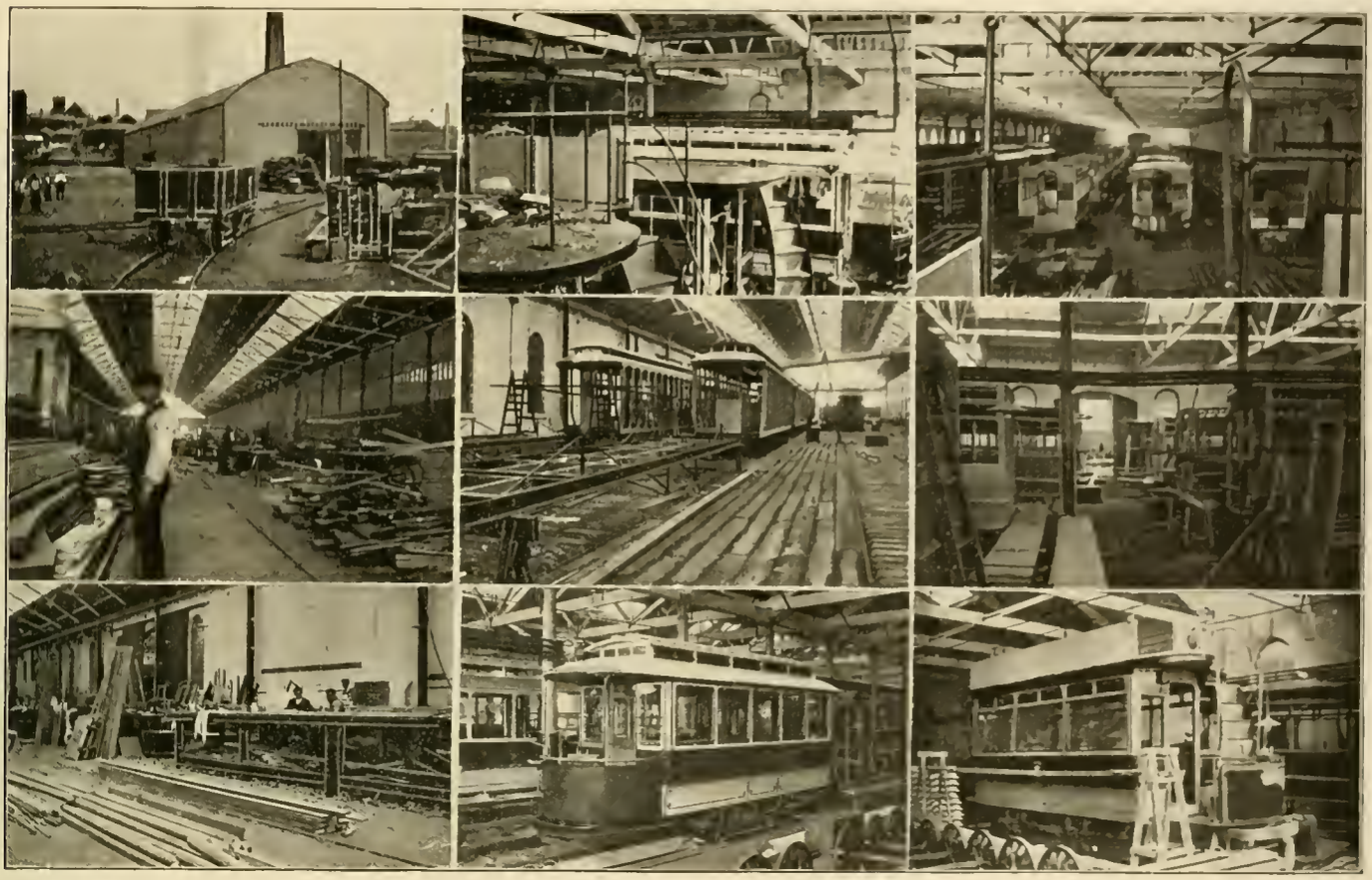
The paint shop requires only little special fitting, but heating arrangements have been provided to keep the temperature uniformly at 65° F. After the finishing touches are put on the car bodies, they are moved along to the pits where the trucks and wheels are attached, and, in the case of electric cars, which will form the majority of the output, the motors are fitted. There is really but one large pit extending the full length of the shop, but between the tracks it is covered over. As there are eight tracks in this shop, and two pit openings in each track, the effect is to give 16 working pits. The depth is ample, so that the men can conveniently work underneath the cars.

When the cars are mounted, and the electric connections and fittings have been adjusted, they are ready for testing. The car is brought out of the paint shop on the testing line, part of which also serves, as already described, for bringing the material into the works. The ground is fairly level, though at the east side, where it rises a little, some cutting was necessary. The track is carefully laid with 56-lb. rails, on creosoted sleepers, and fully ballasted. Its length is a little over half a mile, and is shown on the plan. Including the 15 sets of tracks inside the buildings, the total length of the works is about two miles. The testing line is equipped with overhead trolley wires in the usual fashion, as in the case of an electric tramway. Curves of various degrees of sharpness have been provided on the track, so that the trucks may be tested under a variety of conditions, including those of maximum difficulty.

On the basis of the ordinary size of tramway car with roof seats, the capacity of the works is about 800 cars per annum. Larger cars of the eight-wheeled type both for electric railways and tramways will be turned out when required, and the company will be able, if necessity arises, to build railway carriages. The number of men employed will range from 600 to 800. The manager of the works is Mr. E. A. Stanley, who has had wide experience in America in connection with similar undertakings.

The company now has nearly 500 cars under contract; they are for nearly every tramway of note in the United Kingdom.

The accompanying illustration showing views of the works are from photographs taken by a "Review" representative, when visiting the plant last month. One of the cars built by this company for the Oldham, Ashton & Hyde road is shown on another page.



SCENES IN THE SHOPS.

FIRE AT ST. PAUL.

On July 17th the Ramsey St. station and car house of the Twin City Rapid Transit Co., in St. Paul, was partially burned. The house was divided by a fire wall, one side being but little damaged, while the other half was destroyed. Forty-seven cars were lost, of which 44 were motor cars.

This was the company's principal station in St. Paul and the base of supplies for the St. Paul system. A large amount of supplies for winter equipment, such as stoves, stove boxes, storm windows, etc., were stored here and supplies for the current month had been delivered only a few days before the fire.

The total loss is estimated at nearly $150,000.

At a meeting of the council in Milwaukee last month a resolution was offered for the appointment of a commitee of nine members to confer with the officers of the Milwaukee Electric Railway & Light Co. with reference to the granting of a 4-cent fare.

AMERICAN STANDARD RAIL JOINT.

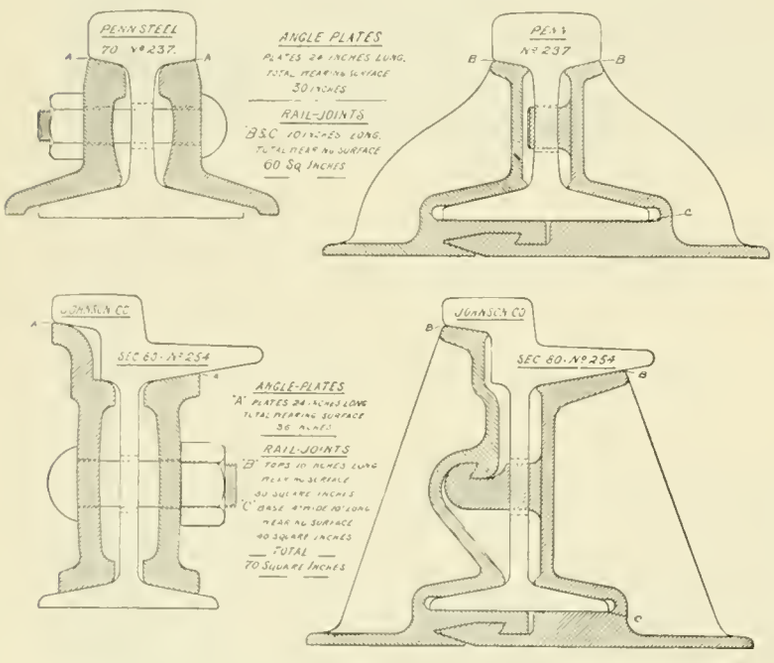
The "American" standard rail joints which are now made by the Chisholm & Moore Manufacturing Co., of Cleveland, O., successor to the American Rail Joint & Manufacturing Co., shows many improvements over those of last season. The locking device at the bottom is now so designed as to be doubled, making it impossible to slip or loosen; also, making a perfectly flat surface to rest upon the ties and when fully driven up making one continuous plate that cannot be forced down, thus tending to pull them out at the top and wearing under the ball of the rail. Another very great improvement is the making of a tight driving fit the full width and length of the joint under the bottom of the rail, thus preventing any settling of the rail. With these improvements it is now believed there can be no friction which would cause wear at any point at which contact to the rail is made.

By making this close contact at the bottom, the carrying or wearing surface has been much more than doubled, and is now stated to be greater than in any other joint or angle-joint in use. To emphasize this point, sections of the "American" joints are shown in juxtaposition to sections of angle-plate joints for the same shapes of T and girder rails.

In the case where angle-plates are used, the width is only about 4 in., whereas, with the joint it is 10 in., which is greater than any tie plate.

Another point on which strong claims are made, is the bracing of the rail at the top; it is claimed that with the use of one of these chairs, or intermediates (which are the same as the joints, excepting in length, being but 5 in.) in the center of the rail, say, about 7 ft. apart, the rail would be held so firmly that there would be no movement of it; and, by keeping the centers of the rail firm, there is much less chance for wear at the joint. These intermediates have the advantage over rods, as they never wear loose or rust off.

After an experience of several years, the manufacturer has decided that it is impossible to make a perfectly fitting joint without making a special pattern for each of the different sections of rail,



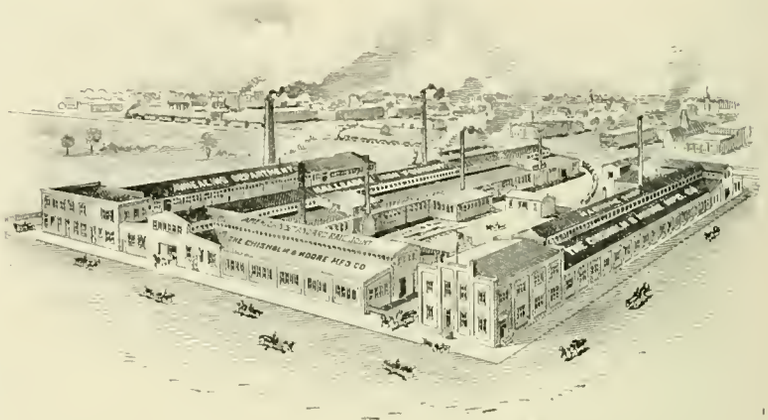
and grinding the joint at certain points, so as to make a perfect fit; and in order to have this work done properly the company determined to build a malleable iron plant of its own, where the work could be done under its own supervision, and machinery could be adopted to do it perfectly.

Our illustration shows the new works just completed, at a cost of over $250,000. In this plant, everything being new, nothing but the latest improved machinery is used, and all work will be guaranteed to be as near perfection as can possibly be made.

In the fitting of joints, special machines that will automatically grind every joint exactly alike, have been designed; this gives a degree of uniformity that is impossible where the work is done by hand. All pattern work, both wood and metal, is done by the most skilled labor that can be obtained in that line.

Probably one of the most important advantages obtained by having its own plant, will be the dispatch with which the company can fill orders; instead of taking from two to four months to fill an order, as in the past, it can now fill all orders in from 30 to 60 days.

Col. W. E. Ludlow, who has been the general manager of the American Rail Joint & Manufacturing Co. since the reorganization



WORKS OF THE CHISHOLM & MOORE MFG. CO.

of that company, will continue the management of this department in the new company, and brings to his work that long experience and careful study which insures success.

MAIL ON CARS IN SPRINGFIELD, MASS..

An attempt is being made by Postmaster Hyde, of Springfield, Mass., to establish a street car mail collection system, but has met with opposition on the part of the street railway, which company's franchise stipulates expressly that it must do a purely passenger business. The question arises whether mail matter would be classed as freight, which the road is not allowed to haul. The company further objects to stopping its cars every time a person wants to mail a letter, and also at the post office to have the mail boxes emptied. It is thought possible that the stopping of the cars might be done away with through the introduction of a device in use in some of the western cities. By means of this arrangement mail can be dropped by a person beside the tracks while the car is in motion. An extra "lip" is built upon the "hip" over the running gear at the sides of the car. From this a slide or chute leads down to a box, and letters dropped in the receiver at the side of the car easily fall down into the box.

AN AMERICAN PLANT IN LONDON.

The generating plant of the Central London Railway, with the exception of the boilers and economizers, is entirely equipped with American machinery and apparatus, even down to the steam and exhaust piping. In a short article communicated to the Electrical Review, of London, the writer comments on some of the details of the machines in a way that should be extremely flattering to the American manufacturers. The Allis-Corliss engines are recommended for their compactness and the provisions which are made for renewing the hard steel surfaces, and the alternators are described as "fine examples of electrical engineering work." After reviewing a number of salient features of the machinery, the writer concludes with a word of praise for the excellent way in which the parts had been packed for shipment.

The Benton & Fairfield Electric Ry., of Fairfield, Me., was formally opened to travel July 22d. Through the courtesy of Superintendent Mansfield, two special cars bearing the officials of the two roads, prominent business men of Fairfield and Waterville, and others, made a trial trip over the road.

GOLD STREET CAR HEATERS.

One of the chief requisites of an electric heater is to be so constructed that the surrounding air has free access to the heated wires, and upon this principle of free circulation of air through the heater the efficiency of the latter largely depends. In the Gold heaters the construction of the resistance coils is according to the method shown in Fig. 1. This consists of an open coil of wire having a high specific resistance and which is entirely non-corrosive. The support of the resistance wire consists of a ¼-in. steel rod which is

FIG. 1.

thoroughly covered with an insulating enamel burned on the rod at a temperature of over 2,000° and which, therefore, is not affected by any heat to which it will ever be subjected. The rod is bent into a zig-zag form and the resistance coil when slipped upon it is held firmly in place, not permitting vibration, and offers the smallest possible amount of friction to the flow of air through the heater.

Fig. 2 shows the interior of the electric car heater in section, which is made to set into the panel under the seat of a car, the front of the heater being flush with the panel. It is lined with asbestos and has an air space provided at the top which prevents the back of the heater from becoming unduly heated.

A car seat under which a Gold standard electric heater is suspended is shown in Fig. 3. As many be seen, the heater is firmly supported by iron brackets in such a position as not to come in

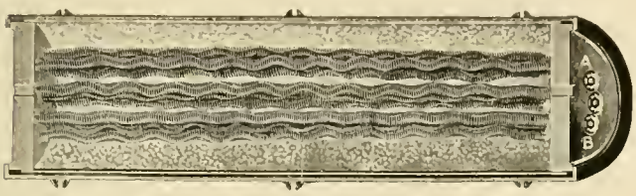


FIG. 2.

contact with the feet or clothing of the passengers. The method of connecting the heater is simple, and means are provided which permit it to be attached or released very quickly.

The resistance coils of these heaters are divided into three circuits, which are controlled from a three-point switch. The connection is made from the trolley into a cutout, then into the switch, from which the heaters on a car are all connected in series. When the current passes through point 1 of the switch the current passes through one-third of the coils of every heater in the car. Point 2 allows the current to pass through two-thirds of every heater, and point 3 passes the current through all the resistance of all the heaters. By means of these changes the temperature in the car may be varied as desired.

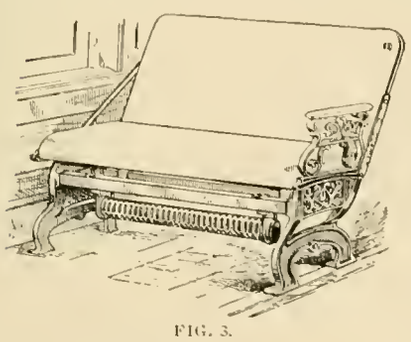


FIG. 3.

Another system of efficient car heating apparatus manufactured by the Gold company is one of hot water circulation, which is in use on a large number of street cars. The generator or stove is suspended below the floor, generally at one corner of the car. It is fed from the top and ashes are removed from the bottom. It is hung on iron brackets which hold it away from the woodwork.

The water coil is inside the stove and the outlet of the coil is connected to a riser pipe which runs up to a sealed jet. The latter is attached to a drum from its back outlet to take care of the expansion of the heated water. The outflow from the sealed jet takes its course through the radiator pipes of the car and returns to the bottom of the coil in the stove. The fire in the stoves only needs attention twice a day, and the pipes are filled with a non freezing liquid which will not rust them.

LIGHT OPEN CAR.

The Quincy Horse Railway & Carrying Co., of Quincy, Ill., has just received a large number of open cars from the J. G. Brill Co. The general type is shown in the accompanying illustration; the cars are 28 ft. 8 in. over the dashers and have 4-ft. platforms and stand 25 in. from the head of the rail to the underside of the sill. They are mounted on No. 21 E. trucks, having a 7 ft. wheel base; the gage is 5 ft. There are two No. 49 Westinghouse motors on each car; the weight without the motors 11,850 lb. The inside

BRILL CAR FOR QUINCY, ILL.

finish is ash and cherry with decorated three-ply veneer headlining; outside they are painted various colors to suit the different routes upon which they operate.

The use of a fancy skirting board below the letter panel is an unusual feature which is a pleasant departure from the severity of the ordinary finish. Round corner seat end panels are used and the trim is of solid bronze throughout. There are electric headlights on all the cars. Taken as a whole these cars show a great taste and neatness.

The Quincy company has departed from the more usual, and we believe the better, plan of providing entrance guards. One of the reasons urged in favor of permitting a passenger to alight on the left side is that he can see danger ahead better than if he gets off on the right hand side and then crosses behind the car.

PARK AT ANDERSON.

With the extension of the Union Traction Co.'s lines in the suburbs of Anderson, Ind., has come a demand for suburban parks and picnic places, several of which have been established. One party has secured a lease for three years on the pretty six-acre grove at Dundee on the line between Elwood and Alexandria. This is the half-way point between the two places. A long side track has been put in and all cars stop here. The grove is adjoining the railway platform. It is the intention to put up band stands, pavilions, summer houses, refreshment stands, swings and other buildings necessary to such grounds and to lay off croquet grounds, ball park and make the place attractive for all kinds of picnics. No intoxicating drinks will be allowed on the grounds. It is to be conducted as a first-class pleasure ground.

STRIKE AT EAU CLAIRE, WIS.

The greater portion of the employes of the Chippewa Valley Electric R. R., Eau Claire, Wis., are on a strike, and for several days there was considerable rioting, which was more violent from the fact that the mayor refused to extend police protection to the cars. The mayor holds that to permit policemen to ride on the cars would violate the anti-pass act passed at the last session of the Legislature.

PERSONAL.

MRS. DR. EMMA L. MERRITT has been re-elected president of the Sutro R. R., San Francisco.

MR. C. T. YERKES has removed his private office from 444 N. Clark St. to the Royal Insurance Building, Chicago.

MR. W. H. PARK has been appointed manager of the park at the terminal of the Youngstown (O.) Park & Falls Street Ry.

MESSRS. P. S. SALTONSTALL AND E. P. SHAW have been chosen directors of the Newport & Fall River (Mass.) Street Railway Co.

REV. C. L. SNOWDEN, Fairfield, Iowa, formerly assistant editor of the "Review," is spending a month in Chicago, and making his headquarters at this office.

MR. GEORGE HOEGER has been appointed superintendent of the Roxborough, Chestnut Hill & Norristown Railway Co., Philadelphia, succeeding Mr. J. C. Lugar.

MR. J. C. LUGAR, lately superintendent of the Roxborough, Chestnut Hill & Norristown Railway Co., Philadelphia, assumed charge of the Wilmington Traction Co. on August 1st.

MR. C. F. HOLMES, general manager of the Metropolitan Street Ry., of Kansas City, is now in London. Mr. Holmes' European trip has improved his health, though the gain has not been rapid.

MR. CHARLES N. COBB, treasurer of the Rockland (Mass.) & Abington Street Ry., since its organization, has turned over his books to his successor, who is treasurer of the Boston & South Shore Ry.

MR. C. W. FOOTE, general manager of the Zanesville (O.) Electric Ry., has tendered his resignation, taking effect September 1st, when he will become manager of the Cincinnati & Miama Valley Traction Co.

MR. GEORGE H. SCRANTON, superintendent of transportation of the Columbus (O.) Street Railway Co., has resigned, and on September 20th will sail for Havana to direct street railway construction work in that city.

MR. C. E. NORMAN, engineer of maintenance of way, of the Victorian state railroads, Australia, is now in this country inspecting steam and electric railroads; he will visit Great Britain and the continent of Europe before returning to Australia.

MR. JOHN P. WILSON, who was tendered the position of general counsel for the Union Traction Co., of Chicago, has decided not to accept the office, as his present engagements are such as to prevent his connection with that company at present.

MR. HARRY DALTON has been appointed superintendent of the Northern Ohio Traction Co. (the consolidation of the A. B. & C. and the Akron road), succeeding Mr. C. D. Smith, who died from injuries received in the recent wreck on that road.

MR. W. H. GLENN, purchasing agent and assistant superintendent of the Atlanta (Ga.) Railway & Power Co., has been appointed superintendent of construction to succeed Mr. N. W. L. Brown, who recently resigned, and will fill the three positions.

MR. E. S. DIMMOCK has been appointed general manager of the Bay Cities Consolidated Railway Co., taking charge August 7th. Mr. Dimmock has had an extended experience in electrical and steam railroad work; he is a brother of W. S. Dimmock, general superintendent of the Omaha & Council Bluffs Railway & Bridge Co.

MR. JOHN C. HENRY, of Denver, Col., the well-known inventor of numerous electrical street railway appliances, has recently perfected a new controller, which is being tested on one of the cars of the Monongahela Traction Co., of Pittsburg, Pa. Mr. Henry is at present in New York, where he is arranging to apply his new controller on an exhibition car and on an electric automobile.

ELECTIONS.

THE NORTH AND THE WEST CHICAGO STREET RAILROAD COS. have chosen officers as follows: President, Daniel W. Hunt; secretary, F. E. Smith; treasurer, L. E. Owsley. The elections are merely to keep up the organization, as the Chicago Union Traction Co. operates the two roads.

THE SPRINGFIELD (O.) RAILWAY CO. at a special meeting of the directors held August 1st, chose officers to succeed Wm. B. McKinley, of Chicago, and Geo. F. Duncan, of Portland, Me., who recently resigned as president and vice-president. Oscar F. Martin, of Springfield, O., was elected president, and Henry J. Crowley, of Philadelphia, vice-president.

THE WINCHESTER AVENUE RAILROAD CO., of New Haven, Conn., on July 31st, chose officers and directors as follows: President, A. B. Turner, Boston; superintendent and treasurer, A. E. Pond, New Haven; directors, A. B. Turner, Boston; A. E. Pond, New Haven; Sidney Harwood, Boston; A. R. Mitchell, Boston; E. E. Floyd, Boston; S. Harrison Wagner, Israel A. Kelsey, James Graham and Henry F. Spencer of West Haven.

THE UNION TRACTION CO., of Anderson, Ind., has made a number of promotions among its employes recently. Mr. B. E. Parker, who has been trainmaster at Alexandria ever since the road started, has been advanced to a similar position at Marion. Mr. Harry Fenton, one of the conductors on the Elwood line, has been given the place of trainmaster at Alexandria. Mr. Hadley Clifford, who was a conductor on the South Meridan St. line, is now trainmaster at Anderson, Ind.

PRESIDENT RIGG, of the United Power & Transportation Co., has made the following appointments for the Wilkesbarre & Wyoming Traction system: General superintendent, Thomas A. Wright; superintendent of transportation, John Clifford; assistant superintendent of transportation, Edward Irwin; electrical engineer and superintendent of motive power, James Fagin; cashier, Pierce Butler; manager claim department, R. W. Day; chief clerk and to be apointed treasurer in thirty days, Theodore Barber.

THE CHICAGO UNION TRACTION CO. has removed the offices of the West Chicago to 444 N. Clark St. We announced last month that John M. Roach had been appointed general manager; since the date of our last issue George A. Yuille, until lately the second vice-president and assistant general manager of the West Chicago, has been appointed assistant manager of the Union Traction. F. L. Fuller, superintendent of the West Chicago, and T. A. Henderson, superintendent of the North Chicago, have the same positions as before the consolidation with the titles of division superintendent.

THE GLOUCESTER (MASS.) STREET RAILWAY CO., the Gloucester & Rockport Street Railway Co. and the Rockport Street Railway Co., control of which was recently acquired by the Massachusetts Electrical Co., have been consolidated, and a meeting has been held for the election of officers and directors. The directors, as elected by the roads, consist of the old members, as follows: P. F. Sullivan, of Lowell, E. C. Foster, of Lynn, Charles Williams, of Wakefield, E. L. Stone, of Lynn, and G. H. Goodspeed, of Boston. The boards organized by the choice of E. C. Foster as president, Charles Williams, treasurer, and E. L. Stone, clerk in each case. Wiliard B. Ferguson, president, and David S. Presson, treasurer and clerk of the company, retired, and the new management will immediately take charge of affairs.

THE TERRE HAUTE ELECTRIC CO. has appointed Mr. Clinton P. Kidder general manager of all its properties, both the street railway system and the lighting plant. Mr. Kidder is a graduate of the Rose Polytechnic Institute and is a trained electrician, besides having had considerable experience in the management of

street railway lines. When the local line was changed from horse to electric power Mr. Kidder superintended the construction of the new plant and was the company's electrician and general manager for several years. Later he was connected with the Cincinnati Incline Plane Street Railway Co., and his last employment was as superintendent of the Overman Wheel Co.'s factory at Chicopee Falls, Mass. Mr. Guy Tripp, treasurer of the Terre Haute Electric Co., who has also been performing the duties of general manager, will return to Boston. Mr. Tripp continues as treasurer with P. P. Thomas as assistant, but will have his headquarters at Boston, making a trip to Terre Haute every six months.

OBITUARY.

MAJ. EDWARD T. ROWELL, president of the Andover & Lowell (Mass.) Street Railway Co., died suddenly on August 4th while going from Boston to Lynn on a Boston & Maine train. Major Rowell was born in Concord, N. H., Aug. 14, 1836; he graduated from Dartmouth College in 1861, and enlisted in the 5th New Hampshires; he served through the Rebellion, being wounded at Gettysburg and at Petersburg, and was mustered out of the service with the rank of major. He was active in politics and engaged in various business enterprises, being manager of the Courier-Citizen-Journal Publishing Co., of Lowell; he served three terms as postmaster of Lowell. Mrs. Rowell and one daughter survive him.

NEW PUBLICATIONS.

THE BOSTON SOCIETY OF CIVIL ENGINEERS has issued its annual pamphlet for June, 1899, containing the constitution and by-laws of the society, with the list of membership.

"THE AUTOMOBILE," a 16-page monthly devoted to the now rapidly expanding field indicated by the paper's name, made its first appearance with the August issue. Our new contemporary is published by the E. L. Powers Co., 150 Nassau St., New York.

"PRACTICAL ELECTRICITY," is the title of a small volume published by the Cleveland Armature Works, which is addressed to a class of readers having some practical knowledge of electricity, such as mechanics who are daily operating electrical machinery without knowing much about its general construction. The subject matter of the book comprises a series of lectures written from daily shop practice on the designing of generators, motors, etc., which have since been thoroughly revised and enlarged by Mr. John C. Lincoln. The work treats of the fundamental principles of electricity, and the explanations and deductions of formulae are very clear and simple. A prominent feature is a list of questions covering the subjects of each chapter for the reader to work out for himself, and his answers may be verified by turning to the back of the book where all questions are answered.

"LE MOIS SCIENTIFIQUE ET INDUSTRIEL," a new French publication, has just made its first appearance with a June issue. The object of this journal, as its sub-title implies, is to present an international review of scientific information, both here and abroad, and the work is in the form of a condensed digest of current technical literature. The editorial staff contains the names of a number of well-known scientific writers, and the subjects which are reviewed in the first number include measures, machinery and apparatus lighting, railroads, tramways, navigation, building construction, industrial chemistry, metallurgy, and other sub-heads which pretty well cover the field of scientific publications. The typographical work is excellent and abstracts are comprehensive, although often rather more brief than the subjects deserve. With the addition to the pages, however, which the publishers promise, the work will form a useful index and resume of current technical literature.

GAS, GASOLINE AND OIL ENGINES, by Gardner D. Hiscox, M. E., was first published in 1897 in order to place before the reader in convenient shape the information concerning explosive motors made in the United States. Prior to the publication of this work there was an entire lack of literature on this subject save such articles as have appeared from time to time in the technical press, European works on gas and oil engines, scarcely even alluding to American engines or practice. The first edition was speedily exhausted and the author prepared a second edition, published in 1898, to which much new matter was added, including some very interesting chapters on the application of this class of motors to road vehicles and launches, a subject of growing interest.

The work contains over 360 pages, standard 6 x 9 size, and is well illustrated. There are 19 chapters which may be grouped under these more general heads: History; theory of gas and gasoline engines; efficiencies; cause of loss in explosive motors; gas engines for electric lighting; the material of power; carburetters and vapor gas; details of constituent parts; lubrication; testing; various types of engines, and motors for different purposes. In conclusion are given a list of the important gas, gasoline and oil engine patents, and a list of the makers of these engines in the United States.

We heartily commend Mr. Hiscox's work to those seeking information on the subject with which it deals; the manner of treatment is excellent, the style good, and the typographical appearance above reproach.

Published by Norman W. Henley & Co., 132 Nassau St., New York. Price, $2.50.

JACKS FOR BARN USE.

The Joyce-Cridland Co., of Dayton, O., has designed the jack, known as No. 220, and which is shown in the accompanying illustration, especially for raising street car bodies in order to change the trucks from summer to winter cars and vice versa, or for removing the trucks for repairs. This work is very tedious and expensive when attempted without an equipment of suitable appliances, and a device such as that shown here is a great convenience; with a pair of these jacks a car can be raised clear of the trucks in less than 10 minutes without the use of any blocking.

The method of operation is to place a beam under the drawbar of the car with a jack at each end of it, the beam resting on the feet of jacks. When the car is raised to a sufficient height trestles are placed at each side to support it and the jacks removed to the other end of the car which is raised in the same manner, it being left supported on the jacks until ready to be lowered, when the operation is reversed. The work can be done in one-third of the time if four jacks are used instead of only two.

The Joyce-Cridland Co. is the maker of all types of lever, compound lever, screw and hydraulic jacks, and among the different varieties are special designs for almost any class of railroad work.

CARRIER FOR HAULING WIRES THROUGH CONDUITS.

Mr. W. L. Mulligan, chief electrician of the United States Electric Co., Springfield, Mass., has invented an ingenious carrier for use in placing wires in small conduits, which will interest electricians who have any conduits under their care. The device comprises a large spiral spring held between side frames and geared to two rubber tired driving wheels, so that as the spring uncoils the carrier is driven forward. At the front end is a third wheel, which is large enough to run over any poor joints that may be in the conduit. The spring is powerful enough to drive the carrier from one manhole to another.

The carrier is used to draw a light string from manhole to manhole; a wire is attached to the string and the cable to the wire.

The first two weeks of July showed a gain of 26 per cent in the traffic of the Metropolitan Elevated, Chicago, over the corresponding period in 1898. Only three ball games were played in this period, so that this traffic increase is not abnormal.

FOREIGN FACTS.

An electric railway is to be constructed between the railroad station and the town of Chiete, Italy.

Application has been made for a franchise to construct an electric railway between Sarria and the Montana de Vallvidrera, Spain.

The electric railways of Hull, Eng., were opened for traffic last month. The present rolling stock consists of 30 motor cars and about 30 trailers.

Magdelburg's first electric railway is now under construction. The work is to be carried out on an ample scale and will cost in the neighborhood of $5,000,000.

The new electric tramways of St. Helens have been officially inspected by the Board of Trade, and a provisional permit to run the cars for public traffic has been given.

The Irish Privy Council have granted an order to the Drake & Gorham Electric Power & Traction Co., authorizing the construction of an electric tramway from Bangor to Donahadee.

The borough engineer of Newport, Eng., has issued an exhaustive report on the proposed adoption of electric railways for that city. The cost of the proposed alteration to electricity would be about £20,811.

City of Carlisle Electric Tramways Co., Ltd., is the name of an English corporation which has been registered to acquire the powers and rights conferred by the Carlisle Tramways Order of 1898. The company will build and operate a railway under the franchise.

The movement to extend the Leeds, Eng., tramways to the city boundary of Rodley is being vigorously pushed, and a petition to this effect to be presented to the Tramway's committee of the city of Leeds is being numerously signed by the taxpayers and residents of Rodley.

The city of Manchester, Eng., is to build a system of electric railways to be operated on the overhead trolley system. At first it was intended to send a committee to New York and Washington to inspect the conduit system here, but after a lengthy discussion the overhead system was adopted.

At a meeting of the stockholders of the British Electric Railway Co. it was stated by the chairman that the installation of the plant for utilizing the water power from the falls of the Gold Stream at Victoria, B. C., had been completed, and the plant had been running satisfactorily since April.

Prof. Kennedy has made his report to the Tramway's committee of Newcastle-on-Tyne, England, to the effect that there is no difficulty whatever in working the overhead trolley and the conduit systems in conjunction with each other. This fact has been demonstrated on several railways in this country.

Among the new electrical enterprises in Brazil is the establishment of an excellent electric railway at Manaos. Mr. Charles R. Flint is the principal owner of this road, which is under the management of Dr. Hebblethwaite. It is 15 miles in length, thoroughly equipped with modern machinery, and has just been put into operation.

The Tramway's committee of Halifax, Eng., has recommended the construction of several new electric railway lines, and the electrical engineer to the corporation points out that with the extended tramway system sub-stations several miles out of Halifax will be required, and these must be supplied with power by means of polyphase distribution.

The Kidderminster & District Electric Lighting & Traction Co., Ltd., has been formed in England with a capital stock of £100,000, for the purpose of acquiring the issued shares of the Kidderminster & Stourport Electric Tramway Co., and of taking over, with the consent of the Board of Trade, the electric lighting order granted to the corporation of Kidderminster.

A novel electrical omnibus built by Messrs. Siemens & Halske, is being introduced upon the Berlin streets. It is equipped with two steering wheels and can be run on the tramway tracks. It has a collector which enables its batteries to be charged from the overhead trolley lines during a journey over the street car lines.

The Corporation of Huddersfield, Eng., has received the sanction of the Board of Trade to borrow £47,782 2s. 4d. for electric traction purposes. Messrs. Greenwood & Batley, of Leeds, have secured the contract for the equipment of the Huddersfield lines, part of which are to be converted to electric overhead trolley at once.

The annual report of the Astronomer-Royal of England states that the continuity of the records of magnetic measurements at the Greenwich Observatory has been secured by building a new magnetic pavilion in which the magnetic instruments have been erected. It is now thought that disturbances due to electric railways, which at one time threatened seriously, have been successfully overcome.

An extension to the Bristol (Eng.) electric tramways is to be made which, with the part previously equipped with electricity, makes about 10 miles of track. This comprises about one-third of the entire system of electric tramways for which the company has acquired a franchise. The entire equipment of the existing lines and the construction of a new power station will cost in the neighborhood of £400,000.

The Cataract Power Co. has purchased most of the stock of the Hamilton (Ont.) Street Railway Co., and it has completed arrangements for the control of the Hamilton & Dundas Ry., and also has control of the Hamilton Radial Ry. Plans have been completed for a line from Hamilton to Guelph and Waterloo, and the Cataract people have been asked to take over the proposed Hamilton, Ancaster & Brantford Electric Ry., but the latter has not been decided on.

A novel electric railway has been built in Berlin to connect the two offices of the Algemeine Electricitats Gesellschaft in the Schiffbauerdamm and in the Louisenstrasse. The line is an elevated one, the track being carried on brackets attached to the walls of the buildings. It is 200 m. long and rises at a grade of 1 in 18 from the first floor of the Schiffbauerdamm. The car is provided with an 8 h. p. motor, and can run at a speed of 8 km. per hour, affording a rapid means of communication between the two offices.

The Railway Commissioners of Sidney, New South Wales, are erecting a power plant of sufficient capacity to operate the whole system of proposed electric railways in that city and at the same time to provide for the electric lighting requirements of the municipality. A committee which has considered the questions of public and private lighting was unable to recommend the use of this station and it was decided by the council not to adopt this power. The station will have a capacity of 20,000 h. p.

A report giving the details of the cost of electric traction has been issued by the tramway department of the Leeds (Eng.) Corporation. The returns cover a period of one year ending March 25th, and the system includes seven miles of track. The car receipts for this period amounted to £48,032, 15s., the car mileage to 934,368 miles; the receipts per mile, 12.33d. and the operating expenses to 4.83d. This does not include interest on capital and sinking fund, or depreciation on electrical plant other than cars. The cost of generating current per Board of Trade unit was .60d. Of the total number of miles ran by electric and trailer cars, motors ran 816,749, and trailers 117,619. The consumption of current per motor car mile was .960 units, and per trailer car mile .480 units. The total units generated for the year was 809,101, less supplied to arc lamps, 32,660.

DEATH OF GEORGE H. WHEELER.

Mr. George H. Wheeler, formerly president of the Chicago City Railway Co., died at the Hotel Champlain, Plattsburg, N. Y., at 8:30 p. m. on August 11th, after a lingering illness.

George Henry Wheeler was born in La Porte, Ind., in 1841. His family removed to Chicago when he was eight years old, and ever since he has made this city his home. His early business career was as a member of the firm of Munger, Wheeler & Co., owners of grain elevators, and he devoted himself to those interests until 1891, when he was called to the presidency of the Chicago City Railway Co. He remained at the head of this road until 1898, making a reputation as one of the most able street railway men of the country. In

GEORGE H. WHEELER.

1898 Mr. Wheeler retired from the presidency of the Chicago City Railway Co. to devote his time to private interests, and was succeeded by the late M. K. Bowen. For many years Mr. Wheeler had been a director of the Continental National Bank and at the time of his death was president of the Washington Park Club, in addition to holding memberships in the Calumet, Chicago and University Clubs and the Sons of the American Revolution. He was a director of the World's Columbian Exposition.

Mr. Wheeler was removed from his home, 1812 Prairie Ave., to Lake Champlain late in July, following a recurrence of malarial fever, of which he had been a sufferer for a year.

Mr. Wheeler leaves two children, Mrs. Lawrence Young, of this city, and Dr. Henry Lord Wheeler, of Yale University. His wife, who was Miss Alice Lord, of Watertown, N. Y., died several years ago.

INCREASED TRAFFIC ON CALUMET, CHICAGO.

General John McNulta, receiver of the National Bank of Illinois and of the Calumet Electric Street Ry., whose stock was the principal asset of the bank, has been directed to advance $368,000 to pay all the indebtedness of the Calumet save the claims due the bank, which aggregate $3,682,300. The court has directed that $73,140 be set aside to repair the Pullman line of the road.

The Calumet is reported to be in an exceedingly prosperous condition, there having been an increase of almost 50 per cent in receipts during the last six months.

Manager Coombs of the Leavenworth Electric R. R., purchased $600 worth of fireworks to be set off near the Soldiers' Home last month.

The rolling stock of the Tacoma (Wash.) Railway & Power Co. is to be entirely re-equipped with new motors, controllers and trucks. A total of 22 practically new cars will then be available. The company let the contract on July 27th for grading a new route for its city park line.

THE WASHINGTON TRACTION & ELECTRIC CO.

The consolidation of the Washington, D. C., street railway properties under the management of the holding company above mentioned, which was described in the June issue of the "Review," has been steadily progressing, and all of the roads are now practically in charge of the new management. The City & Suburban Railway Co., which had agreed to sell out to the new company, was taken over by them on August 1st, and Mr. W. Kesley Schoepf, under whose management the road was entirely rebuilt, retires from the railway business. It will be remembered that the urban portion of this road is equipped with the conduit system, and the suburban portion with the overhead trolley, and it is generally conceded that the City & Suburban is one of the best equipped roads in this country. Its conduit work is specially substantial, and was patterned largely after that of the Metropolitan Street Railway Co., of New York. The suburban line is now completed to a point near Hyatsville, Md.

The change of power on the Columbia Railway Co., another of the consolidated roads which formerly operated by cable, was made on July 23d. When the cable stopped at midnight there remained 1,500 ft. of curved conductor rails to be put in place at the special work on the curves, of which there are 10 upon the road. There was also 450 ft. of grip guard to be removed. This work was all completed and tested out in six hours, and the cars started at the usual time in the morning. This was done under the direction of Mr. Theodore J. King, superintendent of the company, who has been in charge of the rebuilding of the road.

The reconstruction of the Anacostia and Belt lines was commenced on August 1st by Mr. E. Saxton, who has built all the conduit lines in the City of Washington. A large amount of the ironwork has been received and Mr. Saxton expects to have part of the road ready to run by the new motive power in about two months.

The power of the Great Falls is to be utilized for supplying the motive power of the consolidated roads and also the current for the lighting and power plants of the Washington Traction & Electric Co. It is intended to construct a dam below the government dam, and to build sluiceways to convey water to the turbines. It will probably require a year and a half to complete this undertaking, which will involve a considerable expenditure.

At a recent meeting of the directors Mr. George Truesdell was elected president of the Washington Electric & Traction Co. and the other officers were chosen as follows: Charles A. Lieb, vice-president; H. D. Mirick, treasurer; James B. Lackey, secretary, and V. B. Deyber, assistant treasurer.

Mr. Robert Weaver, who remained on the board of directors of the Columbia road at the request of the new owners, resigned as member of the board and the vacancy was filled by the election of Mr. Truesdell. The same set of officers will be placed at the head of all the constituent companies and of the parent company.

A new system of transfers went into effect on the lines of this company on July 16th and has proved very popular. Within the District limit one can ride anwhere on a continuous passage. This means that any person can travel on the Washington Traction Co.'s lines a distance of 10 miles for 5 cents. Even suburban citizens who live outside the city and District limits save about 3 cents on each trip under the new arrangement.

On the opening day of the transfer system the people took advantage of the cheap fares to travel in large numbers. The management of the road is well pleased with the entirely successful manner in which the innovation was received and are assured that it will result in pecuniary profit.

The motormen and conductors on all the company's lines will hereafter all be bonded for $500 each. This plan is an entire change from the old method of requiring the men to deposit cash with their companies, and it is believed by the management that it will be both safer for the company and easier for the men. The companies required their motormen and conductors and other responsible employes to deposit cash when they entered the service, the sum varying from $5 to $25 on the different lines.

Under the new arrangement an assessment of $2.50 will be made, which will be paid by the men to a bonding company. The plan was suggested by General Manager Hart a few days ago, and has been adopted formally.

HALF FARES.

The Northern Ohio Traction Co. will improve its power house at Akron at a cost of $100,000.

Helena, Mont., will soon have a trolley road connecting to East Helena, a distance of five miles, and a 5-cent car fare.

The Chicago Union Traction Co. is completing 50 new summer cars to run in North Clark, Wells, Madison and 12th Sts. and Milwaukee Ave.

The New York, New Haven & Hartford has put the third rail electric system in operation on its Braintree and Cohasset branch, which is 12 miles long.

The work on the Rutland Canadian Ry., between Burlington and Alburgh Springs, Vt., is progressing rapidly, a large force of men being employed upon it.

The North Jersey Street Ry. employes and their friends took possession of Baldwin Park, Jersey City, on July 26th, which was the occasion of their annual outing.

A young man named Mason was arrested and fined $10 and costs for swearing on one of the street cars of Wilmington, N. C. Not being able to pay the fine and costs he was committed to jail.

The Findlay (O.) Street Railway Co. has just erected a new 60-ft. stack over its power house, and a large Turner water tube boiler, recently purchased, has been erected and is about ready for use.

Motorman John Flaherty, of the Citizens' Street Ry. of Muncie, Ind., ran after and caught a runaway team last month, preventing what would have probably been a fatal accident. The horses were frightened by his car.

One, Joseph Miller, has been arrested and identified as one of the men who assisted in holding up the night receiver of the Fairmount Park Transportation Co., Philadelphia, on June 19th. The robbers secured $4,000.

A Missouri couple were married in St. Joseph, Mo., on July 5th on a trolley car. A street car was chosen for the novelty of the situation, and the contracting parties as well as the spectators appeared to enjoy the unusual scene.

Popular conductors on the Syracuse (N. Y.) Rapid Transit line this summer are five Syracuse University men who are spending their vacations in earning a little money which will come in handy next year when college opens.

Proceedings have been instituted by Attorney General Elkin of Pennsylvania, to annul the charter of the Middletown Electric Railway Co. In addition to this the grand jury has indicted the company for maintaining a public nuisance.

The Phoenix (Ariz.) City Ry. has been ordered sold under foreclosure proceedings. The road was built in 1893 and comprises 6½ miles of electric track; interest on bonds has been defaulted for years and the total indebtedness is $356,427.

The Chattanooga (Tenn.) Electric R. R. signed a contract with the Government on July 5th to carry the suburban mails. All the suburban post offices near the city have been abolished and substations of the Chattanooga office established.

The Boston Elevated Railway Co. applied on July 15th for a second track location, thus complying with the law that it should apply for authority to complete at least seven miles of location within a year after the granting of the first location.

Spokane, Wash., has three electric railway companies. There are about 35 miles of electric car lines now in operation. The Spokane Street Railway Co. is petitioning for franchises for two new lines into two opposite suburbs of the city. It agrees to pay two mills per day into the city treasury for each car mile.

A new fraternal order, called the Ancient Order of United Workmen has been formed in Cincinnati, O.; the membership is made up entirely of street railway employes. It is in no sense a labor organization, but is purely a social and beneficiary order.

July 19th was ladies' day at Battle Creek, Mich., and the ladies ran the electric street cars, the steamers on Goguac lake, and the soda fountains of the city. The proceeds of the day were divided between the Woman's League and the Nichols' Hospital.

The motormen and conductors of the Woonsocket Street Ry. had a pleasant outing at Succonesct park on July 24th. A special car was furnished by Superintendent Young, of the railway, who also contributed towards defraying the expenses of the affair.

Some miscreant placed an iron stone roller, some railroad ties and a lot of tile on the tracks of the Monmouth Traction Co., of Bordentown, N. J., on July 22d. The obstructions were fortunately discovered by the motorman of the first car out the next morning.

A prize picnic and moonlight hop was given by the employes of the Cottage Grove Ave. line, Chicago, on July 28th. The affair was held at the World's Fair Park and $800 was distributed in prizes. The picnic was given for the benefit of the employes' club library.

At a recent meeting of the stockholders of the Peninsula Railway Co., Newport News, Va., a controlling interest was transferred to Alexander Brown & Son, of Baltimore, who already owned the stock and bonds of the Newport News & Old Point Comfort Railway & Electric Co.

Some important improvements were commenced in the latter part of July on the First Street R. R., of San Jose, Cal., under the direction of Manager George L. Barker. The new management will put the road in first class condition and the cars are also to be thoroughly repaired and painted.

There is a movement on foot to unite the Citizens Traction Co., of Oshkosh, Wis., and the Fox River Valley Electric Co. of Appleton. If the union is accomplished it is expected that a connecting line will be built from Appleton to Kaukauna and Green Bay, thus traversing the whole Fox River valley.

The Akron, Bedford & Cleveland (O.) line was tied up for some hours on July 21st by the cutting down of about 1,000 feet of trolley wire by striking linemen. The first morning car was stopped at the break and it was late in the afternoon before any linemen could be found to repair the damage.

The Pueblo Electric Street Ry. has purchased 12 city lots in the rear of its present power house from the receivers of the Colorado Coal & Iron Development Co., and work is to be commenced at once on an addition to the power house of 100 x 140 ft. in dimensions. The cost of construction will be $25,000.

For some reason the Citizens' Street Railway Co., of Detroit, determined to discriminate against the Detroit, Lake Shore & Mt. Clemens line, and accordingly the cars of the latter company were last month denied the use of the former's tracks for entrance to the city. The other interurban lines continue to use the Citizens' tracks as heretofore.

A three-year-old baby fell from one of the Portland (Me.) Railroad Co.'s cars last month while crossing a bridge and quickly disappeared into the river. One of the company's conductors, Mr. Herbert Chute, who was riding on the car, dove after the child, which he succeeded in finding, and after being carried down the river by the tide to a steamship wharf, both were taken from the water none the worse but for a wetting.

The United States attorney general rendered a decision last month to the effect that the Havana street railway franchise, known

as the Torre concession, on the evidence submitted is superior to all others, and entitles its owners at their own risk under the permission of the municipal authorities to proceed with the work of construction without the injunction of the military authorities. This opinion has since been confirmed by the Court of Appeals which ends the litigation.

The clerical forces employed by the various roads now under the control of the Washington (D. C.) Traction & Electric Co., are being cut down, and one set of office employes is being introduced for all the lines. The new force is located in the offices of the Metropolitan Street Railroad Co.

The old Sioux City cable power house is being torn down and the material will be rebuilt into a new car barn for the Sioux City Traction Co. with which the old cable road consolidated. The old building was one of the land marks of the city, having been built in 1889, and was a handsome piece of architecture in its day, but with the abandonment of the cable and the introduction of electricity five years ago the old machinery has grown rusty and the building with its well-remembered ball room has long since been abandoned to innocuous desuetude.

With the object of gaining time, the motorman of a Brooklyn, N. Y., car ran back on the track he had just come over, with the result that the car was thrown down a 12 ft. embankment. The car was derailed by striking a switch set for the down cars. The 12 policemen on board shouted for help and blew their whistles. They were heard at the Canarsie depot, whence a wrecking car and the police reserves were sent. The injured policemen were helped to the rescuing car. It was found necessary to dig the motorman out of the sand. The car was a total wreck.

Mr. R. D. Apperson, general manager of the City Street Car Co., of Stanton, Va., sends us a prospectus of a free street fair and trades carnival to be held in that city on Oct. 3, 4, 5 and 6, 1899. The affair is to be held under the auspices of the Stanton Board of Trade, and the City Council has granted to the street fair the absolute franchise of all public highways and buildings. On July 20th, at Highland Park, the leading society ladies of Stanton gave a minstrel show for the benefit of the King's Daughters' Hospital, which was largely attended and highly appreciated.

Mr. Walter Gaston, general manager and treasurer of the Hazard Manufacturing Co., of Wilkes-Barre, Penn., is about to sever his connection with this concern and accept a position with the Taylor Iron & Steel Co., of High Bridge, N. J. Mr. Gaston began his business career with this company when it was known as the Taylor Iron Works 30 years ago. He left it in 1873 and now returns to the same concern after an absence of 27 years. Mr. Gaston expects to be located in New York City. The Taylor company is a large manufacturer of manganese steel, steel castings, car wheels, car axles and ammunition in the line of shells, armor piercing shells, shot, etc.

The investigation of the cause of the accident on the Monongahela Traction Co., of Pittsburg, Pa., which resulted in the death of one man and the injury of several others, resulted in the following probable explanation. There is the privilege given the conductors and motormen of the division to stop for a minute or a minute and a half at Welford's well to get a drink. There were two cars standing on opposite tracks at this point, the one on the eastbound track about half a length farther than the other. As the third car came down the hill the brilliant headlight of the car on the eastbound track must have blinded the motorman and prevented his seeing the car ahead until he was almost to it, and besides, it is a very dark portion of the road where the cars were standing, being heavily shaded with trees close to the tracks.

PHILADELPHIA AND RETURN, $16.45, VIA THE WABASH.

The Wabash will sell tickets, Chicago to Philadelphia and return, September 1 to 4, as above; other tickets, a little higher, giving greater privileges. Write for particulars. Ticket office, 97 Adams St., Chicago.

NEW YORK STATE MEETING.

The seventeenth annual meeting of the Street Railway Association of the State of New York is to be held at Ithaca, N. Y., on September 12th and 13th, and as it promises to eclipse all former meetings in point of interest, instruction and entertainment a large attendance of both street railway and supplymen is desired.

President Rogers and Mr. J. P. E. Clark, of Binghamton, visited Ithaca a day or two ago, and found the local people enthusiastic and very much interested in arranging a program of entertainment. Ithaca possesses unbounded resources as a convention city. There are good hotel accommodations and an excellent meeting place, while Cornell University offers a fine field to those interested in electrical development, and scientific matters generally. The faculty of the institution are very much interested in the forthcoming convention, and will throw the doors wide open. The program of entertainment includes an inspection of the university buildings and the several departments, with a five minutes description of each by the professors in charge of the respective departments, and the following papers will be contributed by members of the faculty:

"Statistics of Street Railroad Construction and Operation," Harris J. Ryan, professor of electrical engineering.

"Experiments on Resistance of Rail Bonds," Prof. H. H. Norris, electrical engineering department.

"Fuel Economy of Railroad Engines," R. C. Carpenter, professor of experimental engineering.

"Polyphase Equipment Used in Cornell University." (Illustrated by practical exhibit of polyphase apparatus.) Prof. H. J. Hotchkiss.

These papers in addition to those prepared by practical street railway men will constitute an interesting and instructive feature of the convention.

The entertainments will comprise a trolley ride to the picturesque environments of Ithaca, including a trip through Cayuga Lake, with luncheon served on the boat; special entertainment and band concert at Renwick Park, and the customary banquet the evening of the first day, which promises to be an elaborate affair, followed by an unusually interesting list of toasts, responded to by brilliant and well-known speakers.

It is believed that this convention will be the most largely attended and the most profitable, from the standpoint of instructiveness, that has ever been held by this Association. The list of other papers to be presented at this meeting is not yet complete but we feel assured that they will in every respect be up to the high standard set by the New York Association.

President Rogers is endeavoring to perfect arrangements for special sleeping car service in and out of Ithaca via the Lehigh Valley and the D. L. & W. railroads. The special service in connection with the regular schedule will provide ample facilities for getting in and out of Ithaca, so that the fact that ordinarily this city is not easily accessible need not deter anyone from attending.

ELECTRICAL ASSOCIATION TROLLEY PARTY.

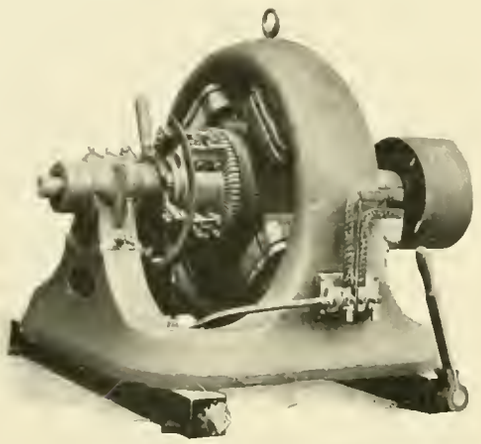
On Thursday, August 10th, the members and friends of the Chicago Electrical Association had a very enjoyable trolley ride at the invitation of the Association. The party, which comfortably filled three cars, assembled at 63d St. and South Park Ave., at 8 o'clock, where they boarded a special train brilliantly decorated with electric lights. After running to the loop at 64th St. and Stony Island Ave., where another delegation was picked up, the train started for West Pullman, where it arrived about 9:30 p. m. A stop of 30 minutes was made at the pavilion at this point, where several ladies of the party volunteered to supply the music for a dance, after which the party boarded the train which next proceeded to Windsor beach. Here another stop was made and the party indulged in another dance. The trip was enlivened by a supply of tin horns and vocal impromptus, and the party reached home about midnight, after enjoying a most agreeable outing.

The Augusta (Ga.) Railway & Electric Co. has decided to erect a bath house for the street car conductors, motormen and other employes of the company. The place will be fitted up with all the necessary equipments for hot and cold baths for summer and winter.

TRIUMPH DIRECT-CURRENT DYNAMOS.

In the accompanying illustration are shown a small belted dynamo and a bar-wound armature made by the Triumph Electric Co., of Cincinnati. This company has been in the field for seven years and claims that there is no more carefully designed or better made apparatus in the market. It prides itself particularly on fine machine work and the reliability and durability of its dynamos and motors.

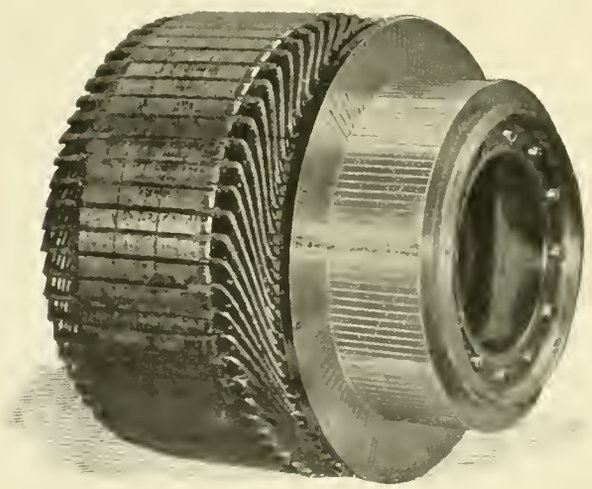
The "Triumph" direct current type of machines has cast-iron multipolar frames, with laminated pole-pieces and cast-steel pole



"TRIUMPH" BELTED DYNAMO.

shoes. Excepting in the smaller sizes, bar windings in armatures are used exclusively without band wires. The armature cores are ventilated horizontally by circular punchings and vertically by distance pieces between the plates. The armature coils are liberally insulated by the best India mica, enclosed in the strongest tape and fiberite board. The commutator bars are drop forged and of such surface that the carbon brushes have never to carry more than 30 amperes per square inch. The bearings are of the best gun-metal and of the ring-oiling and self-aligning type.

Particular attention has been given to the cool running of the machine, even on 50 per cent overloads. The Triumph Co. has



"TRIUMPH" BAR WOUND ARMATURE.

1,600 machines of from 1 kw. to 400 kw. placed in the West. The belted machines for railway work are made extra heavy, both in bearings and windings, and will, it is said, take care of as much as 100 per cent temporary overload without injurious heating or sparking. In sizes above 200-kw. a third bearing is used.

The western office of the company is under the management of Gates & Randolph, at No. 13 Monadnock Block, Chicago.

The new interurban electric railway between Oskosh and Neenah, Wis., is completed and in operation.

FARES REDUCED AT HARTFORD.

The Hartford (Conn.) Street Ry., which operates 70 miles of track, a large portion being suburban or interurban, and charged from 5 to 20 cents fare, according to the distance run, on August 1st made a number of changes in the sections and rates. The sections were rearranged so as to equalize the fares of out-of-town points, on the basis of four miles for five cents, as far as it is practicable, having in view the distance, the density of population and the amount of travel.

The rate from Hartford City to the East Windsor Hill terminus, formerly 20 cents, has been reduced to 15 cents, and the other changes result in large numbers paying one 5-cent fare less than was formerly necessary. Most of the changes made were not requested by the patrons of the line.

LINE TO GENEVA LAKE OPENED.

Geneva Lake, near Chicago, one of the most popular and beautiful bodies of water in the country, is now accessible to thousands who could not conveniently reach it heretofore. The electric interurban from Harvard to the lake, the Chicago, Harvard & Geneva Lake Ry., is now operating and carrying a large number of passengers. The road has a franchise for 50 years, and the right to carry express and all kinds of freight. It penetrates an exceedingly rich territory, which has been trying for 40 years to secure railroad facilities, and aside from the great volume of summer traffic offered, has a fine all the year business. The line is laid with heavy 60-ft. rails, the car equipment includes air brakes, and the road is operated on a dispatching system, with all the modern improvements.

EARNINGS OF CINCINNATI, NEWPORT & COVINGTON.

By courtesy of Mr. James C. Ernst, president of the Cincinnati, Newport & Covington Railway Co., we have received the following statement showing the receipts and operating expenses of that company for the month of June, 1899, and also for the six months ending June 30th, as compared with the corresponding periods in 1898.

The company has just declared a dividend of ½ of 1 per cent, making a total dividend of 1 per cent for the year.

	June.		January—June.	
	1899.	1898.	1899.	1898.
Gross receipts	$63,141.05	$56,955.24	$325,591.95	$303,507.35
Operating expenses	23,064.15	26,435.02	141,603.01	147,571.61
Gross earnings	40,076.90	30,420.22	183,888.94	155,935.74
Tolls, damages, taxes, etc.	11,717.90	9,766.14	75,115.07	60,386.84
Net earnings	28,359.00	20,654.08	108,873.87	95,548.90
Ratio of expenses to earnings:				
With tolls	47.61	56.25	56.72	60.18
Without tolls	36.52	46.49	43.49	48.62

CLAMBAKE OF THE AMERICAN ELECTRICAL WORKS.

In the early part of September the 21st annual clam bake of the American Electrical Works, of Providence, R. I., will mark yet another anniversary of this enterprising concern. The occasion of these outings is one always to be remembered and appreciated by those of the electrical fraternity whose good fortune it is to attend them, and the annual meetings at the Pomham Club have increased in popularity with each succeeding year. Mr. Eugene F. Phillips, president of the company, has become well known as the prince of entertainers, and the occasion of this year's outing is looked forward to with the keenest anticipation.

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CORRESPONDENCE.

We cordially invite correspondence on all subjects of interest to those engaged in any branch of street railway work, and will gratefully appreciate any marked copies of papers or news items our street railway friends may send us, pertaining either to companies or officers.

DOES THE MANAGER WANT ANYTHING?

If you contemplate the purchase of any supplies or material, we can save you much time and trouble. Drop a line to THE REVIEW, stating what you are in the market for, and you will promptly receive bids and estimates from all the best dealers in that line. We make no charge for publishing such notices in our Bulletin of Advance News, which is sent to all manufacturers.

This paper is a member of the Chicago Trade Press Association.

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The publishers of the "Street Railway Review" take great pleasure in announcing that Mr. C. B. Fairchild, for many years so well and favorably known in the field of technical journalism, especially in that relating to the street railway industry, has made a business engagement with this publication. He will represent this paper in both its editorial and business departments in the territory east of Buffalo and Pittsburg, and conduct our eastern office at 100 William St., New York City.

We cordially bespeak for Mr. Fairchild in his new relation a continuance of the same favorable response and commendation that have met his former efforts in this field.

We are happy to note that the committees having charge of the arrangements appertaining to the convention have all their plans for the accommodation and entertainment of our visitors well under way. The details will be given in our next issue.

Exhibitors at the convention of the American Street Railway Association, to be held in Chicago, October 17th to 20th, should note with care the recommendations of the general committee concerning the marking of goods shipped to Chicago, and also the arrangements made for preventing overcharges for lumber, labor, etc.

The preparations so far made by the committee are given on another page, and in the same connection will be found a plan of the convention hall and a list of the exhibitors with the amount of space assigned to each.

The papers to be read before the American Street Railway Association are fewer in number than has been usual, there being but five of them. This is not at all a disadvantage, as there will be more time available for a full discussion. The subjects cover five of the principal divisions into which the work of street railway men naturally divides itself—tracks, car equipment, shops, train service, and investments. Each of these reports will be presented by a man of extensive experience and wide acquaintance with the subject of which it treats, and we look forward to a particularly interesting and instructive convention.

The Street Railway Accountants' Association will have but two papers presented in addition to the reports of the committee on "Standard Accounts" and the secretary's report on "Blanks and Forms." There has been so much discussion of the reports on the standard system of accounts at the previous meetings of the association that the executive committee wisely decided to limit the papers on other subjects to two.

It certainly would seem that members of the so-called learned professions would not find it necessary to resort to the weapons of trade unions—strikes and boycotts—to "protect" themselves against competition. Yet in certain Lancashire (England) colliery districts the Colliery Surgeon's Association considered it necessary to issue a notice that on and after a certain date its members would not under any circumstances attend any miners who were members of the Wigan and District Miners' Permanent Relief Society, unless the cases were covered by existing contracts. The cause of this action on the part of the surgeons was the employment by miners of "non-union surgeons" (!) and the threat to "import" still other surgeons.

Our readers will not fail to be interested in the statement, appearing on another page, made by President Everett, of the Cleveland Electric Railway Co., concerning the strike in Cleveland. The whole unfortunate affair has resulted from a determination on the part of the men that their union shall be recognized by the company, and none but union men employed. The company had not taken the advanced ground that the Amalgamated Association of Street Railway Employes has for its objects the fomentation of discord and strikes, and, therefore, the company could not retain as employes members of that association. On the contrary, no objection was offered to the union as such; all that was claimed was the right of the company to employ competent men, regardless of their membership in unions. But now, after the second strike, the company cannot with justice to itself, do otherwise than make non-unionism the test for men seeking employment.

The boycott which at first met with some success is, we believe, gradually falling to pieces of its own weight and it is confidently expected that the citizens of Cleveland will not longer continue to submit to that tyranny which says a doctor shall not attend a man who rode on a Big Consolidated car under penalty of having the boycott extended to him.

Detroit is to have some more street railway litigation. The city council passed an ordinance requiring the Citizens Street Railway Co. to sell eight tickets for 25 cents and give universal transfers, which was approved on August 16th. As announced on another page of this issue the company petitioned the United States District Court and was granted a temporary injunction restraining the city from enforcing the ordinance. This action has caused a number of Mr. Maybury's friends to feel aggrieved; they say that if the company had only waited some one representing the city would have tried to ride for 3 cents under the ordinance and on refusal have gone into the state courts for a writ of mandamus, whereupon a friendly suit would have followed.

This plea for friendliness is highly ludicrous in view of the language that has been used in discussing the Detroit street railway situation for the past six months. As the suit involves the question of the obligation of a contract it would eventually have reached the federal courts, and it is much preferable to save the time that would be necessary to carry the case up to the state Supreme Court.

As to what the result of the pending suit will be there is little doubt. The company feels that it can show 5 cents to be a reasonable rate, even if its ordinance is not held to be a contract.

The testimonial published in another column, which was tendered Mr. Charles T. Yerkes by a committee representing nearly 8,000 of his employes on the occasion of his retirement from the North and West side roads in this city, was a graceful acknowledgment of harmonious relations which had existed between president and men for more than 10 years. On a previous occasion, several years ago, the men desired to tender some tangible expression of their regard, but as soon as it was known a positive request came down from the president's office that the matter be dropped. The boys, however, thought they saw their opportunity upon the occasion of the sale of the roads and the change of management. Mr. Yerkes, however, again sent a special request that no present be sent him, although it was planned to give him a princely gift of remembrance. But the men were bound to show their friendship in some way, and a beautiful testimonial couched in words which are well worth reading more than once was presented, and there is no doubt that the recipient felt even more than he expressed when he told the committee how highly he appreciated the simple token of regard.

The question of presents from employes to officials in charge of operating departments is one on which there is a great difference of opinion, and it is fair to admit that frequently such expressions, made in sincerity and in a spirit of genuine regard, tend to strengthen a feeling of amity between the recipient and the donors. On the other hand, the individual amounts, while small, often come from men with large families to support, and with whom every dollar counts. The one to whom the gift is sent is much better financially able to buy for himself than the men are to give, and it is impossible for some to give, who have the inclination, but who know that in doing so they are taking money which should be used at home. The street railway employes of the country, as a body, are steady, industrious men, with families, men who do not squander their earnings, but put them to the noble purpose of clothing and educating their children. We believe that the wise and generous position is that taken by Mr. Yerkes in a gentle but firm refusal to accept an offering of money value. There are other ways in which the men can show each day their regard for those who direct and govern, and bonds of strong and enduring friendship and esteem can be welded without resorting to an expression in which a money value is involved. That manager who has the welfare of his men at heart in the largest degree, is the one who least of all requires a present to be assured of their feeling for him.

Until quite recently continuous currents have held practically exclusive sway in street railway work, and as far as can be clearly seen at present they will contrive to hold their advantage over the alternating and polyphase distribution in the tramway service of cities and thickly populated sections where short hauls and heavy travel are the rule. Polyphase current distribution, however, is a comparatively new factor in certain classes of railway work, which has undoubtedly come to stay, and it possesses some notable advantages in the case of suburban and interurban railways, and where cheap water powers are available at some distance from the line of the road. A few cases are to be found abroad where polyphase currents are used direct by means of induction motors on the cars, but this method cannot yet be said to have assumed much prominence, although it is one which gives promise of important developments in the future. The general practice at present where polyphase currents are used is to generate them at one central station, the location of which is not important, as far as the cost of conductors is concerned, and at this station if distant from the line, the current is raised to 5,000 or 6,000 volts by means of stationary step-up transformers. From the central station these high potential currents are led to transformer stations located at convenient distributing points along the railway where the current is first reduced in voltage by means of step-down transformers and then changed from alternating to direct in character by means of rotary transformers, giving a continuous current of 550 volts, which feeds into the trolley line.

At first sight the losses incident to the three transformations of the current lead to the impression that such a system cannot be economical, and such would have been the case of a few years ago. In the modern types of stationary transformers, however, and especially in those of considerable size the loss of energy is very slight, amounting to less than 2 per cent at full load, and perhaps 4 per cent under average conditions. The loss in the rotary converter is somewhat greater, amounting to say 6 or 8 per cent, which is required to overcome friction and core losses. The total efficiency of the transformations, therefore, need not fall below 80 per cent in a properly designed plant, but even if a considerably lower efficiency is realized the loss will be less than the drop usually allowed on long direct current lines, while the whole saving in copper due to the use of the high potential circuit remains to be credited to the polyphase system.

Some examples of this method of distribution are now in evidence upon a number of roads in this country, with results which have proved highly satisfactory for the time this system has been under observation. One of the earliest examples of this system was in Lowell, Mass., where the cost of polyphase transmission was shown to be 70 per cent of the cost of a separate direct current power station. An eighteen day test of this system showed an average efficiency of 70 per cent measured from the alternators to

the direct current output of the rotary transformers, the losses including those of two sets of static transformers, the line and the rotaries. The best day's efficiency during this test was 73 per cent. The Chicago & Milwaukee Electric Railway's equipment is on this same general plan of distribution, and although only opened for traffic over its full length for a comparatively short time, is pronounced by its engineer to have shown remarkably good results. This plant will undoubtedly show a higher efficiency than the preceding one, as the generators deliver three phase currents directly to the converter station without the intervention of step-up transformers. The frequency of these generators is considerably lower than the general practice for combined lighting and power plants, being 25 cycles per second, while from 40 to 60 is more common, the higher number being essential where lighting is involved.

A similar system has been introduced in Washington, D. C., where all the city and suburban lines have been consolidated under one operating company. All the lines extending beyond a certain distance from the power house are supplied with three-phase currents and considerable economy over the former separate stations has been realized even with the temporary plant now in use. The Citizens' Traction Co., of Oshkosh, has just completed a plant of this description and two others in course of construction for the Toledo, Fremont & Norwalk and the Dayton & Northern roads in Ohio. Other examples of this distribution could also be mentioned, showing the growing use of this system in railway work, and it may be said that when we come to distances beyond possibly 15 miles the polyphase system must be used for economical transmission.

A farther development of this system promises to be introduced at no distant date which will add still more to the efficiency of such transmissions. This lies in the use of induction motors on the cars, which, as suggested above, has already met with some success in Europe. In this case rotary transformers are entirely dispensed with, and only static transformers are used, which not only increases the efficiency of the transformation but dispenses with the labor of personal attendance at the converting stations. The troubles incident to commutators are also avoided, although the necessity of a double trolley system is introduced. This system was installed in Lugano, Switzerland, in 1896, at Evian-les-Bain, France, and at other places, where it is working successfully.

There are some advantages in the induction type of car motor over direct current types, one of which is the retarding action of the motors when driven beyond a certain speed by the car on down grades. They may be designed to develop a retarding force much greater than their working torque when their speed increases above the normal, and this effect takes place automatically, being inherent in the machine. The working torque may also be increased by connecting the motors in series, the torque being proportional to the number of motors so connected.

No better example of what can be accomplished by everybody pulling the same way, under competent leadership, could be desired than that furnished in the history of the new York State Street Railway Association, particularly in that history, since 1895. At that time—when Mr. G. Tracy Rogers was elected president—the affairs of the association were in a somewhat undeveloped condition: in fact it was little more than a social club. But Mr. Rogers thought he saw in this small collection of street railway men the possibilities of an organization, whose influence would be far reaching and whose power for good to its members, would be practically unlimited. He now has the satisfaction of seeing his hopes fully justified. Under his energetic guidance the membership roll has increased until it includes every prominent system in the state, and its meetings have grown so enormously in value that its influences is felt way beyond the boundaries of its own state. Its methods are carefully watched by officials of similar organizations, and the papers and discussions presented at its conventions are largely read and studied by managers all over the United States.

CONVENTION PROGRAMS.

The papers to be read before the convention of the American Street Railway Association next month are as follows:

"Maintenance of Car Equipment." J. H. Van Derveer, Brooklyn Heights Railroad Co.

"The Modern Street Railway Shop: Its Design, Machinery and Shop Practice." B. L. Kilgour, electrical engineer, Cincinnati Street Railway Co.

"Train Service and Its Practical Application." Ira A. McCormack, general superintendent, Brooklyn Heights Railroad Co.

"Construction and Maintenance of Railway Track." Edward Butts, Metropolitan Street Railway Co., Kansas City.

"Investments in Street Railways: How Can They Be Made Secure and Remunerative." Charles T. Yerkes, president, Chicago Traction Co. and Union Elevated Railroad Co., Chicago.

The papers and reports before the convention of the Street Railway Accountants' Association of America in October are to be as follows:

"Materials and Supplies Accounts." W. M. Barnaby, chief accountant, Brooklyn Heights Railroad Co.

"Car Mileage." H. C. Mackay, comptroller and auditor, Milwaukee Electric Railway & Lighting Co.

"Report of Committee on Standard System of Accounts." C. N. Duffy, chairman.

"Report on Department of Blanks and Forms." W. B. Brockway, secretary of the association.

DETROIT SITUATION.

The ordinance passed by the city council of Detroit, as published in the "Review" for August, page 509, was approved by the mayor on August 16th. On the same day Judge Swan, of the United States District Court, issued an interlocutory order restraining the city, the mayor, council, corporation counsel or any city officials, from attempting to enforce the provisions of this ordinance on the grounds that it was a direct violation of existing contracts (ordinances) entered into between the city and the company. This stops the proposed mandamus for which the mayor had intended to ask the lower courts, to enforce the ordinance and also places the entire matter in the United States courts, where it will probably reach the highest judicial tribunal in the land and settle once and for all the question of whether or not an ordinance is a contract regarding fares, or whether a city can reduce fares below that provided in the ordinance.

The New York Convention.

Seventeenth Annual Meeting of the Street Railway Association of the State of New York at Ithaca, September 12th and 13th A Most Enthusiastic and Well Attended Convention—Papers and Discussions.

The 17th annual convention of the New York State Street Railway Association convened at the New Ithaca Hotel, Ithaca, N. Y., September 12th, at 11:15 a. m., with Persident Rogers in the chair. The meeting was scheduled to open at 10 a. m., but owing to a delay in the arrival of all the morning trains the time was postponed to the later hour. About fifty gentlemen were present when the meeting was called to order, and the roll call showed delegates representing 28 roads in attendance. On motion by Mr. Vreeland, the reading of minutes of previous meeting was dispensed with, and they were approved as printed.

President Rogers then read the following address:

PRESIDENT'S ADDRESS.

Gentlemen of the Association:

It is again my pleasure to extend to you all a most cordial greeting, to this our Seventeenth Annual Meeting. Each succeeding convention has proven more largely attended and interesting than the former, and judging from the papers and topics we have before us for discussion and the environments with which we are surrounded in this beautiful university city, this meeting promises to be no exception. I have often called your attention to the benefits to be derived from a free discussion and interchanging of ideas and experiences at these conventions, and I trust you will not wait to be

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called upon, but that each one in attendance will appreciate the duty and privilege both by interrogatives and explaining his views on each subject as presented.

In former years it was very difficult to induce members to prepare and present papers, and still more difficult to provoke or obtain a free discussion of the papers and topics presented. One day was sufficient to transact the business of the annual convention, leaving ample time for the pleasure, which our host had in preparation, but the two days we now devote to our meeting are fully occupied. Notwithstanding the general invitation extended, we have often been obliged to depend upon the larger roads for papers and discussion. This should not be. The men connected with the smaller roads, also those in subordinate positions on the larger ones, ought to appreciate the great benefits and opportunities extended to them at these conventions, to present their ideas, and bring themselves more clearly before the street railway world.

It has been my privilege each year to congratulate you on the condition of our association. I attribute our substantial growth and development to the interest that each individual has taken in its affairs. This not only applies to the presidents, but to the various officers and heads of the different departments of the roads, constituting this association. It is the result of united effort on the part of the progressive street railroad men of the Empire State. Our reports of annual meetings are not only sought for by various libraries in this country, but we have many inquiries for them from abroad.

The past year has been one of more than usual advancement in every department of street railway development. Compressed air, as a motive power, is now a practical success, not a theory, and in actual use on the Metropolitan, of New York City. The underground trolley, as used in New York City, has successfully wintered through, and today, I believe, is the acme of street railroad operation in large cities where the traffic will warrant the tremendous outlay. Increase in cost of material continues. Iron and all its manufactured products are in strong demand, and important street railroad and municipal work is delayed on account of the inability to fill orders for material, particularly special work. The use of aluminum in place of copper as an electrical conductor furnishes a possible relief for the embarrassment occasioned by the rapid increase in the cost of copper. Aluminum has already been successfully used to some extent on long distance lines.

Expansion seems to be the order of the day and is not confined to the Government. The street railways of this country have been the means of expanding our cities and reaching out into the adjacent villages and hamlets, and the building of interurban roads has been more marked than ever, and I believe the work will be of untold benefit.

The development of interurban roads is one of the most interesting and promising studies of the day, both sociologically and physically; by it the farm life is relieved of many of the disadvantages which belong to isolation. The new electric railway construction is on a healthy basis. Practical street railway men who are now interested in street railway properties are quietly looking about and planning interurban lines, which, if they build—judging from past experiences, will soon become paying properties.

The interurban railroad proposition is an attractive one, especially to street railway owners and managers who have had experience with city property. The question of franchise is much simpler than in the cities, in spite of the fact that concessions usually have to be secured from a greater number of municipalities. The abutting owner is benefited to a greater extent by having the railway in front of his property than is the case in cities. It gives him direct transportation at his door, and, in fact, the community as a whole is ready to welcome a transportation agency, which is more convenient and cheaper than heretofore existed. In the next place franchises are usually perpetual and the conditions are less apt to be reviewed by a common council with each change of administration. In many cases, mechanical problems, which render the life of the city manager a burden, disappear in the interurban railroads. The track can be built and rails or ties replaced without permanent excavation. There seems to be less chance for radical changes in the development of the interurban roads than in the present city service.

The success which has attended the alternating current has largely contributed to the rapid development of the interurban service, and the cheap accommodation as compared to steam railroads has very materially stimulated the building of these roads. In many instances steam railroads which were losing ventures have been electrified and made to pay handsome returns upon the investment. By experience it has been shown that a trolley line can be constructed, maintained and operated at a less cost than a steam line. The steam railroads recognize this dangerous competitor for short distance travel, and in some instances are doing their utmost to suppress it, but "it is a condition and not a theory that confronts them."

The carrying of freight by electric railroads is one of the most important matters which affect interurban roads, and some of them to a serious extent. In some instances the steam railroads have

questioned the right of the trolley roads to carry freight, but in a recent decision in the Supreme Court of New York, rendered by Judge Merean, it was clearly decided that the trolley roads of this state had a right to transport freight and express matter. I think that the steam railroads stand in their own light in attempting to fight this proposition, as transportation begets freight and creates business, while in a few cases the interurban roads will interfere to a small extent with existing business between two points, at other places it would give more than it takes. There is no good reason why the trolley roads, occupying streets and highways, should not haul freight and express over its tracks as well as any company organized to do a general teaming business, which hauls the same identical merchandise over the same roads in wagons, and which use the streets and pavements of our cities or country roads. The movement of cars drawn by steam locomotives over streets is an entirely different proposition.

The question of carrying the United States mail on electric cars has been discussed both pro and con. I am satisfied that the carrying of the United States mail at the present rate is not a profitable department of the trolley road, but there is no question but that it is a great accommodation to our patrons and a convenience to the public. This compensates, in a large measure, for the meager payment we receive for this service, however, I believe "The laborer is worthy of his hire," and a united effort on our part to secure adequate compensation for the carrying of the United States mail should be made.

The employers and employes of the street railroads of the state of New York are to be congratulated upon the pleasant relations existing between them. This is largely due to the intelligence, ambition and appreciation of the men connected with our roads and the sincere efforts on the part of the employers, to better the condition of employes. As a rule, great care has been taken by the management of our street railroads in the selection of help, and they have been regarded as reasonable, intelligent men, and recognized that each is doing a work as dignified in its way as that of the head of any of the departments, or the president of the company. Merit and ambition have been recognized and promotion has been made from the ranks. An interest and friendship has been taken in the men employed, and the ambition to rise from the lowest place in the ranks has been respected and rewarded. In many instances the men have learned that the management takes more than the usual interest of the employer, not only with the duties connected with the road, but practical sympathies have been shown them in their personal troubles, and no effort has been spared on the part of the management to better their condition. Upon the manager's treatment of employes depends the success of his administration more than upon any other feature.

Too much interest cannot be taken in the mutual benefit aid societies connected with our roads. They are doing a wonderful work in developing a cordial fraternal feeling as well as stimulating an interest in their work. It also gives the management an opportunity to show its genuine friendship and interest for the men as a body, and to assist them in many directions, such as furnishing literature, libraries, club rooms and entertainments; in short, being one of their number. The successful managers of today are men who do not hold themselves aloof from their employes. They are honest in their friendship for the workers in every branch of the service, showing practical interest in their welfare and advancement, listening patiently to all the grievances and discussing them frankly and freely, promptly investigating and correcting any abuses or unfairness which may creep into the service. The manager who conducts his road on these lines teaches his men to be loyal and enthusiastic in the service of the company, creates in them a self respect and manliness, and he need have no fear of strikes. Should one be brought about, the proof of justification would rest with the employes, and the verdict of the public would be in favor of the road.

The operating expenses of the average street railway is 60 per cent of the gross receipts. Labor constitutes from 40 to 60 per cent of the total operating expenses, i. e., from 25 per cent to 35 per cent of the gross earnings goes to pay labor; therefore, when earnings are reduced 5 per cent through hostilities, legislation, or otherwise, the natural result is that the employes will suffer a reduction in wages from 15 to 20 per cent.

The street railroads have pursued a liberal and progressive policy; they not only keep abreast of the times, but have, of their own accord, made good and valuable concessions, and this without moral or legal obligations. The public, as a rule, seem to accept these concessions with a "thank you" at the time, but it is not long before they expect still further concessions and forget the past. Extensions are being made in every large city, gradually increasing the haul but without increasing the fare, and now in large cities 5 cents carries the rider to almost any part of the city, and four or five times as far as it did 10 years ago. Without question, a liberal policy pays everywhere, and the broad gaged, progressive ideas adopted by the street railroads cannot fail to be appreciated by a fair-minded public.

Progressive citizens make successful cities. Villages grow into cities by the efforts of men more than by the force of circumstances. The progressive street railway man of this country has, in many instances, been obliged to fight bitterly in order to carry out the advanced ideas or plans which he may have conceived for rapid transit. Often these plans were far in advance of the times and the public failed to grasp the benefits to be derived from them and has not only made it difficult to carry them into execution, but, in many instances, defeated enterprises which would have added very largely to the public comfort and the advancement of taxable property. The public should take into consideration the fact that a street railroad (differing from almost every other business) must be operated 365 days in the year, and from 18 to 24 hours a day, and the manager must meet the complaints, desires and whims of the public with a pleasant smile and must be like the compass with the four cardinal points. He must understand the people's wants, the employes' wants, the cities' wants and the stockholders' wants, all four having claims which must and should be satisfied. In many cases these interests are conflicting. The people seem to regard the operation of a street railway as a decidedly easy matter. While it may appear so to them—and they, no doubt, intend to be fair—there are difficulties which have been worked out by systematic methods which mislead them in their judgment. No line of business tends more rapidly to build up suburban territory, furnishes cheap, comfortable and healthful homes to people within reach of their business, develops the growth of the city, brings unimproved and dormant real estate into the market and increases the assessed value of city property. The street railroads have done much toward the social and moral advancement of the communities in which they are located.

Much has been said against trusts and consolidation of business interests. We are one of the exceptions. I can state without fear of contradiction, that in every instance of consolidation of street railroads the public has been benefited, and the conveniences of civilized life have been enhanced.

We have been accustomed to hear the familiar expression, "Everything has been cheapened in price, but street car fare remains the same." It is now an undisputed fact that nearly everything has advanced in price, especially material used by street railways, but "street car fare remains the same," and in this connection I will state that twice the accommodation and benefit is being given for a 5-cent fare than at the beginning of the present decade, and hence street car fares have actually been cheapened by more than 50 per cent. What constitutes a ride in a street car today is certainly double the ride of 10 years ago, and the cost of operating is twice as much as under the old method and system. The more than generous distribution of transfers has, I believe, had the effect to quiet the 3 or 4-cent advocate. The average total cost of carrying a passenger is 3.8 for each person, and if one will carefully study the street railway system of New York City he can live aboard the cars for an indefinite period, for a nickel.

The successful managers are those who watch carefully the traffic and regulate their car service by the daily receipts. In many cases it is necessary to withdraw cars from service on the lines where the returns are less than satisfactory, and in others the car speed has been gradually increased to a degree where one or more cars could be withdrawn, and by enlarging the cars, give the same service. Wages by this means have been reduced, reserve equipment obtained, and the maintenance charges also reduced proportionately. The people are being educated to rapid transit, and so far as is consistent with safety, the public demands it. They cannot do otherwise. By the adoption of the highest practical rate of speed the value of property will be approximately increased in proportion thereto, as the outlying land will comparatively be brought just so much nearer the business center. Rapid transit is the most important factor in the building up of residence territory compara-

tively remote from the business center. The general belief that the trolley is "The Juggernaut" of the city, is fast disappearing.

The action of the Supreme Court of our state in granting the Brooklyn Heights R. R. an allowance of $500 against the plaintiff in an unsuccessful damage suit, is greatly to be commended. If this precedent is followed in similar cases it cannot fail to greatly decrease this class of litigation. The greater number of persons injured who commence suit against the street railway, are incited by the unscrupulous and avaricious ambulance lawyers, who know that they have no case, but rely on the sympathy of jurors, or the forcing of the company into a settlement.

The handling of damage cases should be conducted by men naturally qualified for this class of work. They should have the best interests of their road at heart, and yet not be too greatly prejudiced in its favor. They should have good, sound judgment, and be careful of the details to the highest degree and have an even, calm temperament, ever ready for a call, polite and sympathetic. They should be men accustomed to handling all clases of people without combating or irritating, and must never appear over anxious for a settlement.

It has been stated on good authority that the high water mark of bicycles was reached in 1897. In my opinion, the bicycle will be continued as a convenience, but its use as a pastime is on the wane.

The automobile has taken a position of the utmost importance in the transportation of the world. What effect it will have upon street railway travel we are unable to state. It will, no doubt, in a large degree, take the place of the horse, but I question it ever supplementing the street car. As yet it is largely experimental, however, the possibilities of the automobile's practicability in the line of cabs, omnibuses, etc., must be regarded by street railway men with close attention, if not concern.

Much has been said and written regarding the maintenance of parks by street railways; also the question of furnishing free entertainments for the public at these pleasure resorts. There is no question but that this department of our business can be overdone and made unprofitable, and each road should be governed by circumstances and surroundings. For instance, in New York City, the question is, "How can we carry people who desire to ride?" and in smaller cities, "How can we induce the people to ride?" Again, great judgment should be displayed in the location of the park or pleasure ground, as relative to the city and the ability to transport the crowd rapidly. The amount expended in this direction should at least show an equal amount in the returns. There are also other advantages which are evidently overlooked; in the first place, it is a natural tendency for the number of pleasure seekers to increase, and the advantages of a park in the neighborhood of a city are considerable and will appeal to the continually changing number of people. The real value of property of this kind is increased somewhat by its accessibility, but depends largely upon the manner in which the park is conducted. The success or failure, in some instances, is almost entirely dependent upon the proper selection of attractions. The park is looked to for amusement, and unless amusement of some kind is furnished the public, the road depending upon it for increased travel, will, in my opinion, be very much disappointed. The question of charging admission to parks has been thoroughly discussed heretofore at various conventions. In most instances where the sale of liquor has been conducted, I am informed, the parks were failures.

The question of the paving of street as required, under the present railroad law, and the Court of Appeals decision in the Conway case, makes the building of roads or the maintenance of the present ones, especially in villages and small cities, a very serious problem. It is an impossibility for these roads to live and comply with the present state law and do the paving required, and before roads can be successfully financiered or maintained, in these municipalities, they must have some relief from the Legislature. There are many obvious reasons why this legislative relief should be furnished. There is no one element that tends more to build up small cities than rapid transit, and the increase of value of taxable property thereby, alone more than offsets the unfair burden placed upon the railroads to help pay for pavements which they, under mechanical power, do not use.

Municipal ownership has received some very severe blows of late. In nearly every instance where fair propositions have been discussed as to the method or means by which municipalities could become the owners of street railroads, we have seen the municipalities dodge the issue; but if municipal ownership could be obtained by confiscation, no doubt that theory would have plenty of adherents. I believe it has been very thoroughly demonstrated that it would be utterly unwise to place the control of a city's transportation agency in any other than private hands. The interest of a growing city and its street railroads should be mutual, and no pains should be spared on the part of the street railway to meet every fair, legitimate demand made by the city's officials, the public and the press, and all should work together to build up and develop on broad lines, the municipality.

There are two sides to the question of short time franchises. In one instance, the obtaining of capital to finance the property on a short term franchise is not only difficult and dangerous to the investor, but large rates are demanded, and the same degree of permanency cannot be used in construction and equipment, as illustrated by the New York City railway companies, which have expended millions of dollars in the adoption of cable and electricity, and are giving New York the universal transfer system and improved cars and car service, which they could not have done under short term franchises.

The Metropolitan, of New York City, has given the people many evidences of conception and generosity of action and breadth of view, which, when dealing with questions of public interest, always bring about the greatest possible benefit to the community. The proposition made by this company to the city of New York this last year, to furnish them with rapid transit, could not be duplicated by any other transportation agency or individual capital, owing to their inability to provide the transfers that the Metropolitan alone can furnish, a condition due largely to their existing lines. In my opinon, the proposition was a broad and generous one, and upon the refusal of the concessions which they asked for, I am not at all surprised at the prompt withdrawal of the proposition, as it would demand an enormous outlay of capital, upon which the remote future would be called upon for dividends. The result is that the city of New York is still dawdling with the question of rapid transit, and is no nearer the much sought for relief than it was some years ago. It is difficult to predict any relief in relation to the question of rapid transit in Greater New York, except through the efforts of the present companies.

During the past year many miles of road in New York have been changed to the underground trolley, and much new equipment added. Still further important changes are in progress and will be completed as soon as possible. The contemplated tunnel under the East River, when completed, will furnish great relief to the traveling public between these two cities. The purchasing and consolidation of the various roads—including the elevated—in Brooklyn, by the Brooklyn Rapid Transit System, illustrates again the benefits to the public of consolidation. They have already placed the Fifth Avenue, Coney Island branch of the Brooklyn Elevated road under electric operation, and very satisfactory train service is now being obtained.

The purchasing and remodeling of the Brighton Beach Hotel by the Brooklyn Rapid Transit Co. is a new departure, and, I am informed, has been a marked success.

I would call your attention to the purchase and consolidation of the 18 roads in the western part of the state, including Buffalo. I am informed that this consolidation has already proven to be a great benefit to the public at large in that territory.

The history of recent legislation is too fresh in the minds of all of you for me to dwell upon at any length. The general expression on the part of street railway officials in relation to the taxation of franchises is, that a street railway or any other corporation using the streets of a municipality, should pay a tax, based upon its earning power.

The Ford franchise bill, as you are aware, was hastily passed the day the Legislature adjourned. A hearing was granted by Governor Roosevelt, and the corporations of the state presented the reasons why this unjust and illy constructed bill should not become a law. We were treated by him at this hearing with his usual fairness, and our arguments were patiently listened to. We asked, first, that the governor adhere to his message of March 27th, in which he suggested that a committee from both houses be selected to deal with this question and prepare a bill and report to the next Legislature. In case he did not see his way clear to do this, that he reconvene the Legislature and a graduated bill based upon gross earnings be passed. The Legislature was reconvened

and the present bill was enacted, which, in my opinion, is an improvement over the Ford franchise bill for numerous and obvious reasons, among which is the fact that under the Ford franchise bill the franchises were to be assessed as real estate by the local assesors. I am satisfied that the State Tax Commissioners are men of good, sound judgment, and will treat this matter fairly. It is the general opinion, I find, that the street railways are not now paying a franchise tax, and the public as a rule have the idea that we have been exempt from taxation; such is not the case, as we are all well aware. The last published report of the State Board of Railroad Commissioners shows that the combined street surface railroads of this state paid 28 per cent of their net income in taxation and a dividend of but 2.3 per cent on their capital stock.

The following are a few of the arguments which I presented before the governor, and the same will, I think, bear repeating at this time.

One hundred and three street surface railroads submitted annual reports to the state, 49 of which show a surplus amounting to $1,102,855, and 54 show a deficit amounting to $471,848.

Of the $1,102,855 surplus, $805,288 is shown by 12 companies in Greater New York, leaving but $297,567 to be divided among the 37 companies outside of that city.

Of the 103 companies reporting, but 18 declared dividends (5 of these being in Greater New York) the total dividends amounting to $3,069,465, of which the five Greater New York roads paid $2,512,374, leaving a balance of only $557,091 to be divided among the remaining 13 dividend paying roads. Six of the dividend paying roads showed a deficit after so doing. Eight of the 103 street surface railroads mentioned have gone into the hands of receivers during the past four years.

In addition to the above mentioned 8 companies, at least 12 or 15 have gone out of business entirely or saved themselves from going into receivers' hands by making some arrangements with the bondholders.

Briefly, the above report shows that the small and medium sized street surface railroads in New York State, and in fact all the roads with the exception of those in the very largest cities, are struggling along under the most discouraging conditions.

There is $1,683,195,740 invested by the combined transportation companies of this state in roadbed and equipment. A large portion of this enormous amount invested—representing the capital stock and bonded indebtedness of the several companies—has been sunk in a depreciation of the value of both construction and equipment and in expenditure for replacement made necessary thereby, particularly by street surface railroads for the development of mechanical traction, especially electrical, the operation of which for the past decade has been largely experimental, necessitating frequent expensive changes of station and car equipment, and the consignment to the scrap pile of costly machinery, which necessarily had to give way to more improved and modern equipment.

In many instances where horse street railroads were purchased for the purpose of equipping with electricity, the entire equipment, for which high prices were paid, proved absolutely valueless to the purchasers.

In the early days of electrical traction enormous prices were charged for equipments of all kinds; for instance, 10 years ago $3,000 and upwards was the price charged for a car equipment, which today, owing to its crude and undeveloped condition, is worthless, and which can be replaced by a modern, up-to-date outfit for $720.

Without going into details, I would state in a general way, that the same rule applies to track and overhead construction, to car bodies and appurtenances, all of which have to be kept up to date and carefully maintained to meet the requirements of an exacting public.

The interest paid upon that portion of the bonded indebtedness, sunk by depreciation of values, and expended for replacement by the several street surface railroad companies of the state, in order that the city or village wherein their respective roads are located, might be properly subserved, is a material and permanent burden imposed upon each individual road, which should be taken into careful consideration in the adjustment of the important question of taxation.

There was $164,161,692 paid out in operating expenses in 1898, the greater portion of the amount being for labor, proving the benefit of these institutions, and demonstrating the fact, when taking into consideration the immense amount of money invested and the cost of operation, that the net income as shown by the above statement, is small, and proves conclusively that the proposed tax imposed upon the railroad companies of this state would be unjust, unfair and undeserved.

Two years ago the Legislature of this state passed a gross earning tax bill, imposing upon street surface railroads a tax of 1 per cent upon gross earnings (while the tax law affecting steam railroads remained unchanged). This measure imposed a serious additional burden upon provincial street surface roads, particularly the non dividend paying companies.

The street railroad companies of the smaller cities of this state are entitled to consideration and relief, rather than additional burdens. In fact they must receive such consideration and relief, otherwise the number of street railroad companies in receivers' hands will be materially increased.

The State Railroad Commissioner last year made a number of recommendations to the Legislature and had bills introduced in compliance with same, and no fair-minded man can fail to concede that these recommendations and bills were in the line of public safety and convenience, and were both fair and just to the railroads and the public.

It is a matter of congratulation that we have in the Railroad Commission of the State of New York the fair, able, and most painstaking commission, and all interests have been zealously guarded by them. In closing, I congratulate the street railroads of the state upon the degree of prosperity they have attained and upon the intelligence and energy of the management which has made their operation so progressive and successful. Let me add the hope that still greater success in all the elements of railway service, both to managers and investors as well as to employes, will be the reward during the present year.

Next came the reports of the executive committee and the treasurer, which were submitted and accepted. The treasurer's report showed $1,400 in the treasurer's hand, $5,000 having been expended during the year.

The president next announced that there was in attendance the chairman of the New York Board of Railroad Commissioners, Mr. A. W. Cole, and the commissioner's engineer, Mr. C. R. Barnes, and called on Mr. Cole to make a few remarks. Commissioner Cole expressed the regrets of the other members of the Commission at their inability to be present, through the pressure of important official business. He then reviewed briefly some of the work accomplished by the board of which he is chairman, and also by the Convention of Railroad Commissioners of 25 different states, held at Denver a few weeks ago. At this latter meeting a standard system of accounts was accepted, which is, in the main, the same form as adopted by the Street Railway Accountants' Association of America. Mr. Cole was accorded a vote of thanks for his remarks.

The secretary then read letters of regret from officers of the Ohio State Street Railway Association, the American Street Railway Association, the Connecticut Street Railway Association, the Delaware & Hudson Canal Co., the Delaware, Lackawanna & Western Railroad Co., and the New York, Ontario & Western Railroad Co., and from T. C. Platt and B. B. Odell, of New York City.

HOW CAN WE INCREASE THE EFFICIENCY OF EMPLOYES?

BY F. D. ROUNDS, GENERAL SUPERINTENDENT METROPOLITAN STREET RAILWAY CO., NEW YORK.

A few years ago any discussion as to how to increase the efficiency of employes would have been deemed a waste of time by the average street railway manger. His first thought was for his horses, the second for his cars, and very little remained for the men on the cars. The introduction of rapidly moving mechanically driven cars, with the attendant increased liability to accidents, especially when improperly handled, has forced this question more and more to the attention of managers.

There is still plenty of room for improvement, and a careful supervision of these details of hiring and handling men will result in a decrease of accidents, an increase of patronage and a lessened liability of labor troubles among the men employed.

We can increase the efficiency of employes:

1. By paying a rate of wages which will make it an object for men to engage and continue in the street railway service.

2. By making an intelligent selection from among the applicants, taking those who seem from their appearance best fitted for the work, requiring from them a full statement of their employment for some time past and looking up their record.

3. By giving the men a careful education for the duties which they are to perform.

4. By handling employes in such a way that they will feel that they are being treated as men and that they will not lose their loyalty to the company and to their immediate superiors on account of harsh and unjust treatment.

5. By making them feel that intelligent service, loyalty to the company, and a good record gives them a chance for promotion to a better position.

1. The rate of wages to be paid depends of course upon the size and business of the street railway and upon the standard wages of other classes of employment and cost of living in the locality. In some cases it is beneficial to pay a minimum rate of wages for the first year, increasing it the second year and in some cases in the third year. This plan makes the men value their positions the more, from the fact that they have something more to work for, and in consequence they are more careful to hold their places. Liberality in paying employes for extra work and for special service creates a very good feeling on the part of the men toward the company and makes them loyal. In a great many instances this can be done in such a way as to create great satisfaction among the men without imposing on the company any very heavy additional burden in pay rolls. This plan has been carried out by the company with which the writer is connected to a very large extent for the past six years. While of course smaller companies with less earnings could not be expected to do as much, yet it might be interesting to cite briefly some of the ways in which the above idea has been carried out. Men who are detained on the road in blockades caused by fires, accidents, snow, etc., are paid for the time they lose on the road. In snow work the best motormen are detailed on the sweepers and paid double time by the hour from the time they are called until they are relieved from duty, whether they are actually at work on the sweepers or swinging at the car house.

Men called to the office to make reports of accidents or other reports and who unavoidably lose trips by so doing, are paid for their time. In July last, at the time when an attempt was made to tie up the lines by a strike, men who reported for work and who remained on call unable to go out on account of having no conductor or motormen were paid for their time. As a reward for the loyalty of the great body of men who stood by the company and made the strike a failure, the men who worked during the two days the strike was attempted, July 19th and 20th, were allowed double time, and afterwards were given a three days' vacation with pay.

2. In selecting men for service from among the applicants, a great deal is to be gained by carefully choosing those who appear the most intelligent, sober and neat in appearance, requiring them in their applications to give their past places of employment and reasons for leaving same, and investigating these statements. If this investigation is well carried out it will weed out a great many undesirable men who have made false statements.

3. In molding the more or less unskilled labor into competent conductors and motormen, it is well that the man should gain correct first impressions of their work. If a man is instructed as to the handling of his car by a careful and competent teacher, it will save a great deal of trouble later on; also, if he receives a good impression of his relations with and the treatment he is to receive from his new employer, it will tend to make the man careful and attentive to his work from the start. Our company employs a chief instructor of motormen and several assistants, who devote their whole time to the education of motormen. There is also an instructor for conductors, who devotes his time to the education of conductors. The company has a large room fitted up with some 25 controllers and brake handles connected with a spring. The men are given their first instruction in the use of the controller and brakes on these dummies, where they can learn the feeling of the handles, and how to use them without the danger of running down some one with a moving car.

There is also a skeleton car completely fitted up with trucks, brakes, motors, controllers, fenders, lights and with the wiring exposed and connected with power. On this car the men are given instruction in such matters as it is important that motormen should know. After they have spent two weeks in the school and on the road they are put through a very careful examination before being turned in.

In addition to this instruction a talk is invariably given to the men before they are turned in, by the general superintendent or one of his assistants, in the course of which they are told very plainly and forcibly that their connection with the company will depend entirely on their own efforts; that no question of any "pull" or political influence of any kind enters into their service and that their future depends entirely upon what sort of a record they make for themselves. Every endeavor is made to make each man feel that he has entered the employ of a concern which proposes to treat him fairly and to retain his services as long as possible.

4. After a man has been pronounced competent to handle a car and has been turned in for actual service, how long he will remain in this service depends very largely on what sort of treatment he receives from his immediate superiors. The work of a new man on any street railroad is hard and discouraging enough in the long waits about the depot to be assigned to a car, and in the long hours of duty, without the addition of tyranny and unjust treatment on the part of his superiors.

We use what is called the Brown system of discipline in a slightly modified form. A man is seldom suspended from duty without pay, and never until he has had a hearing. In some few cases where men by mistake have been suspended without a hearing and it was found that they were not at fault, they have been advised that the suspension was an error and their pay allowed them for the lost time. When a man is brought up on any charge he is allowed to make as full an explanation as he desires and if necessary, a further investigation is made, so that when a case is finally settled the man feels that he has had every opportunity to exonerate himself. We endeavor to make him feel that an entry of the offense on his record is a black mark which adds so much to the weight of that record, and that when his record becomes too bad, we can do nothing else than to dismiss him from the service and fill his place with some other man.

In many cases where it appears that starters, inspectors or other subordinate officials have treated any man unjustly, the matter has been immediately taken up and the official who was at fault had been given to understand that such action will not be tolerated. More trouble and discontent among the men can be caused by arbitrary action and unfairness on the part of starters and inspectors, particularly the former, than in almost any other way.

5. The feeling should exist among the men that length of service counts for something. The oldest man in the service of the company should invariably have his choice of the schedule runs. When there is a position to be filled as inspector, starter, in the office or in any line higher than that of conductor or motorman, the men on the cars should be eligible for promotion to the position ahead of any person not in the employ of the company, the promotion to be made from among the older men in the service.

With our company the length of services of uniformed men is marked by service stripes worn on the left coat sleeve. One blue stripe for each year up to five years, at the end of five years a gold stripe, discarding the four blue stripes, with an additional gold stripe for each succeeding five years. These service stripes are invariably taken into consideration when making promotions as above.

The significance of these stripes is quite generally understood by the public who use the cars, and in many instances it tends to save a dispute between a passenger and the employe, partly because the employe feels that a number of stripes lends added dignity to his position, which he must be careful to maintain, and partly because the passenger talking to an employe wearing a number of stripes recognizes the fact that they represent several years of service and that the wearer is not a new man.

A long and unusually interesting discussion followed the reading of this paper, a number of delegates taking part.

Mr. W. W. Cole, of Elmira, asked the author if the Brown system of credits and debits was employed in New York City. Mr. Rounds replied that his company employed a modification of the Brown system, but did not have an elaborate system of credit and debit points. The question was asked if the Metropolitan company had had any trouble in defending its rules for the government of its employes, in the courts, in accident cases, etc., to which Mr.

H. A. Robinson, of New York City, replied that it had not to any great extent. Its rules for the ejection of passengers had been called into question a few times, but the only point that had been raised then was the amount of force used. He added that juries usually decided that unnecessary force had been used. Mr. R. E. Danforth, of Buffalo, by request, here stated that in Buffalo a similar system for the treatment of employes was in use as was in force on the Metropolitan lines in New York. No classified records are kept, as in the Brown system, but a man's past general record and the seriousness of the offence are taken into consideration when punishment is necessary.

Mr. Danforth was asked what had been the experience of his company in the matter of giving outings and excursions to its employes. He said that a very elaborate outing had been given all the employes this year, including power station, car house and track men, and conductors and motormen. The company paid all expenses, furnished refreshments, etc., and the management is convinced the men fully appreciated it; it will continue the custom each year in the future. Mr. W. C. Ely, of Buffalo, spoke at length on the relations that should exist between employer and employes. He said the way to increase efficiency of employes is to know the people that work for you and to treat them as one man should treat another in the spirit of kindness and consideration. He referred to the relations between the men of the Metropolitan company, of New York, and Mr. Vreeland, and attributed the failure of the recent effort to induce these men to strike, to the fact that the employes knew Mr. Vreeland and as a body realized that he was their best friend.

Mr. Vreeland said that from observations in many different cities he had become convinced that most of the trouble with employes arose from the handling of the extra forces. He had often asked street railway managers why they had such large extra lists, and found it was necessary because so many of the regular men were out of service on account of suspension for trivial offences. Mr. Vreeland does not believe it necessary or good management to have such a condition of affairs. He said that in his early steam railroad experience, he had handled freight brakemen—a class of men that includes some of the toughest characters found in any line of work—and used simple principles of good will. He is positive men will respond to decent treatment. He reduces the extra forces on his system by reducing the number of suspensions. Whereas the men on his road a few years ago would lose $70,000 a year in salaries through suspensions, they now loose but a very small proportion of that amount. The extra men now earn as much as regular men did at that time. Mr. Vreeland, by request, gave a short account of the organization and efforts of the Benefit Association among his employes. This has been very successful, and is a very valuable adjunct to the operation of the road. The heads of the departments and other officials of the company attend its meetings and are in this way brought into closer contact with the men than would be possible in any other way. An important feature of this association is the extensive circulating library which was established not alone for the employes but also for the benefit of their families. This goes a long way toward strengthening the good feeling toward the company. A public meeting of the Benefit Association is held each year, the company providing the hall, a vaudeville entertainment, etc., at its own expense. This year Carnegie Hall, one of the largest auditoriums in New York, was engaged, and a half hour before the meeting was to begin the hall was packed to the doors, and over a thousand people had been turned away. The Metropolitan company gave all the men in its employ who remained loyal during the recent labor disturbance, three days' vacation with full pay.

Mr. T. S. Williams, of Brooklyn, said his company had endeavored to apply the same principles in dealing with its men as were used on the Metropolitan road and thought the fact that nine-tenth of its old men remained loyal through the last strikes was evidence that the disposition, at least, of the company was appreciated. In his opinion the occupation of motorman and conductor is a higher one than formerly, and more intelligent men should be invited and encouraged to take these positions. One way to accomplish this is to promise long tenure of office if the man is faithful. Mr. T. J. Nicholl, of Rochester, expressed grave doubts as to the value of getting the men together in outings, excursions, etc., thinking that the opportunity thus offered would be utilized to talk over the affairs of the company in an undesirable way, magnify grievances, form unions, etc.; he wanted information on the subject, however. Mr. C. L. Allen, of Syracuse, disagreed from Mr Nicholl and thought men joined labor unions principally for the sick and benefit funds. In his city, therefore, the company had itself formed an organization among its men, with these two latter features. This society has been very successful, paying all of its claims and having several hundred dollars in its treasury It has a club room with all appointments. Mr. Allen considered the discussion that occurred on the street corners as injurious, and not those that occurred in the club room Mr. Nicholl explained that he has no question in his mind as to the value of benefit associations, but does not think it is good to assemble the men together and let them get too intimately acquainted with each other. He wanted the opinions of the delegates from some of the smaller roads. Mr H. S. Cooper, of Schenectady, thought it was better to have the discussions occur where they could be governed Mr Ely said he also represented a small road, the Buffalo & Niagara Falls Electric Railroad Co., and on which the most cordial relations between the men and the management existed, due, he thought, to the fact that the officers of the company became personally known to the men through an organization somewhat similar to the one in New York. He recognizes that the trend of the times is toward organization, and is afraid if he had no organization of his own among his men, some outsider would form one. He raised a laugh by declaring that he believed unions, organizations and trusts are good things—if you are in them. Mr. Vreeland said: "Get your men where you can talk to them." He declared his system is so run that if necessary he could meet and talk with every man on the road at the association's hall, upon just a few hours' notice.

Mr. Edward E. Higgins, of the Street Railway Journal, was accorded the privilege of the floor, and stated that an important consideration in the strengthening of the relations between employer and employe was the treatment of the sick. In his opinion, if the superintendent or general manager would arrange to have serious cases of sickness and trouble brought to his attention, and would then call upon or send a note of condolence or messenger to the troubled household, it would greatly tend to improve the standing of the company with the employes. Mr. Vreeland stated that his Employes' Association acted as a means of communication between himself and his men, and enabled him to hear (through the officers of that association) of particularly sad cases of death, sickness, financial troubles, etc., and he could then set the proper machinery in motion to relieve the conditions, and again and again has his company paid the bills of old and faithful employes where misfortunes had overtaken them.

Mr. Cooper remarked that he gives one week's vacation with full pay each year, to men who have been in his service for twelve months or over and have clean records.

Mr. Cole, of Elmira, asked if anyone present had adopted the Brown system for keeping records of employes. No one had.

ELECTRIC WELDING.

BY R. F. DANFORTH, SUPERINTENDENT INTERNATIONAL TRACTION CO., BUFFALO.

Since the first carriage started on its trip on an iron-clad roadway, the problem of maintaining joints has been an unsettled one. Within a decade we have made steady progress in the improvement of our roadway construction, having gone from a strap to a Richards rail, from the Richards to a 4-in. girder, then to 6-in., and now to a 9-in. girder with its concrete base. Devices innumerable have been exploited to preserve the continuity of the roadway. Wedged joints and bolted joints have been found to be uncertain and miles and miles of rail have been "scrapped" because the ends have become badly battered and the rail surface bent from lack of proper support at the joints.

The question has resolved itself into one of obtaining a practical method of securing a continuous rail by welding the lengths of rail together. Two well known methods have been followed, and it is the writer's desire to present one of these to you.

The Thompson Welding Co. has for years successfully welded together pieces of iron and steel by use of electricity. The Johnson Co. has taken up this process with a view of welding its girder rail into continuous lengths, in the street. Its first method of welding the abutting ends of rail by bringing the joint to a welding

heat by the flow of an enormous current has been found to be a failure, because the homogeneity of the metal was destroyed. In the process of welding now being used in Buffalo, it has been the endeavor to follow as closely as possible the method employed in ordinary welding. After the metal is brought to a welding heat it is worked by being put under a pressure of about 35 tons, which has the same effect upon the material as the repeated blows of the blacksmith's hammer.

Under the former process of electric welding track joints the ends of the rails together, the entire cross section of the rail has to be brought to a welding heat. In the process now in use the ball of the rail seldom reaches more than a dull red. It is believed that the quality of the steel in the rail head is not injured by this low temperature.

In the true sense of the word, the abutting rails are not welded together, but the splice bars are welded to the web of the rail. These bars are of steel of the same quality as the rail, and measure 1 x 3 x 17 in.

The weld is made at three points, the center and ends of the bars. After the center weld is made, the ends of the bars are welded. Each bar has in the center a strip of steel pressed over the face 1¼ in. wide and ⅛ in. thick. The ends of the bar are drop forged, making a pear shaped projection on the side, having an area of about 3½ sq. in. and projecting ⅛ in. above the surface of the bar.

In order to obtain contact for the welder at the point opposite these end projections, a sheet of iron of the same shape as the projection is pressed into the depression on the back, which was made by forging the lug on the opposite side.

The process of making a weld on old rails is in general as follows. The pavement is removed for a space of 20 in. on either side of the rail and about 40 in. along the rail and the material removed to the ties. The splice bars are taken off, and, if the bolt holes in the rail were punched, the holes are reamed out about 1¼ in. or more to remove any check which may have resulted from punching the metal. The joint is then slightly crowned by driving a wedge between the rail and the tie. The three points to be welded are then cleaned by a sand blast. The bars are placed in position, resting on small wood blocks, and the contact points of the welder placed at the center of the bars. By means of a hydraulic device, the jaws are brought together with about 14 tons pressure, the rail web is heated because of the resistence of the metal itself and the current turned on and kept up one minute until the points of contact are brought nearly to a white heat; the pressure is then reduced to about 3½ tons, and at the end of another minute or less, the metal comes to a welding heat. The current is then shut off and the pressure increased to about 15 tons and kept on for one minute, or until the metal "sets." The end contacts are then welded in a manner similar to the method followed in the center contacts, with the exception that the pressure, when the current is shut off, is raised to 35 tons and is kept on for two minutes. Under this pressure the bar is brought in its entire length in close contact with the web of the rail and the upset metal in the boss or projection disappears. After the weld is made the head of the rail is ground to a true surface by an emery grinder and is then complete.

The machines used in this process may be described as follows: The current from the line is passed through a railway booster, which raises the pressure to 500 volts. (This booster is not used where the initial voltage can be maintained at 500 or over). This direct current at 500 volts is then used to drive a rotary transformer generating alternating current at 300 volts. This in turn is reduced to five volts in a static transformer; the secondary circuit consists of a single loop of copper and its ends form the contact points which are brought to bear against the bars.

It is found that at 500 volts the current required is about 250 amperes. The current flowing through the weld at five volts is about 30,000 amperes alternating. With this current flowing through the low pressure secondary circuit, it is found necessary to cool the contacts by circulating water around them.

An ingenious cooling device is used to reduce the temperature of the water so used. A tank is provided upon the top of the welding car, containing coils of pipe through which the water flows. These coils lie close together and the tank is filled with water. The air is forced through the water from a coil lying in the bottom of the tank through perforations in the coil. The evaporation from this cooling tank is found to be 47 gallons in 12 hours.

The welder proper is in the form of a rectangle, the lower portion of which is hinged so that the parts may be moved back and forth in the plane of the rectangle. On the upper portion there is a transformer coil, the primary of which consists of many turns of wire, the secondary being the rectangle above mentioned. This is a solid bar of copper 4½ x 7½ in. in cross section. The hinges in the two sides are spherical contacts. Around the outside of this rectangle is a steel frame of horse shoe form, having at the upper end a modified hydraulic jack. The movement of the piston in the cylinder back and forth moves the lower jaws of the contact points. A varying pressure can be placed on the material grasped between the jaws. The pressure is measured by a pressure gage, placed in a convenient position. The joints in the secondary circuit, the contact points and the transformer itself are cooled by a flow of water.

The sand blast is obtained by blowing sand, by means of compressed air, through a flexible hose. The air is compressed by a motor driven compressor.

The emery grinder previously referred to consists of an ingeniously designed carriage, supporting in its center the emery wheel, and running on two rollers, which are moved back and forth on the surface of the rail to be ground. Its action is similar to a carpenter's jack plane. The depth of cut made by the emery wheel is governed by means of a regulating screw, which raises and lowers the emery wheel. The wheel is driven by a belt from a collar motor mounted on the car.

Welds can be made as described at the rate of a joint every 13 minutes. It is found that the machine will average four joints an hour without any difficulty. In Buffalo the line voltage has averaged 410 and the current required about 375 amperes.

You probably ask why we decided to use the welded joint. The reply is that we find that the welded joint not only solves the problem of maintaining a continuous rail, but also of the best return circuit. The carrying capacity of the bars as welded is greater than that of the rail itself; there is no opportunity for electrolytic action between two dissimilar metals; there are no expanded contacts to work loose and no added investment for copper.

Another question frequently asked is "What do you do about expansion and contraction of your rail?" This is solved in two ways. First, by placing an expansion joint every 2,000 ft.; second, by leaving the bolted joints at the special work.

The reason for doing the latter is found in the method of construction used in Buffalo. When the rail is laid in concrete it is firmly gripped its entire length by this mass of material. The weak points in the rail or in its concrete base are bound to be developed. If there is any tendency for the rail to contract, the movement will be greatest where the pressure upon the rail is least. The rail is liable to break under the great tension at this point. The chances are very small for this movement being near enough an expansion joint to have that joint save the rail. If the rail breaks, a regular expansion joint can be easily placed at the break. In following years the expansion and contraction of the rail will be taken up at that point. In order to thoroughly test this question, track has been laid in Buffalo, both with and without expansion joints. The coming winter will solve the problem.

The effect upon a piece of old track, of welding the joints, is most satisfactory. In one instance we welded 6,000 ft. of 6-in. girder rail, which had been in use since 1891, and whose surface was so badly bent and battered that it was thought to be well nigh useless. The rail had been originally laid on chairs with special two tie joints. We removed the chairs and relaid the track in its proper position, but with low joints. After the pavement was in place (except at the joints) we brought the rail ends up by shims. After the welds were made and the shims removed, the track was found to be in fine condition. After this experience, we welded our track first and resurfaced and relined it afterwards.

The cooling of the weld depresses the joints about ⅛ in. We, therefore, raise the joints to allow for this depression. The old rail in question is considerably worn under the head as well as upon the ball of the rail, and it would therefore be difficult to fit loose splice bars or other mechanical joints so as to obtain a tight fit. The welded bars maintain the joint in its position and make that portion of the rail stronger than any other part.

The cost of welded joints is not materially more than that of the bolted joint with ample bonding. The same result may be obtained with cast-welded joint mechanically, but it is doubtful

whether the cast-welded joint gives as good electric contact as the method described.

At the end of another year the Buffalo Railway Co will be able to present interesting data upon the saving in coal resulting from a perfect return circuit. The work of this year has been largely done with the intent to furnish an ample return circuit to the power stations. As the work progresses, a marked saving is shown in the economy of the station.

The convention adjourned for lunch and the discussion of Mr. Danforth's paper was taken up in the afternoon, the meeting being called to order at 3:15.

Mr. M. G. Starrett, of New York City, asked the author what experience he had had in Buffalo with effect of change in temperature on the electric welds, also did the raising of the temperature of the steel in the ends of the rails in the welding process have any effect on the structure of the steel. Mr. Danforth replied that as far as his experience went, out of 3,100 welds, 17 had broken, and these failures were due to defects in manufacture. In the work they are now doing in Buffalo they do not expect 1 per cent of the joints to break during the coming winter, and they have the makers guarantee to that effect. So far two joints have broken in Buffalo. The heating of the rail in welding has no noticeable effect on the steel. Mr. W. B. Reed, of New York City, asked if the joint is found to be as rigid as the rail itself. Mr. Danforth answered that after repeated testing with falling weights at various heights they had been unable to break a single joint at the joint.

The president called on Mr. Nicholl for his experience with electric welding. He replied that his company had done no work of this kind, but was considering the advisability of electrically welding its joints.

Mr. Alfred Green, of Rochester, was to have read a paper at this point on track bonding, but sent word that he had been unable to prepare this paper. President Rogers, however, called for a discussion on the subject of bonding. Mr. Nicholl, of Rochester, described the methods of bonding in his city. Within the corporation limits the usual supplementary No. 0000 buried wire is employed, but in the suburbs this cannot be used, as the track is T-rail construction without paving and considerable trouble has been experienced from copper wire thieves. Outside the city limits a No. 0000 coper wire bond is used.

Mr. H. S. Newton, of Syracuse, uses in his city a long solid bond soldered to the rail. This is giving fair satisfaction, no trouble having been experienced from the bonds working loose when properly joined to the rail. This company has also had considerable trouble with wire thieves in the suburbs. All the outlying lines in Syracuse are now equipped with the Newton bond under the fish plates, but Mr Newton is of the opinion that welded joints are the real solution to the joint problem except in interurban work, where the rail is exposed.

Mr. Danforth described various methods of bonding employed in Buffalo.

The next paper was

THE PAVING QUESTION.

BY T. J. NICHOLL, VICE-PRESIDENT AND GENERAL MANAGER ROCHESTER RAILWAY CO.

At a meeting of street railway men it would seem to be unnecessary to discuss the question of street paving, from the fact that we have all had unpleasant and unprofitable experience in this line, and further, there is very little left unsaid as to the injustice of compelling electric street railway companies to pave a very large share of the streets of our cities. Be this as it may, however, if we do not keep on reiterating the question in our conventions, the probability is that the old rule "What is everybody's business is nobody's business" will be applicable in our case, the important question would in time be forgotten, and all of us continue to accept the burden with grinning teeth.

It is scarcely the province of this paper, and, in the short time allotted it is hardly possible to consider the different kinds of pavement used,—in fact, it will be better to leave that interesting subject for the engineering departments, but I will say in passing that it is exceedingly important, and a question that, perhaps, many of us do not go into as deeply as we should. It is not at all clear in my mind that city engineers or city councils should have it in their power to determine what kind of pavement should be used between the rails, without being compelled to consult the interests of street railway companies, if they are to bear the expense. The life of our tracks and the interruption and inconvenience that we are to suffer, largely depends upon the kind of pavement that is used between the rails. We all know that a smooth pavement between the rails and a poor pavement outside of the same, will place the traffic really where it does not belong, but I must not dwell upon this interesting part of the subject, although I should like to, very much.

Street improvements, which generally mean new sewers, new pavements, electric conduits, new gas and water pipes, etc., are at present projected and carried through on a much larger scale than ever before in the history of this country, by reason of its prosperous condition. A single season suffices, in a small city like Rochester, to run the expense up into the hundreds of thousands of dollars. Inasmuch as the street car tracks are generally located in the main streets, it is not at all surprising that these streets are the first to receive attention, where, as a rule, there is a double track, which, with 2 ft. outside of the outside rails, covers fully one half of the average street. Now the railway company is called upon to pay fully one half the expense, although it does not in reality use more than the space occupied by the four rails, say 20 to 24 in. in width. This is not all. The rails that have for many years done good service, and might for many more if the street remained unimproved, are not good enough to be relaid in the new pavement; hence they must be removed, as also the ties and sub structure generally. Again this is not all, for does not the street remain impassable for many months? and while it may be argued that some of the traffic will be diverted to other lines, at the same time we all know that but a small portion of it is saved in this way. The great bulk of the traffic is lost forever, and not only is it lost, but during the time the street is torn up the people are educated to walk, use bicycles or other conveyances, so that in the long run the cost to the street railway is probably more than the paving of the entire street.

The electric railway, to my mind, is doing more at the present day to civilize the country and put down crime, than any other institution in the land. It is the great power that scatters or separates people, and makes it possible to extend the areas of our cities, far ahead of the actual necessity of the time giving the people plenty of room to breathe the purest air, and at the same time do business conveniently in the heart of the city; but this is only partially appreciated, without reciprocity.

We find, for instance, that a short time ago a street was opened. The railway company was induced, by much persuasive talk and highly polished prospects, to lay its track therein, and establish a line of travel. Many people build and locate in this vicinity. The value of the land is advanced far beyond its former price, and in a very short time the farm becomes a part of the populated city. A little later the people living in this locality become dissatisfied with an ordinary dirt road, and like all true Americans are progressive in their ideas. They must have a paved street, electric lights, water works, etc., for which I do not blame them, but I do believe that such improvements as they desire in the pay of paving should be made without expense to the street railway company, which is in no wise benefited thereby; in fact, the contrary is the case as I have before intimated, as with a dirt road the tracks could more easily and quickly be repaired, and there is a great inducement for people to use the "poor man's carriage."

Notwithstanding, however, our rights or desires in the premises, an ordinance is passed, the street is improved, and we are asked to pay one-half the bill. "Might makes it right," and we cannot help ourselves, and the dear people (whose bank account we have enlarged by building the road into a locality that did not pay us operating expenses for several years), look on with great satisfaction, and try to feel that they have done a great work, and that the people composing the railway corporation should atone for the sin they have committed in banding themselves together for the welfare of humanity.

I sometimes think that the people who ride in street cars, who believe in oppressing the street railway corporations, and who, in fact, instruct their legislative representatives to see that laws are passed to compel more frequent service, double track, better cars, a seat for every passenger and cheaper rates, etc., never stop

to think that they are going the wrong way to work, and that one dollar will buy only just so much whiskey; in other words, if railway companies were exempt from taxation of all kinds, they could give much better service at a lower rate, in which the whole population would share, instead of the few whose taxes are made lighter by reason of the imposition of a large portion of them on the railway.

In the days of the horse car, the horses of the railway company used the street between its rails, as any other vehicle used other parts of the street, and the pavement between the rails was kept in repair by them. There was some little justice in this, but when horses were supplanted by electricity, and the motor car began its career, the question presented a very different aspect, as the electric car does not in any way use or injure the pavement between the rails; on the contrary, it provides a pair of smooth rails for the use of others, and all the wear and damage to the pavement on that portion of the street becomes properly chargeable to wagons and drays, which constantly use the same. The public however, have been educated in the horse car school, and still cling to the old idea. Perhaps this may be considered good "horse sense," but can hardly be called "up-to-date."

I have said there is a little justice in requiring the railway company to keep the pavement in repair, but why is not every other vehicle required to do the same, which provide no rail; especially, for instance, regular lines of busses and carettes, such as may be seen in New York and Chicago, which constantly travel one route, and, as is the case in Chicago, the route is immediately along the railway tracks, and the gage of the carette being wider than the railway, has resulted in a deep grove being cut about 1 ft. outside of the rails. For this the carette pays nothing, but the railway company, I believe, is compelled to bear the expense. Why should this be? The whole system is wrong and sinful, and the shareholders of the street railways should rise in their might, which is their prerogative as American citizens, and endeavor to get justice. Only justice, nothing more; otherwise we had better go out of the business, or sell our tracks to the people, which I am not quite sure is not the proper thing to do in any case. Then they could make improvements as they pleased and when they pleased, and pay the expense of the same. In such an event, I would, of course, be in favor of leasing the right to use these tracks upon much the same principle as a person or corporation leases the right to run a line of busses or carettes.

I was very much interested in President Boyle's admirable paper published in the Utica Herald of March 23, 1899, (St. Ry. Rev. Apr., 1899, p. 266.), in which he says:

"The fact that a railroad is built, and cannot be picked up and carried out of the city if unjustly treated and taxed, renders it a peculiarly safe object of attack. The people know that even while they are endeavoring to slaughter the corporation, they will miss none of the conveniences and benefits of its service. A railroad cannot afford to retaliate by lowering the excellence of its accommodations. There is everything to gain and nothing to lose. The position taken by a portion of the public is not the loftiest one in the world, but it is exceedingly human." And I quite agree with him, except as to "lowering the excellence of the accommodation." As I have said before, "one dollar will buy just so much whiskey;" if you spend it on taxes and pavements for the benefit of the public and against your own interests, you certainly cannot prevent the "lowering of the excellence of the accommodation," unless the franchise is so valuable that you can well afford it, which I take it is much more the exception than the rule.

Again Mr. Boyle says: "The attitude of the press toward the street railways is perhaps excusable (if sometimes a little aggravating). It is a question of existence with them. As the railroads object to a law which means bankruptcy for them, so a newspaper should not be expected to adopt a policy which means bankruptcy for it, and the newspaper which boldly and openly championed the cause of the railroads would be doomed from the initial letter of its first editorials."

Knowing full well that such is the case, and desiring to reach the public independently, the railway company in Rochester has for some months published a small weekly paper, which is circulated in the cars, in which the public is given an opportunity to see things from the railway's point of view. This has no particular bearing on the pavement question, but I mention it as an idea which is well worth developing in some of our cities, as it tends to educate the public to see that there are two sides to all questions (even when a street railway company is one of the parties). That it has done much in Rochester to open the eyes of passengers as to the trials to which the railway company and its employes are subjected, is already apparent, and the policy of treating everything in a fair and open manner, and ridiculing, rather than "kicking" against some of the common abuses, has had a wholesome effect.

In conclusion, I will quote again from Mr. Boyle's paper—his last remarks, which make a most fitting close to his able argument. Speaking of the state of public feeling towards the railway company, he says: "There is only one law which does justify it, and it is the law under which the highwayman says to the traveler: 'I am a larger man than you are. I am armed and you are not. You are here and can't get away. You have money and I want it. Give it up.'"

If the courts will sustain such gross injustice, there is no doubt but the railways will have to "give it up."

Mr. M. M. Fenner, of Fredonia, opened the discussion by asking for some facts regarding what is know as the Conway paving decision in the Court of Appeals of New York. He wanted to know what the clause in this decision, requiring street railway companies to pave and keep in repair for 2 ft. outside of the tracks, really meant. Considerable difference of opinion existed among the delegates on this point, Mr. Nicholl, of Rochester, believing that it meant a strip 2 ft. wide outside of the outside rail, but Mr. DeForest Van Vleet, of Ithaca, was of the opinion that 2 ft. outside of the rails meant 1 ft. on each side.

Mr. Robinson, of New York, also gave his opinion on the Conway decision.

Mr. T. F. Williams, of Brooklyn, thought that the cost of paving is a franchise tax, and under the new Ford bill companies should not be required to pay it, if double taxing on the franchise value was to be avoided.

Mr. Nicholl, of Rochester, asked for the experience of the delegates on a city's power to compel the street railway companies to repave streets where the paving had settled, owing to poor foundation which had been constructed by irresponsible city contractors after sewers had been laid.

Mr. W. B. Reed, of New York City, stated that it was the practice of the Metropolitan company when notified that the city was going to repair sewer or gas pipes underneath its tracks, to lay side tracks around the excavations. His company had always maintained pavements over sewer and gas pipes even though the work had been poorly done in the first place by the city contractors. This he said was done principally to avoid the expense of litigation on the subject rather than from a feeling of compulsion in the matter.

This ended the regular list of papers for the day, but the Chair called for a discussion on the subject, "Transfers: Their Use and Abuse," and asked Mr. J. H. Steadman, of Rochester, to make a few remarks. Mr. Steadman said he had presented papers on this topic at various conventions and had nothing further to say upon the subject.

Mr. Nicholl, of Rochester, requested information from the Metropolitan company of New York City as to the benefits derived from printing the section of the penal code referring to the abuse of transfers on the back of each ticket. Mr. Robinson, of New York, replied that in his opinion the public read this code to a large extent, and it had a good effect in an educational line. His company had experienced considerable difficulty in making cases against people accused of misusing transfers and had never succeeded in securing a conviction. His company has had the section of the penal code printed on large cards and hung on the rear and front platforms of each car.

Mr. Danforth, of Buffalo, by request of the president, gave the experience of his company with transfers. It has had but two cases of serious abuse of transfers and in these was unable to get sufficient testimony to punish the offenders. Mr. Warren, of New York, in reply to a question, stated that there were 58 different transfer points on the Metropolitan company's system. This company has had considerable trouble in its transfer points. Passengers will board a car a block away from a transfer station, and before the conductor has had an opportunity to collect the fares, will jump from the car and secure a transfer.

The fact was here brought out that there were but three cities in the state that register their transfers, namely Rochester, Buffalo and Syracuse. Mr. Warren considers it a mistake to give a transfer any cash value whatever. Mr. Williams, of Brooklyn, called transfers the nightmare of the street railway manager. His company employs over 40 girls that do nothing but sort and classify used transfers of which 50,000 are returned each day. The company is aware of the fact that it is being defrauded continually both by conductors and the public, through its transfer system, but knows of no way to check the abuse. Mr. Williams thinks that a small additional charge should be made whenever a transfer is given. He also believes that the extensive transfer system on his road tends to greatly increase the number of accidents, owing to the necessity of passengers changing from one car to another at so many different points. Mr. Newton, of Syracuse, wanted to learn from the companies that do not ring up transfers how they keep a check on conductors. Mr. Root and Mr. Warren, of New York, explained the workings of their system quite fully. Mr. Allen, of Syracuse, stated that his road had had considerable trouble with suits brought for improperly punched and dated transfers, which had been refused by conductors.

Mr. Root stated that 425,000 transfers are issued each day by the Metropolitan company of New York. The transfer system, however, has increased traffic enormously and the benefits derived far outbalance the losses from fraud. Mr. Vreeland considered the question purely a local one to be decided by local conditions. He said, in New York one of the rides taken by a transfer passenger was short; either the rider first traveled on one of the long main lines and then transferred to one of the shore cross-town line or vice versa. In Philadelphia, however, both rides were often very long, averaging more than five miles apiece. This is the reason the 3-cent additional fare is charged in the latter city. It is Mr. Vreeland's opinion that the increase in gross receipts per mile of track on the Metropolitan system from $30,000 to over $70,000, is due very largely to the liberal transfer arrangements instituted. After further discussion on this subject, in which Mr. Stedman, Mr. Warren and Mr. Williams joined, President Rogers announced a question meeting, and stated the convention would be pleased to entertain any question on any subject of interest. This opportunity was taken advantage of by several of the delegates. A motion was then made to appoint the nominating committee to name officers for the ensuing year. President Rogers appointed on this committee Mr. DeForest Van Vleet, of Ithaca, Mr. T. S. Williams, of Brooklyn, and Mr. C. Loomis Allen, of Syracuse.

President Rogers then requested Commissioner A. W. Cole to address the convention. Mr. Cole spoke at some length, reviewing the recent work of the New York Commission in testing street railway brakes in New York City and touching upon the relations existing between the railroad commission and the street railway companies of the state. An extended discussion upon brakes followed Mr. Cole's address. The brake invented by Mr. Millen, of New York, was mentioned and described.

The meeting adjourned at 5.20 p. m.

Early in the evening of the 12th the delegates and visitors to the convention were taken in special cars to Renwick Park as the guests of the Ithaca Street Railway Co. Here an elaborate concert by the Ithaca Prize Band was enjoyed.

At 10 p. m. the annual banquet of the association was held at the New Ithaca Hotel.

At 9.30 a. m., on Wednesday, the visitors were taken in special cars over the lines of the Ithaca Street Railway Co. to Cornell Heights. Several stops were made along the way to enjoy the scenery and view the University buildings. At 10.40 a. m. the convention was called to order in Sibley College lecture room with President Rogers in the chair. The first paper was

RAILWAY POWER DISTRIBUTION OVER LARGE AREAS.

BY A. H. ARMSTRONG, OF THE GENERAL ELECTRIC CO.

The formation of the International Traction Co. brought under one management the various roads operating in Buffalo and vicinity. Previous to this consolidation, each of the several roads had its own source of power and the question of the most economical method of operating the entire system was of the greatest importance

The Buffalo Railway has installed in its Niagara Street power house, two rotary converters of the General Electric type in the fall of 1896, power being supplied by the Niagara Falls Power Co. Two additional converters had been added a year later, making a total nominal capacity of 1,600-kw. installed. This converter capacity, together with an engine capacity of 7,500 h. p., supplemented by a storage battery of 1,500 ampere capacity, had operated the lines of the Buffalo Railway Co.

To operate the enlarged system there were three courses open: increasing the capacity of the Niagara St. power house, building a new power house on the other side of the city to work in conjunction with the Niagara St. station, or the adoption of rotary converter sub-stations fed from Niagara Falls. The cars running to Niagara Falls and to Lockport were already partly fed from rotary converter sub-stations and the enlargement of the Niagara St. power house would not contemplate the shutting down of these sub-stations. The operation of all the lines in Buffalo by a single power house was open to the serious objection that either a considerable increase in feeder copper would be necessary or boosters must be used. The amount of feeder copper installed provided for a number of feeding points into the system, and would have to be largely increased if the entire system were fed from a single point, as would be the case with one large power house. Heavier cars, equipped with electric heaters and operating at a much faster schedule are being installed, which would still further increase the amount of feeder copper required to the extent that a single generating station was not looked upon as desirable.

The use of boosters as a permanent means of replacing feeder copper in a system where heavy overloads may be of long duration, is very objectionable, owing to the losses entailed. Overloads of short duration, and especially local overloads due to some special local event can very well be taken care of by boosters, but the cost of the energy lost in boosting daily overloads may be sufficient, as in the present case, to more than offset the interest on additional copper investment required.

The second method of operation, the building of another power house on the east side, was also open to serious objections. The capital investment called for in this case would have been still larger than that required for the additional copper with a single generating station, while the cost of operating two separate stations would have been greater than that of operating a single station of the combined capacity of the two. The required feeder copper also, while less than that for a single station, would be considerably greater than in the third method of operation, by rotary converter sub-stations. The successful operation of a railway system and especially one with suburban branches, calls for as high a schedule speed as can be maintained with safety.

It is, therefore, of paramount importance that the line voltage shall be kept up, as it not only ensures a good schedule being made, but results in less heating of the motors themselves. The rotary converter sub-station system permits sub-stations to be located wherever there is the greatest demand for power, as the comparatively small transmission line required can be carried underground to any locality, while the sub-station itself, requiring no boilers or engines can be located in any neighborhood on account of its cleanliness and noiseless operation. The sub-station also requires a very small amount of floor space for its output as compared with a steam driven generating station, and hence can be located in the business districts where property is high, which, together with the cost of carting coal, would make a generating station in such a locality expensive to operate, especially as it must probably run non-condensing. The largest congestion of cars, and hence the largest demand for power, exists in the business districts, and it is owing to the possibility of locating sub-stations close to the points of greatest demand that makes the converter system especially adapted to the operation of large city railway systems.

As sub-stations can be located where most needed, it is obvious that the amount of direct current feeder copper required for such a system is much less than would be required for the same effective operation with a single direct current generating station, while the high potential transmission line at 10,000 volts would demand but a small amount of copper.

The number of attendants in a sub-station need not exceed two men for a station having a capacity of say—three 400-kw. convert-

ers, so that the labor account would be much less than in the case of a number of small generating stations.

The above advantages apply to the converter system whether the sub stations are driven from a large steam driven generating station, located in the outskirts of the city, and enjoying cheap coal and cheap real estate, or as in the Buffalo sub-stations, they are fed from a water power station.

After careful consideration of the several methods of operation open to them, Mr. W. Caryl Ely, president of the International Traction Co., and Mr. B. Van Horn, general manager, decided upon the adoption of the rotary converter sub-station system as offering the greatest advantages in its economy of operation and first cost of installation.

The method of operating the Buffalo city system, as adopted, involves the installation of five rotary converter sub-stations, besides the operation of the four converters and storage battery in the Niagara St. power house.

The steam plant at Niagara St., however, will be shut down and kept as a reserve, thus permitting the entire lines of the International Traction Co. in Buffalo, Niagara Falls, Tonawanda, and Lockport, to be driven from rotary converters fed by the Niagara Falls power.

There will be a total of six sub-stations, including Niagara St. No. 6, having the following maximum output during the winter months, where heaters will be used:

	Max. Output.	Converter Installed.	Ultimate Capacity.
Sub-station No. 1	760 kw.	800 kw.	1,200 kw.
Sub-station No. 2	870 kw.	800 kw.	1,200 kw.
Sub-station No. 3	1,230 kw.	1,200 kw.	1,600 kw.
Sub-station No. 4	870 kw.	800 kw.	1,200 kw.
Sub-station No. 5	890 kw.	800 kw.	1,200 kw.
Sub-station No. 6	1,600 kw.	1,600 kw.	1,600 kw.
Total	6,220 kw.	6,000 kw.	8,000 kw.

The peak of the load is somewhat in excess of the rated capacity of the converters to be installed, but the storage battery in the Niagara St. station has been increased to 3,000 amperes capacity, and this will be used to take the peak of the load, the ultimate capacity of the station providing for reserve apparatus and increase of traffic.

These six sub-stations will feed into a common feeder network through automatic circuit breakers, the load being taken on the larger stations during light traffic at night. The composition of the various sub-stations will be similar in all respects, with the exception of sub-station No. 6, which is located in the present Niagara St. power house. The other stations differ only in the number of rotary converters of 400-kw. capacity contained in each, the entire apparatus being furnished by the General Electric Co.

Sub-station No. 1 contains two rotary converters of 400-kw. capacity, with an ultimate capacity of three converters, each converter being fed through three step-down transformers of 150-kw. each, reducing the line potential of 10,500 volts to 375 volts, corresponding to 600 volts on the direct current side of the converters. These transformers are of the air blast type and feed directly into the rotary converters, the controlling switches being placed in the primary circuit.

The converters, being of the three phase-type, enable the step-down transformers to be connected in delta, so that the disabling of one transformer of a set does not throw the converter out of service. In addition to the individual switch controlling each rotary converter with its transformers, there is a main emergency switch opening the high potential bus bar circuit of the sub-station in case of necessity, where it is desired to throw out the entire station at once.

Artificial reactance is introduced between transformers and converters to enable the converters to regulate with varying loads, this reactance also being cooled by artificial air draught, for which purpose direct current blower sets are provided in duplicate and feed into a common air chamber, from which individual transformers and reactances draw their supply.

In a large railway system of this character it is desirable to provide a ready means of starting the converters that will be effective and require a minimum time. While any one sub-station is in operation it is, of course, possible to start the converters of a second sub-station from the direct current side and suitable starting resistances are provided for this purpose. This can only be satisfactorily accomplished, however, when traffic is very light, and the line voltage high.

A possible shut down may occur during a time of maximum load when it would not be desirable to start several sub-stations from the alternating current end of the converters, owing to the large lagging current affecting the regulation of the system. To provide an efficient method of starting, there has been installed in two sub-stations a starting set, consisting of an induction motor direct coupled to a direct current generator of sufficient capacity to start one converter.

This method permits the starting of the converters in these stations from the direct current end, which will ensure bringing them into synchronism in a minimum time with the right polarity. The converters in adjacent sub-stations can then be started from the direct current feeder system.

By sub-dividing the city into several sections, each fed from a separate sub-station, the present amount of direct current feeder copper need not be increased to any considerable amount, especially as the track joints are being welded, thus making the ground circuit exceedingly good. With the completion of the different sub-stations, the International Traction Co. will have in operation a model railway system, having sub-stations fed from a single generating station as a source of power, cars using electric brakes operating over tracks with welded joints and high speed suburban lines to the several adjacent towns.

A brief discussion followed this paper, Mr. Newton, of Syracuse, Mr. Ely, of Buffalo, Mr. Nicholl, of Rochester, and Mr. Armstrong taking part.

A paper was to have been read by Prof. R. C. Carpenter, of Cornell University, but this was dispensed with, owing to the unavoidable absence of the author.

SOME ELECTRIC STREET RAILWAY DATA.

BY HARRIS J. RYAN, PROFESSOR OF ELECTRICAL ENGINEERING, CORNELL UNIVERSITY.

During the spring of 1899 copies of a question form for gathering statistical data relating to the construction and operation of electric street railway plants were sent to the managements of some of the plants in our country with the request that they be filled in with the requisite data and returned to the writer. In this request it was stated that average results of the replies would be published. Replies were received from 12 plants that were fairly complete. The data from eight of these plants have been averaged as far as possible. The results form the composite answers to the questions in the form as given below, which was originally sent to the management of each plant.

Whenever percentages appear in an answer they mean that the answer applies to plants aggregating in capacity those percentages of the total average daily kilowatt output for the eight plants.

BUILDINGS.

Size of complete power house, 319 ft. x 574 ft.; 183,500 sq. ft. Engine and dynamo room, 240 ft. x 440 ft.; 105,000 sq. ft. Boiler room, etc., 188 ft. x 440 ft.; 82,900 sq. ft.

Constructive materials:

Foundations: 37.0 per cent masonry; 23.2 per cent concrete; 29.2 per cent concrete and stone masonry; 6 per cent brick in cement; 4.6 per cent not reported.

Walls: 76.8 per cent brick; 12.2 per cent pressed brick front; enameled and pressed brick in engine room; 11.0 per cent steel structure filled with brick.

Roof: 12.2 per cent tile with tar and felt; 11 per cent matched pine on steel structure; 20.5 per cent composition tar roof; 6 per cent wood asphalted; 4.6 per cent wood; 10.5 per cent slate, steel trusses; 16.5 per cent slate over engine room, corrugated iron over boiler room; 18.7 per cent slate on pine sheathing supported on steel trusses and purlins.

Floor: 18.7 per cent vitrified tile laid on concrete arches and supported on steel I-beams; 16.5 per cent concrete; 10.5 per cent wood in engine room, cement in boiler rooms; 23.2 per cent mill construction, hard wood finish; 24.5 per cent wood; 6 per cent wood covered with steel plate.

Car barns: 76.8 per cent, 444,645 sq. ft.; 21 per cent, no report.

Repair shops: 78.9 per cent, 83,722 sq. ft.; 21.1 per cent, no report.

Cost of power house, building only, no reports.

POWER HOUSE EQUIPMENT, MECHANICAL.

Engines:

Total number of engines, 46.

Types of engines: One (125 h. p.) high speed; four (2,100 h. p.) Porter & Allen; sixteen (12,200 h. p.) American Wheelock; one (1,200 h. p.) Green Wheelock compound condensing; twelve (9,250 h. p.) "Corliss" or "Simple Corliss;" three (1,200 h. p.) Simple Corliss condensing; five (3,650 h. p.) Corliss compound condensing; four (2,400 h. p.) Providence Green tandem compound condensing.

Average rated h. p. of each, 700; aggregate rated h. p., 32,125.

Condensing, 8,450 h. p.; non condensing, 23,675 h. p.

Cost of engines erected, including foundations:

Simple non condensing, 15,550, h. p.; cost $14.88 per h. p.

Tandem compound condensing, 2,400, h. p.; cost $20.60 per h. p

Number of spare units, 14; total i. h. p., 9,250.

Boilers:

Total number of boilers 106; steam pressure, 100 to 125 lb.

Rated power:

Fire tube boilers 19—3,800 h. p.	100 lb.
Fire tube boilers 19—3,800	110 lb.
Fire tube boilers 24—7,200 h. p.	115 lb.
Fire tube boilers 6—750 h. p.	120 lb.
Water tube boilers 6—2,250 h. p.	100 lb.
Water tube boilers 7—2,650 h. p.	120 lb.
Water tube boilers 23—5,950 h. p.	125 lb.
Total fire tube boilers 65—14,150 h. p.	100 lb. to 120 lb.
Total water tube boilers 36—10,850 h. p.	100 lb. to 125 lb.
Total Cahill vertical boilers 5—1,250 h. p.	120 lb.

Aggregate capacity of boilers, 26,250, h. p.

Number of spare units, 24; capacity, 6,725 h. p.

Steam fitting and appliances:

System of steam piping: 89.5 per cent single; 10.5 per cent double.

Natural draft: 100 per cent use.

Forced draft: 89.5 per cent do not use; 10.5 per cent use.

Hand firing: 58.1 per cent use.

Mechanical stokers: 41.9 per cent use.

Coal conveyors: 29.7 per cent use.

Ash conveyors: 46.2 per cent use.

Economizers: 15.6 per cent use.

Cost: 11 per cent fire tube boilers with natural draft, mechanical stokers, coal and ash conveyors, installed about 1897, cost $19.75 per rated h. p.

Summary:

Cost of steam plant, including engines, boilers, piping, and all auxiliary apparatus, erected and ready for operation: 17,950 h. p.; total cost, $816,514, or $45.50 per rated h. p.; varying from $29.10 to $56.90, according to date of installation and nature of equipment.

POWER HOUSE EQUIPMENT, ELECTRICAL.

Generators:

Total number of generators 54; aggregate capacity, 25,930 kw.; 17 generators, direct driven, 11,000 kw.; 21 generators, belt driven, 4,530 kw.; 16 generators, rope driven, 10,400 kw.

Average daily load, 9,608 kw.; maximum, 14,437 kw.; minimum, 5,981 kw.

Number of spare units, 17; capacity, 7,090 kw.

Cost of generators, including foundations, etc.:

8—4,600 kw.—direct connected, cost $23 per kw.

16—10,400 kw.—belted, cost $13 per kw.

Switchboard:

Number of generator panels, 59; feeder panels, 131.

Cost of switchboard erected, including necessary apparatus, etc.:

1. Generator panels: No report.
2. Feeder panels: 16.5 per cent, $1.65.
3. Total: 23.2 per cent, $3,600.
4. Per kw.: 23.2 per cent, 3.46.

Recording instruments, 64.4 per cent use.

Wattmeters, 84.9 per cent use.

Summary:

Cost of electrical equipment, including generators, switchboards, wiring, etc., erected ready for operation: 15,050 kw., cost $18.05 per kw.

Grand summary:

Cost of completed station and all contents: Excluding land, 15,050 kw., cost $75.25 per kw.

ROAD AND EQUIPMENT

Track:

Mileage: 58.4 per cent have 213 miles of road and 335 miles of track; 25.1 per cent, 138 miles of track, single or unspecified; 16.5 per cent, not reported.

Rails: 18.7 per cent, 60 ft., 90-lb. girder, a few 60 ft. and others 30-ft. girder and T, ranging in weight from 35 to 107 lb.

Track foundation: 23.2 per cent, dirt mostly, ballasted to some extent with crushed stone; 20.5 per cent, macadam; 4.6 per cent, slag; 10.5 per cent, earth, ashes, broken stone, concrete; 18.7 per cent, 90 lb, 60 ft. girder rails with broken limestone ballast 6 in. deep under cross ties.

Bonds: A variety, generally copper rods riveted, vary in size from No. 4 to two No. 000 B. & S. per rail joint.

Supplementary wires: 23.2 per cent have 35 per cent in excess of feeder copper.

Ties: 6 x 8 in. x 7 ft. average; mostly oak (a few chestnut) spaced 24 in. c. to c. In one instance steel ties 1⅜ x 7 in. x 5 ft. 6 in. spaced 10 ft. apart and laid in concrete were used.

Paving: Depends entirely on local conditions.

	Per Mile of Track	
	Single	Double
Cost of all material used	$ 6,800	$13,600
Cost of all labor required to install	3,680	6,160
Cost of paving, labor and material	6,200	12,400
Total cost of road bed, complete	$16,080	$32,160

This is the average report for 42 per cent. Part earth and part broken stone ballast, 7-in. girder rails, cast weld joints, no bonds.

Overhead construction:

Span wire or bracket construction: 67 per cent, span wire; 16.5 per cent, span wire and bracket; 16.5 per cent, no report.

Size of trolley wire: 83.5per cent. No. 0 B. & S., hard drawn copper, except about 5 per cent of this where No. 00 is used; 16 per cent, no report.

Poles: 39.2 per cent, iron pipe spaced 100 ft. to 110 ft.; 29.2 per cent, steel and wood, spaced 115 ft. to 120 ft.; 4.6 per cent, cedar, spaced 110 ft.; 10.5 per cent, chestnut, spaced 100 ft.

Feeders: 22.5 per cent, have 45 feeders aggregating 1,066,400 ft.; 23.2 per cent, have 125 feeders aggregating 1,900,000 lb., including insulation.

	Per Mile of Track	
	Single	Double
Cost of all material, overhead construction	$2,325	$2,826
Cost of all labor for erection	213	427
Total cost of overhead construction	$2,538	$3,253

The above is for iron poles. For wooden poles material one-third and labor one-half the above.

Equipment:

Number of motor cars: Closed, 1,197; open, 1,008; convertible, 75. Total, 2,280. These figures reported for 83.5 per cent.

Average daily number of cars in use: 83.5 per cent, 698.

Average daily mileage per car: 79.9 per cent, 122.4 miles.

Total car-miles per day, 58.4 per cent, 57,862.

Length of car bodies:

	Closed.	Open.
18.7 per cent	20 ft.	30 ft.
10.5 per cent	16 ft., 18 ft., 28 ft.	27 ft., 30 ft.
4.6 per cent	18 ft.	28 ft.
6.0 per cent	16 ft., 18 ft.	18 ft., 21 ft.
20.5 per cent	28 ft.	22 ft.
23.2 per cent	21 ft.	28 ft.

Cost of car bodies: Closed, 20-ft., $900 to $1,200; open, 30-ft. to 32-ft., $600 to $800.

Cost of trucks: Single, $175 to $250; double and maximum traction, $315 to $425.

Type of motors: G. E. 800, Walker No. 5, Westinghouse Nos. 3, 12A, 49C.

Number of motors per car: Two, except for a few 28-ft cars on which four motors are used.

Rated power of motors: 25 to 50 h. p. each.

Cost of motors and appliances per car, installed: $700 to $1,100, according to size of motors.

Summary.

Total cost of motor car, including car body, truck, motors, and all appliances installed ready for operation:

1. Closed motor car, average, $1,700 to $2,500.
2. Open motor car, average, $1,400 to $2,070.
3. Convertible motor car, average, $2,375.

Roads built between 1892 and 1898, average.

OPERATING EXPENSES.

Kind of fuel and cost delivered:

23.2 per cent, Indiana screening @ $1.07 to $1.25 per ton.

20.5 per cent, soft coal.

6.0 per cent bituminous @ $3.00 per ton and slack @ $2.35 per ton

10.5 per cent, anthracite bird's eye and buckwheat @ $4.46½.

18.7 per cent, bituminous slack @ $.00 to $.70.

Kilowatt-hours per day: 49.7 per cent, 79,480.

COST OF POWER PER KW. H.

Average report for 42 per cent:

Operation:	Fuel	$.0060
	Water	.0001
	Labor	.0027
Repairs:		.00053
	Total, without interest or depreciation	$.00933

COST OF OPERATION PER CAR-MILE.

Average report for 42 per cent; cars of medium size:

Power			$.01015
Maintenance of Equipment:			
Trucks	$.00285		
Motors	.00502		
Car bodies	.00669	Total	.01456
Maintenance of way			.01000
Motormen, conductors, inspection, etc.			.05968
General expenses, salaries, etc.			.00386
Taxes, insurance, legal expenses, damage, miscellaneous, etc.			.01681
Grand total			$.11506

Several delegates expressed their intention of carefully reading this paper at home, but there was no discussion. Next was

EXPERIMENTS ON RAIL BONDS.

BY PROF. HENRY H. NORRIS, CORNELL UNIVERSITY.

The importance of the subject of rail bonding is evidenced by the increasing extent of the papers and discussions about it. Although compared with some of the more showy parts of the railway equipment, its place is very humble, yet the railbond has the ability to do a great deal of harm in a quiet way.

The use of the ground for the return of the power current is out of the question. If the current does not return to the station on the rails, it is probably not coming in through the ground, for that has a resistance much too great for this purpose. The experiments of Mr. J. H. Holt (Electrical World, Vol. XXIV, p. 290) show that the earth may and does often have a very high resistance which is much more than is usually supposed. Between good ground plates 3,000 ft. apart the resistance was found to be from about 70 to over 500 ohms, depending upon the number of terminals in parallel. In street railway work the resistance will depend largely upon the condition of the surface of the soil, but is usually less than the figures just given on account of the large surface exposed to the ground by the rails. The rails are universally used for the return, or are ostensibly so used, for sometimes it is difficult to find the current in the rails when it is supposed to be there. It is as important to have plenty of conducting metal in the rails as to see that there is enough in the main feeders.

A common effect of the poor quality of the return circuit is the destruction of metal pipes in the vicinity, and it is this trouble more than any other that has driven so much attention to the matter of rail bonding. If an easier path is to be found by some other route than that through the rails the current is bound to take that path, or, at least, enough of the current will do so to make the fall of pressure along the shunt path equal to that in the rails. But with the high resistance of the earth it should not be possible for any great quantity of current to leave the rails unless there is trouble with the bonding, for the rails have carrying capacity enough for most cases.

The difficulty in keeping the bonding in good condition is that there are so many electrical contacts to maintain and that they are so inaccessible. When a bond is put in it should be of the best quality in every way so that repairs will be seldom necessary. The requisites of a good bond are both mechanical and electrical. They must not be able to work loose, for a loose bond is of very little use. To this end flexibility is important, for joints will "give" under the weight of cars and the space between the ends of the rails will vary with the temperature. From the electrical standpoint, the conductivity must be good, especially at the joints. The copper resistance of the bond may be first class, but with a joint of small area and insufficient pressure between surfaces, the results will be unsatisfactory. In addition, there must be no chance for oxidation of the surfaces.

The effect of poor bonding is very far reaching. The power lost and the corresponding drop in pressure in the cars amount to something, but the unseen destruction of pipes and cable coverings is more. Even the loss of power is enough to pay for some attention to the matter. The consumption of power should not be calculated from laboratory tests of the bonds or even of road tests when the rails are newly laid, but when the joints have been subjected to the hammering action of the cars and the weather has had a chance to oxidize the contacts if it can.

It would seem unnecessary to state that a frequent inspection of the bonding of a road is desirable, but it is a fact that in a great many roads the matter is not thought of after the rails are once installed. Yet bonds have been found so hot that they could not be touched, dissipating energy at a rapid rate. Of course the trouble with bond inspection is that ordinarily it is difficult on account of the immense number of the connections and from the fact also that it is not considered as important as some other matters. In the test which will follow, bonds have been found with a resistance of upwards of 2 milliohms. With 100 amperes this would mean a drop of .2 volt in this one joint with an expenditure of 20 watts, if such current would flow across it. Of course it would not usually do so but would flow out into the ground in search of a more attractive path. This was a very bad joint, but in the road tested there were several of them. With a possibility of cases like this occurring an inspection of the bonding, if it can be made simply, will prove a good investment of time and money.

The resistance of the rails and bonding of a road should be made both as a whole and bond by bond. By a measurement of the resistance of the whole track return any considerable number of bad bonds may be detected. It is usually the case that bonds will become loose at a section of the road where there is a great deal of racking, and a number usually becomes loose at once. Such sections would naturally be especially watched.

If individual joints can be examined the results are much more satisfactory. The measurements are very simple and if there were but few the matter would be easy to arrange for. The method used in the tests to be described was to measure the current and drop in the joints while the road was in operation. It would have been better to have drawn through them a current by means of a water or other rheostat and then on a pair of millivoltmeters to have measured the current and the drop caused by the resistance of the joint. By connecting one voltmeter between two points on the rail separated by some little distance, the drop will be proportional to the current if the distance between the contacts be kept constant. The contacts may be brushes or sharp joints fixed on the ends of a wooden rod. In order to translate the readings into amperes it will be necessary either to know the resistance of the rail or to calibrate the voltmeter by taking readings when a known current is flowing through the rail. Simple as the method is, it is difficult to apply on account of the great amount of time required for its performance. The tests should be made very rapidly so that the testing apparatus will not interfere with the schedule runs. Where there are thousands of bonds, as is usually the case, it would be almost impossible to make the tests. Mr. Parshall calls our attention to the items making up the joint resistance as the resistance of the copper bond itself; that of the contacts between bond and rail;

and the extra resistance due to the "gathering in" of the current around this contact. After the bonds have once been installed the question of the conductivity of the conductor becomes of comparatively little importance but that of the resistance of the contact is the main item. A measurement of the joint as a whole will tell the whole story.

It is easy to estimate the return resistance which a given road should have, as the resistance of the rails will be about 0.45 ohm per inch mile. Then if the specific gravity of rails be taken at 7.8, the weight per square inch per yard is 10.2 lb. If the weight of rail per yard be known the area is obtained by dividing this by 10.2. A single track road of rails weighing 45 lb. per yard and having a length of five miles should have a resistance of about 0.25 ohm, the two rails being connected in parallel. This is on the assumption that the resistance of the bonds is equal to that of the corresponding length of rail, which is the ideal case. Often the resistance of a joint is less than that of a similar length of rail on account of the assistance afforded by the fish plate, but it is not safe to count on this. If the road cited gave a greater resistance than this the trouble would be in the bonds. The resistance, as actually measured, will usually not be as high as it should be on account of the assistance afforded by neighboring pipes and the moist soil itself, but a test will show in a general way the state of affairs. This test can be readily made by sending a current through the rail and making voltmeter contacts at the ends of the line, a feeder or telephone wire being used for the connecting wire.

The following tests of individual bonds were made by Messrs. P. H. Little and R. L. Reynolds under the direction of the department of electrical engineering of Sibley College. The tests were made on a road of good average construction, the newest part of the track being about two years old, while most of it was much older. The bonds used were of copper wire of two sizes; No. 000 and No. 0, B & S gage. They were riveted into the web of the rail and were about 33 in. long. Such bonds would have resistances of about .175 and .3 milliohms respectively at summer temperature.

Two Weston millivoltmeters were used, one much more delicate than the other. One would answer the purpose if a resistance were used in series with it for large readings. Strictly it would be better to use two voltmeters, one for the current and one for the pressure measurements, for the current varies rapidly and it is difficult to shift the voltmeter connections quickly enough. By means of spring clamps, the voltmeter terminals were connected to points on the rail, the distance between them for current readings being 15 ft. As readings were made on upwards of 500 bonds, it will only be possible here to summarize the results. For location marks the poles were principally used but any other convenient and permanent objects also served this purpose.

The sample from the log shows the general method of procedure.

LOG OF INDIVIDUAL BOND TEST.

Bond.	Location marks.	Drop on rail, Millivolts.	Amperes in rail.	Drop on joint, Millivolts.	Resistance of joint, Milliohms.
387		21.1	121.5	11.4	.09
388		4.	23.5	50.	2.13
389		.5	3	23.5	7.68
390		5.5	32	4.1	.13
391	Pole 60	10.	58.	19.5	.34

It appears from the results that the joints vary in quality from a resistance less than that of the bond itself to more than 10 times that value. On one section of single track of less than one mile in length, the sum of all bond resistances was over 0.5 ohm, there being 302 bonds in this distance. By repairing one-quarter of the bonds this amount could have been reduced about 85 per cent. Even by repairing but 27 bonds the resistance could have been improved to one-third its former value.

The plan of procedure followed in these tests would be out of the question with most large roads and the attempt has been made many times to make the measurements more quickly. The matter is simplified by the fact that if a bond is bad it is likely soon to be much worse and might as well be repaired at once. For this reason it is not usually necessary to know its exact resistance but rather to know that the resistance is high. The resistance of the bonds will never be uniform, but a certain deflection of the voltmeter can be taken to mean a bad bond. If the contacts be pushed rapidly over the track a throw of the voltmeter needle will show a bad bond if it can be carefully watched. There are various difficulties connected with this plan, but none that cannot be overcome. These difficulties are: (1) to operate the device fast enough to work in with a regular schedule; (2) to make a proper note of the bad joints; (3) and to operate with few observers. The apparatus, also, must be simple and within a reasonable cost.

The easiest plan than can be devised is that invented and operated by the electrical engineer of the United Railways & Electric Co., of Baltimore, Md. A small quantity of paint is squirted on the track by compressed air through a valve controlled by the observer. Another scheme is to make a permanent record of the test by the use of a recording voltmeter, which, instead of being run by clockwork, is driven from one of the car axles. The writer has planned an apparatus which he ventures to suggest, in closing, that would do the work, while being simple and cheap. A small platform is suspended from the rear of the car, and resting on a flanged wheel traveling on the rail. This wheel drives the cylindrical drum of a recording voltmeter. The drum is given a spiral motion along its axis by having a screw thread cut into one bearing with the shaft threaded to fit. In case any location marks are desired on the drums the voltmeter needle can be given extra movement by a current sent through it from a cell of primary battery. The contact with the rail is provided by means of brushes pressed on the rails from the ends of the platform.

After the reading of Prof. Norris' lecture, the meeting resolved itself into a business meeting, the first business presented being the report of the nominating committee. This committee submitted the following names as officials for the next year:

G. T. Rogers, of Binghamton, president; Charles Cleminshaw, of Troy, first vice-president; John Boyle, of Utica, second vice-president; A. H. Robinson, of New York, secretary and treasurer; executive committee, G. T. Rogers, H. H. Vreeland, C. L. Rossiter, T. J. Nicholl, and W. Caryl Ely.

On motion the election of officers as submitted by the committee was made unanimous and the secretary was instructed to cast the ballot.

Mr. Rogers announced that three or four new applications had been received from companies desiring membership in the association.

Upon the very cordial invitation of Mr. Ely it was decided to hold the next convention at Buffalo on the second Tuesday and Wednesday in September, 1900.

Mr. Vreeland then made a few remarks on the desire of the association to have the representatives of the smaller roads in the state, and also the younger men prepare and present papers on live subjects at the next convention. He pointed out that this would be of great value to these men themselves, as it would give them an opportunity to bring their views and opinions before the entire street railway industry of the country.

Upon motion a vote of thanks was extended to the Ithaca Street Railway Co., the city of Ithaca and Cornell University for the very cordial reception and splendid entertainment the association had enjoyed.

The meeting adjourned at 11.40 a. m. to enable the members to inspect the different departments and laboratories of Cornell University.

ENTERTAINMENT.

On Tuesday afternoon following the business meeting the delegates and visitors were taken by the trolley cars to Renwick Beach, on the lake, where they were entertained by a concert by the Ithaca Band, one of the most noted in the state.

The annual banquet was held in the large dining room of the New Ithaca Hotel; the members and guests to the number of 80 sat down about 10 o'clock. The tables were tastefully decorated with flowers and ferns, and the Ithaca Band furnished the music. A most enjoyable evening was spent, and when the last course had been served, President Rogers called for order, and in his usual humorous vein explained why the convention was held at Ithaca this year, and complimented the local street railway management on the reception accorded the delegates and their friends, the supply men. He then introduced Mr. DeForest Van Vleet, attorney for the Ithaca Street Railway Co., as toastmaster. Mr.

Van Vleet accepted the position in a very happy manner and introduced Pres. E. G. Wyckoff, of the local street railway, who responded to "Our Guests," saying that he was glad to see among the delegates a number of Cornell graduates. Col. T. G. Williams, secretary and treasurer of the Brooklyn Heights R. R., and a native of Ithaca, followed. He spoke to the sentiment "Our Hosts." Col. A. W. Cole, chairman of the Railroad Commission, next spoke of the reasons for his being present and of the harmonious relations existing between the commissioners and the steam and street railroads of the state. Prof. Cuthbert W. Pound spoke of the great change during the last 50 years in the status of college-bred men in the railway field, and of the special work done at Cornell. Hon. Thomas F. Grady responded to "The Empire State," and sustained his reputation as the silver tongued orator. Pres. Frank J. Sillman, of the Pennsylvania Street Railway Association, expressed his pleasure at being able to be present at this New York State meeting. Prof. E. J. Durand next spoke of "Marine Engineering at Cornell," and was followed by Hon. W. Caryl Ely, who responded to the toast, "The Association." Dr. R. H. Thurston spoke of the fact that the course in electrical engineering was the first of the special courses to be developed at Cornell, having been authorized as early as 1870, and dwelt at some length on the work of Sibley College. Pres. H. H. Vreeland, of the Metropolitan Street Railway, New York, discussed "Rapid Transit" in a brief speech.

Wednesday the delegates went to the University Campus by trolley cars, the "Duplex" cars owned by the company being put at the disposal of the party. After viewing the gorges and other interesting points on the line a business meeting was held in the Sibley College lecture room. After this session the University buildings were inspected, and at 3 o'clock the party started for the steamer landing, where they embarked for a trip up Lake Cayuga. Refreshments were served on board, and this proved a most enjoyable trip.

RENWICK BEACH PARK.

EXHIBITION NOTES.

The Morris Electric Co., of 15 Cortlandt St., New York,, occupied the parlors on the first floor of the Ithaca Hotel with an exhibit which included a full line of everything handled by this concern. Among the important specialties shown in this exhibit may be mentioned samples of Anderson line material, Keystone instruments, General Equipment Co. circuit breakers, Rhoades' bell and register cords, micanite rings, seamless structural steel gongs, pole fittings, National Manufacturing Co. car heaters, spiral bearings, R. Thomas & Sons' porcelain insulators, Hercules rail joints, Morris drop-forged bonds, and series cluster lamp bases.

The American Standard Rail Joints were exhibited by the Cheholm & Moore Manufacturing Co., of Cleveland. O. This concern, which is the successor to the American Rail Joint & Manufacturing Co., has introduced a number of improvements with the present season, which made an interesting exhibit. One of the notable features of this display was the locking device for rail joints which lies underneath the rail and when driven up makes one continuous plate to rest upon the ties. Col. W. E. Ludlow, in charge of the rail joint department, represented the company.

The Weber Railway Joint Manufacturing Co. had an interesting display of the different forms of rail joints which it makes. These included girder joints, T-rail joints, insulated joints, and compromise joints.

The Ramapo Iron Works, of Hillburn, N. Y., licensee of the American Brake Shoe Co., exhibited a line of "Diamond S" brake shoes which are well and favorably known among electric railway men. These shoes are used extensively on foreign as well as American electric railways.

The General Electric Co's. exhibit consisted of a complete line of catalogs covering the diversified products made by that concern, being far too numerous to describe.

The Edison-Brown plastic rail bonds were exhibited by James Hollowood, of New York, superintendent of the shops.

THOSE IN ATTENDANCE.

G. T. Rogers, president Binghamton R. R.
John B. Rogers, treasurer Binghamton R. R.
W. Caryl Ely, president International Traction Co., Buffalo.
J. H. Belser, Buffalo.
H. S. Cooper, Schenectady.
J. A. Wilcox, superintendent Corning & Painted Post Street Ry.
F. G. Maloney, superintendent Maple Ave. Ry., Elmira.
W. W. Cole, general manager, West Side Street Ry., Elmira.
H. H. Vreeland, president Metropolitan Street Ry., New York.
C. E. Warren, secretary Metropolitan Street Ry., New York.
H. A. Robinson, solicitor Metropolitan Street Ry., New York.
F. D. Rounds, general superintendent Metropolitan Street Ry..
M. G. Starrett, chief engineer Metropolitan Street Ry.
W. A. Pearson, assistant chief engineer Metropolitan Street Ry.
E. J. McGuire, civil engineer Metropolitan Street Ry

W. B. Reed, engineer maintenance of way, Metropolitan Street Ry., New York.
Thomas Millen, master mechanic Metropolitan Street Ry
A. C. Tully, purchasing agent Metropolitan Street Ry.
Orin J. Root, Metropolitan Street Ry., New York.
Henry Wells, Metropolitan Street Ry., New York.
A. F. McCabe, Metropolitan Street Ry., New York.
Don R. Almy, Metropolitan Street Ry., New York.
R. L. Post, Ithaca Street Ry.
J. A. Mortimer, treasurer Ithaca Street Ry.
DeForest Van Vleet, Ithaca Street Ry.
Chas. G. Hoyt, Ithaca Street Ry.
W. A. Gordon, Ithaca Street Ry.
Charles Schoepflin, Gardenville & Ebenezer Ry.
Louis J. Riggs, Canandaigua Electric Light & Street R. R. Co., Shortsville.
M. M. Fenner, manager Dunkirk & Fredonia R. R.
T. C. Cherry, assistant superintendent track Syracuse Rapid Transit Co.
A. B. Bond, Syracuse Rapid Transit Co.
Marston R. Cockey, John A. Roebling's Sons Co.
J. N. Du Barry, jr., Consolidated Car Heating Co.
George C. Ewing, Morris Electric Co., New York.
A. W. Harvey, Chas. A. Schieren & Co., New York.
S. H. Dailey, Weber Rail Joint Manufacturing Co.
F. T. Savage, Hildreth Varnish Co.
P. J. Meaney, Trunk Line Association, New York.
H. M. Shaw, Eastern Carbon Works, Rahway, N. J.
W. S. Silver, W. S. Silver & Co., New York.
A. E. Dresser, Ft. Wayne Electrical Works, Syracuse.
C. W. Underwood, Westinghouse Electric & Manufacturing Co., Buffalo.
F. C. Schmitz, Continuous Rail Joint Co., Newark, N. J.
T. H. Kite Powell, Duplex Car Co., New York.
Paul T. Brady, Westinghouse Electric & Manufacturing Co., Syracuse.
G. W. Swan, John A. Roebling's Sons Co.
F. M. Brown, General Electric Co., Syracuse.
F. M. Nellis, Westinghouse Air Brake Co., New York.
C. N. Wood, Boston.

POOL ABOVE ITHACA FALLS.

R. E. Danforth, superintendent Buffalo Ry.
C. Loomis Allen, general manager Syracuse Rapid Transit Co.
H. J. Clark, Syracuse Rapid Transit Co.
J. P. E. Clark, Binghamton R. R.
J. F. Lavien, superintendent Canadaigua Electric Light & Street Railroad Co.
W. Judson Smith, Syracuse, Lakeside & Baldwinsville Ry.
H. S. Newton, manager Syracuse, Lakeside & Baldwinsville Ry.
R. A. Dyer, jr., superintendent Auburn City Ry.
T. J. Nicholl, vice-president Rochester Ry.
H. A. Nicholl, superintendent power Rochester Ry.
A. Green, master mechanic Rochester Ry.
C. J. Kelsey, claim agent Rochester Ry.
H. C. Evans, Lorain Steel Co.
E. W. Throckmorton, Smith, Gray & Co., New York.
Albert C. Gahl, Burnet Co., New York.
A. C. Vosburgh, New Process Raw Hide Co., Syracuse.
John E. Ward, Gold Car Heating Co.
W. E. Ludlow, Chrisholm & Moore Co., Cleveland.
Elmer P. Morris, New York.
H. H. Haskill, Ramapo Iron Works.
W. Gibson Carey, General Electric Co., Schenectady.
Charles L. Jackson, New York Car Wheel Works.
F. D. Russell, Rochester Car Wheel Co.
O. H. Cutler, Ramapo Iron Works, Hilburn, N. J.
C. T. Chapin, Rochester Car Wheel Works.
J. H. Stedman, Rochester.
C. B. Fairchild, "Street Railway Review."
C. B. Fairchild, jr., "Street Railway Review."
E. E. Higgins, Street Railway Journal.
A. W. Cole, N. Y. R. R. Commission.
C. R. Barnes, engineer, N. Y. R. R. Commission.
E. C. Stewart, Ithaca.
Dr. R. H. Thurston, Cornell University.
Prof. H. H. Norris, Cornell University.
Prof. C. W. Pound, Cornell University.
Thomas F. Grady, Albany.
Jared T. Newman, Ithaca.
H. J. Ryan, Cornell University.
Frank Silliman, jr., president Pennsylvania Street Railway Association.

Dividends on the preferred stock of the Chicago Union Traction Co. will begin in October at the rate of 5 per cent, being 1¼ per cent quarterly. Net earnings are now said to be at the rate of about 3 per cent on the common stock.

PROGRESS OF THE JAMAICA BAY ROAD.

Work on the new electric road between Brooklyn and Rockaway Beach is being rapidly pushed Considerable valuable property along the water front on Jamaica Bay has been conveyed to the syndicate building the new railway, of which Patrick J. Flynn is the head. As the plans for the syndicate's roadway across Jamaica Bay call for one 70 ft. wide, containing, beside the tracks for the cars, two bicycle paths and a 20-ft. wide macadamized roadway, a splendid route to the seashore, will be opened. It will build up all the marsh lands along the line and enable the sportsmen to reach their favorite fishing and shooting grounds more easily than at present. Already several club houses have been erected on the meadows on the line of the new road. Several hundred piles have been driven for the trestle across the Raunt and across Goose Creek.

NO MUNICIPAL OWNERSHIP FOR CLEVELAND.

The question of municipal ownership of street railway lines received a setback last month in Cleveland, O., where Law Director Hogsett submitted an adverse report on the resolution offered in the city council, providing for the building by the city of street car tracks and leasing them to the highest bidder. He said:

"I know of no law authorizing municipalities in Ohio to either build, maintain, or operate street railroads, either in whole or in part, and am therefore unable to comply with the terms of the within resolution by preparing an ordinance which in my judgment would be valid."

The report of the law director was accepted, which ends the movement for municipal ownership.

CLAMBAKE OF SYRACUSE RAILWAY MEN.

The employes of the Syracuse Rapid Transit Railroad Co. gave a clambake at the Iron Pier at that city on August 24th, which was a credit to all concerned. Over 400 people, including the railway men and their friends, were served at the two appointed hours.

There were two pits in which the food was cooked, both being 12 ft. in diameter; the first was opened at 4 o'clock and the second three hours later. At each serving there were about 200 people.

Music was furnished by Gaylord's City Band, and in the afternoon there was a ball game between the North and South Side employes of the road, with General Manager C. Loomis Allen as umpire.

UNDERGROUND WIRING OF THE TOLEDO TRACTION CO.

The Toledo Traction Co., which also does the commercial lighting, has but recently completed the work of placing underground its lighting mains and feeder wires in the business district of the city. The city council of Toledo on Aug. 31, 1896, passed an ordinance requiring that wires of every description, with the single exception of trolley wires, within the district bounded by Summit, Monroe, Michigan and Cherry Sts., be placed underground by Dec. 31, 1899. This action of the council had been preceded by a great deal of agitation of the subject, and the ordinance was anticipated by the Traction company, as it began its first conduit in September, 1895.

The conduit construction during the first two years, 1895 and 1896, was done by the National Underground Cable Co., of New York, as contractor; since then the Traction company has done the work itself, completing the system Aug. 1, 1899. The telephone, city fire telegraph, lighting and the street railway feeder wires within the district named are now underground and the telegraph companies will soon commence the work of placing their wires in conduits.

The first of the Traction conduits laid were those in Madison St.; in 1896 those in Summit St.; 1st Alley and 2d Alley were put down, and the system has been extended each summer since till it now comprises about 250,000 ft. of cable ducts for the various cables and about six miles of Edison tubes for the lighting system. At the present time about one-half of the conduits are filled with cables.

MONROE ST., TOLEDO, SHOWING TRENCH WITH NINE DUCTS.

The underground district, which is approximately half a mile square, and the location of the conduits and mains, are shown in the maps. Fig. 1 is a plan showing the Edison tubes and giving the number of ducts in each section of the conduit work. The Edison tubes are for the three-wire direct lighting circuits and some of the power circuits. These tubes are in three sizes; the heavy lines in Fig. 1 indicate "400 mains," which are 2½-in. wrought iron pipes, carrying three 400,000-c. m. solid copper wires (about ⅝ in. dia.) placed at the corners of a triangle, 1 in. c. to c.; the light lines are "250 mains," 2-in. pipes with three 250-000-c. m. wires; the dotted line is a "200 main," a 2½-in. lead pipe with three 200,-000-c. m. stranded wires. These tubes are all 20 ft. long, the wires being 20 ft. 4 in. long, giving a projection of 2 in. at each end. The tubes were made by the General Electric Co. The coupling clamp, coupling boxes, elbows, and Y's are all the standard General Electric. Six-way junction boxes are used. The 200 main is a "tie-in" to connect the systems of tubes. For service mains 1½-in. tubes with 120,000-c. m. wires are used.

The direct current three-wire lighting district is to be limited to a radius of a mile from the power house and the mains are in all cases to be connected to the underground system. There are now on this system the equivalent of 40,000 16-c. p. lamps, arc lamps being taken as equivalent to 11 incandescents. Inside of the underground district are about 1,000 h. p. of motors, mostly in sizes from ½ to 10-h. p., which are operated on a 226-volt circuit; this is obtained by tapping the positive and negative wires only, the lighting pressure being 113 volts. Outside of the underground district are other motors, aggregating 1,000 h. p., for which the Toledo Traction Co. supplies power; out to a mile from the power house the current is supplied over a metallic circuit connected to the underground system; beyond the mile limit power motors are placed on the railway circuit.

For passenger elevator service within the underground district a special 500-volt line with two 500,000-c. m stranded cables is laid.

The alternating current lighting system now comprises about 30,000 16-c. p. lamps.

For carrying all the feeders, the special power cables and the alternating current feeders, conduits are laid as indicated in Fig. 1. These ducts are of No. 26 sheet iron pipes, lined with Rosendale cement, ½ in. thick, giving an internal diameter of 3 in. They and the cables were furnished by the National Underground Cable Co. and by the American Electrical Works, of Providence, R. I.

The street railway feeders are shown in Fig. 2. There are 12 500,000-c. m. stranded paper insulated cables, of 31 No. 9 copper wires. Four of these are carried up on an iron pole at Michigan and Madison Sts. and supply the lines in the southwestern part of the city; two are for the northwest lines; five extend down Summit St. to Swan Creek and are connected to iron armored stranded submarine cables to take the current south of the creek from which point the feeders proceed overhead to supply the south lines; one feeder, known as the intersectional feeder, supplies current to sections of the three north and south railway lines which cross the underground district, this feeder being the only one brought above ground within the district.

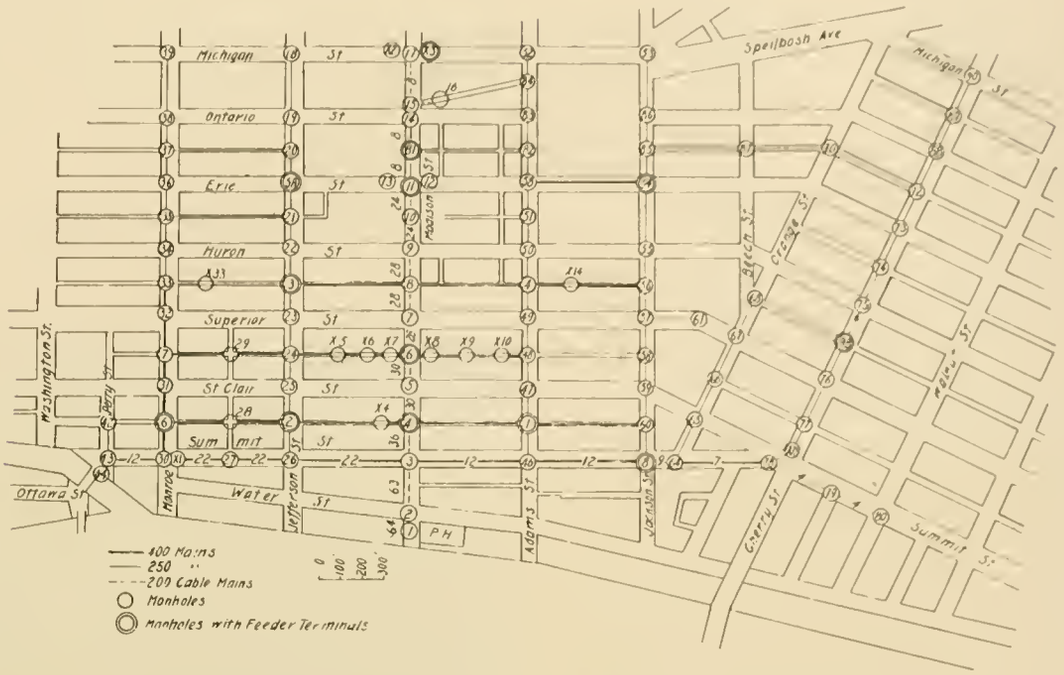


FIG. 1. UNDERGROUND THREE-WIRE EDISON SYSTEM—TOLEDO TRACTION CO.

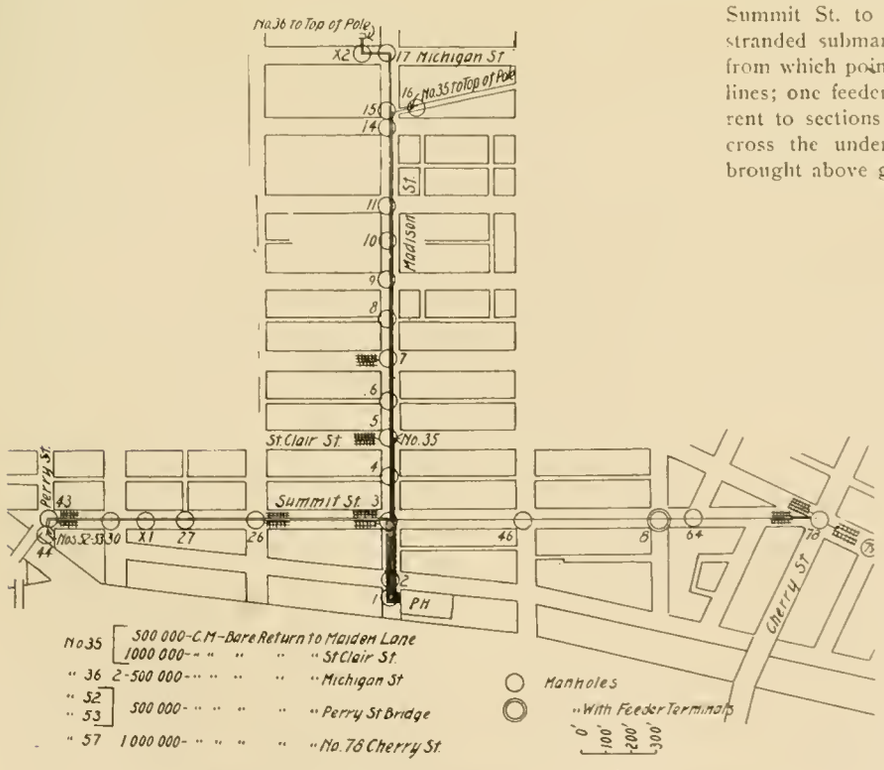


DIAGRAM OF TRACK RETURN WIRES TOLEDO TRACTION CO.

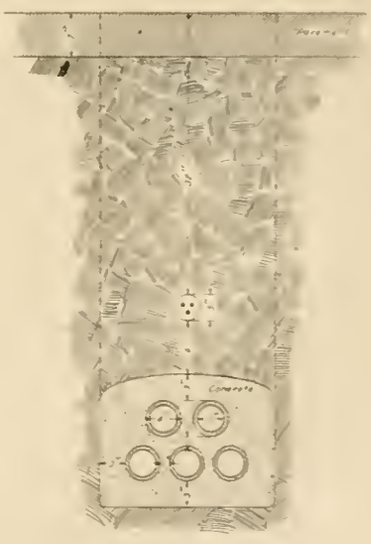


FIG. 4—SECTION OF TRENCH.

The line on Cherry St. (the northern boundary of the district) is fed from overhead feeders carried along Walnut St. All the East Toledo railway and lighting feeders, the feeders supplying current to the northern part of the city and to the Casino are carried overhead on Water St., this being outside the underground dis-

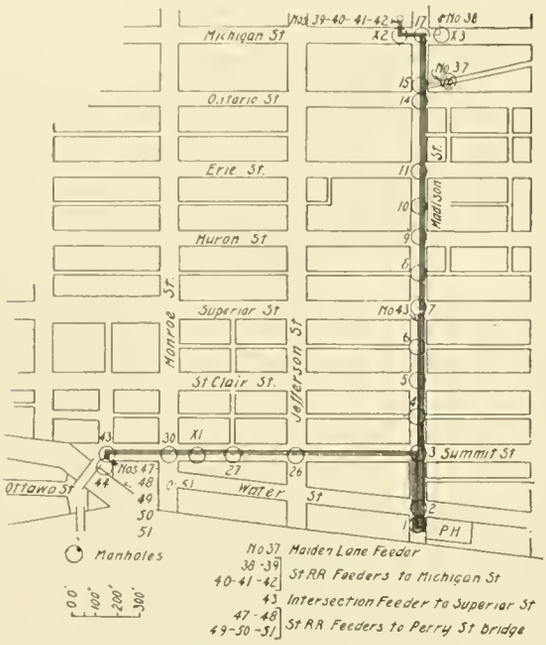


FIG. 2 DIAGRAM OF RAILWAY FEEDER WIRES.

trict. The East Toledo lines are carried under the Maumee River as submarine cables. The Casino, owned by the Traction company but leased, is a pleasure resort on Lake Erie, 4.69 miles from the power house, and has two No. 00 wires that carry alternating current at 2,000 volts for lighting. This current is generated at 1,000 volts and raised in step-up transformers to 2,000.

Rather an interesting feature of the system is the booster used for the railway line to the Casino. This is a 100-kw., 135-volt, belt-driven lighting machine which is run as a booster during the Casino season; the shunt fields are removed and series fields, wound for the purpose, put on instead. At the end of the season the old fields are replaced and the machine used for lighting during the winter.

A series of readings taken one Sunday afternoon when the traffic to the Casino was quite heavy, shows the reasons for using this booster. The voltage varied from 520 to 440, the load being from 200 to 1,100 amperes. The booster raises the voltage 1 volt for each 3 amperes.

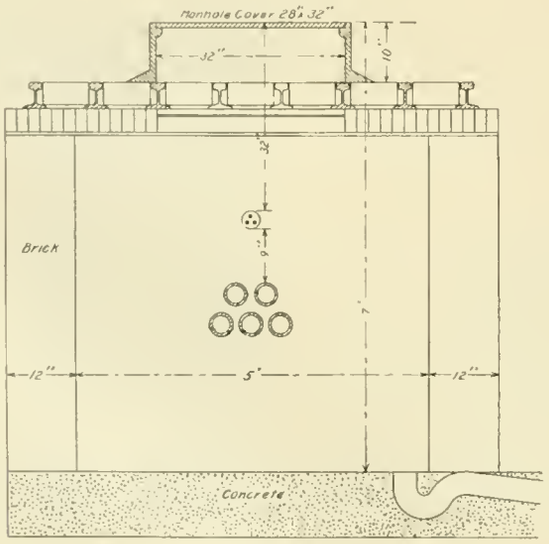


FIG. 3—SECTION OF MANHOLE

There are in all 103 manholes for giving access to the ducts. These vary in size according to the number of junction boxes, etc., it was necessary to install; most of them, however, are 5 x 5 ft. inside and 7 ft. deep, though one is 9 ft. and one 12 ft. deep. One of the manholes is shown in section in Fig. 3; for a 5 x 5 x 7 manhole 2,250 brick are required. For the roof sections of 60-lb. T-rail 7 ft. long are laid across the walls spaced so that bricks may be supported on the flanges, after being cemented a second layer is put on the rails, being laid at right angles to the first set. The manhole cover box is 28 x 32 in. inside. Sewer connections are provided for the manholes where possible; two near the power house are below the river level and are drained by steam syphons.

Fig. 4 is a section of the trench between manholes. The Edison tubes are placed 32 in. from the street surface, about 6 in. below these are the conduits, which are arranged 1 in. apart and filled about with concrete, there being 3 in. of concrete at the top, sides and bottom. The ducts are arranged, according to the total number, in 8 rows of 8, 6 rows of 7, 5 rows of 6, etc.

No. 3 manhole was originally 6 x 8 ft., but was enlarged in Sep-

FIG. 5—REBUILDING MANHOLE NO. 3

tember, 1898, to 10½ x 13 ft.; Fig. 5 is a view taken during this work.

The cables now in place aggregate in length: Street railway feeder cables, 28,000 ft.; street railway returns, 13,825 ft.; 500-volt elevator circuit, 2,386 ft.; 1,200-volt alternating feeders, 7,278 ft.; 6,500-volt arc 32,000; three-wire feeders for Edison tube system, 70,422; total 153,911 ft.

Since the underground feeders have been in use there has been only one interruption, which affected three or four customers for six hours only, which was caused by a burn-out due primarily to a fault in construction. While the expense of the underground work has been very heavy, it has the advantages that there are no poles to maintain and no danger from storms.

New cables will be added as the service demands, and at the present time the company contemplates putting in underground series arc cables for lighting the down-town district.

The underground work is now in charge of Mr. E. J. Bechtel, superintendent of construction. During the construction it was under the supervision of Mr. G. A. Cooke, assistant superintendent of the company, to whom we are indebted for the accompanying illustrations. The superintendent of lighting is Mr. W. S. Smith.

During last month the Atlanta Railway & Power Co. and the Atlanta Railway Co. made contracts amounting to more than $100,000. This expenditure represents the outlay for extensions, equipment and improvements.

The Madison St. car barns of the Allentown (Pa.) & Lehigh Valley Traction Co. was burned on August 30th, together with 10 cars, practically new, and two snow plows. The loss is estimated at $35,000 to $40,000, partially covered by insurance. The origin of the fire is unknown.

HALF FARES.

The new electric road from Toledo to Norwalk will issue 1,000-mile books at a rate of $12.50, or 1¼ cents a mile.

The Long Island Electric Railway Co. reports for the year ended June 30th gross earnings of $86,588, and net earnings of $12,987.

The South Side Elevated of Chicago carried an average of 52,599 passengers a day in August as against 41,770 in the same month of 1898.

The Joliet (Ill.) Street Railway Co. ran its first car to Rockdale on August 18th, taking a party of newspaper men and a few others over the route.

The Alton (Ill.) Railway & Illuminating Co. and the Alton Railway, Gas & Electric Co. have consolidated, and the new company has a capital of half a million.

The Macon (Ga.) & Indian Spring Electric Street Railway Co. has just completed a new power house on which the road has been running since August 29th.

A trust deed for $500,000 to the Royal Trust Co., of Chicago, has been placed on record by the Citizens' Traction Co., of Oshkosh. It is virtually a first mortgage bond.

Mr. John A. Rigg, president of the Reading (Pa.) Traction Co., has announced the company decision to increase the wages of the conductors and motormen 8 1-3 per cent.

The Chicago City Railway Co. has declared its regular quarterly dividend of 3 per cent, payable September 30th to stockholders of record at the close of business September 15th.

The Jackson (Miss.) Electric Railway Co., with five miles of track and operating seven cars, was opened for regular traffic on August 1st.

An exchange says that the Germans call their new electric cabs "automobiletaxameterdroschken." By the time they get through calling them, the cabs are generally out of sight.

The Detroit, (Mich.) Plymouth & Northville Electric Ry. was put in operation to Northville on September 1st, and on that day the town held a celebration in honor of the event.

The Wilkesbarre & Wyoming Traction Co. notified its motormen and conductors of an increase of 10 cents a day in their wages. They will now get $1.80. The increase is unexpected.

The Willimantic (Conn.) Street Ry. charter, which was owned principally by Judge John M. Hall and General Boss, was sold last month to a Boston syndicate represented by J. M. Pettis.

A number of the men employed in the car barns of the Metropolitan Railroad Co., of Washington, D. C., resigned last month on account of an increase in their working hours from 9 to 12.

The management of the South West Missouri Electric Railway Co. has announced that Midway Park, which was formerly a great resort for Joplin and Webb City people, will again be reopened.

The Market Street Railway Co., of San Francisco, recently donated $1,500 to the Red Cross Society of that city for the relief of the soldiers of the First California Infantry just returned from Manila.

The earnings of the United Traction Co., of Pittsburg, Pa., for July, were as follows: Gross earnings, $161,474; operating expenses, $66,646; net, $94,828; interest, rentals, etc., $53,294; surplus, $41,531.

The formal opening of the new street railway in Fond-du-Lac, Wis., took place on the evening of August 12th. Lakeside Park was the scene of the festivities and a brilliant display of fireworks was given.

The Mobile Street Railroad Co. is putting in a large McIntosh & Seymour engine of 500 h. p., together with a direct coupled generator. This has been demanded on account of the large increase in the traffic of the road.

The East Side Electric Ry., of Kansas City, Mo., is now entirely completed with the exception of installing the engine and generator at the power station. The road is expected to be in operation by September 25th.

The Goshen (Ind.) & Eastern Traction Co., which is applying for a franchise intends to build its road on private right of way parallel to the highways. The only franchise asked is to cross the highways at different points.

Some maliciously disposed person has been working injury to the Fond du Lac Street Railway Co. during the past week by burning holes in the seats of the new cars. There are one or two holes burned in nearly all of the cars.

All of the double truck cars of the Union Traction Co., of Philadelphia, are to be equipped with air brakes. The order for the attachment of the brakes to a large number of cars has been given out and they will be applied at once.

The new electric railway from Ypsilanti, Mich., to Saline is expected to be in running order by September 7th, and the management expects to give a big celebration in these cities on the occasion of the opening of the road.

Permission was granted the Dallas (Tex.) Consolidated Electric Street Railway Co. to suspend service of its San Jacinto line for 90 days with the understanding that both the city and the street railway are to begin improving the street.

The new street railway, of Petersburg, Va., which is owned and operated by the Southern Railway & Development Co., was opened for traffic on August 17th. The road when completed will cover 9¼ miles, about half of which is now finished.

Superintendent Ellis, of the Rockford (Ill.) Railway, Light & Power Co. put a new scale of wages in force on September 1st for motormen and conductors. This will increase the wage account of the company about $3,500 for the coming year.

Judge F. W. Downs, of Downsville, N. Y., celebrated the opening of the Downsville branch of the Glenwood street car line by driving the last spike, which was a golden one, in the rails on September 2d. Formal exercises attended the opening.

The first trip over the Syracuse (N. Y.), Lakeside & Baldwinsville R. R. from Long Branch to Baldwinsville was made on August 26th, by Superintendent Newton, Attorney Frederick Pierson and Attorney Wills of the Brooklyn Rapid Transit Co.

A Chicago syndicate which already owns large interests in the South is reported to have secured options on all the electric railway systems and the two inclined railways in Chattanooga, Tenn., and it is expected that a purchase will soon be made.

The work of double tracking the line between Cleveland and Akron was begun this spring and some 8 miles of the 27 owned by the old A., B. & C. company have been completed. The rails used were 70-lb. T, laid on white oak ties 6 in. x 8 in. x 7 ft.

The Cleveland Electric Railway Co., the Big Consolidated, has recently put in operation 50 new open cars built by the Brill company; they are 14-bench cars mounted on Brill double trucks and equipped with two 35-h. p. Westinghouse motors each.

A Brooklyn trolley car caught fire last month in Fulton St., near the Brooklyn Bridge. Flames shot up through the floor and the pasengers formed a bucket brigade, getting the water from a neigh-

boring grocery store. The flames were soon quenched and the disabled trolley was shoved to its destination by a following car. The damage was slight.

During a storm on Saturday, August 26th, at Defiance, O., lightning burned out the armatures of the generators in the power house of the Defiance Light & Railroad Co. which necessitated shutting down the road for several days until repairs could be made.

It is said that William C. Whitney is now one of the largest stockholders of the New York Manhattan Elevated, and that an arrangement has virtually been agreed upon by which Manhattan will be operated as part of the Metropolitan system under lease.

The Northern Ohio Traction Co., which controls the Akron, Bedford & Cleveland R. R. and the Akron Street Ry., has authorized an issue of $3,000,000 bonds, $1,000,000 of which is to retire existing indebtedness and the rest for extensions and improvements.

The United Railways & Electric Co., of Baltimore, has ordered 50 new cars to be delivered this fall. The Brownell Car Co., of St. Louis, will build the bodies of the cars, the Baltimore Car Wheel Co. the trucks, and the Westinghouse Co., of Pittsburg, the motors.

A number of the conductors and guards of the Manhattan Elevated, of New York, are mourning the loss of their beards, the edict having gone forth that all beards must be shaved off, and only men with smooth faces will be employed after November 1st.

Three of the principal street railway systems in Seattle have become the property of a Boston syndicate headed by Stone & Webster, and a fourth road will be transferred to the same people in a few days. The purchase price for the four lines is about $2,500,000.

For nearly a year the Snoqualmie Falls Power Co., of which W. T. Baker, of Chicago, is president, sought entrance into Tacoma. It has recently transpired that the Snoqualmie company has sold the bulk of its power to the street railway combine of Tacoma and Seattle.

Thomas Griffith, of Pittsburg, has filed a bill in equity in the United States Circuit Court against the Duquesne Garden Co. and the Consolidated Traction Co. He charges that he is the inventor of a patent ventilator which the defendant companies are using without any right.

The Union Traction Co., of Anderson, Ind., is negotiating for a large tract of land four miles east of Anderson to convert into an up-to-date park. The ground, thirty acres, has a frontage on White river, and is the most picturesque place between Muncie and Anderson as to river scenery.

An unusual accident at Quincy, Ill., resulted in the death of a conductor. He was on the ground in front of the car for the purpose of reversing the trolley pole, when his arm accidentally struck the controller handle, causing the car to jump forward, knocking him down and running over him.

The Brooklyn Rapid Transit Co. has closed a contract with the Kings County Electric Light & Power Co. for the power necessary to operate the electric elevated railway of the former company. The new power station of the latter company has just been completed and is equipped with machinery of the Tesla system.

President Rossiter, of the Brooklyn Rapid Transit Co., has told a committee of Flushing citizens who petitioned the company for a 5-cent fare to Flushing, that this branch of the road is not yet on a paying basis, and a reduction of the fare would be a bad business policy. He offered to supply monthly commutation tickets at about a 5-cent rate.

The annual report of the Oneida (N. Y.) Street Railway Co., which was filed last month, shows the total receipts were $3,715.10 and the operating expenses $2,974.83. The sum of $220.74 was expended in taxes, leaving a net income of $316.98 and a balance on hand of $386.19. The total number of passengers carried during the year was 79,615.

President Herbert H. Vreeland, of the Metropolitan Street Railway Co., of New York, issued invitations to all the heads of departments of his company, to be his guests on Saturday, August 12th. He arranged a Rhode Island clam bake to take place at the Tonetta Outing Club grounds near Brewster, where Mr. Vreeland has his country home.

The officials of the United Railways Co., of St. Louis, have decided that they will be compelled to change the motive power of the Broadway line from cable to electricity at once, as the track is said to be in such bad repair that it will not last through the winter, although it was intended not to begin the work of reconstructing the line until spring.

The annual report of the Citizens' Street Railway Co., of Fishkill, N. Y., gives the following figures for the year's business ending June 30th: Gross earnings from operation, $34,012; operating expenses, $22,870; net earnings from operation, $11,142; other income, $412; gross income, $11,554; fixed charges, $8,306; net income from all sources, $3,248.

A fast express service is to be established on the electric line between St. Paul and Minneapolis, and it is proposed that the company be authorized to charge 15 cents fare between the two cities on the fast cars. The present service on the interurban line is to be preserved, and the fast cars will pass the slower trains on a series of four switches between the present tracks.

Benjamin S. Lawlor, of New York, who constructed the engines of the battleship Maine and built the first locomotive of the New York Elevated system, has been in Syracuse, N. Y., for a year or more perfecting a new electric compressed air motor, designed to operate street railway cars. He claims his invention will effect a saving of 25 to 30 per cent over electric motors.

An electric pay car has been put into service on the Montreal Street Ry. It is closed at both ends, the entrances being at the side. These are two in number, the idea being to have the men go in one way, get their pay, and make their exit by the other. The inside fittings are not unlike those of the average bank in miniature, there being gratings, a paying window, etc.

It is stated that arrangements have been made whereby the cars of the Chicago & Milwaukee road will connect with the Northwestern Elevated road by means of an inclined plane and run around the Union Elevated loop in Chicago. The Chicago & Milwaukee cars will connect with the Northwestern Elevated over the tracks of the Chicago, Milwaukee & St. Paul R. R.

A firm of Indianapolis brokers has devised a scheme to unite all the electric railways in Indiana in one system, making divisions of the different branches. The firm has gone in a private car over the various electric roads with a party of capitalists they expect to interest in the scheme. The understanding is that the owners of the Indianapolis Street Ry. are also interested in the scheme.

The annual report of the Metropolitan Street Ry., of New York, for the year ending June 30th shows the following figures: Gross earnings, $13,158,630; operating expenses, $6,408,711; operating ratio, 48.70 per cent; surplus, $6,749,919; fixed charges, $4,477,757; net earnings, $2,272,162; other income, $366,893; net total, $2,263,055; dividends paid, $2,471,675; surplus over dividends, $167,380.

The Cleveland City Railway Co., locally known as the Little Consolidated, is now building a new car house at Rocky River, the terminus of its Detroit St. line. The building is of brick, 84 x 340 ft., divided into three bays by brick walls. There are three tracks in each bay. A small repair shop will occupy a portion of the building. This company has recently ordered 12 closed cars from the J. G. Brill Co.; they measure 30 ft. inside and are mounted on double trucks. Brill trucks are used under 10 of these cars and Peckham tracks under two.

THE CLEVELAND STRIKE.

Mr. Henry A. Everett, president of the Cleveland Electric Railway Co., has very kindly furnished the "Review" with the following statement concerning the relations of the employes with the management and the two strikes:

"The writer became the president, and undertook the management of the Cleveland Electric Railway Co. in January of this year. Some time in the December preceding, the motormen and conductors began to agitate the question of organizing a union, and the matter was in progress when the management of the road changed.

"About eight weeks before the strike in June, the scheduled time of certain of the lines of the company was changed so as to increase the speed, and increase the number of trips that each operative would make, by one. However, the hours which they run were not increased. This was done to accommodate travel and to meet the demand which the public was making for more rapid transportation. We believe that but for the formation of this union this change would not have been considered a serious matter with the men, for, while they made one extra trip, they made fewer stops in each run, for it furnished a large number of additional cars and runs to carry the same number of passengers. But this was seized upon and made as obnoxious as possible. The men would run their cars slow up to certain points, and in that way bunch the cars, and then run at a very rapid and unlawful rate of speed at other points, and by thus running rapidly make it appear that it was necessary in order to make their time. We knew this was going on. The city authorities began to arrest the men because of their running at an unlawful rate of speed. In every instance the company paid the fines of the men and protected them, although it knew that the men were not acting loyally.

"One example will serve as an instance: A friend of the company was upon one of the cars when a policeman in citizens' clothes got upon the car. The motorman remarked to the friend, "That's a policeman; I'll give him a run for his life," and he ran the car at its highest possible rate of speed, and, of course, was arrested. The company paid his fine, knowing all of these facts.

"This went on until the company returned to the old schedule, which was done before the strike. No other complaint was being made at that time to the company by the men.

"On the 10th of June of this year the employes, as Division No. 106 of the Amalgamated Association of Street Railway Employes of America, submitted to the company a proposed agreement, which contained no grievances set forth which they desired to have righted. This agreement the company refused to sign, and the men struck. After two weeks an agreement was entered into through the intervention of a committee appointed by the city council of Cleveland, the substance of which was given in the "Review" for July last. You will observe that this made no mention anywhere of union or non-union men; it provided that 80 per cent of the striking employes were to be returned, and that 20 per cent of the force should be new men employed during the strike. The old men agreed to treat the new men loyally, and it was agreed that the company would adjust the men and their runs as speedily as possible.

"No provision was made in the contract as to when men's names should be placed upon the run-boards in the various barns, but in good faith the company, just as soon as it possibly could, assigned to the old men their runs and placed them upon the run-boards, leaving every fifth place vacant to be filled by the new men, expecting to take time enough to select from the new men those most competent and best fitted for the work.

"In less than three days it became apparent to the company and its managers that the old men came back with the full determination to drive the new men out of their positions, and before a week had expired every man connected with the company knew that if the new men's names were placed upon the run-boards they would be driven out, with the expectation on the part of the old men that they would be moved forward and those places filled by the old men. As a consequence the company refused, as it then believed, and still believes, it had a right to do, to place the names of the new men on the run-boards in those runs.

"Also, in cases where for any reason a new motorman or conductor could not take out his run, the old men refused to go out on the run with a new man on the car, insisting that under the contract union men were not required to work with these new men. The company concluded that in these cases there was only one thing to do in order that it might maintain discipline and properly operate its road, and that was to discharge men who thus refused, and it did discharge several for that reason.

"This was the condition of things when, on the 17th day of July, the old men, without presenting, by committee or otherwise, a single complaint or grievance, left the company's employ, and from that day to this have not officially given any notice to the company or made any complaint, but we know that their grievance was that we would not place the names of the new men on the run-boards, and that we insisted upon their working with these men when it was necessary.

"To show you that they did intend to drive the new men out of the employment of the company, it is only necessary to state that when the old men went out of the employ of the company, 12 of the new men were in the hospital, being taken care of by the company, who have received their injuries either directly or indirectly through these men after that settlement was made.

"Since the men went out the last time the company has absolutely refused to either negotiate with them or arbitrate, and has simply filled up its complement of employes and has operated and is operating, its road without the old men, and will so continue from this time on. You have only to read the newspapers of Cleveland to know the violence that has been used to compel the company to yield to these men, and that the violence only ceased when the military compelled it. Then the boycott was adopted, and the newspapers will fully inform you what has been and is being done by respectable citizens and merchants of this city in relation thereto."

The means adopted by the strikers and their sympathizers to gain their ends were described in the "Review" for August. It is difficult to fix a date for the end of the strike; the company now has a full complement of men and the regular schedules have been in operation since August 1st. The boycott declared against the company and intimidation of passengers by placing torpedoes and bombs on the tracks caused a reduction in receipts, but the traffic has been steadily increasing, and within a few weeks will probably be as heavy as before the trouble.

Parties concerned in the assaults on cars are promptly arrested and fined; the fines range from $10 and costs to $25 and costs, the usual charge being "disorderly conduct," which includes the offence of crying "scab" at the non-union men.

CITIZENS TEAR UP TRACKS.

The citizens of Pontiac, Mich., and the Pontiac & Sylvan Lake Railway Co. have been at odds for some time over the question of removing some of the company's track, and the dispute culminated last month by the citizens tearing up about a mile of track before an injunction could be obtained to restrain them.

The trouble between the street railway company and the city is of long standing. Under the franchise granted to the Sylvan Lake Co., and acquired by the Detroit and Northwestern, the company is obliged to pave between the tracks, also a foot on each side, whenever the city sees fit to pave the streets. A franchise has been granted to the Hendrie Co., of Detroit, for a third track and in order to render the three tracks symmetrical it was necessary to change the two tracks in Saginaw St. and the city determined to take advantage of the opportunity to do some paving.

A crowd of citizens and workmen congregated in Saginaw Ave. at midnight and a number of trucks and drays were also in evidence. At a signal three gangs of workmen began to tear up the tracks at as many different points. It was the east track that was attacked, the west track being left free. Only one side of the street was left available for railway traffic.

At a subsequent meeting of the officers of the company and the city authorities, the former agreed to put down grooved track rail as the paving progresses, to pay its proportion of the paving and to repair its track in other parts of the city under the supervision of the street commissioner.

The Milwaukee Electric Railway & Light Co. have agreed to place fenders and guards on all cars operated on their system in Racine, Wis.

IN THE POWER HOUSE.

This department is devoted to the construction and operation of electric railway power houses. Correspondence from practical men is specially invited. Both the users and makers of power house appliances are expected to give their views and experiences on subjects within the range of the department.

POWER HOUSE COSTS, LOUISVILLE RAILWAY CO.

	Cost Per Kilowatt-Hour in Cents.								Maintenance in Dollars.							
1898	Output kw. h.	Coal	Wages Eng.	Wages Boil.	Oil.	Water	Maintenance	Total	Boilers	Piping	Pumps	Engines	Condensers.	Gen. & S. B.	Buildings	Tools	Total
Jan.	836,140	.268	.068	.105	.023	.022	.112	.597	161.94	324.61	43.30	191.24	58.52	19.45	192.50	332.68	941.76
Feb.	750,460	.264	.075	.100	.024	.021	.095	.579	31.71	248.18	15.85	81.56	26.20	19.04	155.79	136.84	715.17
Mar.	834,500	.264	.070	.102	.008	.020	.115	.579	41.82	383.73	8.23	49.97		.40	183.57	289.53	957.25
April	835,630	.261	.075	.090	.011	.019	.106	.562	45.09	107.20	100.31	260.03	116.25	50.14	60.45	146.79	886.26
May	894,190	.259	.069	.088	.008	.020	.111	.555	399.92	221.42	9.81	22.22	4.75	133.29	75.13	128.74	995.28
June	851,400	.279	.072	.084	.011	.023	.083	.541	73.55	163.82	1.50		7.09	65.38	160.30	230.28	701.92
July	857,640	.257	.069	.084	.020	.023	.086	.537	18.50	215.23		3.38	19.51	19.90	11.55	451.13	739.20
Aug.	901,900	.261	.065	.091	.011	.022	.076	.527	60.74	355.38	4.81	6.51		5.33	37.50	218.75	689.02
Sept.	874,800	263	.065	.088	.019	.023	.062	.520	88.03	115.25	3.38	2.74	73.64	24.20	190.53	48.43	546.20
Oct.	911,000	.254	.066	.083	.017	.021	.069	.509	91.41	175.90	8.13	4.93	6.99	13.76	7.47	318.32	626.91
Nov.	859,000	.257	.070	.093	.013	.025	.051	.507	22.50	210.57		4.01		35.66	29.48	134.48	436.70
Dec.	913,000	.260	.059	.091	.012	.022	.061	.504	62.93	118.85	2.96	57.41	27.70	54.59	93.65	135.73	553.82
1899 Jan.	935,707	.259	.063	.086	.014	.025	.063	.510	120.59	157.70	25.92	63.82	5.00	24.45	35.31	156.96	589.74
Feb.	864,056	.256	.063	.098	.012	.030	.041	.500	47.26	129.93	16.83	4.40		11.57	19.50	122.78	352.27
Mar.	896,214	.257	.064	.101	.015	.022	.040	.500	82.15	37.10	43.26	15.55	2.75	14.58	28.32	134.56	358.27
April	960,572	.236	.062	.112	.017	.025	.056	.510	10.30	123.45	12.21	1.15	26.72	16.03	96.10	269.42	555.38
May	1,014,582	248	.057	.100	.013	.019	.063	.500	64.66	108.16	4.62	12.03	43.83	56.34	117.76	234.22	641.62
June	954,000	.255	.059	.089	.016	.025	.062	.506		157.35	30.29	54.57		17.61	111.99	223.07	594.88
									Per Kilowatt-Hour—Cents.							
Jan.—June, 1898		.264	.071	.094	.014	021	.104	.568	.015	.029	.004	.005	.004	.006	.017	.025	.104
July—Dec., 1898		.258	.065	.088	.015	.023	.068	.517	.006	.022	.000	.002	.002	.003	.007	.025	.068
Jan.—June, 1899		.252	.061	.098	.014	.024	.055	.504	.006	.013	.002	.003	.001	.003	.007	.020	.055
Year, 1898		.262	.068	.092	.014	.022	.085	543	.011	.025	.002	.003	.003	.004	.012	.025	.085
18 Months		.258	.066	.093	.014	.023	.075	529	.009	.021	.002	.003	.003	.004	.010	.023	.075

POWER HOUSE COSTS, LOUISVILLE RAILWAY CO.

By the courtesy of Mr. W. T. Cook, chief engineer of the power station, we have received the itemized statement of the cost of operating and maintaining the power house of the Louisville Railway Co., Louisville, Ky., from Jan. 1, 1898, to June 30, 1899. This station was described in the "Review" for July, 1899, page 442, but for convenience we enumerate the main equipment here. There are 4 Babcock & Wilcox 250-h. p. boilers with B. & W. stokers, 6 Heine 200-h. p. and 8 return tubular 50-h. p. Six new B. & W. are now being installed. In the engine room are one verticle cross-compound engine direct connected to a 2,400-kw. G. E. generator, four horizontal cross-compound engines, each direct connected to a 500-kw. G. E. generator, and two tandem compound engines each belted to two 150-kw. Edison machines.

The data on fuel, wages, supplies and total maintenance have been reduced to kilowatt-hour basis while the itemized repairs are given in dollars for each month, and appear in the table.

LOUISVILLE RAILWAY CO

REPORT OF POWER STATION FOR 189

OPERATION		MAINTENANCE.	
Coal		Boilers	
Water		Engine	
Oil		Condensers	
Waste		Pumps	
Pay Roll (Engine Room)		Piping	
Pay Roll (Boiler Room)		Dynamo and Switch Board	
		Building	
TOTAL		TOTAL	
GRAND TOTAL			
No Motor Car Miles		Daily Average Kw Hours	
No Trail Car Miles		Total Kilo watt Hours	
Total Electric Mileage			
Cost per Car Mile		Cost per Kw Hour	
IMPROVEMENTS			

It may be interesting to reproduce in this connection a copy of the blank used for making the report of the power house costs. The blank measures 8 x 10½ in., letter size.

POWER FOR INTERURBAN CARS.

Our readers will be interested in the following figures given us by Gen. Mgr. C. A. Denman, of the Toledo & Maumee Valley and the Toledo, Bowling Green & Fremont roads. The Maumee Valley road owns 14 miles of track from Toledo along the Maumee River to Perrysburg, thence across the river to Maumee and down the other bank to Toledo; under an agreement with the Toledo Traction Co. the Maumee Valley cars run through Toledo over the latter's tracks, making a belt line of 23 miles in length.

In January, 1898, the average power per car-mile for 44-ft. cars equipped with two 25-h. p. motors, and seating 48 persons, was 1,859 watt-hours. Mr. Denman states that in summer the watt-hours per car-mile are about the same as in winter, the better track in summer being offset by the heavier loads carried. The average mileage per day of 18 hours on the Toledo & Maumee Valley line is 220 miles for each car.

THE DURABILITY OF WATER TUBE BOILERS.

At a recent meeting of the Institution of Naval Architects (England) Mr. A. F. Yarrow presented a paper upon this subject and gave the results of tests made to determine the comparative merits of mild steel and of an alloy of steel containing from 20 to 25 per cent nickel.

The deterioration of the tubes is probably owing:

1. To the action of acids in the water, due to grease, which, in spite of every precaution, finds its way into the boiler.

2. To the tubes becoming overheated and oxidizing on the outside, through contact with the hot gases when passing from the furnace to the uptake.

3. To the action of the steam, which, if superheated, decomposes, causing deterioration on the inside of the tubes.

The last two conditions occur when the tubes from defective circulation, shortness of water, or from the collection of scale, become overheated.

A "corrosion test" was made by placing specimens in dilute hydrochloric acid; they were weighed after various periods, varying from 21 to 168 hours, the total time of submission being 533 hours.

To summarize these tests, the results showed that the loss of weight in the first series of tests of the nickel steel tube amounted to 5 grams, being 2.63 per cent, and in the mild steel tube to 98 grams, being 52.68 per cent. In the second series of experiments the loss of weight of the nickel steel tube was 7 grams, being 3.72 per cent, and the mild steel tube 100 grams, being 53.19 per cent.

The mild steel lost 16½ times as much as the nickel steel.

A "fire test" was made by placing two tubes side by side in a small furnace. The loss in weight by oxidation was for the two mild steel tubes 78.37 per cent and 76.06 per cent, respectively, and for the nickel steel tubes, 24.47 per cent and 27.60 per cent.

A "superheated steam test" was made by placing two tubes, one of each material, 1 ft. 8⅝ in. long and 1 in. outside diameter by 14 L. S. G., in a furnace, steam at 60 lb. pressure was supplied at one end and allowed to escape slowly at the other so that the steam was highly superheated; the tubes were heated to a bright red. The nickel steel tube at the end of 10 hours had lost 12.7 grams, the weight being originally 612 grams; the mild steel tube at this time had worn out, having lost 85 grams. A second mild steel tube weighing 607 grams was worn out in 8 hours, losing 73 grams; the nickel steel lost 43 grams more during the same time, and finally failed after 21 hours, and a total loss in weight of 78.5 grams.

In a second superheated steam test with tubes 3 ft. 6 in. long, heated to a very dark red, the steel tube was worn out in 84 hours; the first mild steel tube failed after 30 hours and the second after 42 hours.

The conclusions reached are that it is not unreasonable to assume that nickel steel (20 to 25 per cent nickel) boiler tubes will have, as regards acid corrosion, a vastly longer life than those of mild steel, and, as regards deterioration from the action of heated gases or steam, at least twice the durability of mild steel.

Mr. Yarrow states that steels with small percentages of nickel (up to 5 per cent) have a slightly increased durability, but not so much as make the metals of importance for boiler tubes.

ADDITIONS TO THE POWER PLANT OF THE TOLEDO TRACTION CO.

The Toledo Traction Co. is now building an extension to its power house. The engine room was originally 70 x 206 ft., and when the station was illustrated and described in our January, 1897, issue, there was space for the installation of an additional unit at the north end of the room. This space was filled in the fall of 1897 by a vertical cross compound engine with cylinders 19 and 38 by 32 in., removed from the old power plant of the Toledo Electric Co. This engine was built by the Lake Erie Engineering Co., of Buffalo. It is direct belted to two generators, one a 250-kw. Westinghouse alternator, and one a 300-kw. T.-H. alternator; both of these machines were formerly driven from the station jack shaft.

The addition now almost completed is an extension to the engine room, making it 284 ft. long. In the new portion there is to be a vertical cross-compound Allis engine, with cylinders 28 and 60 by 48 in.; this will be direct connected to a 1,000-kw. 500-550-volt Westinghouse railway generator. This makes an addition of 1,000 kw. to the railway capacity of the station, and as only 500 kw. more is needed at the present time, one of the 500-kw. railway machines is to be rewound to give current at 270 volts for the 3-wire lighting circuit.

The company has also installed a battery of two 574-h. p. Heine boilers, completing the boiler equipment. These boilers are fitted with McKenzie furnaces, and two others of the boilers will also be so fitted.

A Warren-Webster feed water heater has been placed in the boiler room; water is delivered to the heater by the pumps formerly used to feed the boilers and as delivered to the boilers, through the economizers by two Blake vertical duplex pumps, each of which has a capacity of from 300 to 500 gallons per minute.

Another improvement in the station is the oil room and oiling system. The oil room is in the basement of the boiler room and contains storage tanks and Turner oil filters. The receiving tanks are rectangular with rails along the top, onto which the oil barrels can be rolled through a window opening onto the wharf, which is adjacent to the building. These tanks are three in number, one of 12 barrels capacity for engine oil, and two of 6 barrels each for the two grades of cylinder oil used. Small pumps transfer the oils from the receiving tanks to pressure tanks of 10 barrels capacity each; hydraulic pressure of 20 lb. is on the distributing system, water being taken from a tank on the roof of the building. Engine oil is piped to the various bearings, but the cylinder oils are drawn from faucets in the engine room and the cylinder lubricators filled by hand. The engine oil only is filtered and again used; it flows by

gravity to a Turner oil filter and thence transferred to the pressure tank.

In order to blow the dust out of the armatures of the various generators in the station, a motor-driven air compressor with a capacity of 17 cu. ft. of free air per minute has been installed. This machine, which was made by the General Electric Co., and the storage tanks are placed in the basement of the engine room. Pipes lead to four points in the engine room, a flexible hose being attached to one of these.

The Toledo Fire Department has placed an 8 x 24-in. whistle at the station of the Traction company for use as an alarm in event of large fires. The whistle is controlled by an electrically operated valve in circuit with the fire alarm circuit.

THE COST OF POWER.

About two years ago the Engineers' Society of Western Pennsylvania appointed Messrs. H. W. Fisher, L. B. Stillwell, W. A. Bole and D. Ashworth a committee to ascertain, if possible, the cost of power, and report the results to the society. In June last the committee made its report, in which are a number of paragraphs that will appeal to everyone who has made similar attempts to collect data on this subject.

The report says: "Your committee met and, after a good deal of discussion, decided to issue to the members of the society and to a large number of manufacturers and users of power, a list of questions to be answered categorically. These questions were carefully selected, and were intended to bring out answers which would be explicit and definite, and were so framed that they could not well be answered except by positive statements of facts. The list of questions was accompanied by a letter setting forth the purpose and aims of the society and issued in such a way as to afford opportunity to impart the requisite information without prejudice to the contributor. Out of several hundred such circulars sent to all the prominent users of power in this section of the country, only about half a dozen met with a response, and all of these except one are incomplete and insufficient. * * * * Undoubtedly the reason why so few people are found to contribute such information as is here sought is because the average user of power does not know."

Concerning the ease with which data on boiler performance may be secured and the value of keeping daily records, it is said: "The chief elements of such an investigation are two only, viz: the water evaporated and the fuel consumed in doing it. These two quantities can usually be obtained accurately by the proper provision of meters for the water and weighing scales for the coal. It is always conducive to economy and good order to have those who are entrusted with the use of any material, realize that an account is expected, and it is also conducive to wastefulness and extravagance to have such people know that no trace is being kept of their doings. The very presence of the meter and the weighing scales is sure to have a good effect. If a daily log is kept, the meter is read and recorded at two or more definite periods each day, and the water thus used is set over against the fuel burned, the most ignorant or careless firemen will be apt to keep a sharper lookout on all the duties entrusted to him, than though he can console himself with the cheerful reflection 'the boss don't know.' The expert investigation (complete boiler test) usually establishes a basis of performance with which the daily performance may be daily compared, and when the performance in daily operation falls below the average, an opportunity is afforded to promptly discover the fact and the reason. If this should lead to an investigation, correction and a restoration of standard good performance, it is no more than should be expected."

Of course the same general information concerning engine performance in a manufacturing plant can not be so readily obtained, but much may be done by a frequent use of the indicator.

In electric lighting and street railway plants the same difficulty is not experienced, as a recording wattmeter will give the output of the generators and with water meter and coal weight records enable the daily performance of the engines to be daily compared with the average performance of the station. The number of companies which are equipping their stations with meters and keeping complete records of the cost of power is constantly increasing, and at the present time nearly every new road has a "Thomson wattmeter" on its switchboard, so that there is every reason why the cost of power for street railways should not be known and placed on record.

By the courtesy of the managers of several of the larger street railway companies we have received since June, 1897, monthly reports of power station costs, which have appeared in this department, and in this issue is an itemized statement furnished by the Louisville Railway Co., showing costs for the 18 months ending June 30, 1899.

Such data are of interest to engineers, but more information concerning the plant would enhance their value. We therefore reprint, with slight modifications, the questions of the power committee which we have quoted and urge those of our readers who are in charge of power plants to assist us in securing data on performance by sending us descriptions of their plants and the cost of operating them.

1. Name of company—.
2. Where located—.
3. Is current furnished for lighting also?

If more than one plant, put in particulars of each plant on separate sheet if possible.

BOILERS.

4. How many boilers employed?
5. Type? (give in detail.) Size? Whether set in battery or singly?
6. Kind of fuel used? Calorific value per lb.
7. Kind of grates? Stokers? Furnaces? Fuel economizer?
8. Mechanical stokers or hand firing?
9. Height of chimney?
11. Name and type of heater employed?
12. Boiler pressure regularly used?
13. Do you exhaust steam for any other purposes? If so, state in full what use, and if possible what amount is so used?—.
14. Have you made boiler tests to determine the evaporation of feed water, and the consumption of fuel? If so, with what result?—.
15. What is the average evaporation of feed water per pound of fuel in actual running?
16. What is the temperature of feed water?
17. Is steam taken from your boilers for any other purposes than for engines reported?—; if so, state in full.
18. Do you measure the amount of feed water used by boilers? How?—.
19. How many hours per day are boilers in use?
20. Can you state the amount of fuel used per day and night in banking fires.

ENGINES.

21. How many steam engines do you employ?
22. Give in detail the cylinder diameter, stroke, revolutions per minute, and rated horse power of each engine, stating whether automatic, cut off, or otherwise?
23. Do you use a condenser? What vacuum do you regularly obtain?
24. Is your power regular or fluctuating? Give details and nature of work it is used for.
25. Have you made indicator tests to determine the horse power of engines?
26. What is the average daily, and maximum daily, horse power of engines?
27. What is the average consumption of fuel, per indicated horse power developed by engines, when at full load?—; also average per day per horse power hour?—.
28. What is the back pressure on engines, when exhaust steam is employed for heating or other purposes?—.
29. How many hours per day are engines employed?
30. How is the power applied?

INVESTMENT.

31. What is the capital invested in boiler plant, and its accessories, including feed water heaters, pipes, foundations, and chimneys, etc.?
32. What is the capital invested in engine plant, and its accessories, including foundations, pipes, etc.?

COST OF POWER FOR ELECTRIC RAILWAYS.

Output Measured by Wattmeter in Each Case.

Station.	Month, 1899.	Monthly Output, Kilowatt-Hours.	Cost of Electrical Output per Kilowatt-Hour—Cents.						Gals. Cylinder Oil per 10,000 k. w. h.	Gals. Lubric'ting Oil per 10,000 k. w. h.	Lbs. Water per Lb. Coal.	Lbs. Fuel per k.w.h.	Price of Fuel per Ton of 2,000 Lbs.	Kind of Fuel
			Fuel.	Labor	Supplies, Oil, Waste, etc.	Water.	Repairs.	Total.						
1	May	1,428,274	.274	.174	.042	.030	.042	.562	4.50	1.09	12.23	2.61	...	Bituminous
5. Metropolitan Elevated, Chicago.	"	995,748	.377	.279	.036	.044	.033	.769	1.99	.93	7.12	4.48	...	"
6	Mar.	518,722	.846	.262	.070	...	.159	1.337	...	...	...	2.78	$.9604**	Oil
6	Apr.	501,122	.749	.267	.066	...	.231	1.313	...	...	...	2.46	.9709**	"
6	May	523,748	.773	.264	.048	...	.172	1.257	...	...	..	2.45	.9801**	"
8	"	678,316	.394	.188	.013	.037	.006	.638	...	..	..	...	.	Bituminous
9	"	768,316	.631	.273	.034	.058	.019	1.015	...	..	..	...	.	"
10 Central Av., Metropolitan, Kansas City, Mo.	Apr.	399,766	.246	.139	.016	.007	.018	.428*	.308	5.00	..	5.1	...	"
10 "	May	447,109	.249	.112	.007	.006	.016	.421*	.156	2.23	...	5.0	...	"

*Miscellaneous, .002. **Cost of Oil per Barrel.

33. What is the capital invested in real estate and buildings occupied by engine and boiler plants?

DEPRECIATION.

34. What is your estimate for the annual depreciation of value?

35. What is the annual cost of repairs?

OPERATING EXPENSES.

36. What is your annual fuel bill?

37. How many hours per annum is your plant in active operation?

38. What is the cost of fuel per ton on your premises?

39. Have you had experience with other fuels?

40. What is the cost of water for your steam plant?

41. What is the annual expenditure for wages to employes to the plant?

42. What is the annual expenditure for supplies of all sorts for boiler, hydraulic, air and electric plants?

43. What percentage of the general expenses of your business do you consider proper to apportion to power plant? And what does this amount to, expressed in dollars, per annum?

Mr. S. J. Prentiss, engineer of the La Crosse (Wis.) City Railway Co., sends us the following data concerning the operation of his power station:

The plant began operating August 4, 1893, and with the exception of one Sunday has run every day since that time; the cause of the single shut down was a bad splice in the main belt, which did not dry and compelled the plant to lie idle for one day. The engine room equipment consists of one 18 x 42-in. condensing corliss engine and two 90-kw. General Electric generators. Shingle saw dust is used for fuel, about seven wagon loads per 24 hours being required.

The company has 15 miles of track and operates 16 motor cars and from 15 to 18 trailers; in winter snow plows have frequently to be run all night. The cars run from 5:15 a. m. to 11:15 p. m., except on special occasions, when they are kept out till 1 o'clock or later. For the last five years the average time of operating the station has been 560 hours per month.

Mr. Prentiss does not explicitly say that there have been no armature repairs necessary during this time, but from his letter we infer that such is the case and that this is a record for long lived armatures, which beats that submitted by Mr. H. J. Termohlen, of Rockford, Ill., last month.

The American Pneumatic Railway Ditcher & Grader Co. has been incorporated in Illinois. The capital stock is given at $250,000. The company will handle a new machine for ditching and grading, making embankments and cuts, etc., for railways. The directors in the new company are W. B. Doddridge, C. S. Pullman, Rolla Wells, C. T. Westlake and E. F. Goltra. The offices will be located at Granite City, Ill.

THREE ATTEMPTS TO WRECK TROLLEY.

The third attempt to wreck a car was made on the Youngstown Park & Falls Street Ry. on the night of August 9th, by placing a tie upon the track. This makes the third attempt upon the cars of this company, and the man who was seen placing the obstruction on the track was pursued and narrowly escaped being shot. As the car was descending a steep hill the motorman noticed a man lying beside the track in front of the car. He immediately applied the brake and stopped the car, which was going at a slow rate of speed. Meanwhile the man who had been crouching beside the track took to his heels and leaped over a fence. Electrician Birchfield, who was on board the car, pursued the man and fired five shots at him with his revolver, but the fellow escaped, aided by the darkness and thick bushes. In his flight he lost his hat, which was picked up by Birchfield and turned over to the police. The hat has two holes through the top of it, which were possibly made by one of Birchfield's bullets.

The company is making every effort to capture the villian who has three time tried to wreck cars on its lines. The road throughout its entire length is watched during the night by special watchmen. The cars are run carefully and slowly down all grades. Each car has an inspector aboard who walks ahead of the car at every curve and carefully examines the tracks.

NEW YORK CITY TROLLEY EXTENSIONS.

It now seems probable that the long standing contest between the Metropolitan Street Railway Co. and the Third Avenue Railroad Co. in the Washington Heights district of New York City, will be amicably settled. A joint application for extensions has been made by the two companies up the old Boulevard to the junction with the Kingsbridge road, near 169th St. This application has been passed by the Municipal Assembly and signed by the mayor.

The joint application for extensions applies only as far north as 169th St. The Metropolitan wishes to continue thence up Eleventh Ave. to 175th St. The Third Avenue makes further application to continue up the Kingsbridge road to and across the Government ship canal, across Spuyten Duyvil Creek and along 230th St. and Riverdale Ave. to the city limit, there connecting with the Yonkers branch of the Union Railway Co. The Union Railway Co. already has tracks down the new Broadway that will connect with the proposed line at 169th St. This will give the Third Avenue two West Side lines into Yonkers and connections east from Yonkers by way of McLean Ave. and Yonkers Ave. with Mount Vernon and the towns on the Sound.

These extensions would enable passengers to ride by trolley from the postoffice as far as Hastings-on-the-Hudson, the longest single ride, it is said, that Greater New York offers. Whether the fare will be 5 or 10 cents is a question which the company has not yet taken up. It is understood that there will be no opposition to granting the extensions which both roads demand.

TO SETTLE THE MILWAUKEE CONTROVERSY.

The reduction of street car fares has been a favorite project with the city councils of Milwaukee for several years. An ordinance requiring the company to reduce its rate of fare to 4 cents was, after long litigation, held to be invalid by the United States Courts; this decision was rendered May 31, 1898. Following this decision efforts were made to reach an amicable agreement, the company preferring to waive some of its rights for the purpose of securing peace. Mayor Rose and the company succeeded in reaching such an agreement (St. Ry. Rev., Dec. 1898.), but because of opposition on the part of the press and the public the company decided to withdraw its proposals. The subject has been further discussed since that time, and on July 31, 1899, the council passed a resolution looking to an agreement for lower rates of fares.

August 15th the following letter was submitted to the council:

"To the Honorable, the Common Council of the City of Milwaukee—Gentlemen: We are in receipt of copy of the resolution passed by your honorable body on the 31st of July, 1899, relating to the reduction of the street railway fares, which seems to call for an expression of the attitude of our company. We are willing to take up the whole question of our relations with the city; any re-adjustment, however, to be permanent must be based upon considerations, of mutual benefits and mutual concessions, but no attempt at re-adjustment is advisable, unless it is such as appeals to the business sense of the public and insures an enduring settlement.

"The principal franchises of this company do not expire until July 1, 1924, and several not until a latter date, with the right thereunder to charge a 5-cent fare without transfers, and we should not be expected to reduce the earnings of the property unless the city is willing to make reasonable concession which will contribute to the security of our investment. If this principle is frankly recognized, we have little doubt that a conclusion can be reached which will be of lasting and increasing benefit to the people of the city and acceptable to this company.

"The concessions which we are disposed to consider favorably are as follows:

"First—A gradual and increasing reduction in the rates of fare, until a 4-cent rate is secured by the sale of commutation tickets.

"Second—The permanent establishment of the transfer system.

"Third—The extension of the railway lines to the city limits at points necessary for the convenience of the people in the several localities interested.

"Fourth—We are willing, in case the city desires, and has the power to purchase the railways and physical property of the company within the city, to grant an option to purchase on terms to be agreed upon, or, determined by arbitration.

"For these concessions the city should grant to the company:

First—Franchises upon certain streets which will enable the service to the public to be improved, and the railway system perfected.

"Second—An extension of the railway franchises for 10 years.

"The foregoing is intended as an outline of the points which we deem essential. Should your honorable body conclude to take up the negotiation on these lines we shall be glad to meet your committee and endeavor to arrive at an agreement as to the terms of an ordinance."

This was signed in behalf of the company by Vice-Pres. H. C. Payne, Gen. Mgr. John I. Beggs, and Frank G. Bigelow and Charles F. Pfister, local directors.

LONDON UNITED TRAMWAYS.

In our issue for July, 1899, page 487, we published a description from a paper by Mr. J. Clifton Robinson, managing director and chief engineer of the company, of the general features of the London United Tramways. As there stated, the lines to be constructed within the county of London comprise 4.32 miles; of this 2.87 miles will be on overhead trolley system and 1.45 miles on the underground conduit system.

The accompanying illustrations are reproduced from drawings recently prepared by the company's engineers, Mr. Robinson and Mr. H. F. Parshall, consulting engineer. Fig. 1 shows sections of the conduit and Fig. 2 a plan view of the conduit tracks; from these it appears that the construction closely resembles that of the conduit roads in Washington and New York. Fig. 3 is a drawing of the conduit plow. The type of car to be used is shown in Fig. 4. Fig. 5 shows the types of iron poles used; the center pole is designed for a light pole also.

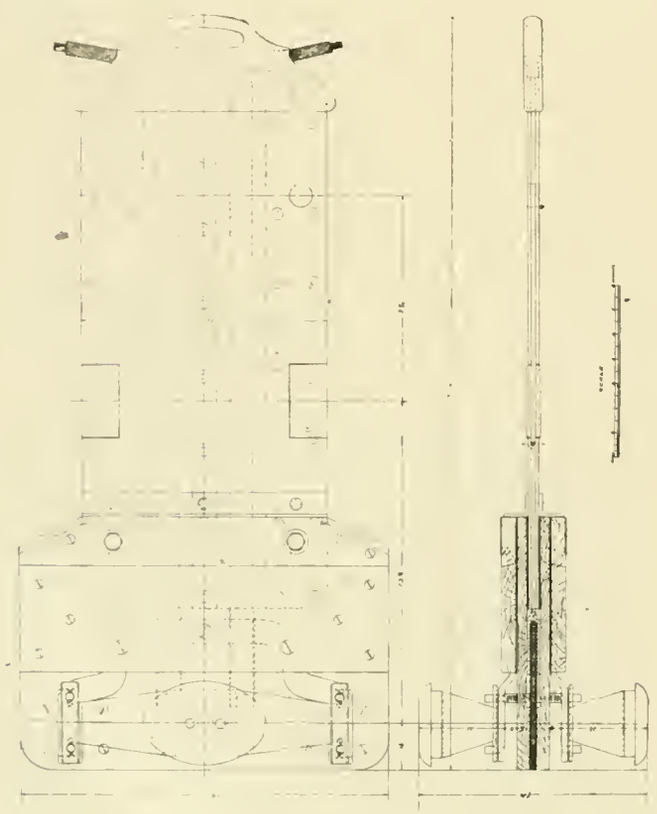


FIG. 3 ELEVATION AND SECTION OF PLOW.

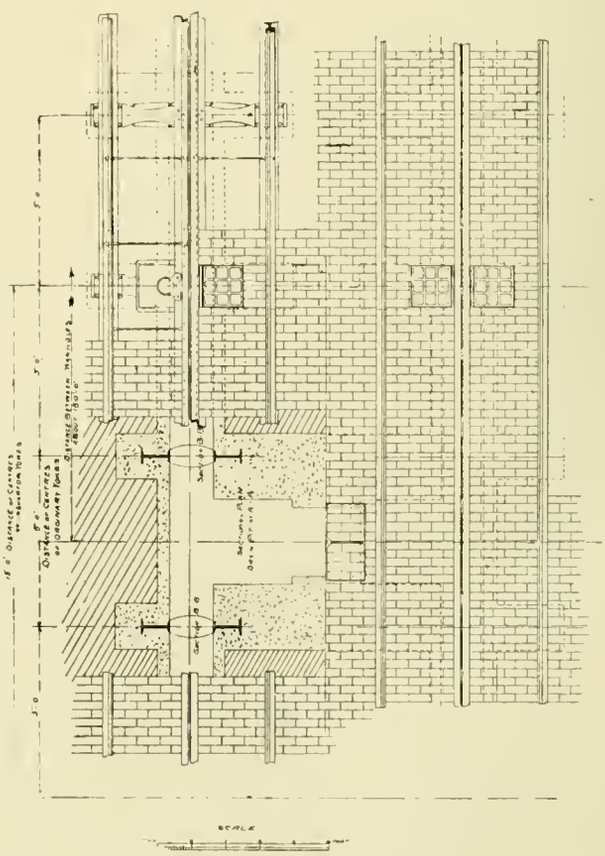


FIG. 2—PLAN OF CONDUIT ROAD.

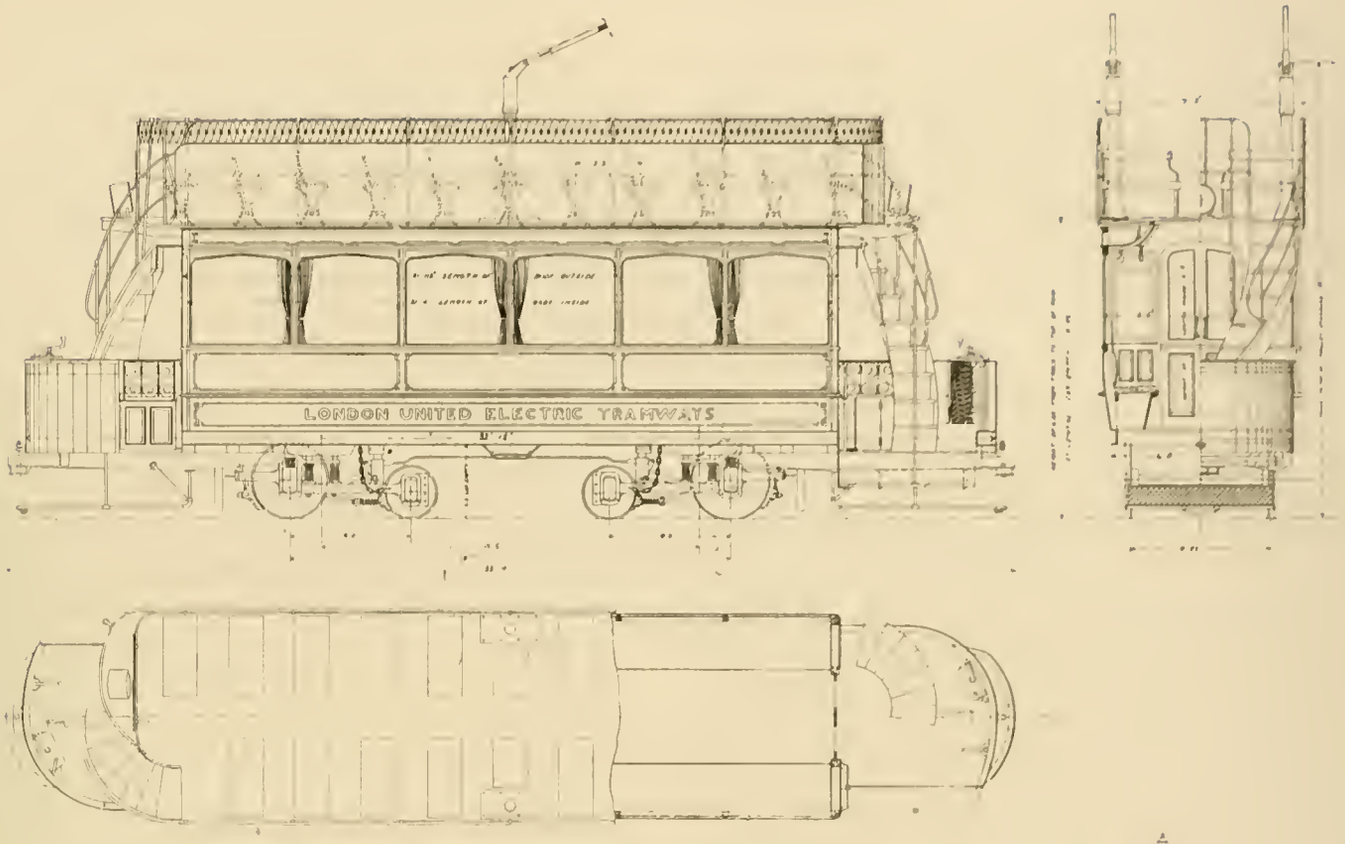


FIG. 4—STANDARD CAR.

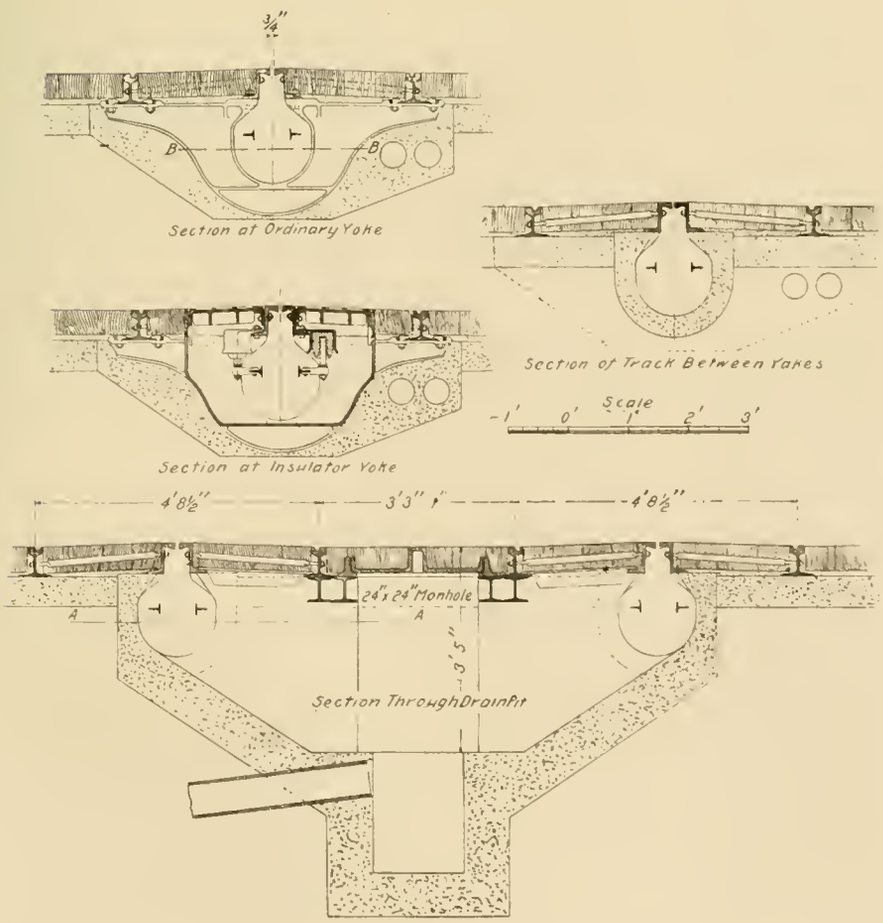


FIG. 3—SECTIONS OF CONDUIT.

FIG. 5—TYPES OF POLES.

TESTIMONIAL TO MR. YERKES.

A testimonial from the employes of the West Chicago Street Railroad Co. was presented to Mr. Charles T. Yerkes on August 10th, expressing the regrets of the employes on his severing his connection as president of the company and their appreciation of his treatment. A delegation of 10 conductors and motormen were ushered into Mr. Yerkes' office at three o'clock in the afternoon, where the presentation and acceptance of the testimonial took place.

The gift of the men was in the form of a memorial address, engrossed in black ink. Around the body of the address is pen and ink scroll work, a trolley car and a trailer being in the design. The address is framed in oak and reads as follows:

"Memorial address to Charles T. Yerkes, from the employes of the West Chicago Street Railroad Co., Chicago, Ill., July 15, 1899. Mr. Charles T. Yerkes—Dear Sir: With the feelings of the profoundest regret, we have read your letter announcing the severance of your connection with the West Chicago Street Railroad Co., and at a meeting held July 15, 1899, it was unanimously resolved that we take this early opportunity of expressing our regret, and also assuring you of our hearty appreciation, both individually and collectively.

"1. Of your wise and efficient management, even under the fire of unmerited public censure.

"2. Of the faithfulness with which you have kept the pledges given at the beginning of your administration, maintaining them, as you have, through fluctuating money markets and desperately hard times.

"3. Of your successful work along the line of street railway extension, which, in its far-reaching influence, is, perhaps, one of the greatest benefits ever realized by the city of Chicago and its suburbs, and which will increase with the coming years.

"4. Of your strict justice and your many acts of generosity of which the world has not known, and, above all, your personal interest in the men themselves. We thank you for your words of commendation. We are proud of the fact that each man's work, however humble and insignificant it may seem, is considered by you a necessary and important part of the mighty whole.

"In conclusion, we wish to assure you that we will give to the new management the same loyal service which we have given to you during your administration of the affairs of the company.

"Bespeaking for you all the great and good gifts that a beneficent providence can bestow, continued prosperity, and a long life crowned with health and happiness, we remain,

"The employes of the West Chicago Street Railroad Co."

The chairman of the delegation, Mr. Brennan, in presenting the testimonial, made a brief speech in which he expressed the gratification of the men at the agreeable and harmonious relations that had always existed between them and the management, and their appreciation of Mr. Yerkes' work in Chicago.

Mr. Yerkes made an informal response in the course of which he said:

"This meeting touches me very much. Those resolutions touch me much. They show me what the feeling of the men really has been. While I was aware of that feeling, this brings it up afresh.

"What you have stated about my opinion of making presents and showing a regard for employers is all a fact. When Mr. Roach told me of the determination of the men to contribute so that I should have the handsomest watch in Chicago—and as each man was to contribute 50 cents, with the thousands of men, that no doubt would have bought the most expensive jeweled watch—I said: 'Tell the men to stop that. It has always been against my principles.' I said I was opposed to any employer accepting anything of value from employes. Many conditions exist which would preclude the possibility of me accepting anything of that kind. One superintendent at one time securing a post that was somewhat better, the men, in goodness of their hearts, decided to buy him a watch. I knew nothing of it. After I learned of it, I called him to me and gave my opinion this way:

"'Men are asked to subscribe who can't afford it. Those will subscribe because they don't want their associates to feel that they do not regard their employer, or that they are poor. Stop it! If the watch is bought, have them sell it.' From that time on, I don't know of any one receiving any gift of money value from the employes.

"The men are not paid more than they can expend for their needs. Every 50 cents is precious to the men. For that reason, nothing could induce me to accept a token valued in money. I think ever so much more of that (pointing to the testimonial) than I could of all watches and diamonds."

In conclusion he said:

"Gentlemen, you have put me through another ordeal this afternoon. I haven't much more to say, except that I hope the public with whom you come in contact will appreciate you as I do. For these resolutions I thank you more than words can tell. I have pictures in frames, some of considerable money value, but there is none I value as must as I do the black and white in that frame."

NEW CHICAGO CITY RAILWAY OFFICIALS.

September 1st, the following appointments for the Chicago City Railway Co. were announced: Capt. Robert McCulloch, to be general manager; George O. Nagle, superintendent of the road since January, 1898, to be assistant general manager and superintendent; C. N. Duffy, to be auditor.

Capt. McCulloch, whose presidency of the American Street Railway Association made him well known to nearly all the street railway men in the country, comes to assume the management of the Chicago City Ry. under his former chief, Mr. Hamilton, with whom he was associated in St. Louis when manager of National Ry. lines there.

Mr. Nagle's promotion is a very gratifying testimonial as to the able way he has filled the position of superintendent for the last two years.

Mr. Duffy has been the auditor of the St. Louis railways under the management of Captain McCulloch, but is most widely known by reason of the work he has done in connection with the Street Railway Accountants' Association. Mr. Duffy is chairman of the permanent committee on "A Standard System of Street Railway Accounts," and as such did a great deal to bring the standard system to its present degree of perfection and secure its adoption by the Convention of Street Railroad Commissioners. The street railway fraternity of Chicago extends a most hearty welcome to the new comers from our sister city.

STEAM RAILROAD MILEAGE IN THE UNITED STATES.

From the 11th Report of the Inter State Commerce Commission, it appears that on June 30, 1898, the total single-track railway mileage in the United States was 186,396.32 miles, there being an increase in this mileage during the year of 1,967.85 miles. The States of Arkansas, California, Louisiana, Missouri, New York, and Wisconsin show an increase in excess of 100 miles. The aggregate length of railway mileage, including all tracks, on the date given was 247,532.52 miles, the increase being shown as 4,088.11 miles. This aggregate mileage was distributed as follows: Single track, 186,396.32 miles; second track, 11,293.25 miles; third track, 1,009.65 miles; fourth track, 793.57 miles; yard track and sidings, 48,039.73 miles. The length of the single track operated mileage covered by railway reports filed with the commission was 184,648.26 miles, which indicates that the mileage of the country is covered by reports in a substantially complete manner.

SAUGATUCK'S TROLLEY OPENING.

Nearly 7,000 people were present from all parts of the state to attend the opening of the Saugatuck (Mich.), Douglass & Lake Shore Electric Ry., August 19th. The cars commenced arriving early, and continued every half hour during the day to bring the crowds, until the town was filled.

Holland business men came in a body, accompanied by the West Michigan Band. G. J. Dykema, of Holland, and Judge J. McGarry, of Grand Rapids, delivered orations on the public square.

In the evening a display of fireworks and water carnival were given on Kalamazoo Lake. The day closed with a naval battle and the sinking of the Spanish fleet of gunboats.

All the cars of the Exeter (N. H.), Hampton & Amesbury Street Ry. will soon be equipped with air brakes.

THE DEVELOPMENT OF ELECTRIC TRACTION IN THE UNITED KINGDOM.

(Special Correspondence.)

The great and growing development in electric tramway enterprise in this country has only just affected London. While Glasgow, Liverpool, Manchester, Sheffield and Hull have been deeply engaged upon carrying out municipal tramway schemes, the premier city of the world has been content to go jogging along with its old 'buses and its smart, if somewhat extortionate, hansoms. Sometime ago, however, the County Council of London and inter alia many local authorities were somewhat rudely awakened by the enterprising, if not audacious, schemes of Mr. J. Clifton Robinson, the managing director of the London United Tramways Co., who proposed to entirely transform the system of West London tramways. This line of tramways comes no nearer than two or three miles to the center of London, but it penetrates into some of the best and most thickly populated portions of suburban London, and it was apparent to anyone with half an eye that it was most admirably suited to electric working, or, probably, electric working was admirably adapted to its needs.

For this system, powers to use electricity have been obtained, not without a tremendous fight, but opposition has only whetted the appetite of the tramway company, for it is now seeking to add to its already extensive franchises by creating a new system of light railways and tramways which will be connected together and provide a magnificent means of transit to many people who have been hitherto practically unprovided for. No time has been lost in carrying Parliamentary powers into effect, and by the time this reaches you the roof will have been placed on the power house, and, judging by what I have already seen, I should say this country will not be able to show anything better in the way of generating plant or machinery. [A description of the novel features of this road was published in the "Review" for July last, page 487. Some drawings of the proposed conduit work and of the cars and poles are shown on another page of this issue.]

One of the most startling incidents in the history of electric tramway development in London is the publication of Prof. A. B. W. Kennedy's report to the London County Council on the subject of mechanical traction. I need hardly say that Professor Kennedy is one of the most eminent consulting engineers in this country on electric lighting, and it was felt that, when the County Council asked him to prepare a report on the subject of applying electricity to the Council's lines the matter would be most carefully gone into. The general feeling expressed on the report is one of disappointment. It has been an uphill struggle in this country to convince municipal and other authorities that the overhead wire system was the best under most circumstances, but the strong advocacy of Professor Kennedy for an underground conduit will tend to unsettle many people who are considering the adoption of electric working. The professor states that he cannot help doubting whether any system of overhead wires can be really regarded as likely to prove a permanent and final solution of the traction problem in a great city like London. He further points out that at crossings and street junctions the trolley system is inevitably accompanied by such a metallic network overhead as to put it altogether out of the question in busy London streets. Probably overhead wires at street crossings would not enhance the appearance of the streets, but it can hardly be doubted that it is just at these points where the conduit is likely to prove troublesome. Apart from the question of expense, the construction of a conduit system in London will be attended with enormous difficulties. Within a few inches of the surface of most London streets there is an extraordinary mass of pipework, and to lay down a conduit would mean in many cases the bodily removal of these pipes.

To give an idea of the trouble that may be met with from this cause alone it may be mentioned that a certain route was selected on which to lay down an experimental conduit track, but on the engineer examining the route it was found that there are three 30-in. water mains at no very great depth below ground, and for that reason the experiment will be tried along another route. In the opinion of many, however, the foregoing difficulties fairly represent the character of the London roads.

It ought to be mentioned that most of the municipalities in this country who have adopted electric tramways, were in the first instance predisposed in favor of conduits, but an investigation into their probable cost and the inconvenience to ordinary traffic during the construction period, has induced them, without exception, to adopt the overhead system.

Electric tramways are developing very rapidly in the provinces. The Glasgow Corporation has commenced on its large scheme, and last week the Tramways Committee decided to recommend the acceptance of the tender of the E. P. Allis Co., of Milwaukee, which offers engines for £114,554. This is far and away the largest contract for engines ever given in this country, and if the corporation adopts the committee's recommendation, the American firm is to be congratulated.

One of the most interesting systems of tramways yet inaugurated in this country is the one owned by the Corporation of Plymouth, and it is chiefly interesting from the fact that the generating plant has been erected for supplying electricity for lighting as well as for tramway purposes. The problem was a little complicated from the fact that the lighting is carried out by means of alternating currents, but the difficulties have been surmounted in a highly ingenious manner. Combined plants, consisting of an engine driving a continuous current dynamo and an alternator arranged in line or one shaft have been adopted, the whole of the plant being upon a combination or coupled bed plate. The alternator is placed between the engine and the continuous current machine, clutching devices being employed so that the engine may drive either machine, or, if need be, the engine may be disconnected and either machine may be used to drive the other. The following are some of the functions that can be carried out by such a combined plant. The engine may drive both machines, one for lighting and the other for traction, or the alternator may be uncoupled and the plant used only for tramway work; then, again, the continuous current machine may be uncoupled and the plant used only for lighting. When the engine is uncoupled the machines may be run as motor generator for lighting or tramway purposes; for the former purpose the continuous current machine would act as motor, obtaining current from accumulators, or the alternator could be run as a motor, obtaining current from the lighting bus bars, the set being thus rendered of use for tramways.

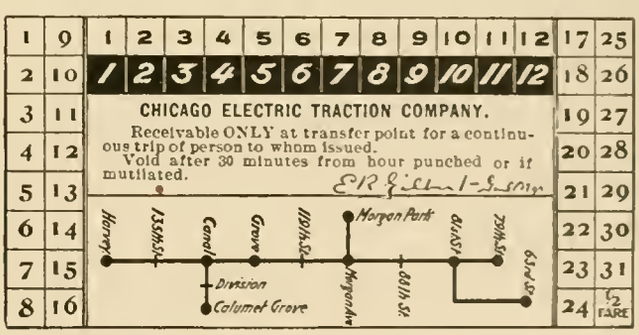
There has been considerable discussion in this country on the subject of combined plants, and the foregoing plant is an interesting contribution to the discussion.

H. S.

London, Aug. 19, 1899.

A NOVEL TRANSFER.

The accompanying illustration shows a transfer ticket designed by Mr. E. R. Gilbert, general manager of the Chicago Electric Traction Co., which, it is believed, is quite original as regards the manner in which the destination is indicated. The ticket is 4 in.



long by 2 in. wide. The day of the month and the hour of the day are indicated by punching out the proper figures in the top and margins in the usual manner. For indicating the destination a diagrammatic sketch of the company's lines is placed in the lower portion of the ticket and it is only necessary for the conductor to punch the proper point on this map.

The Consolidated Street Railway Co., of Bay City, Mich., has been ordered by the city to place safety devices in front of all its cars.

THE BOMBAY TRAMWAYS.

Indian Engineering has the following on the street railway system of Bombay:

There are two institutions of which the people of Bombay are justly proud: The first is the Port Trust, which has done so much to extend the area of the city by judicious reclamation, and to enhance the importance of the port by the construction of docks, jetties, and piers; and the second is the Tramway company, absolutely the best of its sort in the East. The ramifications of that service are already so numerous that the termini are almost as many as the municipal wards; the tariff is so lenient that the cars are patronized by all but the very poorest; the furniture is so decent, and there is so high a tone of respectability pervading the whole economy, that the most fastidious are glad enough to avail themselves of the easy transit. All this, however, would be futile were it purchased at the expense of regularity and celerity of traffic. But one of the greatest boasts of the Bombay Tramway Co. has ever been, that, despite of all the disabilities and limitations of horse traction, the regularity of their service has been their chief recommendation; and now it is proposed to improve this particular department, and increase the company's hold on public popularity by the introduction of electric traction on the overhead system. Mr. F. C. Rimington, the local representative of the board of directors, has applied for the sanction of the Municipal Corporation to this reform, setting forth the advantages which are tersely stated thus: (1) Increased regularity, speed, and comfort of car service; (2) much reduced congestion of traffic in the streets, the space occupied by horses being saved; (3) increased cleanliness of the streets; (4) greater safety, owing to the cars being under more perfect control, and being fitted with more efficient fenders or wheel guards than is possible with horse cars; (5) greater flexibility as a motive power, and consequently increased capacity to meet the demands of a fluctuating traffic. He places the expense of the improvement at Rs. 15,000,000, and asks a modest enough guarantee of possession for 14 years. Knowing what we do of the Municipal Corporation of Bombay, we have no hesitation in saying that the proposal will be accepted with alacrity and thankfulness; and knowing what we do of the methods of the Bombay Tramway Co. we dare to predict that the genesis of electrical traction will be complete in Bombay before in Calcutta it has passed the first stages of incubation. This is, in the nature of things. Municipal institutions in the metropolis of India partake in every way so much of the nature of the megatherium that the observant philosopher is in no way astonished at an extended period of gestation, however much he may chafe under prolonged expectancy.

If the Calcutta Commissioners would but study the question of the Bombay tramways with intelligence and a conscientious desire to profit by its lessons, they would realize that the proposed departure is of the utmost importance to them at the present juncture, when electrical traction has been accepted as the last resource to improve the most inefficient tramway service that has disgraced one of the chief cities of the world.

The history of the Bombay Tramway Co. is pregnant with instruction. The company was formed in America, because Mr. Kittredge, to whom Bombay certainly owes a statue and the Government a knighthood, could not obtain the money locally to float it. This was Bombay's misfortune, and the citizens have never ceased to regret the temporary myopy which prevented them from seeing, in the little Yankee's scheme, a very important factor in the development of the city. Having brought the money from New York, Mr. Kittredge also brought with it American thoroughness, American enterprise, American practicalness, and American adaptability to the surrounding environment. Once the municipal concession of the track was secured, he took good care to allay any public irritation at the monopoly by reducing to a minimum the inconvenience of the lines. These were scientifically laid, and it has long been a significant comment that the streets which the tramways pass are the best kept in Bombay. There are no cobbles to jar the nerves and imperil the salvation of the owners and drivers of public conveyances; and, when repairs have to be done, they are done quietly and quickly, chiefly at night when the busy world is sleeping. Horse traction being the only one feasible at that time, Mr. Kittredge obtained the best and most powerful draught animals procurable in Australia. They were cared for with much humanity; they were housed in the most scientifically constructed stables we have seen anywhere outside of London; their number was large to ensure a fair distribution of labor; and they were fed and tended with a liberality and solicitude which would have done credit to any private owner and lover of horses. The consequence was that few private individuals in Bombay could show a more efficient and atractive equipage than that seen in an ordinary street car. Then, in the construction of the cars, particular attention was paid to ventilation, lightness and elegance of design. The result is a clean, open, and roomy vehicle, which, by the very nature of its structure, renders overcrowding impossible. The details of management are as nearly perfect as human ingenuity can make them. The company demand in their traffic employes a high standard of intelligence and respectability; their ticket system is simple, and, even at the beginning, could not by any chance have produced the nightmare which Mark Twain has immortalized in his jingle—"Punch, Brothers, punch with care." With the introduction of the uniform one-anna rate—a concomitant of electrical traction—the simplicity of the system will be perfected, and the difficulties of management considerably reduced.

All this strengthens our belief in the ability of the Bombay Tramway Co. to make electric cars a huge success, and we would strongly advise both the Calcutta Corporation and the Calcutta Tramways Co. to depute officers to Bombay with the special object of studying the Bombay methods. Herein lies, in our opinion, the only salvation of the Calcutta Tramways.

FIGHT FOR RICHMOND, VA., FRANCHISES.

As was previously stated in the "Review," a syndicate composed of a number of Richmond gentlemen, headed by Messrs. James N. Boyd and Virginius Newton, has made a proposition to purchase a controlling interest in the Richmond Railway & Electric Co., and to put the property in a high state of improvement.

The purchase, however, is conditional, as the council must give the new company the franchises held by the old one without waiting for them to expire.

The question to be considered is a somewhat complicated one, it appears. It is claimed that the committee has no right to take up the matter until the Richmond Railway & Electric Co. agrees unconditionally to relinquish its franchises.

There is, however, another factor in the fight, and, to all appearances, the most important which has so far developed. The fact has come to light that a second syndicate, composed of merchants, bankers and business men generally, has been formed to contest for the franchises. The Richmond Traction Co., which owns competing lines, is also making a strong bid for the franchises, and the contest promises to be a warm one.

RAPID CABLE LAYING.

A method of remarkably rapid cable laying was used under special conditions on the new Victoria Jubilee bridge over the St. Lawrence River, near Montreal. The bridge with its approaches is about 8,750 ft. in length, and is crossed by the transmission line from the water power plant which is building at Richelieu, 16 miles from Montreal.

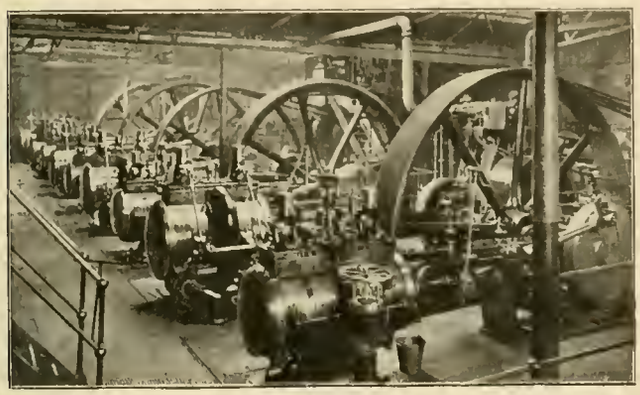
The cables for this section of the line are laid in a wooden box placed on the sleepers 4 ft. outside of the track, and they were laid by means of a locomotive and flat cars. Four flat cars were loaded with reels, each reel containing 1,000 ft. of cable, and jacked up into position ready to pay out. The cable paid out over a cast iron sheave 22 in. in diameter, which was shrouded with leather to avoid abrasion of the lead covers. The ends of the cables were lashed to the cable box and the locomotive was started and kept running at the speed of 4 miles per hour. The cable paid out over the cast iron sheave and extended to the end of the car over two wooden rollers from which it dropped into the wooden cable box on the floor of the bridge. Two reels of cable were laid in this way in five minutes by actual count and 26,000 feet were placed in position, ready for joining, in eight hours.

It is reported that the Terre Haute Electric Co. wishes to buy the Brazil (Ind.) lines.

ENGLISH TYPES OF TRACTION ENGINES.

That fact that American built engines have taken the lead in the English markets for traction purposes is probably due to the greater development of electric traction in this country, but the fact that for lighting purposes, also, American engines are very much in evidence in England, cannot be attributed to the same cause, and is largely due to the fact that orders can be filled much more expeditiously by the American engine builders than be English firms. In a series of articles on electric light and traction engines running in the Electrical Review, of London, our contemporary states: "It is greatly to be hoped that with the growth of electric traction, English engine builders will no longer suffer themselves to be ousted from their own market by American engines. If foreign made engines are to come to England, we should prefer American to any other, but we see no necessity for the continuance of the practice."

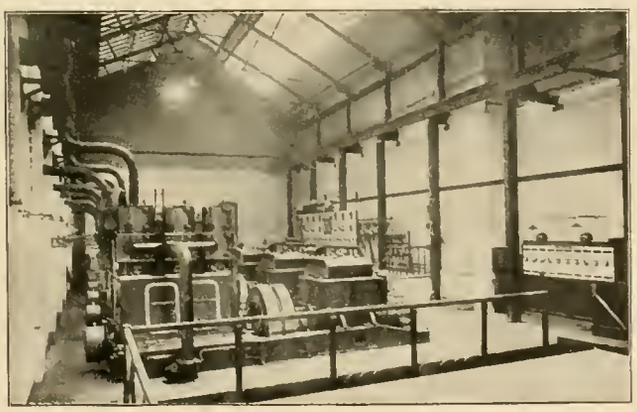
In the same series of articles a number of illustrations are given showing some of the types of engines which are being produced by English manufacturers for the class of work, some of which we



LIGHT AND TRACTION ENGINES—NEWCASTLE-ON-TYNE.

have reproduced as being of interest for the comparison of English with American built machines.

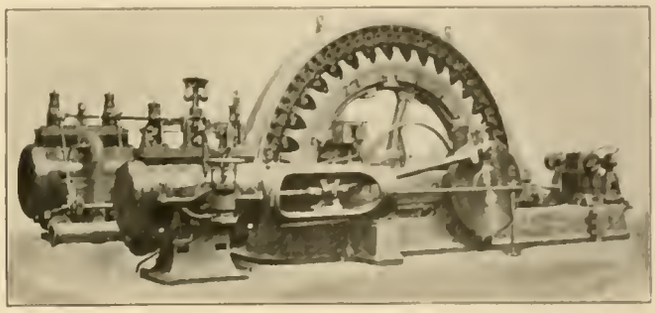
Among the types of engines mentioned are those of G. E. Belliss & Co., Ltd., which are installed in the power plant of the Waterloo & City Electric Ry. These are direct coupled to Siemens Bros.' 200-kw. generators, the units being quite different in general appearance from any in use in this country. The engines are of a vertical 3-crank pattern with a complete tandem compound engine working on each crank. They are designed for a capacity of 300 i. h. p., running at 380 r. p. m., with a steam pressure of 150 lb. at the engine valve. The working parts of the engine are inclosed by a casing to keep out dirt and to permit the use of Belliss' patent system of forced lubrication for the bearings. The speed of these engines, it will be noticed, is much higher than is usual for this class of work in this country. There are six units in this station, which has a provision for still further extension, the units



WATERLOO & CITY ENGINES.

being smaller than are generally used here for stations of this size.

Another and quite a different class of engines are those manufactured by Robey & Co., Ltd., which are installed in the plant of



LIGHT AND TRACTION ENGINE ST. HELENS.

the corporation of St. Helens and in the station of the Newcastle on-Tyne Electric Supply Co. The engines of the St. Helens station is of the cross compound condensing type direct connected to an alternator of 115 kw. capacity, and runs at a speed of 100 r. p. m. The engine and alternator are mounted on a massive iron bed plate and are furnished with continuous lubrication to all the moving parts. The Newcastle-on-Tyne engines are of the same general type, but drive the alternators by rope connections.

WESTINGHOUSE RAILWAY GENERATORS.

The direct-connected railway generators of the Westinghouse company, in which the armatures are built so as to be keyed to the shaft of any engine of suitable power and speed, are provided with a special winding for balancing the magnetic circuits between the different poles which is described in a circular recently issued by that company on direct-connected railway generators.

It is of great importance that all the brushes of the same polarity be maintained at exactly the same potential. In the older types considerable difficulty was frequently experienced in the operation of large multipolar direct current machines owing to the fact that it was impossible to always secure the same magnetic strength in all the poles, and consequently the potential generated in a set of the armature conductors under one pole was sometimes greater or less than that generated in a corresponding set of conductors similarly located under any other pole of the same polarity. The result of this was a certain difference of potential between the brushes of similar polarity so that currents, sometimes of considerable magnitude, flowed from one brush to another or from one section of the armature winding to another, causing heating of the conductors and sparking. This trouble is remedied in the new machines by connecting together a number of points in the armature winding which are normally of the same potential, by leads through which current may pass from one section to the others of equal polarity to which it is connected in parallel. These currents change in direction and may lead or lag with reference to their respective e. m. f's. so that they magnetize or demagnetize the field magnets, thus automatically effecting the required balance between them. In case an armature becomes decentralized from the wear of the bearings or otherwise, the potential generated in the coils of the armature where the air gap is smallest is much higher than that generated in the coils of corresponding potential on the opposite side of the commutator where the air gap is largest and a current corresponding to this difference of potential tends to flow from one section of the armature to another through the brushes and connecting leads causing sparking and wasteful heating. With this method of balancing, however, the armature could be considerably out of center without causing trouble, as the balancing currents do not flow through the brushes but through the special connections mentioned above.

A further advantage of this method is that it prevents any heavy magnetic pull on one side of the armature if it should get out of center when the bearings become worn. The pull upon one side of a large armature in this case may amount to several tons unless the induction under all the poles is equalized.

THE SPRAGUE MULTIPLE-UNIT SYSTEM.

In the "Review" for December, 1897, we published a description, with sketches, of the electrical car equipment for operating the South Side Elevated R. R., Chicago, on the Sprague multiple-unit system. At the meeting of the American Institute of Electrical Engineers, in May last, Mr. Frank J. Sprague read a lengthy paper on the subject of "Multiple-unit System of Electric Street Railways," from which we extract a portion relating to the equipment of the South Side Elevated, and interesting details as to its operation. While the portion descriptive of the car equipment is in part a repetition of what was previously published in the "Review," we give it here because it is more complete as to some matters and is Mr. Sprague's own statement, he having been unwilling to furnish data for publication in 1897. After an extended review of the development of electric railways, Mr. Sprague said:

It has been already pointed out that the multiple-unit system is an aggregation of transportation units of variable size, each equipped with the power required to operate that unit at a given schedule and under determined conditions, with means for controlling the aggregation from two or more points. This does not necessarily mean that every car is equipped; that depends upon the schedule and the requirements of acceleration, for the method is equally applicable whatever the number of cars that are equipped with motors or the number of motorless or "train-line" cars which are mixed in with them. For example, a train can be made up of pairs, each of which forms a transportation unit consisting of one motor and one motorless car, so that the train can be made up of two, four or six cars, that is, one, two or three couples, thus averaging one motor per car in use. Three and five-car trains can be made up, the third and fifth being a motor car or a train-line car. In any case, two-motor equipments can be put on one-half of the cars and the balance equipped with a "train-line" so as to get one schedule, and when it is desired to increase the schedule motors and a controller can be added to the partially equipped cars.

Of course, the finality of the system on roads with frequent stops, to get the maximum schedule speed, is a motor on each axle, but in a large number of cases and with pivot-truck cars, commercial demands are such that two motors per car are sufficient, and on some service two motors on alternate cars only.

The equipment of the South Side road has been made on a mixed plan, 120 cars first being each individually equipped with two motors, then 30 cars with a "train-line," but without motors, and finally 30 additional cars completely equipped.

The position and arrangement of the South Side yards and the running of trains into a Y at one end and around a loop at the other produces every possible aggregation of cars. Hence, for the equipment, in order to avoid head and tail switching, and to permit of this variable aggregation, there was one vital condition, which was that no matter how trains were made up, like hand movement at the end of any car must at all times mean like track movement relative to the operator, and the system of connections from one car to another must automatically provide for such a result.

THE CAB.

This variation of car aggregation, and the further condition that no seat-room should be taken up by the motorman, made it necessary to provide each car with a movable cab on the platform such that it could be left open for the free use of the ordinary entrance gate when in the body of the train, and yet be readily closed and afford protection to the motorman when at the leading end, at the same time allowing free passage from one car to another. On each car, therefore, at the right-hand diagonal corners the ironwork has been removed and a three-part cab constructed, the outer end being a fixture with a drop window, and carrying in the angle formed by the platform the initial controlling mechanism, being the master controller for the electrical system and the engineer's valves for the air brakes. On each side is a door, each hinged in opposite direction, and folding back one over the other against the header of the car, leaving, when in this condition, the platform clear and the ordinary gate in operation.

When used by the motorman, one or both doors are closed, the iron gate swung in place, and a small protecting cab is the result.

MOTORS AND CONTROLLERS.

Under one end of the car, in place of the ordinary truck, is a motor truck carrying two 50 h. p. (hour rating) standard railway motors of capacity and gearing such as to safely allow the motors to work up to the skidding point of the wheels with 60 per cent of the weight of the car equipment and load upon them. The motors are of the General Electric manufacture and of the usual Sprague suspension.

In the hood of each car is a controller for the motors enclosed behind a trap-door which can be lowered for ready inspection. The controller is of the multiple-series type, is driven by a small pilot motor, and provision is made for at will or simultaneously producing a step-by-step or interrupted by periodic forward movement of the controller, and a continuous or interrupted return movement of it to the off position through various automatics connected with the pilot motor and the initial control circuits.

In addition to the current-varying controller, there is a main reverser, likewise operated by the same agencies as the pilot motor, for determining the direction of the current delivered to the motors, and for instantly opening the circuit of the motors in case of emergency.

Inside of each cab is a small master controller or operator's switch mounted on a standard and fastened to the woodwork of the cab. Through this master controller the pilot apparatus of the current-varying controller and the reverses are governed. It is provided with a movable handle operating a spring-retracted spindle which, through various degrees of movement, makes contact with the reverser circuit and with three determinate positions—coast, series and multiple. Momentary contacts on these various points give any desired intermediate position of the main controller, which has a stepped movement. In order to maintain the controller at any point, or to keep the governing circuits or train-lines energized, the handle of the master controller must be held in position. If the handle is released, whether from accident or design, the spindle instantly returns to coast position, and the controller automatically returns to the off position and cuts off the current, or if the master controller is allowed to go to the center position, the reverser is instantly opened and the controller then comes to open-circuit also automatically.

The arrangements of circuits is such that by the use of a relay and throttle and the proper interconnection between the controlling circuits, the operator is at liberty to do about as he pleases with the master controller, and can rely upon the main controller operating satisfactorily.

For example: He can go to the series or to the multiple position, or from the last reverse movement instantly, and the controller, instead of responding instantly, responds progressively, the pilot being limited in its movements by increment of the main current to or above any definite amount.

The throttle is set just short of the skidding point of the wheels on a normal track, allowing 15 per cent adhesion, and absolutely limits the current input to that which is required by the determined rate of acceleration. Any rate less than this can also be effected by proper handling of the motor controller, so that any movements, no matter how refined, are perfectly possible.

This throttle is in the circuit of one motor only, so that it is equally effective whether in the series or multiple position.

Although there is a master controller on each platform, their construction is such that interference with them is difficult, and has never been known to occur.

THE "TRAIN-LINE."

So far, the system described is that of a secondary electric control of a single controller, but by paralleling the relay and other circuits it is evident that the two or more equipments on a single car can be operated, and also that if these equipments are put on different cars they can likewise be operated, provided means exist for properly connecting the prime controlling circuits and insuring practical synchronism of the different controls and equal work on the different motors. Where the equipments, however, are on different cars, it then becomes necessary to have a "train-line" and couplers, so that a governing circuit which can be energized at various points is made up of a "train-line" individual to either car and couplers of some kind between them.

This "train-line" is necessarily an independent line, not being a part of the main motor circuits on any car. It can be energized, of course, from any electrical source, but for convenience the main source of supply is the one used.

This "train-line" consists of five wires perfectly insulated, made into a common cable permanently located in the car and terminating at each platform in one or more couplers, in this particular case in a pair of couplers, one under each corner of the platform, these couplers being shrouded so as to prevent dirt or rain entering them.

When trains are made up the train-lines are connected by a reversible jumper having corresponding wires, and the system is so disposed and connected that no matter from which corner the connections are made, or how the cars are reversed or altered in sequence, the circuits are automatically established such that like track movement is always assured with like hand movement of the master controllers.

The section of train-line in each car is not a part of the normal controlling circuit individual to the control equipment, but is connected with it with switches, which enables a severance of the two systems, that is, the local-car system and the train-line, so that no matter how many trains may be made up, it is always possible to disconnect the controlling mechanism of any train for any purpose whatever.

The practical result of the system is that every aggregation of cars, whether one or more, has identically the same characteristics in the matter of load, capacity, motor-equipment, rate of acceleration, etc., as are possible with a single car, and every combination is made without the slightest thought being given to pairing of electrical circuits.

AIR BRAKES.

Each car is equipped with an automatic air-brake system, supplied by Christensen air compressors, with a reserve tank, and an equalizing pipe running from car to car, the compressors being started and stopped automatically through an air-governed switch by fall and rise of air pressure.

On each platform, alongside of the master controller, is a small engineer's valve, so that from any selected cab the air brakes can be operated with equal facility.

A balance wire runs through the train, and is included in the same coupling as connects up the electrical train-line, so that when an air governor on any car closes circuit, all compressors start and continue in operation until the last governor throws out. This is to effect equal work on the various compressors and to maintain absolute certainty of air supply at all times.

AUTOMATIC PROTECTION.

If a train should start, three systems of automatics come into play. The reversers go to open circuits, the controllers to the off position and the air brakes also automatically operate.

If the main circuit fails, all reversers open instantly and the controllers must come to the off position, which they will do automatically as soon as current is restored, before current can again be put in the main motors.

So, too, if there is an instant reversal of the master controller. The reversers first open circuit, the controllers return to the off or any determined position, then start again, and are instantly arrested on the first contact. Provision is made so that it is impossible to run backward at more than one-half speed from any platform when operating from that platform.

PERFORMANCE.

For several weeks, on account of lack of equipment, the motors on the equipped cars in the morning and evening hours were subjected to a regular increase of load of about one-third, and at times every motor car has been in operation. The economy of quick acceleration for high schedules has been thoroughly demonstrated. When coasting freely, on test, with car making 15-mile schedule, and under the conditions of grade and station intervals on the South Side road, the energy used at the car was about 73 watt-hours per ton-mile.

A very large number of records has been taken by Mr. Lundy (of Sargent & Lundy, the consulting engineers for the South Side Elevated Railroad Co.), these running into the hundreds, under all possible conditions of acceleration and all sorts of motor and trail car combinations, for determining the best methods of operation, the highest degree of economy under various loads, and for ascertaining track, car and gear resistances, resulting in a very satisfactory equation with speed and weight at factors. These are conclusive of the benefits of this method of operation, independent of the influence on passenger traffic of high-schedule speeds and short time intervals.

The system was put to the hardest test on October 19th, Jubilee Day, and although operating with only 148 cars on nearly 20 miles of total trackage, 240 cars per hour were sent into and out of the loop at Congress St., hour after hour, without a hitch. This was done by reversing trains at cross-overs at three or four different points, thus intensifying the car movement where traffic demands were greatest.

On this particular day, when the car mileage was increased about 80 per cent and with very heavy loads, the central station had six 400 h. p. (standard rating) boilers only in use, with but two men in the fire room, and there was no straining of engines, dynamos or batteries.

As an example of extraordinary duty, the operation during the recent holidays may be cited. During a good portion of the time the central station is reported by the consulting engineers as operating as follows:

Fifty per cent overload for six hours, full load for 17 hours and 74 per cent load factor for 24 hours.

Out of 120 motor equipments designed for individual operation, 119 were in daily operation morning and night, with 28 or 29 trailers, thus overloading the station one-third, and often these trains coming out of the loop from two to five minutes late have made up time before reaching the end of the run, but naturally, of course, at a loss of officiency.

The average duty of this equipment is higher than that of any other elevated railroad in the world. Cars have frequently made as high as 290 miles a day for days in succession, and the average maximum of cars in operation for long periods ran to nearly 100 per cent.

TROUBLES.

So much for the actual results accomplished on the South Side road. The question naturally arises, Have there not been difficulties, and if so, of what character?

Of course there have been, and I should have been surprised, and almost sorry, if it had been otherwise, because it is only through the difficulties incident to the earlier operation of a system of this character that the essentials are fully determined and apparatus developed to a state of perfection.

It is curious, however, that there have been more troubles with what is classed as "standard apparatus" than with that individual to the multiple-unit control. These latter troubles were, first, with the rheostats, which were of new construction, and later, poor brush terminals, cracked gear cases, and with the earlier type of air governors.

With the specific multiple-unit apparatus the principal troubles were with poorly and hastily wound relay coils, too light and unsubstantial construction of auxiliary contacts and improper jumper construction, causing an occasional opening of the controlling circuits.

Taken all in all, however, the preseident and superintendent of the road state that there were less troubles than when starting with their compound locomotives, and on the whole the success of the road has been unparalleled in electric-railway history where so radical a departure has been taken.

CONCLUSION.

Coming to New York conditions, I may say that, based upon the Chicago performance, and allowing for difference of coal cost, the Manhattan road, now operating at 12½ miles actual schedule during time of maximum load, and making about 43,000,000 miles annually, can be operated at over a 16-mile schedule at not exceeding 9 cents, instead of 11.9, and on the existing mileage this would mean a saving, excluding interest on investment, of about $1,250,000 per annum, or allowing interest on investments of about $750,000, to say nothing of any other gains. A 17-mile schedule can actually be made with two motor equipments.

In closing, perhaps I may venture an opinion as to the general features which should characterize a suburban passenger railway

equipment. I think it may be safely stated that the first is the use of the continuous current in the motor equipment, in spite of the claims which have been made and the results accomplished with alternating-current motors, at least so far as we can judge by any present developments.

The problem, then, is whence shall be derived this continuous current, and that depends upon distances. For moderate distances continuous-current generators supplying current directly to the line with or without the addition of storage batteries are preferable. When the extent of the line becomes at all serious, then it must be considered as made up of a number of shorter sections joined together, each of which derives its principal source of supply from a local station, which station can be driven directly by water or steam power, or by an alternating current from a distant station, using a motor-dynamo combined in a single type of machine, the rotary converter, or joined in the form of a directly coupled set, the dynamo end being for continuous current and the driver a synchronous or induction type of motor.

Generally the sub-station should be supplemented by a storage battery, to take care of fluctuations in the load, to make even the duty on the sub-station and, as far as possible, at the central station, and to take care of some portion of the peak-load caused by abnormal variations in the aggregate service at different times of the day.

Of course, with the storage battery comes the necessity of a means of some kind of automatic regulation; there are various methods, but I will not enter into them here.

Looking forward, however, to a perfectly assured future of a heavy service over considerable distances, I may state that the general equipment of such a road should generally involve the following essentials:

High-potential alternating-current transmission from one or two well-placed central stations, with or without static transformers.

Motor-dynamo sets or rotary converters at a number of conveniently placed sub-stations, to convert high-pressure currents into continuous currents of about 600 volts pressure.

Storage batteries of quick charge and discharge capacity at the same sub-stations as the motor converters, to equalize their duty and to prevent sharp variations in the generating plant as well as the sub-station.

A system of feeders and main conductors.

A power rail or trolley wire supplying continuous current, but ordinarily without any switching of currents.

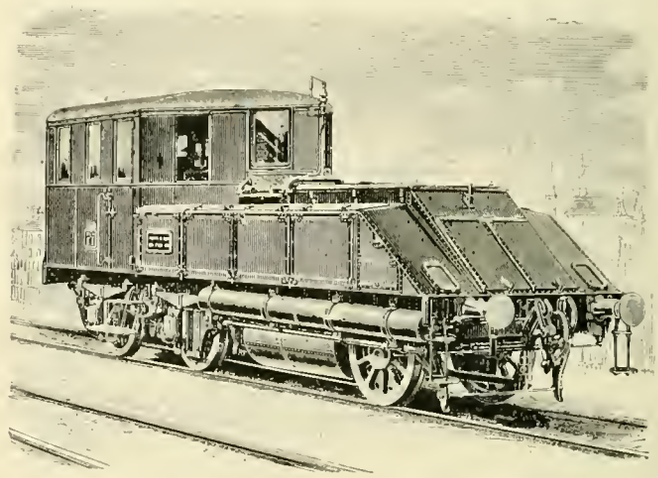
Individual transportation units with a multiple-unit control, so that combinations of cars without regard to sequence or end relation can be made up at any portion of the line independently and controlled from any selected point.

A STORAGE BATTERY LOCOMOTIVE.

The Campagnie de Lyon has in operation a storage battery locomotive built under the direction of M. Baudry, chief engineer, and M. Auvert, engineer of the central service of this company, which has been described by the latter in an article published in the Revue Generale des Chemins de Fer. This locomotive, which is illustrated herewith, was completed in 1897, and since that time has been in trial service upon the line from Paris to Melun. The machine has three axles, of which two only are drivers, and possesses about one-half of the power of the ordinary express locomotives on this road, but it is only necessary to double the number of driving axles to bring it up to the full power. It is connected to a tender carrying the accumulators, the hauling of which absorbs a notable part of the power generated on account of its very great weight.

The three sets of wheels of the locomotive all have the same diameter of 1.1 m. The front wheels are simply pilot wheels and are 6 m. in front of the middle pair. The boxes of the forward axle permit a lateral play of 15 mm. The two rear axles are separated by a distance of 2.2 m. and are driven by electric motors independent of each other. The housing of the locomotive is built in five distinct compartments. The one in the rear, which is situated directly above the motors, is the cab for the motorman and his assistant, and the forward compartment, of which the highest part is only 1.3 m., so as not to obstruct the view of the motorman, contains an air compressor run by a small electric motor of 5 h. p. This apparatus furnishes the compressed air necessary for the operation of the Westinghouse air brakes, the whistle and the starting apparatus. Of the three other compartments, two are situated, one on the right and the other on the left hand side of the engine, and are 1 m. in height. Each of these contain nine cells of accumulators, which, connected in series, are used to excite the fields of the motors and furnish the current necessary for the compressed air and the lighting. They can also run the locomotive at a very slow speed, say from 3 to 6 km. per hour. The fifth compartment, of a height of 1.3 m., contains a large water rheostat which opens and closes the circuits of the motor fields and also regulates their intensity.

The current for the locomotive is furnished by two batteries of accumulators of 96 cells each, which are carried upon the tender mentioned above and which are connected to the motors by four cables. The normal maximum current for which each armature is designed for continuous running is 700 amperes, and the effective power corresponding to this current is 300 h. p. This gives a speed of 103 km. per hour with the wheels revolving at 500 r. p. m. Under the conditions the difference of potential at the brushes is 360 volts. The available capacity of the 18 accumulator cells carried by the locomotive is 1,500 ampere-hours. The electrodes of one cell represent a weight of 140 kg. The total weight of the locomotive is 44,500 kg., of which 12,500 kg. are supported by the forward axle and 16,000 kg. on each of the two other axles.



STORAGE BATTERY LOCOMOTIVE.

The tender is carried on four axles with wheels .99 m. in diameter; the wheel base is 7.7 m. The total weight is 45,800 kg. It contains 192 cells and has a capacity of 1,000 ampere-hours, having an average rate of discharge of 500 amperes. The electrodes of one cell weigh 90 kg.

Upon each driving axle is mounted an electric motor with the armature placed directly upon the axle. The armatures have a commutator at each end. The fields are composed of two large horse-shoe magnets of soft steel placed one in front and the other behind the axle, the pole pieces embracing almost the whole exterior surface of the armature.

The armature is of the Brown type with the winding enclosed in a laminated sheet iron core, the armature conductors being surrounded by micanite and passed through holes close to the surface of the core. Two carbon brushes are used on each commutator.

On its trial trips between Paris and Melun, with a train weighing 147 tons, including the weight of the tender but not that of the locomotive, it has attained a speed of 45 km. per hour. The trials up to this time have been made chiefly to test the working of the locomotive, but a series of methodical trials are soon to be made to test the full capacity of the machine.

The Detroit, Ypsilanti & Ann Arbor Electric Ry. have put six new cars in operation upon its lines. The cars are 50 feet in length, five feet longer than those in use on the line now. Each car will seat 56 passengers, and contains a compartment for the use of smokers, separated from the body of the car by a glass partition. The seats are upholstered.

RECENT STREET RAILWAY DECISIONS.

EDITED BY J. L. ROSENBERGER, ATTORNEY AT LAW, CHICAGO.

FRIGHTENING HORSE BY SPLASHING THROUGH WATER.

Ayars v. Camden & Suburban Railway Co. (N. J.), 43 Atl. Rep. 678. June 12, 1899.

According to the verdict of the jury for the plaintiff, and the decision of the supreme court of New Jersey that it was a question for the jury to determine, the running of an electric car at the ordinary rate of speed through a pool of water upon the public highway is negligence where the unusual noise produced and splashing frightens a horse being driven upon such highway, causing a runaway.

CONDUCTOR AND MOTORMAN FELLOW SERVANTS.

Savage v. Nassau Electric Railroad Co. (N. Y.), 59 N. Y. Supp. 225. July 1, 1899.

The motorman and conductor on an electric street car, the second appellate division of the supreme court of New York holds, are fellow servants, so that the negligence of the conductor, as for example in taking out a car on the wrong track on a densely foggy morning, will be imputed to the motorman, preventing him from recovering from the company for injuries sustained thereby, as in a collision consequent thereon.

SHOULD HAVE HAD KNOWLEDGE OF DEFECTIVE CONDITION OF BRAKE SHOES.

Butler v. New York & Queens County Railroad Co. (N. Y.), 58 N. Y. Supp. 1061. July 1, 1899.

An accident having occurred by reason of the sudden falling of the brake shoes from a car, the second appellate division of the supreme court of New York holds that this was a defect of which the plaintiff, an employe, who was injured by the accident, could not be reasonably supposed to have had notice, although he took out the car, under directions to select the best one, but it holds that it was a defect from which the jury were authorized to find that the defendant in the exercise of reasonable care, should have had knowledge.

ASSUMES FENDER PLATFORM CARRIED BOY.

Green v. Metropolitan Street Railway Co. (N. Y.), 58 N. Y. Supp. 1039. June 30, 1899.

Regardless of whether he has not himself been negligent, the first appellate division of the supreme court of New York holds that reasonable care must be used to avoid injuring a boy after he is placed in a position of danger. As having a bearing on this, especially as to whether a car was promptly enough stopped after it struck a boy, it suggests that, the car in question having no fender in front, but being furnished with a fender under the platform, placed just before the front wheels, the inference could be fairly drawn that against or upon this fender the boy rested for a period of time while being carried a distance which was variously estimated by the witnesses.

SHOULD HAVE BEEN INFORMED OF PERIL.

West Chicago Street Railroad Co. v. Johnson (Ill.), 54 N. E. Rep. 334. June 21, 1899.

On this appeal, the supreme court of Illinois affirms a judgment for $3,000 damages for injuries sustained by a boy of about 16 years of age who was struck on the leg by the sudden flying back of an iron brake lever on a grip car. The evidence was deemed sufficient to justify the jury in finding that the cable train was so crowded as to warrant the boy in pushing past other passengers into the gripman's aisle, where, it appeared, it was not unusual for passengers to stand when riding on similar cars operated by this company, under like circumstances. The evidence was conflicting as to whether the gripman told the boy to move back, or motioned or pushed him back. But with regard to this, the supreme court says that the boy had been accepted as a passenger, and as such was, of necessity, entitled to space in the car, and that the mere suggestion or request on the part of the motorman that he leave the position taken by him, without informing him of his peril, taking into consideration the crowded condition of the car, presented a question of fact as to whether he was guilty of contributory negligence in not obeying, to be determined by the jury, and not to be determined by the court in an instruction.

CROSSING STREETS COMPARED WITH OTHER TRANSACTIONS.

Baltimore Consolidated Railway Co. v. Rifcowitz (Md.), 43 Atl. Rep. 762. June 20, 1899.

In crossing streets, the way the court of appeals of Maryland states the rule, due and ordinary care must be exercised, as in all other transactions of life.

AUTHORIZES CHANGE IN ROUTE.

People, on relation of Long Island Railroad Co. v. Board of Railroad Commissioners (N. Y.), 59 N. Y. Supp. 144. July 6, 1899.

A change in route, not affecting substantially its character, and made in order to obviate objections of the local authorities, the third appellate division of the supreme court of New York holds, might well be deemed a defect such as might be allowed to be corrected under section 59 of the railroad law of that state, which gives the board of railroad commissioners power, before granting a certificate for the construction of a road, to permit errors, omissions, or defects to be supplied and corrected; and it holds that such a change might be disregarded or approved, if made after the filing of the articles of association, and before the application to the board.

MOTORMAN MUST DO ALL IN HIS POWER UNDER THE EMERGENCIES SURROUNDING HIM.

Citizens' Street Railway Co. v. Dan (Tenn.), 52 S. W. Rep. 177. April Term, 1899.

In this case, wherein the supreme court of Tennessee affirms a judgment for $2,500 for the killing of a child four years of age, it holds that, in the connection in which it was used, a charge to the jury was not too strong, nor did it exact too high a degree of diligence, which was substantially that it is the duty of the motorman to keep a vigilant lookout for children in, upon, or using the street, and, upon the first appearance of danger or probable collision with any one of them, to stop his car in the shortest time and space possible. To stop his car in the shortest time and space possible, the supreme court goes on to say, would be but the exercise of ordinary or reasonable diligence under the emergencies mentioned by the trial judge, and this means simply that the motorman must do all in his power under the emergencies surrounding to save human life.

COURT CANNOT LAY DOWN DEFINITE RULES FOR MANAGEMENT OF ELECTRIC CARS.

Lawler v. Hartford Street Railway Co. (Conn.), 43 Atl. Rep. 545. June 8, 1899.

The supreme court of errors of Connecticut declares that it cannot lay down definite rules for the management of electric cars. At the same time, it holds that, in the absence of any law or municipal ordinance regulating the speed of street cars, they must be run at such speed and must be kept in such control as not to interfere unreasonably with the rights of others upon the highway, and reasonable care must be exercised to avoid inflicting injury upon others. More particularly, it thinks it cannot say that, as a matter of law, the defendant was not negligent in running or coasting its car down grade at a speed of what was probably 12 miles an hour.

or in not having more complete control of the car than not to be able to stop it until it had run 130 feet after a collision, or in omitting to sand the track. So that, the finding here being against the defendant, it affirms a judgment thereon for the plaintiff.

CURTAIN RODS DO NOT REQUIRE VERY HIGHEST CARE.

Leyh v. Newburgh Electric Railway Co. (N. Y.), 58 N. Y. Supp. 479. June 6, 1899.

This was an action brought to recover damages for injuries sustained by a passenger by being struck by the end of an iron curtain rod which had just been broken by a strong wind. The plaintiff got a judgment. But this the second appellate division of the supreme court of New York now reverses. It declares that it cannot hold that a common carrier of passengers is bound to use the very highest degree of care in respect to the curtain rods of its cars. The defendant, it holds, was bound to use reasonable care, adequate to the use of the appliance and to the probable results of its use. It was not bound to foresee and prevent such an unusual and not to be expected accident as that developed by the evidence here. It also says that it does not consider that this was a case where the doctrine that "the thing speaks for itself" applies, and that it was therefore incumbent on the plaintiff to establish some negligence on the part of the defendant. That the car was built and the curtains put in by a firm which was proved to be of high standing, and one of the leading car builders of the country, and that similar curtains were in general use on a great many other roads, it points to as showing that care was used and precaution exercised, though not conclusive evidence that the carrier used requisite care.

PARALLELING STEAM RAILROAD IN CONNECTICUT.

Central Railway & Electric Co. v. New York, New Haven & Hartford Railroad Co. (Conn.), 43 Atl. Rep. 490. June 1, 1899.

The supreme court of errors of Connecticut says that the statute gives a steam railroad a legal right to protection against a parallel street railroad until a court has judicially found such road to be of public convenience and necessity. For this reason, it holds that the defendant steam railroad company was a necessary party to the plaintiff's application for a judicial finding that it was of public convenience and necessity, and that as such party the defendant company was entitled to raise all questions involved in the adjudication. The trial judge, it goes on to state, had no power to make the finding asked, if in fact no parallel road was authorized, that is to say, was already duly chartered. The legal right to construct such a road, the court holds, is a condition precedent to the judge's action. It must be found. But the court holds that where the construction of an electric railway was authorized "to a convenient point" in a certain town, "where connections can be made" with a certain named other electric railway, the right to build it would not be affected by the abandonment of the second mentioned railway, especially where the charter merely authorizes, but does not require, the completion of a connection with such other railway.

QUESTION OF NEGLIGENCE IN COLLISION WITH HOOK AND LADDER TRUCK.

Warren v. Mendenhall, receiver of the Duluth Street Railway Co. (Minn.), 79 N. W. Rep. 661. June 26, 1899.

In an action by a member of a city fire department against a street railway company for damages for an injury to him resulting from a collision, at a street crossing, between a street car and a hook and ladder truck driven by him, the question of the defendant's negligence and of his contributory negligence, the supreme court of Minnesota holds, were both for the determination of the jury. As between the plaintiff and the defendant, it was immaterial, the court considers, whether he owned the truck himself, or was driving it as the servant of the city. If he was driving a vehicle which was so unwieldy and unmanageable that it was dangerous to drive it on the public streets, and this was the cause of the collision, it holds that he could not blame the defendant. On the other hand, the court holds that the duties of a member of the fire department of a city, when driving fire apparatus on a call to a fire, might require him to take risks which it would be negligence for a private person to take in pursuit of his private business. Of course, it adds, such a fireman must use ordinary care, that is, care commensurate with the occasion. Aside from any ordinance on the subject, Mr. Justice Canty, who delivered the opinion of the court, says that, in his opinion, the right of way for the fire department would be implied. Order directing a verdict for the defendant and denying a new trial reversed, and new trial granted.

PASSENGER BOUND TO KNOW THAT CAR USUALLY STARTS OR STOPS WITH SOME JERK.

Currie v. Mendenhall, receiver of Duluth Street Railway Co. (Minn.), 79 N. W. Rep. 677. June 29, 1899.

It is the duty of those in charge of a car to give passengers an opportunity to alight in safety, and a high degree of care, the supreme court of Minnesota holds, is required in affording passengers the opportunity to do this. On the other hand, it says that, ordinarily, and usually, a street car jerks to some extent in stopping and starting. And it holds that it is the duty of a passenger to know this, and act accordingly, for the purpose of protecting himself from such a jerk at such a time; and, if he fails to take any reasonable precaution for that purpose, he is guilty of contributory negligence as a question of law, while if he does take such precaution, and is thrown off by an extraodinary jerk, his contributory negligence is a question for the jury. At the same time, it holds that a passenger had a right to assume that the movement of a car, for which the conductor has given the signal to stop, will be the ordinary one, viz. that when a passenger is invited or authorized to alight, and the car is slowing up for him or her to do so, it will not start with a sudden jerk. It further holds that it is not negligence in itself for a woman, after the conductor has, at her request, rung the bell for the car to stop for her to get off, to go and stand for a moment upon the step of the rear platform, with her right hand holding to the rail of a slowly-moving street car, when she believes, and has good reason to believe, that the car is about to stop for her to get off, but that the question of negligence on her part is for the determination of the jury.

RUNNING DOWN STREET SPRINKLER.

Abrahams v. Los Angeles Traction Co. (Cal.), 57 Pac. Rep. 216. May 15, 1899.

The plaintiff was injured while driving a sprinkling wagon by having the latter run down by a street car on the street which he was sprinkling. In affirming a judgment in his favor for $3,000, the supreme court of California says that, in approaching at high speed so unwieldly a vehicle as a modern sprinkling cart, a motorman of an electric car cannot reasonably assume that the track will be cleared as quickly as by a bicycle. In cities, where heavily freighted wagons and vehicles of every description frequently take the track of the street cars, it continues, a common observation teaches, what must be presumed to be well known to motormen, that a warning 700 feet away to the driver of a sprinkling cart, by sounding the car gong, may not be heard by the driver of the wagon; and the motorman would not be justified in quickening his speed to the highest point, and advancing without further warning, on the assumption that the signal would be heard and obeyed in time to clear the track.

BOYS RIDING WITH AND WITHOUT INVITATION OF MOTORMAN.

Little Rock Traction & Electric Co. v. Nelson (Ark.), 52 S. W. Rep. 7. June 3, 1899.

A boy 10 years of age, riding upon a street car without paying fare, by invitation of a motorman in charge of the same, who has authority to receive and let off passengers, the supreme court of Arkansas holds, is not a trespasser. The invitation of the motorman is an act within the general scope of his employment, for which he is responsible to his master. If the boy accepts it innocently, he is no trespasser, and it is the duty of the company to extend to him the diligence due to passengers of his age and discretion.

In entering, riding upon, and leaving street cars, the court further holds, a boy 10 years of age or over is bound to exercise prudence equal to his care, knowledge, and experience. To that extent he

is under a legal duty to avoid danger, and is held responsible in law for acts or omissions contributing to his own injury.

But the employes of a street railway company, the court maintains, are under no obligation to keep a lookout to prevent boys, endeavoring to ride without permission and paying fare, from entering its cars while in motion. Such a boy who does or attempts to do so is a trespasser, and the company owes him no duty save not to injure him wantonly.

Evidence that boys have ridden on the defendant's cars at different times without permission, and at other times by invitation, and without paying fare, the court holds incompetent, as not tending to prove that the plaintiff was or was not entitled to ride on the car he attempted to board at the time he was injured.

MUST MAKE REPAIRS DIRECTED BY ROAD COMMISSIONER.

Maloney v. Natick & Cochituate Street Railway Co. (Mass.), 54 N. E. Rep. 349. June 30, 1899.

By the Public Statutes of Massachusetts, chapter 113, section 32, it is provided that every street railway company shall keep in repair, to the satisfaction of the superintendent of streets, street commissioner, road commissioners, or surveyors of highway, the paving, upper planking, or other surface material of the portions of streets, roads and bridges occupied by its tracks.

This, the supreme judicial court of Massachusetts does not think means that the approval of the road commissioner is a condition precedent to the running of the road, but merely that, if he directs repairs, they must be made.

Furthermore, it being impossible for a road commissioner or superintendent of streets personally to attend to the repair of all the streets, roads, and bridges, so that, in a large town, he must, of necessity, have assistants, the court holds that the fact that an assistant has charge of a certain locality sees the work, and is satisfied, is evidence tending to show that the work is done to the satisfaction of his principal, and to negative the theory that the actual state of things is due to any want of compliance with the directions of the commissioner.

Under another provision of the statutes, the court holds that where an injury is caused by a neglect of the company to repair what it is obliged by statute to keep in repair, notice of the accident must be given it within thirty days, though such notice is not required where an accident is caused by a defective construction.

CANNOT ASSUME BROKEN-DOWN WAGONS WILL GET OUT OF WAY.

Sweeney v. Kansas City Cable Railway Co. (Mo.), 51 S. W. Rep. 682. May 23, 1899.

In no case, does the supreme court of Missouri, division No. 2, consider that a gripman has the right to assume that such obstructions as a broken-down wagon will move out of the way. It further maintains that if the gripman in question could have seen the broken-down wagon on the track in time to stop, had he looked, the presumption was that he did not look, or, if he did look, that he did not heed what he saw, so that in either case he was negligent.

Nor does the court consider that a passenger, who was fatally injured by the car he was on being run into such a wagon, was guilty of contributory negligence in being upon the running board, he having stepped onto the running board when he had reached the place where he wanted to alight and the gripman, through inattention to duty, having failed to stop the car there, was carrying him on to the next street.

There is no question, the court insists, but that the degree of care required of street railway companies towards their passengers is the utmost care and diligence of very cautious persons.

NO INJUNCTION AFTER COMPENSATION FOR RIGHT TO USE TRACKS.

People's Railway Co. v. Grand Avenue Railway Co. (Mo.), 50 S. W. Rep. 829. Mar. 31, 1899.

It is a well-settled principle of law, says the supreme court of Missouri, that where a new duty or cause of action is created by statute, and a particular proceeding, not theretofore existing, to enforce the duty or to vindicate the right conferred, is prescribed, the statutory remedy is adequate, and no other must be pursued. Applying this, the court holds that the proceeding provided by the St. Louis ordinances for the purpose of securing to the plaintiff full and fair compensation for all the injury it might suffer by reason of the delays and inconveniences resulting from the exercise by the defendant of its right under the city charter to connect its track with, and pass its cars over, the plaintiff's tracks, was a valid and adequate one, so that the compensation once having been determined thereunder and accepted by the plaintiff it would not afterwards be entitled to any relief by injunction from any such delays and inconveniences.

ENTITLED TO USE TRACKS FOR OWN CARS ONLY.

South Side Passenger Railway Co. v. Second Avenue Passenger Railway Co. (Pa.), 43 Atl. Rep. 346. May 22, 1899.

By agreement, a street railway company acquired the right to use certain tracks. The use by it was without limit as to amount. But it was a use for itself and its own cars, only. Under these circumstances, the supreme court of Pennsylvania holds that the company had a power of growth, but had no general power of expansion into other fields, or of increase by the absorption of other roads. In other words, the court holds that when the company itself was absorbed by another company, the latter became a practical "assign," which, under the agreement, was entitled to the continuance of all the rights and privileges given to the assignor by the agreement, but nothing more, so that while it was entitled to use the tracks for the cars from the line of the first company, however many, it could not use them in the operation of its leased or consolidated lines, other than for such cars of such first company.

DUTY WHERE CAR SLOWS UP AFTER FAILURE TO STOP AT CROSSING.

Birmingham Railway & Electric Co. v. James (Ala.), 25 So. Rep. 847.

The supreme court of Alabama approves of an instruction to the effect that if an electric car passed a street crossing without stopping for a passenger to alight in response to his signal, and then slowed up to such an extent as would imply, on the part of those persons who had charge of the car, that was an invitation for him to alight at that point, and he endeavored to do so, then it was just as much their duty not to jerk the car suddenly, or give it a forward impetus so suddenly as to imperil his life or his safety, as if it had been at the crossing itself, and that they were under just as much duty to protect him against injury as if the stop had been made right at the street crossing. And the court does not consider that it is negligence, as a matter of law, for a passenger to take, with ordinary care, a position on the steps of a car preparatory to alighting, nor for him to attempt to alight from a car moving so slowly that it would not appear dangerous to do so to a man of ordinary prudence.

DUTY TO CORRECT ABUSES OF JURY SYSTEM.

Messenger v. St. Paul City Railway Co. (Minn.), 79 N. W. Rep. 583. June 14, 1899.

The supreme court of Minnesota admits that it cannot say that there was not some evidence in this case to support the verdict for the plaintiff. But her uncorroborated evidence on the essential and vital point in the case, namely, as to the manner in which she was injured, it insists, was so inherently improbable and unreasonable that the trial court must be held to have abused its discretion in refusing to set aside the verdict, and grant a new trial. And the supreme court itself grants a new trial.

The court says that this rule can be applied by it only in extreme cases. But when such a case is presented it maintains that the court should not hesitate to act. The court which refuses to do anything to correct the abuses of the jury system, it adds, is one of the worst enemies of that institution. Such a court, it believes, is doing what it can to pave the way for the abolition of the jury system, the establishment of "government by injunction," and the establishment of a one-man system, in which the judge who acts as a jury will be altogether too liable to be selected, controlled, or in-

fluenced by great corporations and by men of great wealth or political influence.

LIABILITY FOR INJURY TO TRANSFER PASSENGER BY TROLLEY POLE BREAKING.

Keator v. Scranton Traction Co. (Pa.), 43 Atl. Rep. 86. Apr. 24, 1899.

To change from one line of street railway to another operated by the same company passengers had a block to walk. A transfer ticket issued from one to the other read: "Good upon next south side car within thirty minutes from nine o'clock." The holder walked to the starting point of the south side car. While she was standing on the pavement, the car pulled up. As that was a terminus of that line, the motorman attempted to change the trolley pole to the other end of the car. In doing so, it broke, a piece striking the woman, inflicting a severe injury. When struck, she had moved to a point midway between the curb and car.

The turning point in the case, was on the question of whether the woman was a passenger at the time of the injury, to whom the company owed care accordingly. The supreme court of Pennsylvania, however, stated that there is no definition of the duty of the company to her which fitted the facts of the case. And it called special attention to the fact that the injury to her was from a defect in an indispensable attachment of the very vehicle in which the company had undertaken to carry her.

So far as the transfer ticket was concerned, the court says that it must be conceded that it, on its face, was an undertaking to carry her from the point where the car started to her destination on the south side line, and says that she was not a passenger while on the sidewalk going from one point to the other.

Yet surely, in such situation, under such circumstances, as above stated, the court holds, the carrier's duty to her was what it owed to a passenger—as much so as if her injury had been caused by a rotten step on the car. When she came within reach of the vehicle provided for her transportation, it maintains, the carrier's duty was that she not be injured by the vehicle, if the highest degree of care could prevent it. Such care the company was bound to show affirmatively. It did not attempt to show it. Therefore, the court concludes, it was answerable in damages for her injury.

STARTING OF CARS BY INTERMEDDLERS.

Leavenworth Electric Railroad Co. (Kan.), 57 Pac. Rep. 519. June 10, 1899.

The evidence in this case showed that the plaintiff and her child were passengers on a certain street car, and that she told the conductor to let her off at a particular street. As the car approached that street, it was quite full of passengers. The conductor desired to occupy his time in collecting fares, and, in order to enable himself to do so, asked a conductor of another car, who was off duty, and riding on this car, to let the woman and her child off. This the latter conductor promised to do. He gave the signal to stop at the desired street, but himself left the car at that point in advance of the plaintiff and the child, without giving the starting signal. The child descended in safety, and the plaintiff herself went as far as the steps, when some unauthorized and unknown person gave the starting signal to the motorman. The car started. The woman grew dizzy, and fell to the street.

In affirming a judgment for the plaintiff, the supreme court of Kansas holds that a street railway company is bound to the highest possible caution and prudence in letting off its passengers at its stopping place, and its employes must not merely wait a reasonable time to enable the passengers to alight, without looking to see whether such has been done, but they must see and know that the passengers are safely off before starting the car in motion again.

When a street railway car is negligently started in motion before a passenger endeavoring to leave it has safely alighted from it, and while it is so in motion the passenger is seized with an attack of dizziness, which prevents her from holding on, and in consequence falls off, and is injured, the company is liable.

A street railway company is not responsible for injuries resulting from the act of an intermeddler in the running of its cars, which its employes could not foresee and guard against; but when such act of intermeddling consists in giving the signal to start the car in motion, and the conductor in charge, without seeing and knowing that a passenger has safely alighted before the car started, does not stop it as soon as he can, but allows it to continue in motion in obedience to the unauthorized signal, he will be held to have ratified and adopted the act of the intermeddler, and the company will be liable for the consequent injury as caused by an act of its employe's negligence.

If, by custom among street railway employes, known and assented to by the company, those who are on duty are in the habit of calling for and receiving assistance from those who are not at the time on duty, and an employe off duty, thus called upon, undertakes to render the assistance asked, he will be regarded as in the employ of the company for such service; and, if he negligently abandons the work before completing it, whereby injuries to a passenger occur, the company will be liable.

If, however, such custom does not exist, or, existing, is not known and asserted to by the company, but an employe on duty deputes the one off duty to assist him, and he undertakes to do so, but negligently fails to fully perform it, whereby injury to a passenger occurs, the company is likewise liable, because of the negligent abandonment of duty by the employe directly chargeable with its performance.

PRESUMPTION IS THAT TRACK IS CLEAR.

Kramer v. New Orleans City & Lake Railroad Co. (La.), 26 So. Rep. 411. January 9; Rehearing denied, June 27, 1899.

This was a case of a drunken man lying near an electric street railway track, throwing his feet, or that portion of his legs below the knees, across the track, and in that condition receiving injuries requiring the amputation of his legs near the ankle joint. A verdict was returned in his favor for $12,500. But the supreme court of Louisiana reverses the judgment based on such verdict, ordering that the plaintiff's suit be dismissed, with costs. It does not consider that it can hold that a motorman, entering a curve on a street is required to closely scan the rails beyond the curve to discover the protruding feet of a man in the grass, 70 feet beyond the curve. The presumption is, it holds, that the track is clear; not that this at all releases the vigilance to be exerted by the motorman, but, in estimating that vigilance in such a case as this it authorizes the making of some allowance for a failure of the motorman to discover such objects on the tracks under such conditions. Moreover, it thinks that there is certain to be a difference in the quickness and accuracy of the perception of a motorman in such case, where he has no cause to suspect—still less to know—such objects being on the track, and of a man who puts his handkerchief at the place of the accident and then seats himself to look for and perceive the object he has thus placed in position. In such a case as this, for the plaintiff to recover damages, the court holds, he must show with reasonable certainty that, notwithstanding his gross imprudence in thus exposing himself to peril, the defendant's motorman could, by the exercise of ordinary care, have averted the accident.

CAN ASSUME THAT CHILD WILL NOT DELIBERATELY RUN INTO CAR.

Adams v. Nassau Electric Railroad Co. (N. Y.), 58 N. Y. Supp. 543. June 6, 1899.

Children early learn that contact with some things will produce pain and injury, and their education with respect thereto proceeds with considerable rapidity. While they lack judgment to act with care and circumspection in respect of such matters, yet they are quite sensible of the necessity of avoiding contact with objects which experience has taught will inflict harm. A child will not usually place its hand in the fire, as it early learns that if it does it will be burned, and it will not voluntarily run into a moving car, being sensible that pain will follow. A child of sufficient maturity to play about the streets, and of the age say of nearly 6 years, may be assumed to know that injury would result to him from such an act. These well-known facts, the second appellate division of the supreme court of New York holds, people engaged in traffic upon the streets may reasonably and fairly take into consideration in operating their vehicles thereon. So, in this case, the court thinks that the motorman had the right to assume that an infant of such

age would not voluntarily leave the walk at the side of the street, and deliberately run into the car. Consequently, it holds, he was not, in the exercise of reasonable and ordinary care, required to operate his car in contemplation of such a contingency, although he was undoubtedly required to be upon his guard against the heedless action of immature children. And, as the fact was that the child did not reach the track until some part of the car had passed the child, the court declares itself unable to see that any act was required of the motorman to check his speed, as at no time was the child on the track in front of the car. That the car was stopped within a distance of 20 feet after contact with the child, the court considers showed that it was evidently under reasonable control. Judgment for the plaintiff reversed.

RESPONSIBILITY FOR OBSTRUCTION OF HIGHWAY WITH PILE OF RAILS.

Slayton v. West End Street Railway Co. (Mass.), 54 N. E. Rep. 351. June 30, 1899.

The fact that the plaintiff by her own admission did not notice the pile of rails over which she fell, the supreme judicial court of Massachusetts holds, would not alone require it to be held, as matter of law, that she was negligent as the presence of the rails was a temporary condition which she was not bound to anticipate.

But be that as it might the street railway company argued that the evidence adduced was not sufficient to warrant a verdict against it for the plaintiff, because the work of substituting new for old rails was being done by a firm of contractors. Nevertheless, the court overrules the company's exceptions to a judgment for the plaintiff. It points out that it was to be noticed that the railway which was under repair was in actual use for the transportation of passengers, and that it was more natural that the control of the work of repairs, which would unavoidably affect the safety of operation, should be retained by the company than committed to independent contractors, whom the company could not control. Moreover, it says that whether the relation of the firm to the defendant company was that of an independent contractor or that of an employe was a matter peculiarly within the knowledge of the company, and, when the latter rested its case without introducing evidence upon the subject, some inference might be drawn from this conduct. Again, it insists that the fact that the rails were used to repair the defendant's railway had some tendency to prove that they were its property, and placed in the gutter for its convenience and by its servants.

So, even if each separate piece of the evidence was so consistent with the defendant's nonownership and lack of control as with its responsibility, the court holds that the state of the whole evidence at the close of that part of the trial, in view of the fact that the defendant introduced no evidence as to the true relation of the contractors itself, justified the submission of the issue to the jury.

RIGHTS OF DELIVERY WAGONS VERSUS STREET CARS.

Black v. Staten Island Electric Railroad Co. (N. Y.), 57 N. Y. Supp. 1112. May 8, 1899.

A man driving a wagon for the delivery of groceries, after following the street car tracks until he came to within about 100 feet of his destination, looked behind, but could discover no approaching car. It was about 8 o'clock in the evening, and somewhat dark and misty, but he could probably have seen the headlight of a car for a distance of about 300 feet. The street at the point where he stopped was about six feet and six inches wide from the curb to the first rail of the track. There he turned from the track, hung up his lines on a hook in the wagon, and stooped down to pick up the packages he was to deliver, when a car, approaching from the rear, struck his wagon. He said that he supposed he was clear of the track, but did not look to see, feeling perfectly safe in the place he stopped the wagon. The motorman testified that the hind wheel of the wagon was over the track for a distance of about three inches. The main contention of the company was that the driver was guilty of contributory negligence in failing to look back and observe the approach of the car, and also in failing to make such observation as was necessary to make sure that he was clear of the track sufficiently far to enable a car to pass without coming into contact with the wagon.

So far as the first proposition was concerned, the second appellate division of the supreme court of New York holds that the jury was authorized to find that the driver made such observations as a prudent person would ordinarily make under the circumstances, to discover whether any car was approaching, and therefore acquit him of negligence in that regard.

Upon the other question, it pronounces the case somewhat closer, yet it thinks the evidence presented a question for the jury in that regard. It says that it is to be borne in mind that, while the right of the railroad company to have its cars move over its tracks is paramount to the right of use by the public, yet such rule is not an absolute one in all cases. The railroad company has no paramount right of use, as against persons having occasion to make use of the street for proper purposes.

People with vehicles, engaged in the delivery of merchandise, continues the court, have an equal right with such railroad company to occupy the street, for a reasonable time, to insure such delivery, even though it prevents, for the time being, the operation of the cars thereon.

Where a street is so narrow that a vehicle may not be stopped upon it for the purpose of delivery of merchandise without obstructing the tracks of the railroad company, such persons have the right of reasonable use, for the purposes of their business, equal with the railroad company; otherwise, it might well be that the street could not be capable of use by any one with vehicles, save the railroad company. Under such circumstances, the court thinks that their rights are equal, and that one may not exclude the other.

In this case, the court says, the plaintiff was lawfully using the street for the purpose of delivering his commodity; and if, in the accomplishment of such purpose, it became necessary to obstruct the railroad track, the defendant company was required to yield to such necessity, and give the plaintiff reasonable opportunity for such delivery.

Even if the street were wide enough to admit of the delivery wagon standing between the curb and the rail and permit the car to pass, of which the court is by no means sure, it holds that if the plaintiff exercised reasonable care in looking for the approach of a car, he had the right to stop for a time necessary to make delivery of his goods; and it was for the jury to say whether, in view of the width of the street, and of the space between the rail and the curb, the observation which he made for the approach of the car was such as a person in the exercise of ordinary prudence would have taken.

The defendant company was chargeable, equally with the plaintiff, the court holds, with knowledge of the space between the curb and the rail, and in the operation of its cars upon such street it was required to exercise due care in passing vehicles thereon, and not to so operate them as to come into contact with such vehicles; and if it could not pass a vehicle standing upon the street, or if the vehicle was necessarily upon the track, then the obligation of the company required it to suspend operations for the time necessary to enable the person so standing to make delivery of his merchandise.

Taking into consideration the width of the space between the rail and the curb, the width of the plaintiff's vehicle, the overhang of the car, and the obligations of each to the other, the court finds itself unable to say that the plaintiff in this case was guilty of contributory negligence, as matter of law, in permitting his vehicle to come to rest at the time and under the circumstances disclosed by the evidence. On the contrary, it thinks that the question was one of fact, and was properly submitted to the jury.

Judgment for the plaintiff affirmed.

NEW MAINE ROAD OPENED.

The Westbrook, Windham & Naples (Me.) Electric Railway was formally opened to the public on August 17th, which was the occasion of a general celebration all along the line. The directors and their friends were given a royal reception in the form of a celebration. Extra cars kindly furnished by the Portland Railroad Co. were put on the line and were busy all day.

An elaborate banquet was prepared and afterwards congratulatory speeches were made by a number of the townsmen; a band concert, fireworks and illumination concluded the evening.

UNIFORMS.

The late Emepror William of Germany was a great stickler in matters of apparently small concern. On one occasion he was reviewing troops, when suddenly he ordered one of the soldiers to step from the ranks and thereupon proceeded to administer a most scathing censure. When he had finished, he remarked to the officer in charge: "It is the leaving one button unbuttoned that spoils the discipline of an army."

While in street railway service there is certainly no such occasion to narrow instructions down to the buttoning of a certain number of buttons on a pleasant or stormy day, it cannot be denied that a missing, or battered or rusty button, does greatly detract from the appearance of the rest of the uniform, and it is much more noticeable than the loss of a button from a citizen garment. The very word uniform means "all alike," but where one man wears a single-breasted coat and the next a double-breasted garment there is obviously a wide difference. We think the roads of the east generally give more attention to uniform matters than do our western lines; but both east and west there is a growing tendency to raise the standard of the appearance of the men.

It is difficult to tell exactly just wherein lies the benefit which certainly results from a thorough uniforming, but there can be no doubt of the effect. A western steam road a few months ago decided to extend its uniforming into all departments, including brake-

MILWAUKEE ELECTRIC RAILWAY & LIGHT CO.

men on freight trains, depot and baggage men, and even the crossing flagmen. In short, all employes who come into public view. The president of the road reports the result as both highly satisfactory and surpassing. An employe of the road in citizen's clothes standing on a depot platform may be inclined to return a careless or even uncivil reply to some traveler; the same man in uniform is not only recognized as belonging to the road, and hence easily singled out when information is needed, but he is more careful in his conduct and treatment of others, for the inquiring stranger may be an officer or director of the road. The men also are less free to visit saloons when on duty and in uniform. On this road the extension of the uniform service brought a radical improvement in the general discipline, which was considered good before.

We believe that on many street railways the question of the uniform is not appreciated, and the management is satisfied with a general order specifying a certain uniform. Our observation and experience in this work leave no doubt that to be effectively done requires a good and frequent system of inspection and a firm insistance on keeping up to the regulations. It may not be necessary to issue a blanket order that on May 1st and November 1st every man shall procure a new suit, though nearly all steam roads and police departments require the wearing of the summer and winter uniform in season. The work of a conductor especially is particularly hard on aparel, but the same man at the wages paid for conducting would not expect, as a clerk in a store, to appear in the decidedly shabby outfit we frequently see him wear on a car. The conductor is certainly sufficiently well paid to warrant the company in expecting him, as the principal representative of the company before the public, to present himself in attire at least whole and clean. Yet time and again we have seen men on duty on a car clad actually in rags. What impression of the management that allows such things is made upon the public and strangers in the city needs no comment, and yet that road may be—otherwise—well managed and conducted.

The daily press frequently comment in severe terms on the arbitrary order, as they term it, of a road when it issues a uniforming order. They never do for a police department or a military company. Any yet the prices which companies secure for their men for uniforms are extremely low and almost always several dollars less than the employe could get the same garment made elsewhere. Uniform makers, like other business men, can afford to make a lower price per suit on 100 or 1,000 uniforms than tailors can, making an occasional suit out of the same materials.

Naturally some men wear their suits longer and take better care of them than others, but there are few conductors who can get along and still look presentable with less than two suits in one year, or three suits in two years at longest.

With a strict system of inspection and a firm enforcement of rules it is less difficult than many suppose to bring the standard up where it should be. We have known cases where men reported as in bad uniform when called in for inspection to borrow a good suit for the occasion, and when returned to work don the old garments. But a simple system of records showing when the order was last issued for a suit readily throws light on the subject.

There are several ways in which the standard may be kept up; inspection at car depots is one placing the responsibility entirely on the depot master or car house foreman for the appearance of his men, or by an order and record system. A plan adopted by one company will suggest its application anywhere. Bids are received for furnishing a garment in accordance with the company's specifications. When a man needs a uniform he goes to the uniform clerk, who issues the order on the maker. The man presents his order, which is in duplicate; one coupon he retains and attaches to his monthly bill to the company, the other he fills out and returns each day stating that John Smith, conductor No. 300, has been measured for his uniform. By checking these coupons against his order book stub, the uniform clerk knows the garment is being made. This prevents the men from accepting an order and not using it. A transfer of the reading of the stub into simple record book gives a complete history of a man's uniforming for any term of years. In the case of the road just mentioned the company pays for the uniform and deducts the amount from two pay days, thus making it easier on the men.

Many street railways do not find it necessary to use different weights of cloth summer and winter. The steam roads frequently do; the New York Central, for instance, use a 16-oz. single breasted suit in summer and a 25-oz. double breasted in winter. The Metropolitan Traction Co., of New York, which is a well uniformed road, uses two weights for conductors and a double breasted coat for motormen.

The reflex action on the man wearing a uniform is beneficial. It gives him an added dignity and authority. New men going on to a uniformed road quickly discover that the public recognize them as green and take advantage of them. The new man is always glad to get into his regulation suit. On some roads a man is not required to uniform for two weeks pending his acceptance. On others the "student season" is less; on others he is not allowed to take a car until in dress, and must take his chances on proving satisfactory.

The series of three photographs shows the uniforms worn by the employes of the Milwaukee Electric Railway & Light Co. The first two are of a conductor with and without his overcoat and the third represents a motorman with a fur-lined overcoat, which is found to be a great protection in that latitude. Aside from the lining in the overcoat the conductors and motormen are uniformed alike. On account of the cold nights at all seasons of the year, due to the proximity of Lake Michigan, uniforms of the same weight and texture of cloth are worn winter and summer.

The suit is made of 20-oz. blue uniform cloth. The coat is double breasted with lappel collar and 10 buttons in front and 2 on each sleeve. There are 10 pockets in the coat, as follows: two skirt pockets, 2 ticket and 1 breast pocket on the outside, and on the in-

side 2 skirt pockets, 1 ticket and 2 breast pockets. All outside pockets with the exception of the breast are leather corded or all leather throughout, and made of kangaroo calf. The inside pockets are made of heavy twilled pocketing, and all are hung, stayed and fastened in the best possible manner. The vest has 6 buttons, no collar and 1 inside and 4 outside pockets.

The conductors' uniform overcoat is made of 30-oz. blue overcoating, is double breasted, with lappel ulster collar 6 in. wide. On the outside there are 2 skirt, 2 hand and 2 ticket pockets and 2 on the inside. These are made of drab corduroy and are bound and corded with leather. The coat is cassimere lined and interlined with blanketing, and extends 6 in. below the knee. The overcoat for the motormen is the same as for the conductors except that the buttons are nickel instead of gilt; it extends 8 in. below the knee, and is lined with black Colorada sheerling fur.

The uniforms complete with buttons cost $17 each, $7 of which is deposited with the company's tailor at the time of trying it on, the remainder being paid on delivery of the suit. The cost of the conductors' overcoats, blanket lined, is $17, and the motormen's, lined with fur, $22. The caps worn are made with a flexible top stiffened with horse hair linings and covered with cloth to match the uniform. The price is $1.75, c. o. d., and is very serviceable as well as presenting a natty appearance. The cap used by the conductors has a straight peak and gold plated badge, having the word "Conductor" and the initials of the company stamped in, and the conductor's number cut out, thus throwing the numbers in relief with the blue cloth of the cap as a background. The motorman's cap has a visor peak to protect the eyes. The cap badge is silver plated and stamped "motorman." The badge and buttons are gold for the conductors and silver for motormen.

The Wilkesbarre (Pa.) & Wyoming Valley Traction Co. prescribes light weight, blue uniforms with a black silk cap for summer, and heavy weight uniforms with navy blue cloth cap for winter service. The company pays for the summer and winter caps, which are furnished twice a year, and are returned on leaving the company's employ. The uniforms are ready made and cost from $10 to $15, which is paid by the employe at the time of purchase. The standard uniform is the same for conductors and motormen.

The Twin City Rapid Transit Co., of Minneapolis, specifies that the coat shall be cut in cadet style and be worn buttoned at all times. Any neat cloth overcoat may be worn, but fur coats are not permitted. The conductors and motormen are dressed alike. The suits are made to order and cost $15 for summer and $18 for winter, and are paid for by the employes in $5 instalments, deductions being made each pay day, which comes twice a month.

The Nashville Street Railway Co. requires that the motormen and conductors wear single breasted sack coats made of heavy blue cloth for winter and of lighter cloth in summer. These uniforms are ready made and cost $10 and $12 respectively and are paid for when purchased.

The Cleveland City Railway Co. prescribes the style and allows the employes to get the uniforms where they can do the best. The uniforms are of blue cloth, light for summer and heavy for winter. The suits are either ready made or made to order, costing $10 to $13 for summer and $14 to $16 in winter.

The series of five figures show the uniforms adopted by the Chicago City, the North Chicago and the West Chicago Street Railway companies, and these are made in large numbers by C. F. Orr & Co., Chicago. By a simple and effective system of measurements under standard specifications these garments are made to order and cost but little more than the ready made uniforms. The high grade cloths for these uniforms are supplied by the Warrenton Woolen Co., through its agent, Theo. A. H. Weinz, of New York.

The Union Traction Co., of Philadelphia, asks for bids for uniforms from reliable firms and awards the contract to the lowest responsible bidder. The employes are required to make their own financial arrangements. A sample uniform is kept at the office of the general superintendent, and in case of any dispute the sample coat or uniform is used to decide the question. The coat of the summer uniform is a single breasted, four-button sack with straight front. The edges are double stitched and the seams plain. Each sleeve has two buttons with eyelets and rings. Good, substantial-wearing sateen sleeve lining, same as approved sample, must be used. The facing is loose, piped narrow with Italian cloth. There are four buttons below the roll put on with eyelets and rings. The coat lining is of double warped Italian cotton, closed at bottom with 1½-in. plait and to extend to the front edge of the coat. The outside of the collar is cut whole and the under collar is the same goods as the coat and well padded. The cash pocket is on the right side and is 3¾ in. wide and 3½ in. deep; the punch pocket on the left is 3¾ in. wide and 5 in. deep and the lower pockets are made not less than 6¾ in. at the opening. These pockets are faced with shields not less than 1¼ in. wide on each side of the pocket mouth with the edge turned in and single stitched. The outside and inside breast pockets are of unbleached drill and all others are of heavy duck.

The vest is single breasted with notch collar. There are six buttons put on with eyelets and rings. The edges of the vest are double stitched with facing loose. The back of the lining must be of double warped Italian cotton with the inside of good, substantial sateen. There are four outside pockets with welts and one inside breast pocket. In the trousers there are the usual top and hip pockets and the side seams are made with a narrow welt. The legs are to be made with a narrow welt and not less than 18½ in. at the knee and 17½ in. at the foot. All goods throughout are of 15½-oz. Middlesex cloth and all sewing is of silk.

UNIFORMS FOR THE LARGE CHICAGO ROADS.

The uniform overcoat is a double breasted ulster, made of "traction overcoating," weight 30 oz., manufactured by Sullivan, Vail & Co., 329 Broadway, New York. It is to come within 11 in. of the ground for motormen and 14 in. for conductors. There are two rows of six buttons and three on each sleeve, of the company's design, with eyelets and loose facings piped with Italian cloth of good quality. All buttons are put on with rings and button stays. A deep storm collar coming above the ears when turned up is provided with a tab. The two muff pockets are made of velveteen, the two cash and two lower pockets of 8-oz. duck and the one inside breast pocket of heavy unbleached drilling. The cash pocket is to be at least 4½ in. wide with shield of the same cloth not less than 1½ in. in width when finished. The horizontal edge of the coat and all seams are double stitched ¾ in. The body of the coat is lined throughout with warm material and well wadded down below the waist and well stitched. All garments are sewed with pure dye sewing silk, finished in a workmanlike manner and from goods thoroughly shrunk.

A simple, but neat and handsome uniform, as may be seen from the half-tone cut, is worn by the employes of the Lindell Railway Co., of St. Louis. These are ready made and are of light-weight blue cloth for summer and heavy weight for winter, costing from $12.50 to $14, the cash being paid at the time of delivery. There is no difference between the uniforms of the conductors and motormen.

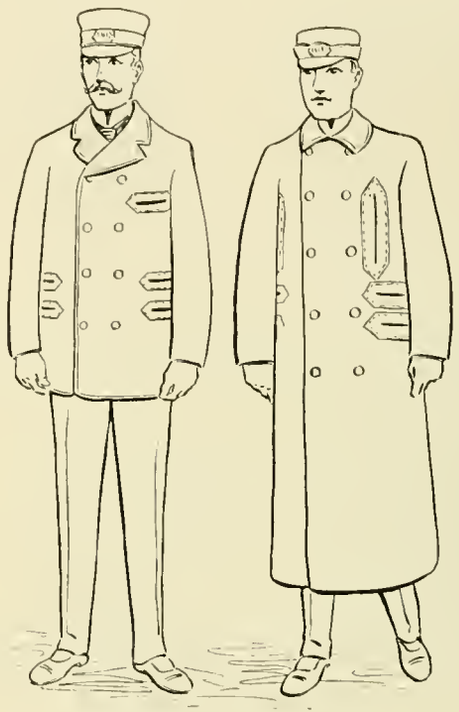
The following regulations regarding the uniforms of the emergency crews are enforced by the Boston Elevated Railway Co. The full regulation uniform consists of a coat of corduroy made single breasted with turndown collar and buttoned close to the chin. The vest and trousers are of the same material. A service stripe of scarlet cloth shall be worn on each coat sleeve for each five years of

LINDELL RAILWAY, ST. LOUIS.

service. Buttons are of gilt of the company's standard design. The badge is always worn on the left breast of the outer garment. The caps are of the same cloth as the uniform with cloth badge in front of same. The full uniform must be worn at all times when on duty, except at such times when the work renders other clothing proper. When off duty full uniform or none must be worn.

The uniforms for the conductors and motormen are of dark navy blue cloth and the coat is double breasted sack with ¾-in. double stitched edge, and cut to fit the form rather full. The cutaway collar is of the same material as the coat. There are 10 large buttons in front and 2 small ones on each sleeve. The regulation buttons and badges are furnished by the company and always remain its property, a deposit being required to insure their return. In the coat there are two side hand pockets, two outside cash, one outside breast, two inside breast and two inside ticket or cash pockets. All pockets are made of ticking or heavy drilling and the outside pockets are reinforced with the same material as suit. The vest is single breasted, with six buttons and four outside and one or two inside pockets. The pants are cut with medium large knee and bottom and have ¼-in. welt on the sides. There are the usual side or top, one watch and two hip pockets.

The overcoat is of heavy weight stock blue kersey or beaver, lined



BOSTON ELEVATED RAILWAY.

with flannel. It is double breasted, with 10 large buttons in front and cut to fit the form rather full and to extend half way between the knee and instep. The collar is 3½ in. wide with step and of the same material as the coat. There are two muff, two outside cash, two side hand, two inside breast and two inside cash pockets made of ticking or drilling. The outside pockets are reinforced with the same material as overcoat or piped with leather. Leather or velvet patches, facings or button holes or velvet collars are not permitted.

The caps are made of navy blue cloth with bell top, leather visor and leather band on front fastened at either side by the official button. On the upper side of the band is a ¼-in. gilt lace stripe on the conductors' caps and a silver lace stripe on the motormen's caps. The winter caps are of blue Scotch havelock, the upper side of the lappel having the stripe. The general order for employes wearing service stripes, issued last fall by C. S. Sergeant, second vice-president of the company, was published in the "Review" of December, 1898.

The company specifies that the uniforms shall be made of dark navy blue woolen cloth, but does not specify the weight of the goods or where they are to be purchased. Uniforms of the starters and inspectors are similar to those of the conductors and motormen, the difference being only in the trimmings. The chief inspector in each division constantly watches the uniforms of all employes and reports thereon to the superintendent, who takes the matter up with the employe in question and requires new uniforms when necessary.

There are several excellent manufacturers who make a specialty of the production of woolens especially for street railway use. Among them may be mentioned the Burlington Woolen Mills, whose product is handled by Dudley, Battelle & Hurd, 53 Worth St., New York. Mr. Charles Bowler, one of the most experienced uniform men in the country, is in charge of this department.

Another established concern whose woolens are in use on a large

number of street and steam railways is the Warrenton Woolen Co., whose excellent output is handled exclusively by Mr. T. A. H. Weinz. Mr. Weinz has also had a long experience in this line and a wide and favorable acquaintance among street railway men.

The Waterloo Woolen Manufacturing Co. operates an extensive plant, the product being handled by Patterson & Greenough, of New York and Chicago. Several grades and weights are made to suit the varying climatic conditions of the country and the goods have an extensive sale throughout the states.

The cap is by no means the least important feature of a uniform, although in manufacture a specialty by itself. Hohenadel Bros., Chicago, make a neat and very serviceable cap which is largely used. This cap was illustrated and described in our issue of March, 1899.

The cap illustrated herewith is made by F. H. Newcomb, Brooklyn, who has a large street railway patronage. Carefully selected materials are used to give long service under the trying conditions of all kinds of weather, and the cloth of a character which will not fade. Skilled workmanship is employed, and the result is a cap which never fails to give satisfaction.

A large eastern uniform house is that of Hackett, Carhart & Co., whose establishment is at 422 Broadway. The concern is always glad to receive inquiries and will freely reply to any questions from managers who are having trouble with their uniforms. They have earned a wide and favorable reputation for perfect and serviceable garments, and are supplying many street railways.

POWER HOUSE OF THE TOLEDO & MAUMEE VALLEY RAILWAY.

The Toledo & Maumee Valley Railway Co., which has heretofore rented all its power from the Toledo Traction Co., is now building a power house of its own on the west bank of the Maumee River, about midway between the city limits and the southern terminus of the loop. The plant will be operated by water power with a steam engine in reserve. Water will be taken from the Erie & Miami Canal, which runs from Toledo to Cincinnati.

The power plant is a brick building, 60 x 150 ft., with a steel roof. It is situated near the foot of the river bank, within 15 ft. of the water. The highway on which the railway is laid passes along the bluff and is about 190 ft. from the building. The bulkhead and floodgates are to be on the far side of the track from the river, and the water carried under the track and down to the wheel through a 6-ft. steel pipe. The bulkhead will be 55 ft. long, 4 ft. thick and 14 ft. high. The available head is 60 ft. The power house equipment is to comprise one 600-h. p. turbine built by James Leffel & Co., a Lombard governor, one twin unit of two 300-kw. G. E. generators, one 150-kw. booster giving a maximum pressure of 725 volts, one 500-h. p. Hamilton-Corliss compound condensing engine, and four Shaw & Kendall water tube boilers, carrying 120 lb. steam pressure.

The wheel pit is at the north end, outside of the building proper; it is covered over and access is had through a door from the generator room. The wheel is coupled to an 8-in. shaft 58 ft. long, extending along the east wall of the engine room. Belted to this shaft are the twin unit, with couplings each side of the driven pulley so that either or both of the generators may be driven, and the booster. The generators are wound for 500 volts at no load and 550 at full load. At the south end of the generator room is the engine with a clutch for connecting it to the line shaft.

The boiler room is at the south end of the building, and is 45 x 60 ft. The stack is 5 ft. in diameter and 65 ft. above the grates.

Between the boiler and the engine room is a space 30 x 60 ft., which will be equipped for a repair shop.

The stock of the Montreal Street Railway Co. is quoted at 320.

TROLLEY MAIL CARS LOADED DIRECT.

Postmaster Wilson, of Brooklyn, has arranged a plan to load the trolley mail cars direct at the Post Office by means of a siding to be built alongside of the building. A piece of property was purchased by the Government for the sum of $20,000, and at present the matter of proving the title is under way. When the legal matters have been adjusted the work of putting the property in shape for Post Office uses will be begun at once.

The present building is to be razed to the ground and a solid roadbed is to be erected flush with the street.

On this two tracks are to be laid, so that the trolley mail cars can be run in over the sidewalk and upon the space now occupied by the building. The mail cars will be run close to the mailing division on the main floor, where doors are to be built so that the cars can be loaded direct from the mailing division.

Besides the saving of time and labor, the sum of $1,200 a year will also be saved in carting.

STATION STREET INDICATORS.

One of our contemporaries, the Electrical Engineer, of London, describes a plan for informing travelers concerning the movements and stopping places of electric cars which is to be tried by the Liverpool Tramways Committee. What are called station street indicators will be placed on one route; they are described as follows: "These indicators consist essentially of an ornamental and conspicuously colored pavement, 4 ft. square, formed of red granite concrete, surrounded by a border of white ornamented with an incised foliated design. The artistic square is conspicuous from a distance, and must almost inevitably be seen by every pedestrian. Each indicator contains (first) the name of the street or road legible under all conditions of weather and at all times of day and night. An arrow indicates the direction of the cars. 'Tramcars stop here on request' appears on those indicators other than those at which 'All tramcars stop,' as at terminal and a few other fixed points on the route. This is followed by a clear and precise statement of the destinations of the various cars—for example: 'For Dingle and Aigburth,' 'For Prince's and Sefton Parks,' and 'For Smithdown-road.' The whole of this lettering is in snow-white characters on a dark-red background, so that the wording can be read with ease."

NEW SCALE OF WAGES IN ATLANTA, GA.

The directors of the Atlanta Railway & Power Co. have declared a substantial increase in the wages of conductors and motormen both in the employ of the above named company and the Atlanta Railway Co. The increase was unsolicited and came in the nature of a surprise to all the men.

The order was issued August 15th, as the result of a meeting of the board of directors held during the first of the month and for the first time in the history of the company a rising scale of wages was adopted in the recent order.

Heretofore the wages of motormen and conductors who have been in the employ of the road for a certain length of time has been 12 cents an hour, while formerly new men just beginning have been paid 10 cents an hour. Under the new scale, the pay of motormen and conductors who have been in the service of the road for three years has gone up to 15 cents an hour. The employes in the service from one year and less than three years are increased to 14 cents an hour, and those who have been with the company less than one year, receive under the new scale 13 cents an hour.

The new order extending over the lines of the Atlanta Railway and Atlanta Railway & Power Co. affects practically 500 men, the number employed on the two roads in the capacity of motormen and conductors. The lines of the two roads at the present time, counting those in operation and those actually in the process of construction, amount in all to nearly 100 miles.

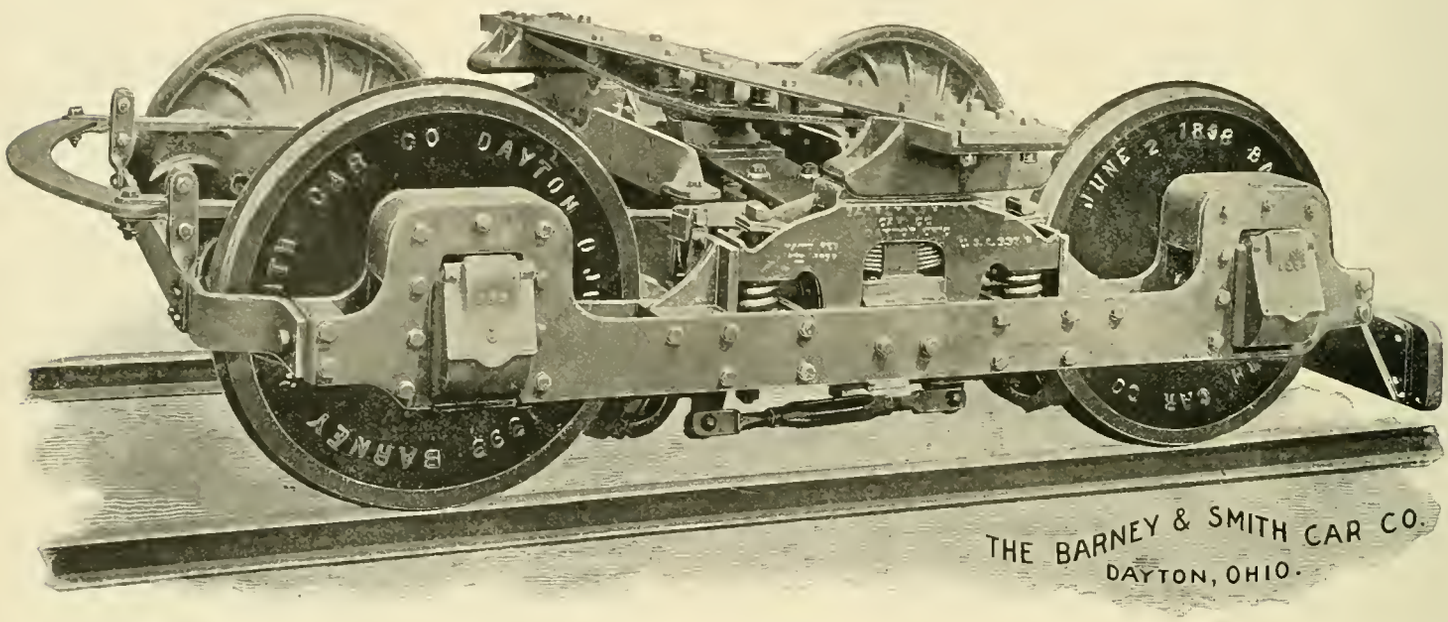
A number of the employes have since held a meeting at which resolutions thanking the company for the increase in wages were adopted.

The Reading (Pa.) & Southwestern Electric Railway Co. has increased the wages of its employes.

BARNEY & SMITH CLASS "H" TRUCK.

The accompanying illustration shows the improved pivotal truck made by the Barney & Smith Car Co., Dayton, O., especially for suburban and city service where double truck cars are used. The marked feature is that it is so designed that the car body may be carried very low as compared with many other trucks of the pivotal type and thus obviate one of the objections to their use.

The side plates of the frame are made of steel in one piece without welds of any kind, and the two plates on each side frame are securely bolted together with distance castings between. Over each journal box and between the side plates of the frame is a coil spring. On each side of the side frame at the center are the side bearings, securely fastened to the end of the truck transom, which is made of 8-in. wrought iron plates, and to which are fastened the center plates. The truck transoms and side bearings, upon which rests the body bolster of the car, is carried by an arrangement of springs, clearly shown in the illustration. This combination gives an easy and uniform movement to the body of the car. These trucks are so arranged with proper connection to the body bolster



CLASS "H" TRUCK.

of the car as to allow the trucks to swivel freely and pass around the shortest of curves without difficulty.

At the center of the truck are two cross bars, to which are fastened the motor supports; this can be adapted to any kind of motor used. The brakes on these trucks are inside hung, as will be remarked. The brake mechanism is very simple and easy to keep in repair; the brake head and brake hanger bracket are so arranged that by drawing up a wedge in each of them by means of a nut, all the slack or play in the brake hanger and pin can be taken up. The advantages claimed for an inside hung brake is that it overcomes the chatter, which is very annoying at times on the old style outside hung brake, and also that the brake is thoroughly equalized.

REPAIRING THE CHILKOOT TRAMWAYS.

A gang of men are now busy repairing the Chilkoot, Alaska, tramway, and it is the intention of the railway company to keep the road in order for emergency use in winter. Two of the towers are being replaced and some of the wire cable is being replaced where it is worn. Snow sheds are being constructed where there is a likelihood of a snowslide coming down next winter or spring. The engineers have been retained at the power station to keep the machinery in condition.

There is little travel in winter and most of the freight will be light stuff, for such can be carried to an advantage on the trains.

ELECTROLYSIS SUIT AT SPOKANE.

In December last we gave an account of the status of a suit then recently brought by the Spokane (Wash.) Gas Co. against the Washington Water Power Co., which operates the Spokane Street Ry. The judge of the Superior Court, in which the suit was brought, has prepared his findings of fact, and issued an injunction to prevent the use of any except cast-weld joints in paved streets and any except Chicago rail bonds in other streets. The defendant will appeal the case, as to observe the injunction would entail great expense.

The suit was begun last October, and many electrical experts examined as witnesses, among whom were Prof. E. Darrow, of the Washington Agricultural College, and Bert L. Baldwin, of Cincinnati.

The court's findings are briefly as follows:

The only method of absolutely preventing stray currents of electricity is the double trolley system.

The best single trolley is the cast weld joint system.

The best wire bond is that known as the Chicago bond.

That it is not practicable to use cast weld joints except where street is paved with such material as asphalt, brick, macadam, wooden blocks or similar material.

That it is shown by the evidence in this case that gas pipes of plaintiff have been injured by electrolysis.

That such injury has been caused by defective bonding of street railway system and an injunction is granted to prevent defendant from injuring plaintiff, and ordering defendant to use the cast weld system on all paved or macadamized streets, and Chicago bond on all other streets.

COLUMBUS RAILWAY MEN'S OUTING.

The Columbus (O.) Street Railway Co. gave its employes their annual outing on August 23d, and a general good time was provided for all the employes and their families. As it was impossible for all the men to spend all day at the outing the car runs were so arranged that every man could spend a part of the day in the enjoyment of Olentangy Park and its places of amusement. The company had 1,600 badges made, which were distributed among the employes.

The badges served as pretty souvenirs of the day and were useful at the park, for they admitted the holder to the Casino and every other place of interest at Olentangy, through the courtesy of the theater company.

TOLEDO, FREMONT & NORWALK R. R.

The Comstock Construction Co., of Detroit, Mich., is now engaged in building an electric line to connect Toledo and Norwalk, O. Messrs. Riggs & Sherman, 613 The Nasby, Toledo, are the chief engineers in charge of the work, and they have completed surveys and estimates. Mr. W. A. Comstock, secretary of the Comstock Construction Co., sends in the following concerning the enterprise:

"The proposed road will run from Toledo in a generally southeasterly direction, going through the following cities and villages: Genoa, Woodville, Hesseville, Fremont, Clyde, Bellevue, Monroeville and Norwalk. The distance traversed will be 60 miles, 31 miles of which is on the Maumee & Western Reserve Turnpike in Sandusky County.

"It is the intention of the company to build the road in a thoroughly first-class manner throughout, sparing no expense to make the construction modern and up to date in every particular. In fact, the road is to be built to keep, not to sell. The whole system will be in operation by May 1, 1900, but only the first half, as far as Fremont, will be pushed hard this fall.

"Contracts have already been let, for the ground construction as far as Fremont, to the Chase Construction Co., of Detroit, for everything except steel in bridges, masonry and ballasting. The Ohio Brass Co. has the order for the overhead material. Westinghouse, Church, Kerr & Co. are to furnish the steam and electrical machinery. The Carnegie Steel Co. is under contract for the rails through Fremont. These are to be 75-lb. per yard. Copper bonds, spikes, bolts and angle splices are also purchased.

"The road will be equipped with the three-phase system. The central power house will be in Fremont, O., seven substations being used. The operating offices will be located at Fremont, and the head office probably in the Majestic Building, Detroit."

The Comstock Construction Co. has been organized to build the road. Its officers are: W. B. Comstock, president; S. F. Angus, vice-president; A. W. Comstock, treasurer; W. A. Comstock, secretary; Henry A. Haigh, general counsel.

"A railroad corporation known as the Toledo, Fremont & Norwalk Railroad Co., will be organized under the laws of Ohio, with a capital stock of $1,500,000. Its officers will be S. F. Angus, president; W. B. Comstock, vice-president; A. W. Comstock, treasurer; W. A. Comstock, secretary; Henry A. Haigh, assistant treasurer and general counsel.

PROTECTION OF WIRE ROPES.

Wire ropes for transmitting power are used under a great variety of conditions and many efforts have been made to secure a satisfactory protective coating which would answer equally well for ropes used in a dry atmosphere, where the tendency is towards a rapid oxidation and sloughing off of the coating, for those exposed to acid vapors, and for ropes running in damp conduits, or even submerged in water. The Ironsides Co., of Columbus, O., has succeeded in perfecting a coating for wire ropes which it submits as perfectly satisfactory and possessing the desirable qualities of being tenacious, pliable, water-proof and free from destructive acids and also acting as a lubricant. This compound is known as "Wire Rope Shield," and has been used, we are advised, on ropes for all sorts of service, from office buildings to mines and dredging machinery. The illustration shows a section of wire cable protected externally by the "shield" and filled with another of the Ironsides products, which is known as "Wire Rope Filler." This latter is to effectually seal the cable against water and acids, and also prevent abrasion of the strands by surrounding them with a lubricant. The company states that many of the prominent makers of wire ropes use this filler in their wire cables, with the result that the life of the product is greatly increased.

Some trips were made last month over the lines of the New Bedford, Middleboro & Brockton (Mass.) road, which is nearing completion. It was expected that the road would be finished by September 1st.

SITUATION IN ATLANTA.

August 21st the city council of Atlanta, Ga., passed an ordinance providing for a close supervision and regulation of the street railways of that city. A bitter contest over the granting of franchises led Joel Hurt, representing the Atlanta Railway & Power Co. and the Atlanta Railway Co., to make the proposition published in the August "Review", page 522, for a payment to the city of a portion of the gross receipts in consideration of exclusive franchises; this the city refused to accept, but one of the provisions of the ordinance adopted grew out of it.

The ordinance contains the following principal provisions:

The city reserves the right to regulate the location and construction of all tracks, wires, conduits, etc.

The tracks of all companies, for a distance not exceeding five blocks, may be used by other companies upon the payment of just compensation.

On the expiration of the original grants to the Atlanta Consolidated Street Ry. (in 1921) all companies shall pay the city a portion of their gross receipts not exceeding 5 per cent per annum. If any of the present companies consolidate, the 5 per cent tax on gross receipts is to become effective at once; but the reciprocal use of transfers shall not be construed to be a consolidation.

The maximum rate of fare for one continuous trip between 5 a. m. and 12, midnight, to be 5 cents, and between 12, midnight, and 5 a. m. 10 cents.

BRIDGE WRECKING BY ELECTRICITY.

On August 18th a wooden bridge over the Wabash river at Clinton, Ind., was wrecked by electricity, the plan of operation being that of Mr. H. N. Mills, of Clinton, and described in the Western Electrician. The bridge was 735 ft. long and consisted of three spans with a 70-ft. draw over the channel; it was desired to remove the bridge without injury to the piers. This was the only toll bridge remaining in Indiana and the approaches, piers and abutments had been purchased by the county, which had contracted for a new steel structure. The late owner had agreed to remove the wooden structure within 30 days but could find no one to undertake the work in this short time. Finally Mr. Mills suggested the use of electricity, and his plan was adopted with success.

Each span was cut through in two places, about 20 ft. from each pier, by burning through the timbers, of which there were 27, with loops of iron resistance wire heated by electricity. The loops, 54 of them, were of No. 12 iron wire with sash weights attached at the bottom to pull the loops down as they burned their way through the timber. Alternating current at 50 volts was used, the wires being heated to a cherry red. The spans were cut one at a time, 1 h. 40 min. being required for each. Current was turned on at 5 a. m. and the last span fell at 2 p. m.

PROPOSED ROADS.

Mr. E. W. Taylor, 85 Commercial Block, Salt Lake City, advises us that he has under consideration several propositions for the building of roads of from 25 to 50 miles each.

A street railway company has been organized at Mankato, Minn., with officers as follows: President, H. A. Patterson; vice-president, S. J. Stanwood; secretary and treasurer, John B. Meagher. No subscriptions to stock have been offered as yet, but the company proposes to do so before January.

The Dayton & Northern Electric Railroad Co., with general offices at Dayton, O., is now making surveys for an electric road from Dayton to Toledo, 162 miles. The company has an authorized capital of $20,000, which will be increased to $1,500,000; the officers are: President, Mr. Randall; vice president, general manager and purchasing agent, A. E. Townsend, Cambridge, O.; treasurer, M. F. Laviness; secretary and superintendent, Samuel Stewart; general consul, Benjamin S. Henderson; chief engineer, Robert Gamble. At the present time the surveys for 20 miles of the route have been completed, and on August 28th the contract for rails was let to a Canadian firm for November delivery.

PLAN OF EXHIBIT HALL, AMERICAN STREET RAILWAY ASSOCIATION CONVENTION.

LIST OF EXHIBITORS.

No. of Space.	Exhibitor.	Sq. Ft.
1.	C. F. Orr & Co.	100
2.	"Street Railway Review"	215
3.	Street Railway Journal	215
4.	K. McLennan & Co.	100
5.	W. R. Garton Co.	125
6.	Electric Railway Equipment Co.	400
7.	Electrical Review Publishing Co.	150
8.	The Railway World	150
9.	Safety Insulated Wire & Cable Co.	125
10.	Novelty Tufting Machine Co.	100
11.	Mica Insulator Co.	200
12.	Manville Covering Co.	300
13.	R. D. Nuttall Co.	300
14.	Chas. N. Wood.	100
15.	American Protected Rail Bond Co.	100
16.	Creaghead Engineering Co.	200
17.	Ohio Brass Co.	500
18.	Consolidated Car Heating Co.	200
19.	Gold Car Heating Co.	200
20.	Haywood Bros. & Wakefield Co.	300
21.	American Rail Joint & Mfg. Co.	100
22.	A. & M. Brake Shoe Co.	100
23.	Hale & Kilburn Manufacturing Co	100
24.	Pantasote Co	100
25.	E. T. Burrows Co.	100
26.	Curtain Supply Co.	100
27.	Adams & Westlake Co.	200
28.	General Electric Co.	1,600
29.	Harold P. Brown.	200
30.	Standard Paint Co.	200
31.	Central Electric Co.	200
32.	Garton-Daniels Electric Co.	200
33.	Westinghouse Electric & Manufacturing Co.	1,600
34.	The Falk Co.	400
35.	American Steel & Wire Co.	400
36.	The Consolidated Car Fender Co.	600
37.	Dearborn Drug & Chemical Works	200
38.	American Mason Safety Tread Co.	100
39.	Standard Underground Cable Co.	100
40.	American Car & Foundry Co.	100
41.	Adam Cook's Sons	100
42.	Leschen, Macomber & Whyte Co.	100
43.	Albert B. Herrick	100
44.	Continuous Rail Joint Company of America	100
45.	American Railway Supply Co.	100
46.	International Register Co.	200
47.	Ohmer Car Register Co.	200
48.		100
49.	Meaker Manufacturing Co.	200
50.	Barney & Smith Car Co.	500
51.	R. Bliss Manufacturing Co.	100
52.	Paige Iron Works	100
53.	Milwaukee Rail Joint & Welding Co.	100

54.	Pearson Jack Co.	100
55.	G. P. Magann Air Brake Co.	500
56.	Christensen Engineering Co.	700
57.	McGuire Manufacturing Co.	800
58.	Pennsylvania Steel Co.	358
59.	Q & C Co.	350
60.	Griffin Wheel Co.	200
61.	W. T. Van Dorn Co.	232
62.	Pennsylvania Car Wheel Co.	300
63.	Loram Steel Co.	1,300
64.	Dorner Truck & Manufacturing Co.	700
65.	Hipwood-Barrett Car & Vehicle Fender Co.	600
66.	Cling Surface Manufacturing Co.	150
67.	Wm. Wharton, jr., & Co.	300
68.	Charles Scott Spring Co.	165
69.	R. M. Stiles	100
70.	American Brake Shoe Co.	100
71.	Ironsides Co	100
72.	Siegrist Lubricator Co.	150
73.	Morris Electric Co.	675
74.	Crane Co.	250
75.	Multiplex Reflector Co.	200
76.	American Vitrified Conduit Co.	150
77.	New Haven Car Register Co.	100
78.	Chapman Valve Manufacturing Co.	100
79.	U. S. Rocking Grate Bar Co.	100
80.	J. R. McCardell & Co.	150
81.	Baltimore Car Wheel Co.	150
82.		100
83.	Major Cement Co.	100
84.	Weber Rail Joint Manufacturing Co.	100
85.	Joseph Dixon Crucible Co.	100

CURB SPACES. WEST SIDE OF BUILING.

Taunton Locomotive & Manufacturing Co....90 ft. x 10 ft.
McGuire Manufacturing Co.....50 ft. x 10 ft.
Taylor Electric Truck Co.....50 ft. x 10 ft.

Mr. Jas. R. Chapman, chairman of the committee on exhibits, 444 N. Clark St., Chicago, advises us that the foregoing list of exhibitors is practically complete. A few of those whose names are on the list may decline to use the spaces allotted to them, still having the matter under advisement.

Gallery spaces have been offered to some late applicants, but they have not yet been accepted.

The Committee hopes to secure permission from the city to fence in the portion of the street occupied by exhibits. It is possible that the curb space for the entire length of the building may be taken, but those assigned to date are given in the diagram.

OTHER PREPARATIONS FOR THE CONVENTION.

The general committee having charge of the arrangements for the convention of the American Street Railway Association met on August 14th and chose Mr. J. M. Roach, general manager of the Chicago Union Traction Co., as permanent chairman. The committees on hotels and entertainment were consolidated and Mr. Roach chosen chairman in place of the late Mr. Bowen.

All the committees are now at work on their respective assignments, and there is every indication that the next convention will surpass all previous ones in attendance and interest.

Exhibitors sending goods should see that they are marked with the consignor's name and addressed to Tattersall's, Chicago, care of H. W. Smith, successor to Anderson Transfer Co., 1618 State St. The bill of lading or advice that the goods have been shipped in his care should be sent to Mr. Smith, giving particulars. Goods will be delivered to the proper assigned space as shown on the diagram of the exhibit hall. An early shipment, with all charges prepaid, should be made to insure delivery at the hall in time. Exhibitors must pay for delivering goods at the hall, but the local committee has made arrangements with H. W. Smith, successor to the Anderson Transfer Co., to deliver all shipments to and from the building at low rates if sent in his care. Electrical connections for power and extra lights must be made at the expense of the exhibitor. The committee on exhibits will make contracts for labor and materials at regular prices, so that exhibitors may not be over charged.

September 1st an announcement was made by the Association, which is in part as follows:

The eighteenth annual meeting of the American Street Railway Association will be held at "Tattersalls," State and 16th Sts., Chicago, Oct. 17, 18, 19, 20, 1899.

We will have a large exhibition of street railway supplies, every foot of space in the hall having been applied for.

At a meeting of the Executive Committee, held in Chicago, Feb. 6, 1899, the following resolution was adopted:

Resolved, That the last day of the convention, Friday, October 20th, be set apart for the systematic and careful inspection of exhibits by the delegates and that all street railway managers be urged to send delegations from their mechanical, operating and accounting departments to inspect them.

The annual banquet will be held Friday evening, when the officers elect will be installed.

The headquarters of the association will be at the Auditorium Annex. The Auditorium is across the street and managed by the same parties. Chicago is noted for its good hotels, so no trouble will be experienced in securing good accommodations.

HOTELS AND RATES.

Auditorium, American plan, $5 per day each person.
Auditorium Annex, European plan, $2 to $4 per day.
Wellington, European plan, $1 50 and upwards.

All of our leading hotels are within a radius of one-half mile. They include the Victoria, Wellington, Great Northern, Grand Pacific, Palmer, Tremont, Sherman and Clifton, and all are within 10 minutes' ride of the hall.

Railroad rates will be as before, one and one-third fare for the round trip on the certificate plan. Be sure and get a certificate from the agent when you purchase your ticket and leave the same with the clerk when you register at the hall; it will be signed and ready for you on Thursday, October 19th.

Our Chicago friends intend to make your visit a pleasant and profitable one, so that you will not regret attending this convention.

Please make your arrangements to be present, if possible.

T. C. PENINGTON,
Secretary-Treasurer.

Approved: CHARLES S. SERGEANT,
President.

The program of papers will be found on another page.

THE TACOMA-SEATTLE AIR LINE.

The Tacoma-Seattle Electric Railway Co. filed on August 10th its acceptance of the franchise for an electric railway recently granted by the city councils. Accompanying the acceptance was a certified check for $2,000, deposited by John Collins, the president of the company, to guarantee the performance of the conditions imposed by the franchise. The company has been assured that the right of way through the Puyalop Indian reservation will be forthcoming, and the franchise rights both in Seattle and Tacoma have been agreed upon. The contractors will first devote their attention to the bridge work and grading along the right of way. The roadbed will be laid with 70-lb. steels rails, which are necessary to insure the rate of speed at which the cars will run. The maximum grade, when the line is completed, will not exceed one-half per cent on any portion traversed, and trains will be able to easily maintain a schedule of 40 minutes between the two cities.

The road will tap the towns of Des Moines, Sunnydale, Buenna and Stones Landing. There are three lakes contiguous to the right of way, and once in operation the line is expected to become a very popular resort for campers and summer pleasure seekers.

Work upon the road is expected to begin in less than 30 days, and it is expected to establish communication between the two cities not later than next April.

The Municipal Assembly of New York has fixed September 18th as the date for a public hearing on the application of the Manhattan & Jersey City Railway Co. for a franchise for a double track tunnel railway from New York City under the Hudson river to the Jersey state line.

MECHANICAL DEPARTMENT

MAINTENANCE AND REPAIR OF ROLLING STOCK.

Editor "Review": In following up the articles on the "Maintenance and Repair of Rolling Stock," by Mr. Greer, of the Yoakum Improvement Co., the thought suggests itself, that the most important thing is whether the ideas that are therein set forth are based on actual results in running a hundred-car road. If there are any hundred-car roads running in the country with a force of seven men, the fact is not well known.

In the first place, what is a hundred-car road? We think it can only mean a road that operates 100 cars.

Mr. Greer speaks as one of the humbler experts who made electrical railroading successful, and success must certainly have been attained if it were possible for 100 equipments to be maintained with the men and appliances mentioned in his article in the "Review" of August 15th. A "humble expert" is certainly a misnomer for the manager of such a road.

Coming first to the painting. If the cars are re-painted every two years, and re-touched twice a year, that means that this painter and apprentice will have to paint one car a week and touch up four cars per week. This makes no allowance for repairs due to accidents and collisions. To properly do this work is impossible, with the force named, unless that apprentice is a freak; two painters could not do it.

We will not speak of that lone car builder, as we dislike to speak ill of the dead, and there is certainly no such man living. But the blacksmith that can help both the machinist and the car builder, besides doing the blacksmith work on 100 equipments, ought to live forever, especially, if he gets that air pipe to his furnace, as recommended by Mr. Greer.

A man that can do all the armature, and other electrical repairs, on 100 cars is something we have read of but never seen; but we reserve our sympathy for that one machinist and the apprentice who do the repairs and keep the equipments clean.

A hundred-car road will average about one pair of wheels per day, if the cars are running, and make the mileage that most managers want them to make.

In the distribution of labor there is no provision made for babbitting bearings, and all such work, unless the machinist incidentally does that work between times, and there certainly is no provision made for repairs to trucks. The only way to avoid these repairs, so far as we know, is to let them stay in the house. How does Mr. Greer propose to take care of the truck repairs? No one (except in his mind) has been able to do this without help.

After attaining such remarkable results, it is surprising that Mr. Greer should not advocate manufacturing all supplies necessary. He says he does not believe in street car companies doing this work, but in this same article he has a drawing of a simple and inexpensive lift, which may be made in your own shop. By the way, that air hoist is a dandy! The statement that air can be admitted to all four cylinders simultaneously is true, but the idea that a hoist so connected can be practically used is ridiculous, and has never been done under the circumstances, as stated.

We won't say anything about the selection of tools, but that son of Vulcan, who prefers a pneumatic hammer in place of a helper, certainly ought to be on exhibition at the next convention in Chicago.

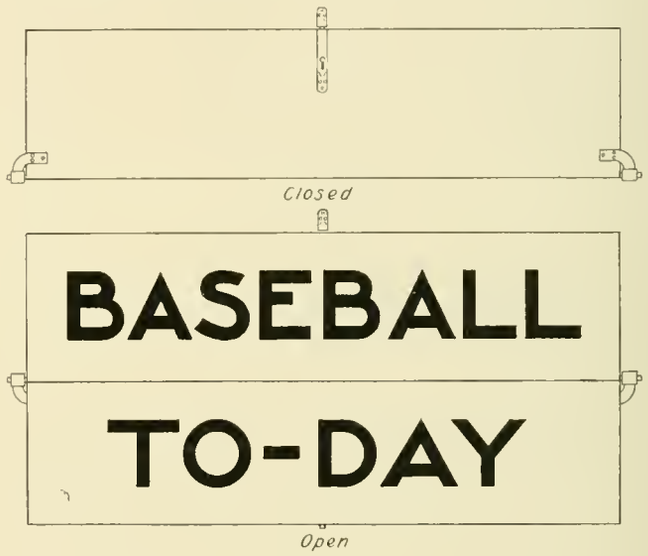
If the results claimed have actually been obtained and can be duplicated then there are several hundred-car lines in this country that waste thousands of dollars every year. If it is ordinary day dreaming, then it has no place in the "Review."

THOS. ELLIOTT,
Chief Engineer Atlanta Consolidated St. Ry.

Atlanta, Ga.

OPEN AND CLOSED CAR SIGN.

The Metropolitan Elevated in this city carries a large number of passengers to the baseball park, and to encourage this business have had all the cars supplied with a sign which is fastened on both sides of the car about the middle and above the windows. To save

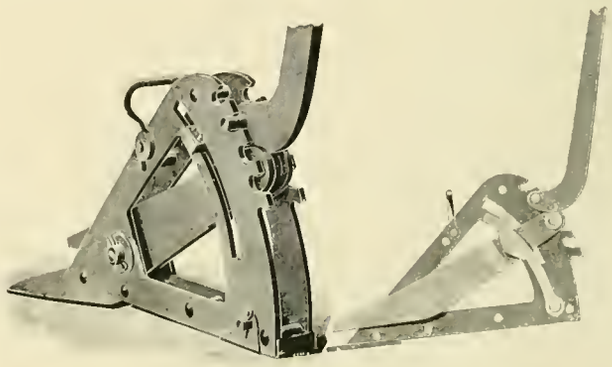


the trouble of putting them on and off the sign is made in two parts, hinged in the middle, and when open carries the notice, and when closed is scarcely noticeable.

Our illustration will readily explain the manner in which the sign is made.

RAIL LIFTER.

The accompanying illustrations show a new rail lifter of European design which is described in Engineering of June, 1899. The illustrations showing the tool in perspective and in section are suffi-



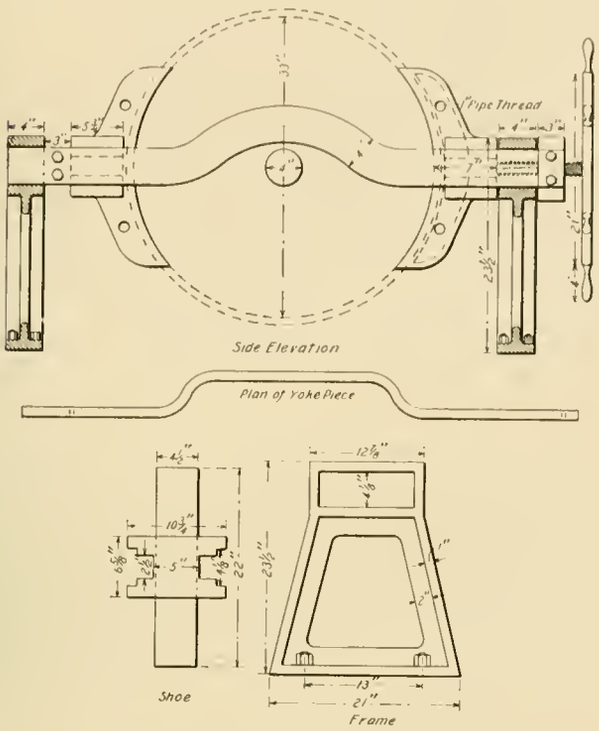
RAIL LIFTER.

cient to explain its operation. The handle lever which is put into the successive notches on the frame pushes the lifting lever down a certain distance, thus raising the track. The lifting lever is held in place while the handle lever is being changed to the next notch by means of the stop pivoted on the lifting lever as shown, which

bears against a locking lever pivoted below. It will be seen that the back of the locking lever is out of center with the fulcrum of the lifting lever, and hence the latter having been forced down cannot fly back when the pressure is taken off, as the follower-piece sliding down in its slots takes up all slack and keeps the locking lever in close contact with its stop. To raise the lifting lever again, it is only necessary to lift this follower-piece, thus allowing the locking lever to move back.

FOR TESTING MOTORS.

The different car equipments at present used by the Chicago City Ry. require that five motors be mounted for testing armatures. Accordingly Mr. C. E. Moore, the master mechanic, has designed



BRAKE FOR TESTING MOTORS.

a special arrangement for convenient testing. The five motors have been mounted with the axle bearings in line and a 4-in. shaft 21 ft. long placed in them; in addition to the 10 bearings thus provided by the motor cases, there are two bearings which are in brackets bolted to posts which are part of the building. These five motors are: G. E. 800, Walker, Westinghouse 12A, Westinghouse 49 and Westinghouse 3. In case another type of motor should be used in the future the main shaft may be readily extended. In the proper place beside each motor a gear wheel is fixed to the main shaft which in this testing machine corresponds to the car axle.

In order to provide a resistance for the motor to work against two car wheels are keyed on the shaft between the third and fourth motors, and a pony brake applied to them. The two wheels are placed close together, the flanges being outside, and give a surface about 5 in. wide to which a brake can be applied, the flanges acting as a guide for the brake shoes.

The brake shoes and the yoke and supports in which they are mounted are shown in the sketch. Each shoe is a large casting presenting a friction surface 4½ in. wide by about 24 in. long, with side flanges to guide its horizontal motion in the yoke; the shoes are hollow with holes tapped for 1 in. pipes to provide for circulating water through them. The yoke is forged from 1 x 4-in. bar iron, offset up to pass the shaft and out to pass the wheel hub, as shown in the sketch; the two sides of the yoke are held apart by two distance pieces. At one end the distance piece is a cast iron block 3 x 4 x 8½ in.; at the front end it is 8½ in. long, but the central portion is circular with a recess in one side to hold a brass nut in which works in form the 1½-in. screw for setting up the brake shoes. This stress is applied by a hand wheel about 30 in. in diameter.

The yoke is supported in two cast frames, shown in detail in the sketch, bolted to the floor. There are no arrangements for measuring the work absorbed by the brake.

A switchboard with the necessary switches and Weston voltmeter and ammeter is located near the side wall; near this board is a series-parallel controller for manipulating the motors.

The testing room is on the third floor of the shops and adjoins the armature winding shops; an overhead traveler system enables the armatures to be run from the shop directly to the motor in which it is tested.

NEW YORK BRAKE TESTS.

In the "Review" for May, page 336, was published the announcement of the Railroad Commissioners of New York inviting the makers of brakes for street cars to submit them for an official test. In response to this invitation, 21 different systems of brakes were submitted for tests, and six of these were to be tested on August 29th and 30th.

The tests were made on the Lenox Ave. line of the Metropolitan Street Ry., between 146th St. and 135th St., in New York City, this portion being approximately level. Fourteen speed and distance curves were taken for each brake, three each at initial speeds of 8, 12, 15 and 16 miles per hour and two at 16 miles per hour using sand. The brakes were all fitted to long cars mounted on Brill maximum traction trucks.

The apparatus for registering the speed, distance and time was designed by Mr. C. R. Barnes, the comissioners' engineer. For

ARMATURE TESTING ROOM—CHICAGO CITY RAILWAY.

recording the speed there are two wooden wheels mounted on an axle and held against the rails for springs; the axle is geared to a shaft which in turn is connected to a screw by friction gearing. On the screw is a carriage with the recording pencil. The pencil has a weight attached to it and is carried downward at a rate determined by a clock mounted on the carriage. A Boyer speed recorder is mounted in the usual manner and an adjustable stop placed so that on reaching a given speed the dial pointer makes contact with it. This contact closes an electric circuit and the action of the current simultaneously throws into gear the friction clutch driving the carriage, releases the escapement controlling the vertical motion of the pencil and rings a bell, which is the signal for the motorman to stop.

The first test, August 29th, was that of the electric brake of the General Electric Co., and this was followed by a test of the Delvin brake; because of rain and a misunderstanding of the method of applying the brakes, these tests were not made a part of the permanent record.

August 30th and 31st and September 7th the first series of tests were concluded, satisfactory records being secured. These brakes tested were the Price momentum brake, controlled by the Peckham company, the Christensen air brake, the Standard air brake, the G. E. electric brake, the Devlin brake. Tests of a brake submitted by the Columbia Electric Car Lighting & Brake Co., and scheduled for September 7th, were postponed, the company not being ready.

PENNSYLVANIA STATE ASSOCIATION.

The eighth annual meeting of the Pennsylvania Street Railway Association will be held at Lancaster on October 4th and 5th, and promises to exceed in point of interest, instruction and entertainment any meeting heretofore held by the association.

The association will meet on Wednesday at 11 a. m. at the Stevens House. Addresses will be delivered and scientific papers on different subjects of interest to the members of the association will be read and discussed, including addresses by Hon. James C. Beck, of Philadelphia; Frank Sillman, jr., of the Scranton Railway Co.; W. P. Mackenzie, of the Harrisburg Foundry & Machine Works, and others.

The addresses to be delivered and papers prepared by practical street railway men will be a feature of unusual interest and instruction to the convention.

The second day will be devoted to a series of entertainments and excursions, including a trolley ride over the system of the Pennsylvania Traction Co., and luncheon at Chickies Park. The indications point to a more largely attended meeting than any that has yet been held by the association. The list of papers to be presented at the meeting has not yet been completed, but programs will shortly be mailed furnishing a detailed statement of exercises for the first day and the entertainments offered for the second day of the convention, which will be both as instructive and enjoyable as any meeting that has yet been held by the association.

By provision of the by-laws of the association not only street railway companies in the state of Pennsylvania, but all manufacturers of street railway supplies, are eligible to membership in the association, the fee for membership in each case being $25 and annual dues $10.

Members of the association are urged to send as many representatives as possible to the convention, and others who have not yet joined the association are also cordially invited to join and become acquainted with the advantages of membership with the association.

For further information address the secretary, S. P. Light, Lebanon, Pa.

About half a ton of trolley wire was cut down and carried off by thieves upon the line of the Norristown (Pa.) & Chestnut Hill road on August 23d. This is the fifth robbery of the kind within a month, and no trace of the thieves has been discovered.

Burglars attempted to break open a safe with nitroglycerin in the office of the Chicago & Milwaukee Electric Ry. on August 28th, but were evidently frightened away. The door of the safe was bent but did not give away. There was about $1,200 in the safe.

CINCINNATI, NEWPORT & COVINGTON EARNINGS.

President Ernst sends us the following figures concerning the operation of the Cincinnati, Newport & Covington Street Ry. for July, 1899:

Gross receipts	$68,703.99
Operating expenses	24,204.53
Gross earnings	44,499.46
Tolls, damages, taxes, etc.	12,062.36
Net earnings	32,437.10
Increase over July, 1898	11,210.96
Ratio of expenses to earnings with tolls	45.92 per cent
Ratio of expenses to earnings with tolls, July, 1898	62.78 per cent
Ratio of expenses to earnings without tolls	35.22 per cent
Ratio of expenses to earnings without tolls, July, 1898	52.86 per cent

AMERICANS SEEKING LONDON FRANCHISES.

A trolley line from London, Eng., to Brighton, one of the principal seaside resorts, has been projected by Albert Johnson, of Brooklyn, N. Y., who until recently was one of the principal owners of the Nassau lines of the latter city. To secure a railway franchise in England it is necessary not only to survey all the territory covered, but furnish the city with lithographed maps illustrating exactly what is to be done and how you are going to do it. The maps are being prepared and should be lithographed at the close of this month. On October 1st Mr. Johnson's company will make its application and hopes to get it without any trouble.

In speaking of the projected road Mr. Johnson says: "The distance between London and Brighton is 45 miles. That distance we will travel over a private way, going over or under all intersecting roadways and interfering and touching no public thoroughfare. The tracks will be 110-lb. T-rails. No grade will be over 1½ per cent. This will enable us to maintain an even speed, so that with the motors we will use the distance between London and Brighton will be covered at an average speed, including stops, of a mile a minute. We have been surveying the ground from London to Brighton and expect to have that work done by the end of this month. A score or more surveyors have been at work since I was over in the spring."

The fares which it is proposed to charge over this route will certainly appeal to the people. The present fare from London to Brighton is $1.50, or 6 shillings. The fare for the trolley route has been fixed at 6 pence. Within the city limits the fare will be 2 pence, which it is expected will attract considerable traffic.

The franchise, of course, depends entirely upon the municipal government. At present most of the electric railways are owned by the city, although they are leased to private corporations, which run them. The capital for the enterprise is ready whenever the requisite permission is obtained.

BOYCOTT AT CHATTANOOGA, TENN.

On August 1st, a number of the employes of the Chattanooga (Tenn.) Electric Railway Co. organized a local division of the Amalgamated Association of Street Railway Employes. The company was convinced that the object of the association was to foment discord and notified the men that those of them who wished to retain membership in the union could not remain in the company's employ. In accordance with this rule 15 men were discharged on August 6th, and their places filled by new men who had been taken on in anticipation of there being vacancies. The company employed 67 men, 26 of whom joined the union; 11 of that 26 afterwards withdrew.

The union organized a boycott against the company, but this movement proved a failure, the sympathy of street car patrons being alienated by the riots and the stoning of cars by which the men sought to injure the company's property. By August 28th the boycott was reported to have petered out.

The new electric road in Fond du Lac was opened on August 21st with a trolley ride of the business men of the town that evening.

SOME NEW TYPES OF STREET CARS.

The car shown in Fig. 1 is of considerable interest since it seems to be the first open car of purely American type ever sent to Europe. It is from the shops of the Brill company, and is of the standard 12 bench type and is mounted on "Eureka" maximum traction trucks. The length over the end posts is 34 ft.; it is 43 ft. 8 in. over the buffers, but the limitations of French streets, however, come in and a width of only 5 ft. 10½ in. is permitted at the sills. This is increased to 6 ft. 5 in. at the posts, but the extreme width at any part had to be kept down to 7 ft. 8¾ in., and for this reason, although the car has 12 benches, its seating capacity will not exceed 48 persons, allowing the American standard of 17 in. each. The platforms are 4 ft. long and are separated from the body of the car by bulkheads in the usual manner. Only two sashes are placed in these bulkheads, and the peculiar form of the grab handles seen on the posts is also made necessary by the narrowness of the body and the limiting width. The openings between the seats are closed by leather covered hook chains and the interior finish is of bird's-eye maple for the head linging, and ash for the trimming over the openings.

FIG. 1—THE FIRST AMERICAN TYPE CAR FOR EUROPE.

The trucks have 30-in. and 20-in. wheels, with a 4-ft. wheel base of standard gage, and are furnished with G. E. 1,000 motors. These cars without motors weigh 15,275 lb., and the weight of one truck is 3,000 lb. The steps are 18 in. from the ground with a 15-in. riser, and the openings are closed by curtains which come to the floor, the round corner seat end panels enabling this to be done easily.

Shipment was effected after the car was entirely completed by taking it apart in sections and packing it closely in boxes. The great length of the car is particularly noticeable, showing that the French street railway people at least are waking up to the advantages of as large a car as can be used on their streets and are beginning to use them.

Another new type of car is the convertible car of the Norfolk Western Street Railway Co., from the Brill Works, which differs materially from any which have hitherto been put in operation. As will be seen from Fig. 2, it is completely vestibuled, giving it the same protection in winter as cars designed for the most extreme northern service. The body of the car is 22 ft. 11 in. long, and the platforms are 4 ft. 6 in. long, giving a total over the dashers of practically 32 ft. It is mounted on a heavy pattern of No. 21-E truck which has an 8-ft. wheel base of standard gage. The wheels are 33 in. in diameter and the car is to be fitted with two G. E. 1,000 motors. The vestibules are arranged so as to have as much window surface as possible and thus give the motorman a clear view in all directions. The windows are fitted with sash and panels which lift out. These panels are of cherry and are finished in the natural color of the wood. When they are removed the car becomes practically an open one. The curved panels below the seat not only strengthen the body but greatly add to the safety of the car in case of accident. It is so low that the passenger has all the advantages of the side entrance type. There are fourteen seats with reversible backs and four stationary seats. The total seating capacity of the car is 36. The seats are upholstered in red plush, the interior finish over the windows is of cherry, and the head lining is of maple veneer highly decorated. The drop platform and a step with a 13-in. riser brings the tread of the step within 15⅞ in. of the head of the rail. It has Sterling brakes, electric headlights and eight lights within the car.

FIG. 2 NEW BRILL CONVERTIBLE CAR.

FOREIGN FACTS.

Siemens & Halske are preparing plans for a projected railway in the city of Coburg, Germany.

Ben Clench, the highest mountain in Scotland, will have an electric road to its summit and a sanitarium.

A new electric line has been put in operation in the City of Como, Italy. The road is only a mile long but will be extended later.

It is proposed to construct a light railway between Beverley, England, and the Hull & Barnsley Railway, a distance of about eight miles.

All the street car lines of Lisbon, Portugal, are to be equipped with electricity. A delegation of Portugese is coming to the United States to study the subject.

The Austrian Government has granted a concession to the city of Prague to construct an electric railway system through the city and suburbs, the line to be completed within two years.

The Sheffield Car Co., of Three Rivers, Mich., has received two orders for a carload of hand cars for both the Russian government railroad in Siberia, and President Kruger's railroad in South Africa.

U. S. Consul Hugh Pitcairn writes that Hamberg, Germany, has the most complete trolley system operated on the Continent, the whole plant being constructed by a local corporation controlling American patents.

The London County Council has voted £10,000 for preliminary plans and surveys for an electric tramway from Westminster-bridge to Tooting. A report on the plan from Prof. Kennedy recommended the conduit system.

The Loraine Steel Co., of Johnstown, Pa., is the successful bidder for furnishing 50 miles of steel rails for a trolley road to be built by the Honolulu Traction Co. in the Hawaiian capital. The road will be completed by the end of next year.

Three rival railway companies in Tokio, Japan, who have unsuccessfully sought street railway franchises, have combined and organized a company capitalized at 15,000,000 yen. It is understood that the concession will be granted to this new company.

The street railways of Paris now have 12 different motive power systems in use operating 31 lines. Of these, six use accumulators, two a combination of accumulators and overhead lines, one an overhead conductor and conduit, one surface contacts and others compressed air, steam, etc.

All the northern part of Italy is covered with a network of steam tramway lines, many of which have now been converted to electric roads. Milan is the center of this system. It is possible to go from that city enormous distances by the "vapore," and it furnishes an ideal means for seeing the country.

For some years rival projectors have unsuccessfully applied for permission to build electric railways in Yokohama, Japan. The council has now authorized the construction, provided the applicants form one company, and throw open its subscription books to all applicants. Such a company is being organized.

The first electric line in the United Kingdom was built in Ireland from Portrush to the Giant's Causeway, and it is now undergoing extensive improvement. The metal center poles which are being put in came from Ohio, and the wire from Massachusetts. The new electric system now being installed is after the design of Sir William Siemens.

The first electric railway in China was opened June 24th between the Peking station at Machiapu and the south gate of the city of Peking. Eventually it is proposed to extend the line inside the city. The barrier at present in the way is the necessity for breaking a new gate through the city walls. It is thought that the authorities will yield this privilege.

Catania, Sicily, has recently introduced electric railways (about 24 miles in length), the concession for which, together with the electric lighting of Catania and district, have been granted to German capitalists. The population of Sicily is rapidly increasing, and the introduction of the electric light in the principal towns is likely to be a feature of the near future.

Meran, in the Austrian Tyrol, was recently the scene of a serious catastrophe. An inclined railway runs up the Schneeberg, and as a party of tourists were making the ascent the cable by which the car was moved broke, the brakes or the safety appliances did not appear to work, and the car was dashed to pieces in the valley below and several of the passengers were fatally injured.

The tramway bill of the Corporation of Sunderland, England, has received the royal assent, and the council has agreed to purchase the undertaking from the Sunderland Tramways Co. at a cost of £35,000. The whole of the old and new routes are to be electrically equipped by August 31, 1900, the total expenditure being estimated at £126,618. The contract has been placed in the hands of Messrs. Dick, Kerr & Co.

The Corporation of Limerick, Ireland, has appointed a committee to consider a new proposal from the Limerick Electric Tramway Co., under which the company proposes to proceed without asking the Corporation to give any guarantee whatever. The company propose to lay six or eight miles of tramways, the cost to be about £70,000, of which £40,000 would be spent in the city, in addition to the company employing permanently a staff of 300 men.

The San Juan and Rio Piedras Railway Co. has been incorporated at Albany, New York, to operate an electric railway and furnish electric light at Porto Rico. The company will operate the first electric railway and electric power plant on the island. It has purchased a steam road eight miles long and electricity will be substituted as a motive power, the overhead trolley system being used. The work of reconstructing the road has already begun.

Consul-General J. G. Stowe writes from Johannesburg, South Africa, that concessions for electric railways are wanted in that city but are refused by the Government believing that they would stop the sale of forage and horses. The streets are wide and the city is a busy one, but the motive power of the street railways consists of horses and mules. He states that electric lines should also be built in Kimberley, East London, and Durban. The horse cars still run in these cities, and the length of the present roads is great.

Nelson, B. C., was en fete on July 31st, the occasion of driving the first spike of the electric street railway. The spike, which was a gold one, was driven by Mr. C. S. Drummow, managing director of the Duncan Mines, and a director of the British Electric Tramway Co., which has lines in various parts of the world. A banquet was held in the evening, at which representative men from all parts of the Kootenay were present. This Nelson railway is the first street railway in Kootenay, and the population of Nelson has reached 6,000.

The British Tramways Co., of England, has contracted with the British Thomson-Houston Co., Ltd., for four 500-kw. tramway generators, coupled direct to vertical cross compound engines of the corliss type, together with three 30-kw. motor generators and two 50-kw. lighting machines; also a complete switchboard for this machinery. Also for 150 single truck double deck cars. The British Thomson-Houston Co. is to act as English representatives for the General Electric Co. Not having the facilities necessary for building the machinery embodied in this contract, everything pertaining to the electrical part of the order, the amount of which is estimated at quite $100,000, will be constructed in the American works of the General Electric Co.

AMERICAN ELECTRICAL WORKS CLAMBAKE.

An event of interest to electrical men throughout the country is the annual clam bake given by the manager of the American Electrical Works, Mr. E. F. Phillips, and the bake of this year, which was held on the 9th of September, was the most noted and enjoyable; it was more largely attended than on any previous year, there being present 360 whose names were registered. Cards of invitation to the number of about 8,000 has previously been sent out to street railway, electric light, and electrical supply men throughout the country, and to the representatives of these industries in Canada, Mexico and some of the South American countries. The cards were unique, in that they consisted of plates of pure sheet copper, 4 x 6 in., on which the invitations to the 21st annual bake were engraved in script.

More than 800 letters were received in reply to the invitations, all couched in cordial terms and many of them very flattering to the management of the company, and all emphasized the importance of the line of goods made by this company.

At 10:30 on the morning of the 9th a number of electric cars waiting at the Narragansett Hotel were quickly filled and an enjoyable ride of five miles brought the guests to the home of the Pomham Club, a most delightful location overlooking the river and bay.

On registering, each guest was provided with a badge, and a crash uniform cap, upon the front of which was printed in large letters "Twenty-first Annual Clam Bake of the American Electrical Works, Providence, Rhode Island, Pomham Club, September 9, 1899."

At 11:30 lunch was served, following which the guests passed the time in social intercourse, and in singing and dancing, until the bake was ready. In the meantime a photograph of the entire company was made, the guests being seated upon the sloping bank facing the south.

Tables were spread with plates sufficient to accommodate the entire number, the main or middle table being reserved for the speakers and press representatives, at the head of which Mr. Phillips presided.

The menu cards were also printed on sheet copper, enclosed in an engraved cover. The feast was a very enjoyable one, the chowder and bake being especially fine; the flavor is peculiar to this region, and it is claimed that no other clam bakes in the country can approach the menu provided by the Rhode Island chefs.

Following the banquet Mr. Phillips made an address of welcome, referring in happy terms to this particular date, saying that the company had become of age, it being the 21st anniversary, and that he wished to make it a family affair, and invited every one present to feel as if they had returned home after a long absence, or come back to their boyhood days and enjoy a ramble over the house, as they would if they had returned to their own homes. In closing his address he introduced Mr. R. S. Brown, of the Westinghouse company, whom he invited to act as toast master, and who filled the position very acceptably, introducing himself and the speakers in a humorous manner, and was followed by an address from Congressman Capron, Mr. Wendall, of Wendall & McDuff, New York, Frank Ridlon, of Boston, one of the oldest representatives of the electrical industry in the country; next by C. B. Fairchild, of the "Street Railway Review", and others.

During the banquet a local band played popular airs, and the whole affair was one of the most enjoyable that it has ever been the privilege of the writer to attend.

Among the other representatives of the technical press were: J. B. Bennett, Street Railway Journal; E. Wood, American Electrician; Frank Perry, Western Electrician; E. P. Shaw, Electrical World.

The engineers of the Brooklyn Elevated roads suffered a cut in wages from $3.50 a day to $2.50. They are now called "motoneers." The surface car motormen receive $2 a day and the Brooklyn Bridge motormen $2.25 per day.

The Denver City Tramway Co. is to get a return of $2,000 in war taxes. On the consolidation with the old cable company revenue stamps were affixed to both the mortgage and the bonds, although they were merely two features to one transaction. Congress passed a law to return one-half of the war tax thus paid in.

NEW PLANT OF THE SARGENT CO.

The increase in the business of the Sargent Co., of Chicago, because of the American Brake Shoe Co., made it necessary for it to increase its shop capacity, and accordingly contracts have been made and buildings are now being erected at Chicago Heights, 27 miles south of Chicago. The site is near the lines of the Michigan Central, Chicago, Joliet & Eastern, Chicago & Eastern Illinois, and Chicago Terminal railroads.

The plans, as prepared by Huehl & Schmidt provide for buildings to cover an area 250 x 260 ft.; the total cost of the buildings, exclusive of machinery and equipment, is estimated at $40,000. The iron foundry is to be 200 x 110 ft. The iron cupola room is 30 x 33 ft.; storage room, 30 x 110 ft., core room, 35 x 110 ft., steel foundry, 50 x 200 ft.; steel melting room, 32 x 30 ft.; work shop, 30 x 200 ft.; cleaning shop, 52 x 200 ft. The steel foundry is to be two stories. The buildings are to be of brick, stone and steel and equipped with machinery of the latest design.

The company fully expects to have the brake shoe department of the new plant in operation by December 1st, and the steel foundry by January 1st. The present plant at 59th and Wallace Sts. will be continued, and the output of steel castings greatly increased when the foundry is removed to the new works.

We extend our best wishes to the company and hope that its phenomenal growth will continue so that other additions may be necessary in the near future.

NEW PUBLICATIONS.

GRANITE STATE SCENERY in and about the Capital City is the title of a handsomely illustrated pamphlet published by the Concord (N. H.) Street Railway Co. The handsome residences of the city, its factories, public building, institutions, etc., are described and illustrated in connection with the lines of the street railway company. The work is handsomely got up, and comprises an interesting souvenir of the city.

CASSIER'S MAGAZINE for August presents a special number devoted exclusively to electric railway literature. The issue is called the Electric Railway Number, and contains 292 pages of reading matter, with over 200 engravings. There are 18 articles prepared by as many well-known engineers and authorities in railway matters. From the historical survey of the subject to its business aspect, every intermediate phase has been carefully considered, and every noteworthy detail has been worked out by a competent authority, and presented in a masterly manner.

"COMPOUND ENGINES" is the title of a new book on this subject by James Tribe, member of the American Society of Mechanical Engineers. It differs from most other works having a similar title in that it is of small size, being a hand or pocket book of 140 pages bound in flexible covers with round corners. There are a large number of steam engineers whose duties make it desirable for them to have a knowledge of the principles and methods of computing the proportions of compound engines, but who are not sufficiently familiar with algebra and calculus to easily follow the discussions of the subject as found in most works on the steam engine. Mr. Tribe has undertaken to present in a compact and simple form the principles underlying the subject so as to make them of service to the practical man; he has carefully avoided higher mathematics, and put the results of formulas in the shape of rules, tables and diagrams, adding many numerical examples to explain their use so that the meaning and application are made very clear. The book is divided into 15 sections; the first five sections, some 38 pages, discuss preliminary matters, the next six sections cover 64 pages and are devoted to multiple expansion engines, the next two treat of condensing apparatus and cylinder oils, and the last two consist of tables and definitions. In the section on definitions we note some errors and ambiguous statements; thus for adiabatic expansion it is the vessel and not the gas which must possess the property of not suffering heat to pass; momentum is the product of mass and velocity, and not "the work stored up in a moving body"; power is the rate of doing work and not "force multiplied by distance, multiplied by time." These misstatements will doubtless be corrected in future editions. Published by James Tribe, Racine, Wis. Price, $1.50.

PERSONAL.

MR. T. E. MITTEN, general superintendent of the Milwaukee lines visited the "Review" on his way east a few days ago.

MR. ENGLUND, of Mayer & Englund, Philadelphia, is justly proud of a fine little daughter who arrived on August 16th.

DR. W. E. BELL has been appointed surgeon of the Terre Haute Street Railway Co., to succeed Dr. T. C. Stunkard.

MR. E. J. LAWLESS, eastern representative of the American Car Co., spent several days renewing acquaintance with his many Chicago friends recently.

MR. E. H. MULLIN, in charge of the publication bureau of the General Electric Co., New York, visited Chicago in connection with the company's printed matter for the coming convention

MR. ROBERT F. FOX recently resigned his position as manager of the Wilmington (Del.) City Railway Co. He was presented with a handsome gold watch by 21 employes of the company.

MR. PHILIP H. WOOTAN, of Boonton, N. J., sailed for China last month, to be absent five years. He is employed by the American Traction Co., of New York, and will represent the company at Shanghai.

MR. CHARLES T. YERKES was last month chosen president of the Chicago Consolidated Traction Co., succeeding Mr. John M. Roach, resigned. Mr. L. S. Owsley succeeded Mr. W. F. Furbeck as vice-president.

MR. MAHLON D. ORDE has been selected to succeed L. S. Owsley as assistant secretary and treasurer of the Chicago Union Traction Co. Mr. Orde was formerly a teller in the Northern Trust Company Bank.

MAJ. RUSSELL B. HARRISON, formerly president of the Terre Haute Street Railway Co., has been critically ill with yellow fever at Santiago de Cuba, but is now convalescent. Major Harrison has been isolated, but was not taken to the fever hospital.

MR. E. L. BEMIS, who has lately been elected to the presidency of the Richmond (Va.) Traction Co., is also president of the Virginia Electrical Railway & Development Co. Mr. Bemis is a native of Louisiana, but for several years has been a well-known resident of Richmond.

MR. WM. CANHAM, president of the Port Huron (Mich.) City Electric Railway Co., has retired from the office and disposed of his one-fourth interest to the firm of F. Saunders & Co. Work on the proposed extension to Marine City will be commenced as soon as practicable.

MR. A. W. LYNN resigned his position as superintendent of construction and maintenance of way of the Milwaukee Electric Railway & Light Co. on August 30th, to become general manager of the Milwaukee Rail Joint & Welding Co., to which position he has been elected. Mr. Lynn has been connected with the Milwaukee street railways since 1886.

THE DIRECTORS of the Logansport, Rochester & Northern Traction Co., of Indiana, have organized by the election of the following officers: President, J. T. McNary, of Logansport; vice-president, L. W. Welker, of Albion; secretary, George Holman, of Rochester; treasurer, B. F. Keesling, of Logansport; civil engineer, Walter Osmer of Logansport.

MR. J. H. SIMMS, for the last year the general superintendent of the Staten Island Electric R. R., has resigned. In his place R. J. Carnahall, of West Brighton, has been named as superintendent of traffic and H. M. Kemp as superintendent of maintenance. The business of the line has doubled within the last two months, and the division of labor was thought desirable.

MR. C. W. FOOTE, manager of the Zanesville (O.) Electric Railway Co., tendered his resignation, to become effective September 1st. Mr. Foote will leave that city for Hamilton to assume the office of general manager of the Cincinnati & Miami Valley Traction Co., owning an electric railway line running between Dayton, Miamisburg, Franklin, Middleton and Hamilton.

MR. FREDERICK LENOIR, superintendent of the Gardner (Mass.) Electric Street Railway Co., has been chosen to fill the same position for the Gardner, Fitchburg & Westminster road. Although the road will not be in running order for over a month, it was found necessary to choose a superintendent to look after matters partaining to the road. He will continue in his present position.

MISS MABEL B. JOHNSON, who was chief clerk to Auditor Smith, of the Lynn & Boston, and one of the most expert lady accountants in the country, has been promoted to auditor to fill the vacancy occasioned by Mr. Smith coming to the Union Traction Co., this city. Miss Johnson has been sought after by several large roads to take charge of the accounting department, but decided to remain in Lynn.

MR. GEORGE M. ELLIS, formerly the superintendent of the General Electric Warehouse, Chicago, for a number of years, is now with the Gregory Electric Co. and the Charles E. Gregory Co., 52-64 South Clinton St., Chicago. Before leaving the General Electric Co. Mr. Ellis was tendered a banquet by the employes and presented with a meerschaum pipe set with sapphires and diamonds, and a handsome gold watch, as a token of the high esteem in which he was held by them.

MESSRS. CHARLES A. RICHARDSON, GEORGE A. MURCH AND W. B. FERGUSON have resigned as directors of the Torrington & Winchester (Conn.) Street Railway Co., and James Alldis, George B. Alvord and A. P. Hine, all of Torrington, were elected in their places. The other directors are Henry Gay and S. A. Herman, of Winsted, and E. H. Hotchkiss and F. F. Fuessenich, of Torrington. James Alldis was elected president and S. A. Herman, secretary and treasurer.

MR. A. J. GIFFORD, who has been connected for the past 10 years with the General Electric Co., in St. Paul and Chicago, left the latter city on August 18th to take charge of the company's transportation department in Schenectady. In his new position Mr. Gifford will have charge of all the company's shipments from the Schenectady factory, a similar position to the one he has previously held, but covering a much larger field.

MR. W. F. FURBECK, long associated with the Yerkes' interests of Chicago, has resigned his position with Mr. Yerkes and will be associated with A. L. Dewar & Co., private bankers.

THE NEW YORK METROPOLITAN COMPANY'S CONDUITS.

Since the introduction of its underground trolley system in New York the Metropolitan Street Railway Co. has put in a great many more ducts alongside of its track than are necessary for the railway feeders. It has laid 36 electrical conduits in Broadway, and is expected to use only four of them in operating electric cars. It is supposed that the other 32 conduits are to be used for electricity which the company will sell to customers along Broadway.

The Birmingham (Ala.) Railway & Electric Co. increased the pay of the motormen and conductors, and in addition to this distributed about $1,000 in cash prizes among them. One hundred and sixty-six men received awards, which were offered at the beginning of the year to the conductors keeping clean cars, the motormen having no accidents, etc.

SOUND VIEWS OF PHILADELPHIA'S MAYOR.

Early this month professional agitators visited Philadelphia and endeavored to work up a strike among street railway employes, taking advantage of the meeting in that city of the G. A. R., as a time when a strike would be particularly undesirable. Two meetings were held, at which 17 were present at one and 21 at the other, out of 4,000 employes. The Philadelphia Times has the following:

Mayor Ashbridge was seen and spoke freely on the subject of a prospective tie-up at this time. As is well known, the chief executive is an out and out friend of the workingman, and has probably done more than anyone else in the city to secure employment for conductors and motormen. Hence an expression of opinion from him on a subject such as this will have exceptional weight with the classes affected.

"No one," he said, "is more anxious to see the laboring man get ahead than I, but I have no patience whatever with these professional labor agitators, who, at salaries of $25, $30 and $50 a week, spend their time in fomenting trouble for the ones who pay them. Of course, we all want to get as much money as possible and work as few hours as possible for it, but when conditions are such that we cannot take as much time to ourselves as we would like, we should not shirk our duty.

"Certainly, if the men want to commit suicide, let them strike on Monday, or at any time during the Grand Army encampment. There isn't a citizen of Philadelphia who would be in sympathy with them.

"But I blame the men who make a business of strikes and labor troubles for such rumors. Naturally, if harmony always prevailed between labor and capital the men would see that they were useless appendages, and so they seize every opportunity to bleed their victims by making all the trouble they possibly can, magnifying grievances, and even manufacturing them, and levying the usual assessment.

"What do they care for the starving men who accept their inflammatory utterances as gospel? What do they care for the suffering families, the disgrace following the violence which their words incite? Nothing, so long as their own salaries are regularly paid. For this class of men I have nothing but unmitigated contempt."

CENTRAL ELECTRIC TROLLEY EAR.

All work is troublesome, but it is more than vexatious not to be able to secure results. In placing the overhead parts of electric railway construction in proper shape, it is important that the parts easily fit and remain fitted; a clip that does not clip and a clinch ear that will not clinch are abominations. Much of the trouble in assembling parts of a whole comes through inherent faults not manifested on the surface; but attributable to the methods of casting. Malleability, to produce pliability and eliminate brittleness, is the salient point in overhead material, where the difficulty of assembling parts is a positive factor and the complex whole is at all times liable to severe strain.

The "Type W" clinch ears are cast in the same position as shown in the illustration, the lips being formed by the prints in the regular

moulding sand. This process of moulding is a secret known only to the makers. Wherever a core is used in casting, the metal coming in contact with it becomes chilled and gains undesirable crystalline properties with resultant brittleness. The method of casting followed by the Central Union Brass Co. leaves the clinching lips of the trolley ear entirely pliable and in condition to readily clinch about the trolley wire, and when once hammered into place to so remain. Installation and maintenance are made more economical by saving of time and no trolley wires will sag by the opening or breaking of the lips of this car.

The Central Electric Co., Chicago, carries these reliable articles in stock, as well as a complete line of railway material.

AN INSULATED THIRD-RAIL SYSTEM.

Experiments which have been carried on for some time on a ½ mile section of the Long Island R. R. by Messrs. Cox and McDonnell to test an improvement in the third rail system have been brought to a satisfactory conclusion, and the system has been pronounced an unqualified success by several prominent railroad men who witnessed the experiments. Messrs. Gould and Sage of the Manhattan Elevated System, President Baldwin of the Long Island Railroad Co., and President Clarke and other managers of the New York, New Haven & Hartford, with representatives of the New York Central and other prominent railroads have visited the place and taken a trip over the half mile of track, and it is said, have all been convinced of the practicability of the system for trunk and elevated railroads.

In this system the third rail consists of a hollow wooden trough on top of which is fastened an iron cap. Inside this trough runs a large copper wire for the transmission of electricity. A smaller iron wire lies loosely on top of this and this wire is lifted as the train passes along by a powerful magnet to the top of the rail, which thus becomes electrified for the length of the car. A short distance behind or ahead of the car the third rail is dead.

It is claimed that the loss from leakage and the danger of short circuiting in wet weather is entirely obviated by this system, which was found to be perfectly reliable on the experimental section during the heaviest storms.

President Baldwin said about the system:

"The only hindrance to our at once taking hold of this matter is the fight over the validity of the patent. There are several others who claims title to the invention. As soon as this is settled we are ready to go ahead."

FIRE AT NIAGARA FALLS, ONT.

The power house of the Niagara Falls Park & River Ry., on the Canadian side at Niagara Falls, was destroyed by fire on the night of September 4th. The first intimation of trouble was when the attendant noticed a short circuit on the alternating current line in the basement. He had hardly time to shut down the water wheels and throw the switches before the interior was ablaze. The building was of stone, and only the walls remain. The station was the property of the International Traction Co. and contained three generators for the railway service, and two 750-kw. generators of the Canadian Niagara Power Co. The damage to the building is placed at $10,000, and to the apparatus about $75,000. It will be recalled that the road has another power station at the foot of Queenston Heights, and this gave a partial service until connection was made across the upper steel arch bridge with the trolley wires in Niagara Falls, N. Y. The Niagara Falls Park & River Ry. will be run by current from the central station of the Niagara Falls Power Co. until other arrangements are perfected.

RAILWAY NEGOTIATIONS IN MOBILE, ALA.

Negotiations are in progress looking to the purchase of the two Mobile street railways by outside capitalists and their consolidation into one system. Mr. W. H. Patterson, of Atlanta, who is connected with the Consolidated Street Railway Co. of that city, has been in Mobile inspecting the property of the street car companies, and has had several conferences with Manager Semmes, of the Mobile Street Railroad Co. and with Manager Wilson, of the Mobile Light & Railroad Co.

Mr. Patterson stated that if he could reach an agreement with the street railway owners he would get capitalists to purchase and consolidate the roads. He expected an agreement would be reached within two or three weeks.

One of the rumors in Chicago is to the effect that the Chicago Union Traction Co., the Chicago Edison Co., the Commonwealth Electric Co. and the Illinois Vehicle Co. are to be consolidated.

The Belleville Electric Railway Co., of Belleville, Ill., has petitioned to have its franchise extended for six years. The present franchise has 14 years to run, and the company wishes to issue some 20-year bonds.

HUBBARD ELECTRIC BRAKE CO.

The Hubbard Electric Brake Co. has been incorporated for $1,000,000 and began the manufacture of electric brakes in its own shops, at Chester, Pa., on September 11th. The inventor, Mr. Hubbard, and the vice-president, G. E. Pratt, are both well known to street railway men. The works are at Nos. 126 to 130 Sixth St., Chester.

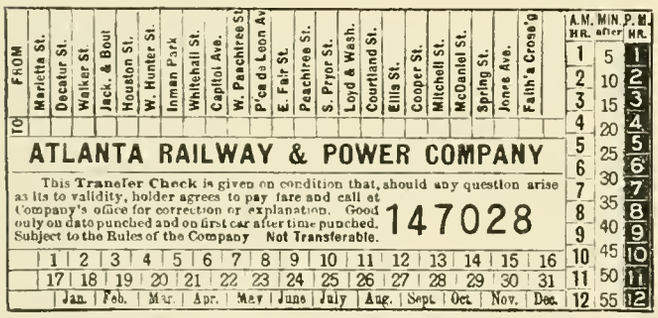
The company calls attention to the following points: The first cost is reasonable, bringing it within the reach of all roads; its simplicity in construction and operation make its use easy by any motorman; sliding and skidding of wheels is prevented, and brake may be operated from either platform by either line or motor current; the braking force works from a jam cylinder under the center of the car, with fulcrum and brake levers working uniformly on all wheel treads; absence of any rigging on the axles and no necessity for additional motors, piping or machinery.

The company has been making some tests which are said to be very interesting, and which will be announced at the coming convention.

ATLANTA TRANSFER CHECKS.

We show herewith the transfer check now used by the Atlanta Railway & Power Co. The original is 2 x 4¼ in., printed in black on olive green paper, excepting the serial number, which is in red. On the back is a copy of the city ordinance relative to the misuse of transfers. The ordinance reads as follows:

"No transfer ticket or written instrument giving or purporting to give the right of transfer to any person or persons from a street railroad car or route to a street railroad car operated upon the same or another line of route of said street railroad in said city, shall be issued, sold or given away, except to a passenger



lawfully entitled thereto and by or from a duly authorized agent of said street railroad company.

"Any person, other than a duly authorized agent of the aforesaid street railroad company, who shall in said city issue, sell, exchange or give away such a transfer ticket with intent to have the same used for passage, and any person or persons not lawfully entitled thereto who shall offer for passage such a transfer ticket, shall be guilty of an offense for each and every act, and on conviction thereof shall be punished by imprisonment not to exceed 30 days, or fined not exceeding $100, either or both, in the discretion of the recorder's court, for each and every such offense."

NEW BADGES FOR THE TRI-CITY EMPLOYES.

The motormen and conductors of the Tri-City Railroad Co. were provided with new coat and cap badges last month. The insignias are very neat and the cap badges designating the office of the wearers, are so arranged that they are interchangeable. On occasions when through rush of business or otherwise a motorman may perform the duties of conductor, or vice versa the badge may so designate, and the advantage of the new scheme will be shown in all the men, extras as well as regulars being properly badged at all times when on duty. The coat badge, an immense button, bears the man's number and the name of the company, but does not indicate his position.

CONSOLIDATION OF THE NASHVILLE, TENN., RAILWAYS.

The City Council of Nashville, Tenn., passed an ordinance last month permitting the consolidation of the three railway companies in that city. This gives the consent of the mayor and city council of Nashville to the acquisition by the Nashville Railway Co. of the franchise, rights and ways, properties and assets of the Nashville Street Railway Co., the Nashville & Suburban Railway Co., and the Citizens' Rapid Transit Co.

The roads are owned by the Hambleton company, of Baltimore, and considerable opposition was made to putting the three franchises in the possession of a single company, but after considerable discussion the measure passed the council by a vote of 15 to 5.

TAMPERED WITH SIGNAL BELLS.

By representing himself as an electrical inspector on the street cars in Cleveland, Walter Bertram, an electrician, managed to put the electric signal bells on 40 cars out of order last month. Bertram's scheme to do injury to the railroad company's property was interesting. He stationed himself at the corner of Perry and Prospect Sts. and boarded every passing car. He would represent himself as one of the company's electricians, and would try all the push buttons in the car. He also worked around some of the electrical apparatus with a screw driver. He worked on a number of cars until he came in contact with a non-union conductor. The latter refused to let Bertram meddle with the electrical apparatus until he displayed his credentials. As he could not do this he jumped from the car and disappeared.

He was soon seen to board another car, and while at work on the electrical apparatus of the latter was arrested.

SANS SOUCI PARK A GREAT SUCCESS.

In previous issues we have described Sans Souci Park, the new South Side Chicago summer resort, and now as the season draws to a close we note the fulfilment of every promise made of its high class and popularity. That Chicago people appreciated the filling of this long felt want has been attested by the 800,000 who have visited the beautiful grounds and witnessed the many pleasing features presented. Under the able management of Mr. W. H. Carter the park has proved to be a great family and pleasure resort, and has been patronized by the most fashionable and discriminating people of this city. During the season first-class vaudeville and out-door attractions have been presented. The electric fountain has proved the most beautiful attraction ever offered for out-door pleasure, and has been a leading feature. It has been the aim of the management to keep the social atmosphere of the park of the purest quality and we congratulate it on its success in an undertaking which will make the park more popular next year than this, if there is any superlative of success. Extensive improvements will be made on the buildings and grounds before the opening of next season. Experience has suggested many changes, and when these are completed along the lines contemplated the rough edges of newness will be removed and Sans Souci Park will present a paradise for the patronage of prosperous people when the season of 1900 opens. We predict even greater results than attained this year, as Chicago people are always ready to lend the stamp of approval to everything good in the line of summer resorts.

TROLLEY PARTIES TOO NOISY FOR PHILADELPHIA.

The order has gone forth in Philadelphia that the noises which attend trolley parties in that quiet city must cease. President Parsons, of the Union Traction Co., has ordered all conductors to maintain quiet and order upon their cars.

When the electric cars were introduced and trolley parties became a fad, the authorities complained of the noise made by some of the riders. The traction companies were asked to suppress these noises and orders to that effect were issued. Now, in time the rules against too much noise on cars were overlooked, hence the new order.

ECHOES FROM THE TRADE

LITTLEFIELD & MYSENBURG, Chicago, agents for the Lorain Steel Co., secured an order for 100 du Pont trucks for the Indianapolis Street Ry.

THE E. P. ALLIS CO. has recently published a handsome pamphlet of nearly 200 pages, descriptive of improvements in its engines. There are numerous fuel page illustrations of its latest types of engines

THE E. P. ALLIS CO., of Milwaukee, was among the bidders for the engines for the new power plant to be erected by the Glasgow Tramway Committee, and its tender was accepted, the price being £114,544.

THE PITTSBURG REDUCTION CO. last month shipped to the Russian Government, at St. Petersburg, 200 cases of aluminum to be used as a conductor line for an electric railway controlled by the Imperial Government.

JOSEPH LOCKWOOD, of the Michigan Electric Co., Detroit, is acting as the representative of the J. G. White Co. in building the power house of the Lake Orion road. This station is nearing completion and will be a model plant.

CHARLES B. HAZARD, manager of the New York office of the Electric Storage Battery Co., of Philadelphia, advises us that the New York office has been removed from 20 Broad St. to the 15th floor of the American Surety Bldg., 100 Broadway.

THE SIEMENS & HALSKE ELECTRIC CO. OF AMERICA has removed its St. Louis office from No. 6 Laclede Building to No. 116 Laclede Building; W. R. Mason is the company's sales agent in that city. Long distance telephone, Main 2212 M.

THE GOLD CAR HEATING CO., of New York, has taken orders during the past month which surpass all former records. Among the most prominent orders for electric heaters is that of the Boston Elevated Railway Co., which has ordered heaters for 100 new cars.

THE KUHLMAN CAR CO., of Cleveland, O., has secured the contract to furnish 12 new cars for the Detroit & Northern Electric Ry., the new line now under course of construction between Detroit and Pontiac, via Farmington. This line will start running through cars about January 1st.

WENDEL & McDUFFIE, of New York, have received since August 1st orders for 50 snow plows and sweepers. The orders for these machines are being placed much earlier than usual and will tax the capacity of the Taunton Locomotive & Manufacturing Co., for which Messrs. Wendel & McDuffie are agents.

THE ELMER P. MORRIS CO., of New York, has added to the list of concerns for which it is agent, the following: Wagenhals Manufacturing Co., Cincinnati; Mundel Electric Works, Springfield; Spiral Journal Bearing Co., St. Louis. The company has recently received a number of large orders, both foreign and domestic.

ROBERT W. BLACKWELL & CO., LTD., has just been incorporated for the purpose of taking over the business of engineers and contractors heretofore carried on by Messrs. Robert W. Blackwell & Co., at 39 Victoria St., Westminster, London, S. W.; 133 Bermondsey St., London, S. E.; 20A Chapel St., Liverpool; 50 Boulevard Houssmann, Paris, and 120 Liberty St., New York. The directors of the new company are: Robert Winthrop Blackwell, Philip Dawson, Benjamin Hunting Howell, Sir Charles E. Howard Vincent, Francis Henry Barker.

A. O. SCHOONMAKER, 158 William St., New York, the extensive dealer in mica, reports a good demand for solid mica segments, and is filling an order for 10,000 for one of the largest street railways in the country, this being a duplicate of an order given last spring. Mr. Schoonmaker is ready to furnish samples to anyone wishing to give his goods a trial.

THE BADT GOLTZ ENGINEERING CO., formerly Meysenburg & Badt, Incorporated, advises us that Mr. Edward A. Meysenburg has resigned as treasurer and retired from the active management of the company, and that the name of the company has been changed as above to indicate the work the company is doing and the active members of the firm.

THE SWARTS METAL REFINING CO., Chicago, with office and works at 20 to 32 North Desplaines St., is buying large quantities of trolley wire from street railways which are tearing down old lines, or have short pieces of wire which cannot be used on the line. The same concern also purchases at the highest market price other metals worn out in car and other service.

THE STARR BRASS WORKS, of Kalamazoo, Mich., has recently doubled its capacity and increased its capital stock from $10,000 to $20,000. This has been made necessary by the success which the company is meeting with in the sale of its long distance trolley wheels and harps. Large orders have been placed with them by many of the leading roads in the country.

F. W. KELLY, general manager of the Consolidated Car Heating Co., Albany, N. Y., announces important changes in his selling department. H. N. Ransom, who has been general agent at New York, has resigned to accept the office of purchasing agent of the Buffalo Railway Co., and the vacancy has been filled by the appointment of J. N. DuBarry, jr., whose headquarters will be in the Havemeyer Bldg.

COL. BONNER, of the Bonner Rail Wagon Co., Toledo, O., was in Douglas and Laxey, Isle of Man, last month when the Isle of Man Tramways Co. inaugurated a freight service on its lines, using the Bonner rail wagons. The company and its patrons are well pleased with the new service, and the manager of the company, Mr. Alexander Bruce, has been warmly praised by the public for his enterprise in introducing the wagons.

ROBERT H. DERRAH, of Boston, is meeting with great success in the promoting of trolley excursions in Eastern Massachusetts, which business he began developing last spring when he severed his connection with the Boston Elevated Ry. During the past summer Mr. Derrah has arranged with the street railways of suburban Boston for special cars, which make trips several times each week; on these trips the excursionists pay the expense, Mr. Derrah does the rest.

THE WESTERN ELECTRIC CO. is agents for hot wire ammeters and voltmeters made by the Stanley Manufacturing Co. These instruments are either direct or alternating current and are of two types, for switchboard work or for portable use. They are accurate, dead beat, possess a wide range of adjustment, and are invaluable for general central station use. The Western Electric Co. has recently placed upon the market the marine type of its "Petite" lamp suitable for shipyards and lake vessels.

ADAM COOK'S SONS, 313 West St., New York City, who are the sole makers of the celebrated "Albany" lubricating compound and compound cups for all lubricating purposes, send us the following extract from a letter from F. M. Sprague, 213 W. Seventh St., New York: "The cups came all right, too. They are doing the work to a T and are filling 'a long felt want.' We have

ordered 50 lb. more of your No. 3 grease." This is a reflection of the usual experience of engineers who use the "Albany" compounds.

THE J. G. BRILL CO. has sent us a pamphlet entitled "Fifteen Months of Experience with a Perfect Passenger Truck," which treats of that company's No. 27 double truck. The experience has shown the special advantages of this truck to be: greater safety, not easily derailed by obstructions, easier riding under all conditions of track, steadiness of the truck itself, no tilting of truck upon applying the brakes, less danger at frogs and switches, less adjustment of shoes where air-brakes are used, equal loads on all wheels at all times, load, not leverage, on wheels.

BULLOCK ELECTRIC APPARATUS continues to find favor, especially among the more exacting users. Sales reported by the company for August embrace 52 machines, ranging in size from 2¼ kw. to 800 kw. capacity. The orders were widely distributed throughout the United States and two were from Great Britain. The latter were for the celebrated "Teaser" equipment, for operating large printing presses, one for a 50-h. p. equipment coming from the Free Press, of Aberdeen, Scotland, and four 50-h. p. equipments from the Scottsman, of Edinborough. We are advised that the company has just issued Bulletin No. 3,432, which will be forwarded to any one applying for it at the general office, Cincinnati.

THE AMERICAN VITRIFIED CONDUIT CO., with general offices at 39-41 Cortlandt St., New York, has issued a new catalog descriptive of its vitrified, salt-glazed underground and interior conduits. The company has developed these ducts from the results of extensive and practical experience, and its present products are admirably adapted to the requirements of trunk, feeder and distributing lines for all kinds of electric transmissions. The joints of these conduits are aligned with dowels, giving the smoothest possible interior surface, and they are made so as to be practically indestructable. They are made up in a number of different styles and sizes, which are illustrated in this catalog, together with views of a number of places where ducts are being installed for electrical purposes.

"WESTINGHOUSE GAS ENGINES" is the title of a new trade catalog of the Westinghouse Machine Co., and it is by far the most complete and instructive catalog of such engines that it has been our pleasure to see; in fact, the avowed purpose of the company was to publish a book which would be a source of information to readers. The pamphlet contains 70 pages, profusely illustrated with views of the engines and details, and the descriptive matter clearly sets out the principles and method of operation. The company makes very strong claims for its method of regulation which consists in varying the volume of mixed gas and air according to the load; the proportions of gas and air in the mixture remain constant, and a charge is admitted at every stroke. The company builds two-cylinder engines in sizes from 10 h. p. to 70 h. p., and three-cylinder engines in sizes from 15 h. p. up. The largest yet built is 650 brake h. p.

"DIXON'S GRAPHITE PRODUCTIONS" is the title of a 6 x 9 pamphlet of over 60 pages recently issued by the Joseph Dixon Crucible Co., of Jersey City. It treats of over 60 different classes of graphite products made by this company. We quote a portion of the preface as follows: "A carefully written history of graphite — its nature, its formations, its sources of supply, its uses in the past and at present, and its possible range of uses in the future — would be alike interesting to the scientific man and the layman. Such a history has never yet been written, although the Dixon company has given publicity to much valuable, and about the only, information on the subject.

"Joseph Dixon, the founder of the Dixon company, was the originator of the graphite industry, and in 1827 began the manufacture of Dixon's plumbago or blacklead crucibles and Dixon's "Carburet of Iron" stove polish. His invention of the blacklead crucibles revolutionized the crucible business, and all plumbago crucibles today, wherever made, are manufactured after his methods.

"Graphite is sometimes called plumbago, oftener blacklead. The three names mean the same thing. Graphite varies largely in its constructure, and the value of graphite for its many mechanical purposes depends not alone on its purity, but quite as much upon a careful selection and preparation of the proper kind for the work intended."

THE NATIONAL WATER TUBE BOILER CO., New Brunswick, N. J., which organized 52 years ago under the name of the National Iron Works, has been recently reorganized and enters the field with the best of prospects. The new owners are all business men of this city of high standing who realized when the concern was to be sold that it augured well. The directors of the company are Hugh McKeag, Philip Weigel, jr., Robt. J. Smith, P. M. Welsh, P. G. Polhemus, C. A. Schenck and Hugh Boyd. The officers are: President, Hugh McKeag; vice-president, P. G. Polhemus; secretary and manager, C. A. Schenck; treasurer, Philip Weigel, jr. Mr. Schenck has been with the National Water Tube Boiler Co. for 11 years. During the latter part of that time he has been acting as manager. Mr. Schneck is a man of ability. He is thoroughly acquainted with the workings of the business as a result of his wide experience and will no doubt do much to improve the condition of the concern.

THE WESTERN ELECTRIC CO. carries in stock some very neat novelties in the way of portable battery lamps. The "Emergency," "Search," or "Flash" light is made in three sizes, cylindrical in form, the diameter of all being the same, and their length being respectively 8½, 11 and 13 in. These lights give from six to eight thousand flashes before the battery requires renewal. They are extremely useful where a light is wanted quickly. The company is distributing a catalog descriptive of this device. This catalog also illustrates the "Ever Ready" electric walking cane, interior search light, electric gas lighter, surgical and dental lamp, electric bicycle lamp, "Ever Ready" night lamp, electric candle, ornamental banquet lamp, electric ruby lamp, for photography, portable reading lamp, the "Ever Ready" scarf pin, and other battery novelties. If any of our readers have not received a copy of this catalog the same will be sent to them upon request.

GEORGE E. FISHER, president and treasurer of the Chase Construction Co., general contractors, Detroit, Mich., has secured the contract for his company for constructing the Toledo, Fremont & Norwalk Ry., from Toledo to Fremont, O., which includes all work outside of the power house and bridges. The company will employ a force of 200 or more men on this contract, when the work is fairly under way, preliminary work having been started last week. Mr. Fisher states his company have had a very busy season and are now completing the large municipal electric lighting plant for the city of Grand Rapids, and the construction of the Cleveland & Eastern Ry. at Cleveland, O. This road runs from that point 36 miles east to Chardon, O., being the second interurban line running out of Cleveland constructed by the Chase company. It has also just completed and turned over to the owners, quite an extensive lighting and power plant, operated by water power, at Belding, Mich., this being a high tension, multiphase alternating system.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING CO. recently received a letter from Pres. A. D. Claflin, of the Commonwealth Avenue Street Ry., Newtonville, Miss., which in substance is as follows:

"We have 16 15-bench cars equipped with Westinghouse 12-A, 30-h. p. high speed motors; these cars are now running their third season over our main line, making the regular schedule of 11 miles in 54 minutes. The traffic on these cars, particularly in the summer season, is very heavy, as they constantly carry from 130 to 160 passengers per trip; our record is 203 passengers on one of these cars at one time. Our road has many curves and several long grades as steep as 5 per cent, two in particular being nearly a mile long each. We have never been obliged to pull a car off the line while in service on account of any trouble with the electric motive apparatus. We have never lost either an armature or a field, and in fact, have had no trouble whatever with your motors running under these trying conditions. We believe this to be an exceptionally satisfactory record for service."

PROVIDENCE FENDERS have been ordered for the cars of the Tri-City Railway—Davenport, Moline, Rock Island—after several months' tests of various makes.

THE CLONBROCK BOILER CO., of Brooklyn, N. Y., has opened a western office at 1457 Monadnock Bldg., Chicago, which will be in charge of Mr. H. B. Ham.

THE MORDEN FROG & CROSSING WORKS has completed the contract for the electric railway at Seoul, Korea, and during August shipped a consignment to Honolulu, Hawaii.

THE AJAX METAL CO., of Philadelphia, extends a cordial invitation to all railroad managers, motive power and other officials, to pay it a visit at Section M-13, Main Building, of the National Export Exposition, which is now being held in Philadelphia. The company will have representatives there at all times, and will take pleasure in offering its services to all visitors. It will provide ample facilities for correspondence, and will give them every attention.

WELLINGTON HOTEL, CHICAGO.

One of the best known and most popular hotels in Chicago, and which we can recommend as enjoying the reputation of having the best chef in the city, is the Wellington, situated conveniently in the down town district. It is at the corner of Jackson Boulevard and Wabash Ave. convenient to the retail shopping district, and within easy walking distance of all the theatres. It is one block from the Lake Front, and cars for the convention hall pass the door. The building is constructed on a fire-proof principle, the walls and cross-walls all starting 3 ft. thick in the basement and continuing up to 12 in. at the roof. These cross walls or partitions surround every space 25 ft. square through the building. The floors are 14 in. deep in fire-proof material, so that, with the side halls and stairways from each floor, the iron bridge across the alley connecting the Michigan Ave. annex, the question of safety is settled beyond argument.

The Wellington is conducted on the European plan, with handsome cafes on the first floor, and a very popular grill room.

BRITISH COLUMBIA ELECTRIC RAILWAY CO.

The second annual report of this company has been issued for the year ending March 31st, from which the following data are taken: In November, 1898, 1,200 shares of non-cumulative 5 per cent preferred stock of a par value of £11 per share, were issued, out of which issue the £60,000 non-cumulative 6 per cent income bonds have been paid off at par. Most of the extensions and improvements previously recommended by the general manager and chief engineer have been acted upon and it is expected that they will all be completed by September 1st, from which time the increase in profits should commence to accrue. Owing to delays in some of these improvements no financial benefit was realized from them during the year covered by the report. The installation of the plant for utilizing the water power from the falls of Goldstream, Victoria, has but recently been put in running order, after experiencing many difficulties. This machinery was started in September, 1898, but various troubles arose which were not overcome until the end of March, 1899, since when it has been in satisfactory service.

The gross profit for the year amounts to £30,188 14s. 1d. From this the directors have paid interest charges and dividend on preferred stock, which leaves £15,550 13s. 1d. available for distribution. From this sum the directors have decided to write off 20 per cent of the preliminary expenses, to pay a dividend of 4 per cent on the common stock, absorbing £8,000. To transfer to reserve account £6,148 19s. 10d. and to carry forward to the next account £189 4s. 9d. In addition to the amount mentioned above, the directors have transferred to the reserve account the surplus of premium received over the expenses of the preferred share issued, £1,349 5s. 2d., bring the reserve fund up to £12,000.

The disastrous fire at New Westminster in September only affected the company by the burning down of about ½ a mile of track equipment. The company donated £2,100 to the relief fund. Owing to the large number of sightseers carried at the time, and the large amount of building materials and general freight carried since, the receipts of the Westminster branch have suffered comparatively little, notwithstanding that the return fare between Vancouver and Westminster has been reduced from 75 cents to 60 cents.

In reference to the state of the company's lines, the report states that the roadbed and track on the Vancouver and Westminster branches have been maintained in excellent condition, and on the Westminster branch work has been commenced with a view to replacing the four small bridges by culverts and a permanent railway embankment. This will reduce the cost of maintenance in future. The directors have decided to entirely relay the roadbed of the Victoria branch, as it is not in good condition, and the rails are light, and they have decided that it will be more economical and wiser to put the track in first-rate permanent condition at once than to follow the system of improvement which was commenced last year, by which the roadbed and track were to be renewed over a period of several years.

A consolidation of the power houses of the Vancouver and the Westminster branches has been commenced and the new plant is expected to be finished by September next. When this is accomplished, with the new installation just completed at Victoria, the company will have throughout thoroughly efficient machinery of the latest type, with all the most recent economical improvements, whilst the old plants at Victoria and Westminster will, as heretofore, carefully maintained for the purposes of reserve. Beyond the regular lighting extensions, the installation of a storage battery, and the reconstruction of the roadbed at Victoria already referred to, there are no new improvements or extensions at present proposed or needed.

The officers of the company in Canada are: General manager, J. Buntzen, Vancouver; chief engineer and general superintendent, J. M. Campbell, Vancouver; assistant engineer and superintendent, R. H. Sperling, Victoria; assistant comptroller, E. H. Wilcox, Vancouver; local manager, A. T. Goward, Victoria; superintendents of traffic, H. Gibson, Victoria, D. A. Shiles, Vancouver.

TROLLEY EXPRESS DISCONTINUED.

The trolley express which has been running for some time between Manchester, N. H., and Rockville, was withdrawn last month. The street railway company's charge for running the express car over its line was one-third of the gross receipts. It has not been a paying venture for the street railway, but the express company had a good thing. The rate was recently raised to 15 cents a mile for each mile that the express car was run. The daily average of the car is about 85 miles, and the express company would not agree to the change, so the car was withdrawn. The trolley express did a good business from the first and the business was steadily increasing. The greater portion of the goods carried would come under the head of freight, rather than express matter.

THE PHILADELPHIA-ATLANTIC CITY LINE.

From the description of the promoters the new line to be run from Philadelphia to Atlantic City will contain numerous points of novelty. A forfeit of $104,000 has been put up with the treasurer of the state, which practically insures the building of the line. The road will be built for through passengers only. There will be no local stops. This clears the road of local trains and leaves the track clear for high speed traffic.

The extra conductors and motormen in the employ of the Middletown (Conn.) Street Railway Co., went out on strike August 12th.

A RAILWAY ORDINANCE CONTESTED.

An ordinance in Brooklyn requires the Brooklyn Rapid Transit Co. to stop its cars before crossing certain specified streets, which are asphalted, and are used by bicyclists. Bicyclists complain that the company has persistently violated the ordinance which was passed by the City Assembly, because of the large number of wheelmen and wheelwomen injured by the trolley cars.

Evidence of these violations has been collected by the police and turned over to the corporation council for prosecution.

The company does not deny the facts charged, but has confined its defense to an endeavor to prove that the ordinance is unreasonable and that, therefore, under a ruling of the Court of Appeals, is not binding upon it.

Judge Van Wart, before whom the cases were tried, has received the company's briefs and reserved his decision.

PRIVATE TROLLEY CAR STRUCK BY LIGHTNING.

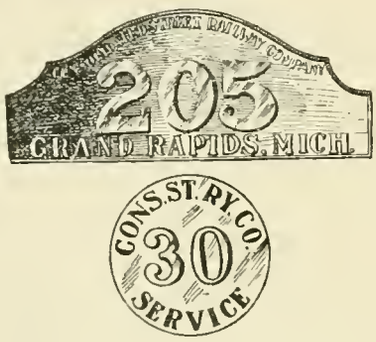
While a party of 13 prominent business men of St. Louis were enjoying a ride in the "Electra," the private car of President Spencer, last month, the car was struck by lightning, causing considerable fright and some injuries to the party.

After enjoying a pleasant trip and a dinner at the other end of the line, the party started to return to the city. All went well until Osage was reached, at midnight, when the occupants found themselves in the midst of one of the worst electrical storms they had ever witnessed, and even the brilliant lights in the car failed to hide the vivid flashes of lightning that continually played about them.

Suddenly there was a deafening crash, accompanied by a blinding flash, and the car seemed to be in a blaze. The occupants were stunned for an instant; when they recovered they saw that the brass lamp fixtures of the car had melted and the molten metal had scattered over several of their number, painfully burning some of them.

NEW BADGES FOR RAILWAY MEN.

The Grand Rapids (Mich.) Consolidated Street Railway Co. has just provided its employes with new badges upon which figures alone are used to designate the men. The old badges bore the words "Conductor" or "Motorman," but as the company frequently uses motormen to collect the fares and sometimes has used conductors to operate the motors, the result has been a con-



fusion of labels and it has been decided to designate the men hereafter by numbers only. The figures on the new badges are of nickle fastened on a background of hard rubber.

The numbers from 30 down are reserved for the use of the company's officers and the service men who are not regularly employed on the cars. The general manager and secretary have small gold badges lettered in black enamel with the name of the company and the office of the person wearing it.

A new style of roadbed has been adopted by the Brooklyn Rapid Transit Railroad Co. Heavy girder rails are being laid upon beds of concrete 10 in. wide and 12 in. deep. No ties are used. The rails are held at proper distance by steel braces running crosswise. These in turn are kept in place by the granite paving blocks.

TAUNTON & BROCKTON LINE SOLD.

The Massachusetts Electric Companies, which has absorbed most of the important electric railways of that state, recently purchased the Brockton & Taunton Street Ry. The price paid was not officially announced, but is generally thought to be $150 per share. When the other roads in the city of Brockton were bought, the majority of the stockholders of this road asked $175 and until the present deal was made, held out for that price. The road is one of the most important in that section and possesses excellent rolling stock. It connects Brockton and Taunton by a direct route.

The plan of the syndicate is to use this road for a direct route from Brockton to Providence, doing away with the Brockton, Bridgewater & Taunton as part of the Providence road. This will make the trip from Brockton to Providence much shorter than at present.

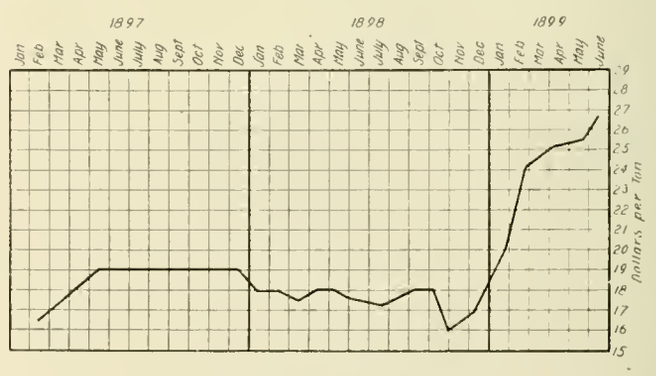
NEW RAILWAY PARK FOR AUGUSTA, GA.

Col. D. B. Dyer, president of the Augusta Railway & Electric Co., of Augusta, Ga., has announced that his company has perfected plans for a handsome 15-acre park in the village of Summerville. The park will be located at the present terminus of the Monte Sano track and the railway company expects to spend a large sum of money in improving the park property.

The pavilion will be commodious, ornamental and presentable. It will have a basement designed for car storage. Walks are to be laid out, shrubbery planted, water arranged and fountains put in.

FLUCTUATION IN STEEL RAILS.

The sudden rise in the prices of crude and finished iron and steel products has been very marked and the following diagram taken from the Iron Age shows the fluctuations in steel rails for the last two years. During 1896 the price of steel rails remained



PRICE OF STEEL RAILS.

stationary at about $28 per ton, but at the dissolution of the rail pool in 1897 the price dropped to a point shown where the diagram commences. Since the beginning of July prices have advanced still farther, so that the upward course of the curve continues.

TRAFFIC ARRANGEMENT DISCUSSED.

A traffic arrangement between the Manhattan Elevated system of New York and the elevated and surface roads of Brooklyn has been under consideration for some time, and there seems to be a prospect of its early consummation. A similar agreement between the Manhattan and the Third Avenue systems, whereby transfers are given for 8 cents, has been in operation for several months and has proved so advantageous as to encourage the management of the Manhattan to extend the same to the Brooklyn roads. President Rossiter, of the Brooklyn Rapid Transit system, and General Manager Skitt, of the Manhattan, have a favorable opinion of an exchange system and have had several conferences on this subject. Neither Mr. Rossiter nor Mr. Skitt will say what exchange rate is under consideration. It is generally supposed among street railway men that the 8 cent rate in force between the Third Ave. and Manhattan systems is the basis of negotiations.

THE CHICAGO CONVENTION.

Eighteenth Annual Meeting of the American Street Railway Association in Chicago, October 17, 18, 19 and 20, 1899 Attendance Will Be the Largest in the History of the Association Hotel Facilities Ample Delegates Can Study Every Type of Motive Power Horse Cars, Cable Cars, Trolley, Third-Rail, 3-Phase, Storage Battery and Compressed Air Systems All Are in Operation Here Strong Program for the Meetings Unprecedented Display of Exhibits A Genuine Chicago Welcome Awaits the Guests.

The American Street Railway Association is getting along in years, and the Chicago meeting will make the eighteenth annual gathering. Chicago invites the street railway fraternity of the world and will endeavor to see that every visitor is royally entertained. Its central location with regard to railroad travel makes it especially easy of access, and with hotel facilities sufficient to care for the population of a good sized city, we believe the attendance will be larger than at any of the previous conventions.

The convention opens Tuesday morning, October 17th, and continues during the succeeding three days. The papers to be presented promise to be unusually valuable and interesting, and abundant time will be allotted to discussions.

The Executive Committee has felt that the excursions and entertainments should not encroach upon the regular work and purposes of the meeting, but the program has been so arranged that work and pleasure will be suitably alternated. The entertainment committee will discharge its duties in a manner which, we believe, will be pleasing and interesting.

One whole day will be devoted to the Exhibition. This is an innovation, but one which delegates and supply men alike will appreciate. The meetings and display will be under the same roof in Tattersalls, which is at State and 16th Sts. It is easily reached by several lines of surface cars without change and requiring only a few minutes' ride.

Chicago affords exceptional facilities for studying the various methods of motive power. We still enjoy (!) a number of horse cars, and the cables and trolleys, the third rail of the elevated roads, with the storage battery line and compressed air in night car service, leave little to be desired by the earnest student of the several methods of propulsion.

The steam raods have made the usual concession of one fare and a third for the round trip. Purchasers must, however, be sure to get the special ticket and receipt when buying in order to avail themselves of the reduction. The ticket must also be stamped for return, by the authorized agent of the traffic association, who will have an office at the convention hall.

The Chicago ladies have organized a large committee and propose to look after the wants and comfort of the visiting ladies in every way. It is earnestly hoped the number of ladies in attendance will be as large as possible.

The Accountants' Association anticipates a large gathering of its members and a very interesting meeting. This association has grown very rapidly and accomplished a vast amount of important work in a short space of time. Its efforts have commanded the endorsement of state railroad commissions and the managements of our largest and best roads. The Accountants will meet at the same place and time but in its own quarters.

As the evenings during October are usually cool in Chicago, visitors will do well to bring with them garments of fairly heavy weight, although the days are usually warm and bright, and light overcoats are not always necessary.

There will be much to interest the visitor in the line of power plants and repair shops. The successful operation of the 3-phase system of long distance transmission of the Chicago & Milwaukee line affords a working demonstration of what undoubtedly will be widely copied for roads of this class. We have described quite fully in this issue the more interesting features of our local power stations and repair shops to enable the reader to select in advance such points as he specially wishes to visit and examine while in attendance at the convention.

The territory now embraced in the State of Illinois has furnished material for an interesting history, which in its early days was full of tragedy, with a chain of thrilling events to mark the aggression of the white man and the recession of the Indian. The picture is aptly painted in the familiar words of William Wirt:

"Not many many generations ago where you now sit circled with all that exalts and embellishes civilized life, the rank thistle nodded in the wind and the wild fox dug his hole unscared. Here lived and loved another race of beings; beneath the same sun which rolls over your heads the Indian hunter pursued the panting deer; gazing upon the same moon which smiles for you, the Indian lover wooed his dusky mate."

Before coming into the hands of the United States this section, in common with all the rest of the country, belonged by right of discovery, to Spain. Then came the French, who were driven out by the English, and who, in turn, surrendered the land to the United States government. But before all these it was the home of the Indian. The Algonquin family extended from Canada, along the St. Lawrence River, west to the Mississippi. In this family were many tribes, and among them was one called the "Illini," an Algonquin word which signifies "superior man;" our present spelling, "Illinois," is said to be a French corruption of the Indian plural, "Illinuk." The main settlements of this tribe were in the middle and northern part of this state. In what is now La Salle County was a thriving Indian village called La Vantun, which in 1680 contained 800 inhabitants. Within the limits of the present state there were 20 other villages. The region was rich and fertile, and attracted the attention of the other tribes of Algonquins, and they began clamoring for a division. Family troubles ensued, which were bad enough, but when the outsiders, the Sioux, the Sac and Fox, the Kickapoos, the Pottawatomies and the Iroquois came in for a share, matters grew serious for the poor Illini. The Iroquois were by far the strongest and most persistent of the enemy. They kept up a constant warfare and nearly wiped the Illini out of existence, until finally a crisis was reached. The Iroquois had made one of its periodical raids and plundered a village, driven away its people and began indulging in a wild and beastly orgy in honor of the victory. The Illini braves were entirely cowered, and from a distance watched the revelries of their enemies. Then uprose an Indian Joan of Arc. It was Watseka, a maid of the Illini. She begged the men to rally and make one more effort to drive out the Iroquois, but the braves were brave no longer. Then Watseka turned to the women and one and all they flocked around her. They armed themselves with bows and arrows and stood ready for the word. This shamed the men and they too prepared for fight. They all, Indians and squaws, rushed upon the Iroquois and not only drove them from the village, but followed them in their retreat and very nearly exterminated them. In honor of this Indian maid the place where this fierce battle was fought is still called Watseka, and it is the county seat of Iroquois County.

Jean Nicolot, a native Canadian, who had lived among the Algonquin Indians for years, discovered Lake Michigan on July 4, 1634. He then called it Lake Illinois. He was the first white man to put foot on Illinois territory, but Louis Joliet and Pere Marquette were the first white men to reach the "Land of the Illini" or to touch the site of Chicago. These two explorers left Mackinaw in May, 1673, paddled down to Green Bay and up Fox River to the Wisconsin River, on which they floated to the Mississippi.

La Salle had become enthusiastic over what Joliet told him, and he organized an exploring expedition. His chosen friend and companion was an Italian, Chevalier de Tonti, and these two men played the most important part in the history of Illinois. It was about 1680 they reached the "Chekogona" River, probably the present Calumet and pushed on to the interior. La Vantum was then a large and flourishing village and just previous to the appearance of La Salle the Iroquois, the old enemy of the Illini, had made a successful raid and completely annihilated it. The village was somewhere in the vicinity of the present city of La Salle, where is an immense rock 185 ft. high, completely isolated, and with a level top surface of nearly an acre in extent. It is inaccessible, except by one narrow, steep path. It now bears the name of "Starved Rock." Here in 1682 La Salle created a fortification, which he called Fort St. Louis. For some years all the region about was thickly populated with Indians and Frenchmen, and La Salle was the governor.

His several expeditions through the country had resulted in the forming of numerous settlements and these have been the nucleus from which the state has grown. Kaskaskia was the most important, and later became the capital of the state. In 1765 this settlement passed into the hands of the English. Then came the revolt of the colonies against English rule, and in 1778 George Rogers Clark obtained from Patrick Henry, governor of Virginia, permission to attempt the capture of the Illinois territory. He was successful and since 1779 the entire northwest territory has been in the possession of the United States. All this section was then considered as a part of Virginia. In 1818 Illinois was admitted to the Union, with Kaskaskia as the capital. Later it was removed to Vandalia, and in 1836 to Springfield. In 1720 slaves were introduced to work the newly discovered coal mines at Ottawa, but slavery was abolished in 1823 by a popular vote of 4,972 for and 6,640 against it.

The Indian era in Illinois ended with the Black Hawk war. Black Hawk was a Sac chief and resisted the demand to relinquish his land to the whites. A war ensued, which lasted for several years and cost more than a thousand human lives. Inch by inch the red men were driven to the Mississippi, and the waters of that river were made red with the blood of the last remnant of the Black Hawk warriors, shot by the soldiers in the effort to escape.

As early as 1673 Louis Joliet had conceived the idea of a canal to connect Lake Michigan and the Mississippi. In 1821 a conference was held in Chicago, attended by many Indians of the Pottawatomie, Chippewa and Ottawa tribes, to discuss the proposition of granting sufficient land for a canal "to connect Buffalo with New Orleans." There were 64 chiefs present, representing the tribes interested, and on Aug. 29, 1821, the treaty was signed transferring to the United States 5,000,000 acres.

Work on the Illinois & Michigan Canal was not begun, however, until July 4, 1836; it was completed in 1848. The cost of the construction from Chicago to La Salle was $6,557,000 to which should be added nearly $3,000,000 spent by the City of Chicago in deepening the canal between Chicago and Joliet to the lake level, which was refunded by the state in 1871. This canal is the only reminder of the internal improvement scheme authorized in 1837 to give every part of the state a railway or canal.

The richness of the soil, the mineral products, the climate and the influence of Chicago, have all combined to make Illinois one of the richest and most prosperous states in the Union. Its growth has been rapid. In 1819 it contained but 12,282 people. Each census since has given the following figures: 1820, 55,162; 1830, 157,445; 1840, 476,183; 1850, 851,470; 1860, 1,711,951; 1870, 2,539,891; 1880, 3,077,871; 1890, 3,826,351. Since 1890 it has made great strides and 1898 there were 5,686,915. As a state it has produced a number of great men. Lincoln and Grant were elected to the presidency from Illinois, and Adlai Stevenson to the vice-presidency. Stephen A. Douglass was also an Illinois man, though born in Vermont. Sheridan and Logan were residents of Chicago for many years.

During the rebellion Illinois sent over 259,000 men to the Union armies, 10,000 of whom were killed or mortally wounded and 24,000 died from other causes connected with the war.

SOME CHICAGO OFFICE BUILDINGS.

1837~1899 Chicago THE MAGIC CITY

The full and perfect history of the city of Chicago has never been written—can never be written. The growth from a trading post among the Indians, in an unsettled wilderness to a city among the first of the earth in commercial importance, all within the memory of men still living, has been too rapid for the historian to keep pace and the best recitals of Chicago's rise and progress are but fragmentary glimpses of the stirring events of the years within which this has all come about. Herewith are given a few facts that will serve as an outline of what would be possible in the way of a historical sketch of the "Magic City by the Lake."

The first building to be erected where the city now stands was a rude log cabin, built in 1790 by a refugee negro, who had fled from San Domingo. In 1804 the government erected Fort Dearborn, which in 1812 was destroyed by the English allies of the Indians, who were then conducting a predatory warfare on the scattering settlers, who had been attracted to the fertile prairies of Northern Illinois. In 1816 the fort was rebuilt and continued to be occupied with a garrison until 1837, when it was abandoned. By this time all danger from the Indians was over, the removal farther west

CITY HALL AND COURT HOUSE.

of almost all of them having been effected. The fort stood, however, until 1856, when it was demolished. A tablet at the intersection of Michigan Ave. and River St. marks the place where it stood.

The first impetus to trade came in 1836, when work on the Michigan Canal was started, and this date properly marks the beginning of Chicago's commercial history. A school with twelve pupils had been opened four years previously, and the little settlement rapidly grew into a village. In the same year, 1832, a post office was established and communication with the outer world assured. In March, 1837, incorporation took place, and in the same year Congress appropriated $30,000 for the purpose of establishing a lake harbor. From this period the growth of Chicago was phenomenal, unprecedented in the history of this or any other country, and has been the wonder, as well as the admiration of the world. People flocked from the four quarters of the globe. All nations and all tongues have sought this city as a Mecca, and the last census disclosed the fact that twenty-five distinct and separate nationalities are represented in the population in large numbers, while several thousand foreigners from many different climes are not classified. Among the principal foreign countries represented in Chicago's population are the following: Germany, with 490,542; Ireland, with 248,142; Sweden, with 111,190; Poland, with 90,858; Bohemia, with 89,280, and Norway, with 45,090. England, Russia, France, Denmark, Holland, Hungary, Switzerland, China, Belgium, Greece follow in the order named, with many other countries of both hemispheres.

At the opening of the present year Chicago covered an area in excess of 187 square miles, almost 120,000 acres. The population was estimated by the school census and the count made by the police early in the present year at almost 2,000,000. The equalized value of the property in the city, for purposes of taxation, aggregates more than $300,000,000. The streets and alleys in the city aggregate 3,940 miles, of which about one-third is paved. Western Ave. extends as a continuous street for 22 miles, and Halsted St. is but two-thirds of a mile less in length. The pupils in the public schools number 230,239, housed in 650 school buildings. Other than public schools report 114,180 pupils. The cost of the public schools for 1898 was almost $7,000,000, and 5,268 teachers were employed. In 1898 the expenditures for all municipal purposes were $33,316,184.

In the matter of water supply this city is fortunate to have at its door Lake Michigan, one of the purest of the great inland seas. The water system of Chicago is one of the largest and best in the world. Water is taken from the lake at points from two to four miles from shore, conveyed through tunnels to pumping stations and distributed throughout the city. The great drainage channel, now nearing completion, which has cost almost $30,000,000, will insure water absolutely free from contamination. This canal is one of the greatest works of its kind, and will well repay an inspection.

Chicago leads the world in many lines of trade and commerce, among which may be mentioned grain, lumber and live stock.

The trade of Chicago for 1898 is summed up as follows: Produce, $469,000,000; wholesale, $618,000,000, and manufactures, $613,085,000, making a total of $1,700,085,000. This was an increase over the business of 1897 amounting to $176,568,000.

As illustrating the growth of the city, there are many men still in business who came to Chicago when it was a city of only 20,000, and men of 40 remember the time when as boys they went swimming in the lake where Michigan Ave. now is, at a point directly in front of the Auditorium Hotel.

The Big Fire.

The most important event in the history of the city is the big fire, which broke out at 9 p. m. on the night of Oct. 8, 1871, and burned for two days and three nights, with resistless fury. The weather for days had been extremely dry, and the frame buildings and roofs were like tinder. Driven by a high wind the conflagration swept east from the starting point at Clinton and Van Buren Sts., across the river and made a clean sweep to the lake. It also moved south to 12th St. and north to Lincoln Park, with but one building that escaped in all this territory. It burned over an area of 2,100 acres, including the entire retail and wholesale business district, and rendered homeless nearly 100,000 people, and destroyed $196,000,000 of property. Insurance to the amount of $44,000,000 was paid. It was necessary to place the city under martial law for a time and General Sheridan took command. The scenes during the fire baffle description. Thousands were driven before the flames into the lake, and remained there for hours up to their necks in water. The wooden pavements took fire and added to the difficulty of travel. Teams commanded fabulous sums per hour; thousands saved only what they could carry in their arms. The response of the entire world with measures of relief was immediate, $7,000,000 being contributed, and without parallel, and placed Chicago under a debt of gratitude it can never forget. The fire was at last stopped by a heavy rain, and because there was little left to burn. The rebuilding of the city began next

day, and the thousands of loads of debris went a long way toward bringing streets to uniform grade. In rebuilding care was taken to erect largely of fire-proof construction, and the event, while a great temporary loss, and one which ruined hundreds of business men, was a lasting benefit to the city.

Railroads.

The unexcelled transportation facilities enjoyed by Chicago have doubtless contributed more to the city's growth than any other one element. The railroad is a product of the 19th century. Within the memory of men now active in business life it has made its appearance and revolutionized the world. In 1830 there were but 23 miles of railway in operation in the United States. During the next decade this mileage was increased to 2,818, and in 1850 it had grown to 9,021. In 1860 there was a total of 30,626 miles, and in 1870, 52,922 miles. The return of mileage in 1880 showed 93,296, and in 1890 this had reached a total of 166,000. It is estimated that by the close of the present year there will be nearly 200,000 miles in operation in the different states. The year of

STATE STREET IN 1865.

greatest railway construction was 1887, when 12,878 miles of new track were laid.

Illinois easily leads the states of the Union in railroad mileage with a total of 10,726, Pennsylvania being a close second with 9,965 miles. As a railroad center Chicago leads the cities of the world, the total number of separate lines entering the city being 39, leading, with their branches and connections to all sections of this country and extending into Canada and Mexico. These roads

WABASH AVENUE.

have 1,515 miles of track within the corporate limits of the city, but this by no means represents the needs of the separate lines, many being compelled to use leased track, by reason of lack of terminal facilities. The entrance to a crowded metropolis by so many lines has been a serious problem and has required engineering skill of the best ability to solve. The lake shuts off all approach from the east, thus further complicating matters.

The first road built from this city was begun in 1847, on a line extending toward Galena, of which 42 miles had been completed in 1850. The first road to reach the city from the outside was the Lake Shore & Michigan Southern, in February, 1852, the Michigan Central coming in later in the same year. From this time on railway building was rapidly promoted, the business interests of the city readily recognizing the vast importance of such connection and contributing liberally in the way of donations and purchase of stocks.

Running into the very heart of the best grain producing sections of the United States, as many of the roads entering Chicago do, their freight traffic in these lines is enormous. Last year five the leading main roads brought in as follows: Chicago & Northwestern, 61,000,000 bushels; Illinois Central, 37,000,000; Chicago, Rock Island & Pacific, 37,000,000; Chicago, Burlington & Quincy, 57,000,000, and the Chicago, Milwaukee & St. Paul, 44,000,000.

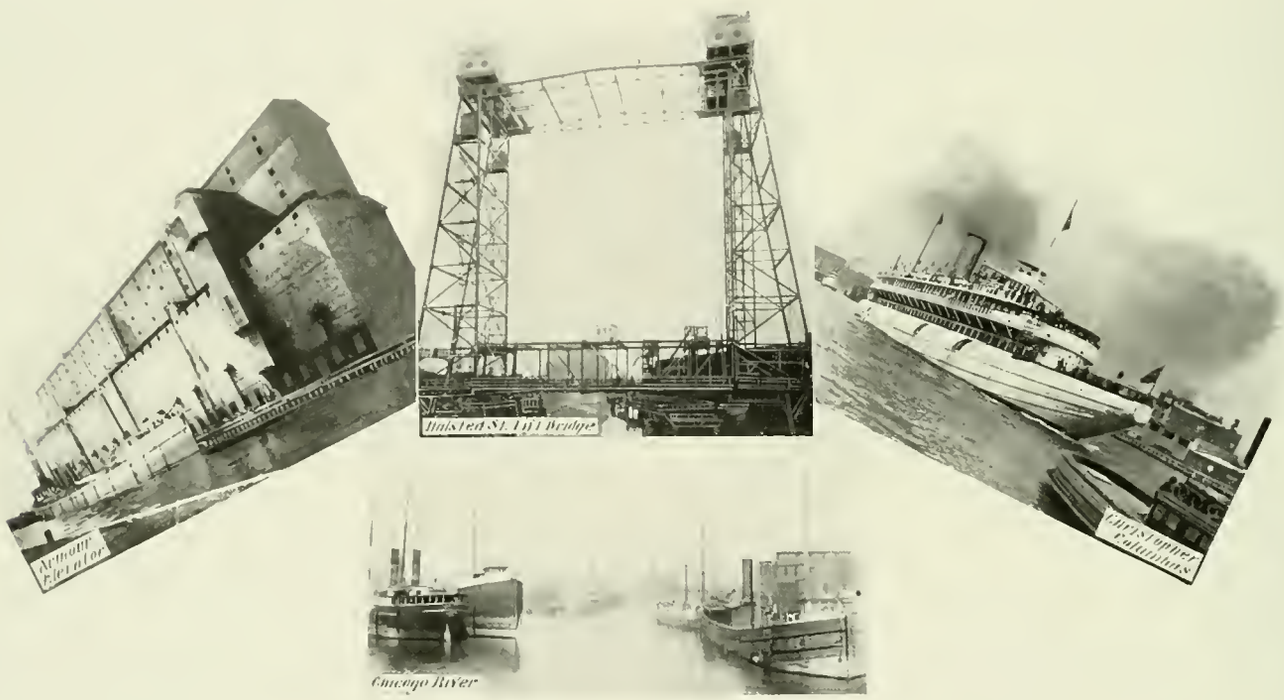
All lines of road entering Chicago are intercepted before reaching

STATE AND WASHINGTON STS.—AFTER THE FIRE – CLARK AND ADAMS STS.

the thickly populated section by a belt line that encircles the city on its three sides and thus enables cars to be transferred from one road to another with small loss of time. This belt system is a separate corporation.

One very important feature in connection with the majority of the roads is the suburban service. By this means rapid transit and frequent trains are assured and many thousands of persons daily avail themselves of this excellent service, some living as far out as 30 miles and daily coming to the city, where their business interests are.

Within recent years the city has became so congested in many parts that it has been necessary to require elevation and depression of tracks. In the past two years more than 200 miles of tracks within the city have been elevated and some 57 miles depressed, abolishing by this means 270 grade crossings. This has been a great saving to life and limb, and at the same time has enabled the roads to make much faster time. The track elevation has necessitated heavy expenditures on the part of the railroads, but the saving in time, in the annual expense of maintaining crossing gates and watchmen, and in damage claims has in a number of instances more than paid the interest charges on the investment.



SCENES ON THE RIVER.

Marine.

The vast importance of Chicago's marine service is but little understood. In no way can the magnitude of this business be better illustrated than to give a comparative statement of the total entrances and clearances of a year at the principal seaports of the United States, with the total at this city.

Baltimore	5,770
Boston	5,793
New Orleans	2,717
New York	14,445
Philadelphia	3,057
San Francisco	2,509
Totals	34,891
Chicago	19,193

The Suez Canal carries much of the commerce of a hemisphere; much, indeed, of the exchangeable products of the world, and is open throughout the year. The canal at Sault Ste. Marie, known as the "Soo," was only open for vessels about eight months in 1898. Yet the traffic via the "Soo" was 21,234,664 tons, and that via the Suez during the entire twelve months about 9,000,000 tons. The internal waterway commerce of the United States during eight months exceeded in tonnage the commerce between Asia and the Western world, through the Suez canal, by 12,000,000 tons. While all of this American tonnage does not come or go from here, yet the figures go to show the immensity of lake traffic.

During last year 9,428 vessels arrived at the port of Chicago, representing a tonnage of 7,557,215 tons, and the 9,502 vessels clearing represented 7,686,448 tons. Of these 179 arriving were vessels engaged in the foreign trade, their total tonnage being 235,790, and 457 vessels engaged in the same trade cleared the port, their tonnage amounting to 401,138.

A record of arrivals and clearances for the past 20 years shows a wonderful increase in the tonnage of the vessels engaged in the local trade. In 1870 the combined arrivals and clearances amounted to more than 25,000 vessels, but their combined tonnage was scarcely 6,000,000, more than 1,500,000 tons less than the 9,428 vessels arriving during 1898. Engaged in the Atlantic and Gulf coasts, and in the Pacific coast trade there are but 299 steam vessels of 1,000 tons and over, and their combined tonnage is but 654,816. On the northern lakes 401 steam vessels of 1,000 tons and over are engaged, their tonnage aggregating 780,296.

During 1898 the following shipments were made by lake from Chicago: Lard, 33,949,200 lb.; oil cake, 46,138,900 lb.; millstuffs, 86,466,060 lb.; tallow, 6,009,300 lb.; hides, 2,145,900 lb.; wool, 3,829,225 lb.; flaxseed, 2,212,560 bu.; timothy seed, 1,432,528 lb.; other grass seeds, not including clover seed, 7,196,957 lb.; wheat, 26,594,263 bu.; corn, 97,166,944 bu.; oats, 28,019,617 bu.; rye, 3,667,659 bu., and barley, 2,815,043 bu.

Traffic on the great lakes has not been as large in many years as during the present season and at no time during the past 10 years have carrying charges been as high during the midsummer months. Taken in all of its aspects the lake commerce of Chicago was never in a more prosperous condition, and it bids fair to not only remain one of the great sources of the wealth of the city, but to increase with the years and the inevitable growth of the great inland metropolis.

At South Chicago are extensive shipyards, where some of the largest of the lake steam craft have been built. The Christopher Columbus, a whaleback excursion steamer, belongs here; has a carrying capacity of 5,000 passengers and sails daily during the summer season.

Elevators and Grain Trade.

To properly handle the immense shipments of grain annually arriving in Chicago has required the investment of large sums of money in elevator warehouses. Much improvement has been made in this class of buildings within recent years, necessitated by the constant increase in receipts of all kinds of grain, and the demand for safe storage and economy in handling. To attain the first the buildings are constructed in a style peculiarly their own, combining great strength with every known precaution to avoid fire and to quickly extinguish it should it originate. To meet the demand for cheapness in handling the grain many devices have been installed so that it is possible to unload both cars and ships by a system of suction pipes and to transfer the grain from place to place within the building by an endless belt, on which the grain falls and travels, and also by the more primitive bucket elevator. Cars are unloaded now within a few minutes after arriving at the elevator, and ships give or receive a cargo with but little loss of time.

Of the elevators in Chicago there are 18 that the Board of Trade recognizes as regular, to be used for the storage of grain and flaxseed under the rules of that organization and the regulations and requirements of the board of directors. The combined capacity of these 18 elevators is 28,050,000 bushels.

On all grain and flaxseed received in bulk and inspected in good condition the storage rates are three-quarters of one cent per bushel for the first ten days or part thereof, and one-fourth of one cent per bushel for each additional ten days or part thereof, so long as it remains in good condition. On grain damp or liable to early damage, as indicated by its inspection when received, two cents per bushel is charged for the first ten days or part thereof, and one-half of one cent per bushel for each additional five days or part thereof. No grain is received in store until it has been inspected and graded by authorized inspectors, unless by special agreement. The inspection of all grain arriving in the city is done under the supervision of the Chief Grain Inspector, who is an officer of the state.

The volume of grain stored in warehouses of class "A," as defined by the statutes of Illinois and recognized as regular warehouses under the rules of the Board of Trade, at the close of 1898 aggregated 11,706,912 bushels. The elevators of Chicago are largely utilized for the storage of flaxseed, the receipts of which for 1898 reached 5,481,173 bushels.

The receipts of grain and of flour in its grain equivalent, for a number of years, cannot but be of interest. The following are the official figures, as given out by the Board of Trade; the totals are bushels.

1898.	1897.	1896.
320,436,357	296,767,115	253,802,134

The receipts of the different kinds of grain during the same period were:

	1898.	1897.	1896.
Wheat	35,741,556	28,087,147	19,933,402
Corn	127,426,374	110,747,389	92,722,348
Oats	110,293,647	118,086,662	109,725,689

The quantity of grain and flour in its grain equivalent at Chicago during 1898 was more than 5,000,000 bu. in excess of like receipts at Minneapolis, Duluth, Milwaukee and St. Louis combined, being, as above stated, 320,436,357 bu. During the single month of October the receipts of grain were more than 42,000,000 bushels.

It is interesting to note the growth of this immense grain business, which is really beyond the average comprehension. In 1838, one year after the incorporation of Chicago, 38 bushels of wheat were received, and this jumped the next year to 3,678 bushels. In 1840 the receipts were 10,000 bu.; in 1850, 883,644 bu.; in 1860 they had increased to 12,402,197 bu.; in 1870, 16,432,585 bu.; in 1880, 22,796,288 bu.; in 1890 only 11,075,276 bu. were received, but in 1891 the grand total aggregated 38,000,169 bu.

As wonderful as this growth is it has been similar in all kinds of grain, until today Chicago leads the world in this branch of commerce.

Chicago Board of Trade.

The influence of the Board of Trade of Chicago has been one of the potent factors in promoting the commercial growth of the city. The early life of the board was simple and unpretentious. Annual dues were at first but $2, and the yearly rental of the building occupied only $110. The membership slowly increased as the years went by, and when the new charter was obtained in 1859 the roll of members aggregated 625. Quarters were taken in 1865 in a building located at the corner of Washington and La Salle Sts., and this continued to be the home of the Board until the great fire of 1871. Immediately rebuilding on the same location the board remained here until 1885, when the present handsome edifice on Jackson boulevard was completed and occupied. At this time the list of members was almost as great as at the present, and the transactions of the Chicago Board of Trade had attracted the attention of the world. The rules and regulations adopted by the board relative to grain and provision dealing were accepted as the standard in all civilized countries and still remain operative. Composed, as it is, of the highest type of representative business men, of capitalists whose names are known in all lands, of financiers whose operations affect the great arteries of commerce, Chicago's Board of Trade daily transacts business amounting to many millions of dollars, and holds one of the highest positions obtainable by any similar body and the confidence of two continents. The great majority of the operations

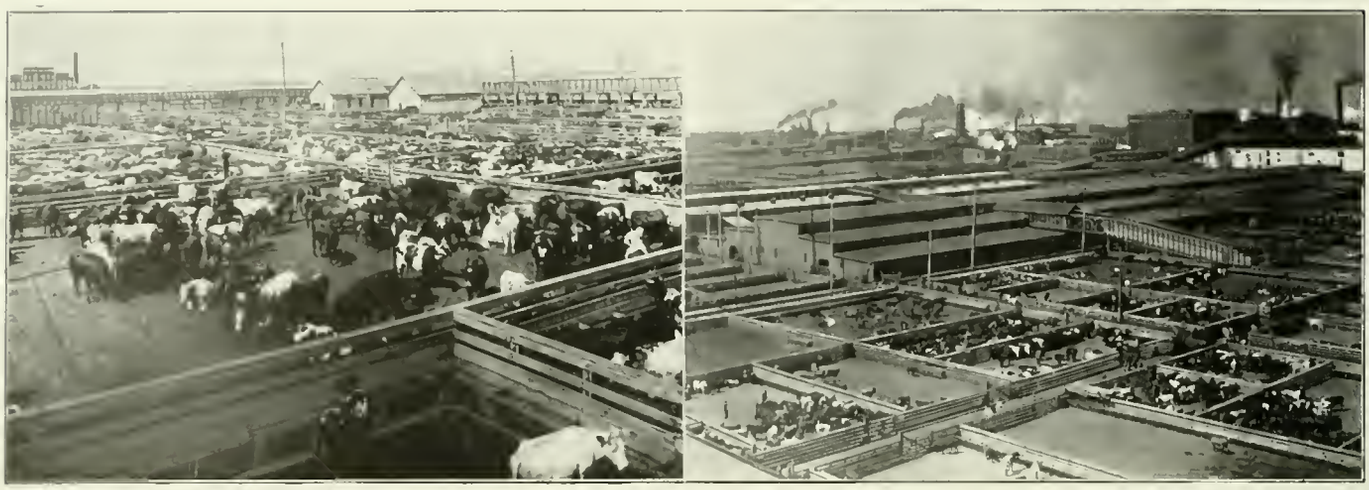
WHEAT PIT, BOARD OF TRADE.

on the Board are founded on mere verbal understandings, a nod of the head or the holding up of a hand often binding members in transactions running into the hundreds of thousands of dollars, yet so high is the standard of honor that seldom in the history of the board has any trouble arisen through a violation of such contracts.

Spacious galleries for visitors are provided, and during trading hours a visit to the Board, with its animated scenes in the wheat and corn pits, and a small army of telegraph employes at work forms one of the most interesting sights in the city. The best time to visit the Board of Trade is about 11 o'clock and strangers in the city should avail themselves of this opportunity.

The transactions on the Board are in no sense of the word gambling, as is supposed by many not familiar with the operations there conducted, and the highest courts in the land have repeatedly decided that the deals come strictly within the lines of legitimate business, and the contracts, whenever questioned on this score, have been invariably upheld. A strong feeling exists among the members against any species of speculation not entirely "regular," as defined by the rules and regulations, and a relentless warfare has been waged against bucket shops, with such success that they have been almost entirely driven out of business in this city. Many of the firms carrying on this vicious form of speculation have, within recent years, been sentenced to long terms of imprisonment and heavily fined.

During the half century of its existence the Board has generously responded to all calls for charity, and whenever and wherever flood, famine, fire or epidemic has caused want, misery or suffering the generous hand of the Board has been extended in no stinted measure.



CATTLE PENS, THE CHICAGO STOCK YARDS.

The Stock Yards.

Chief among the manifold industries of Chicago is the live stock and meat business, conducted almost exclusively at the Union Stock Yards. They are located in the south-central portion of the city, and so situated that a belt system of railway gives connection with all roads entering the different sections without transfer of the stock from cars. The yards afford unequaled facilities for the conduct of the immense business; occupying 475 acres of land, 230 acres of which are covered with plank flooring. The pens for live stock are admirably arranged, both for convenience of unloading from the cars, egress when the stock is to be moved and comfort of the animals while detained and facilities for watering and feeding. These inclosures number 13,000 and occupy some 50 acres.

An idea of the magnitude of the yards may be gleaned from the statement that there can be fully accommodated at one time 75,000 head of cattle, 50,000 head of sheep, 300,000 head of hogs and 5,000 horses. To properly comprehend the magnitude of this industry a visit is necessary, and a study must be made of the methods employed in the management of the enterprise and the regularity with which each department is conducted must be observed to be at all understood. Transactions involving millions of dollars occur daily, and receipts and shipments each 24 hours involve equally large amounts of money. Forty lines of railroad, branching out into the majority of the states of the Union, bring in the stock and take out meats and kindred lines of food products consigned to the four quarters of the globe.

The name and fame of the Chicago Union Stock Yards are world-wide, and there is constantly a stream of visiting strangers bent on investigation. This inspection is facilitated by the concerns engaged and every opportunity is afforded to visitors to see and examine the process by which so many millions of live stock are annually converted into food products.

In addition to the supply of water by the city works the Stock Yards are provided with six artesian wells, varying in depth from 1,250 to 2,250 ft. These furnish an unlimited amount of pure water, much superior in quality to the water of the lake, which at present is more or less impregnated with sewage. The daily consumption during the hottest months of the year, reaches 7,000,000 gallons. Within the grounds embraced in the yards there are 90 miles of water pipes, and the water-troughs with which the stock pens are supplied would, if placed end to end, measure 38 miles in length.

The official returns for 1898 will show the yearly business. In hog packing 18 concerns had an estimated capital invested exceeding $20,000,000; employed almost 25,000 workmen and turned out products aggregating $75,000,000 in value. In beef canning and packing 11 concerns had over $6,000,000 invested, utilized the services of more than 11,000 workmen and produced nearly $50,000,000 worth of goods. In the lard, lard oil and stearine industries four firms, with a capital of $2,000,000, employed 3,000 people and turned out $7,500,000 of finished products. The six firms making butterine had a capital of $2,500,000, worked nearly 2,000 hands and produced $4,500,000 worth of this article. Fifteen firms were engaged in the manufacture of sausage, their combined capital was $2,000,000, the number of workers 1,800, and the value of the product reached $4,000,000. The best estimates obtainable place the total wages paid to the workmen employed as above stated at $24,000,000, in addition to which there is an army of men regularly working in the yards, amounting in all branches of labor to fully 5,000 more than those who are enumerated above.

Some of the largest commission houses in the world have their offices located at the Stock Yards and transact a business there

SHEEP PENS.

A "STREET."

TWO GREAT MARKET PLACES.

that ramifies throughout the West and Southwest, numbering their branches and customers by the thousands. The business done by these firms in 1898 was the largest in the history of the yards. The receipts of all stock aggregated 15,700,000 head, of a valuation of $230,000,000. This was fully 1,000,000 head of stock more than had ever been received in a single year.

A detailed explanation of the many processes of manufacture and the wonderful system under which the work is carried out would require pages. We therefore leave that to be the better understood and appreciated by a visit to the yards, which many of our readers will doubtless desire to inspect. The entertainment committee will provide for all who wish to make this interesting and instructive trip.

"Water Street."

The greatest produce market in the world is to be found on Water St., and should be visited at very early hours in the morning to be seen at its best. Trading begins at 4 a. m., and the several thousand delivery wagons which come from all parts of the city throng the place until 9 o'clock. After that shipping orders are filled, and by 3 o'clock the business of the day is practically over. Commission merchants representing many nationalities and the food products of many climes and countries are here. The district has long since outgrown its limits, but there seems no available place to which to move and the congestion continues, and is constantly becoming worse. Great warehouses are filled from top to bottom with every sort of fruit, vegetable, fish, game and poultry, and the sidewalk piled high with crates, barrels and boxes.

Banks.

Chicago has 36 national and state banks, with numerous private banking houses. The deposits last year amounted to $301,203,931; loans and discounts were $170,771,307; surplus and profits, $20,157,457. The First National and Illinois Trust & Savings occupy the largest, and the latter the finest, banking establishment to be found anywhere.

And so we might go on with added pages of history and reports of the varied business interests of the city, but will pass with only a brief reference to others of those many interests of importance. It is the largest center for the manufacture of farm machinery; one firm alone employing 6,500 men in its works. Its lumber interests are of great magnitude and occupy the "lumber district" on the south branch of the river. In iron works there is a large and diversified line of manufacture, and in certain lines of shoe and furniture trade it also leads the country.

ILLINOIS TRUST & SAVINGS BANK.

It is a pleasure, however, to turn from figures and commerce to those things which stand for culture and higher thought, and in these matters the new city of the prairie has distanced many a city of the East.

RIVER SCENE—SLOOP THAT CROSSED THE ATLANTIC TO THE WORLD'S FAIR.

The Art Institute.

The Art Institute of Chicago is housed in a magnificent stone building in the Lake Front Park, facing on Michigan Boulevard, directly opposite Adams St. The Institute was known originally as the Chicago Academy of Design, its beginning dating from 1866, when New York and Philadelphia were the only cities in the United States claiming similar associations. Many vicissitudes were encountered up to 1882, when the academy became known by its present title. In that year Mr. Charles L. Hutchinson was elected president, and from his induction to office, contributed much of his valuable time to the active management and gave liberally of his means. Mr. Hutchinson has been re-elected to the position annually since that year, and the wonderful growth of the institution may be attributed, in great measure, to his efforts in behalf of it. The Hon. Lyman J. Gage, Secretary of the Treasury, has been the treasurer during the entire career of the Institute.

In 1892, when the World's Columbian Exposition was in its beginnings, the opportunity offered for the Art Institute to combine with the Exposition management and erect a building on the lake front, which was to be used for sessions of the World's Congress of Religions. Upon its close, the property reverted to the Art Institute, and cost it a little less than half a million dollars. The ownership of the building is vested in the city of Chicago, while the right of use and occupation is given to the Institute so long as it shall fulfill the purposes for which it was organized. It must be open free to the public on Wednesdays, Saturdays, Sundays and legal holidays, however, thus being in effect a gift to the people. The building is of Bedford limestone and is thoroughly fire proof.

THE ART INSTITUTE.

The Institute has a number of fine collections of sculpture (both of originals and reproductions), a department of Egyptian antiquities and relics of the Pharoahs. Prominent among these collections are the Elbridge G. Hall plaster casts from representative original sculptures; the H. N. Higinbotham collection of Naples bronzes, which include reproductions of objects found in Herculaneum and Pompeii. The Egyptian antiquities were the gift of Messrs. H. H. Getty, N. W. Harris and C. L. Hutchinson, and all of them are real. They have been collected and presented to the Institute as illustrative of the more usual applications of art in ancient Egypt, aside from architecture. One coffin displayed antedates the period of decorated mummy cases, and is undoubtedly of the time of Abraham, that is, about 2,000 B. C. Another is part of the famous discovery of the final burial place of the Pharoahs at Deir El Bahari.

One of the collections which should prove of interest, not solely to the Egyptologist is that of the scarabs or seals in the form of the sacred beetle. This is one of the rarest and most complete in existence, surpassed only by that in the Boulak Museum, Egypt. It is almost a complete series from the time of Mena, the earliest known earthly potentate, down to the Christian era, when ancient Egypt passed out of history. The scarabs are made of a great variety of stones and gems, and bear the signet of the monarch whom they represent.

The classical antiquities, presented by Messrs. M. A. Ryerson, C. L. Hutchinson, P. D. Armour and others, consist chiefly of Greek and Roman specimens, and are real. They include prehistoric American vases (terra cotta) from New Mexico and Arizona, Greek and Roman coins, Graeco-Italian vases, Greek glass, bronzes, etc., Roman lamps and terra cotta masks of rare value.

On the second floor of the Institute are the paintings. The Henry Field Memorial Collection comprises 41 original oil paintings by 20 of the most esteemed modern painters, including canvas by Carot, Millet, Rousseau, Diaz and others. Breton's "Song of the Lark" is also there on exhibition. The room is splendidly arranged, every facility being at hand for viewing the works with the proper light and shade. The Munger collection embraces 63 paintings, including oil and water colors, and was the private collection of the late Albert A. Munger of this city. While it contains very important examples of some of the most noted modern painters, such as Meissonier, Bougereau, Gerome, Munkacsy, Michetti and Troyon, it has but one specimen of each, and represents not only the French and German schools, but also the Belgian, Italian, Austrian, English and Swedish.

Thirteen of the most important art paintings by old and modern masters, which were purchased in June, 1890, by the Institute from the famous Demidoff collection in Florence, are now on exhibition. They include several by Van Ostade, Rembrandt, Hals, Rubens, Van Dyck, Murillo (The Immaculate Conception), Titian, Goyen, Von der Neer, Hobbema, de Keyser and others. In the collection lent by Mr. Cyrus H. McCormick are landscapes by Daubigny, Corot, Troyon and the late George Innes. Charles Sprague Pearce's magnificent "The Beheading of John the Baptist," which was painted in Paris in 1881, attracts the attention of all visitors. Among the modern oil paintings, perhaps none are more interesting than those lent by Mrs. P. C. Hanford. This

CHICAGO PUBLIC LIBRARY.

NEWBERRY LIBRARY.

collection embraces more than 50 paintings, among which are some by such well known artists as Rosa Bonheur, Breton, Corot, Meissonier, Millet, Munkacsy, de Neuville, Troyon, Verboeckhoven and others.

Nowhere in the city could one's leisure hours be more profitably spent than in the Art Institute, where everything displayed is alike interesting to both layman and connoisseur.

In the instruction department 1,200 students are enrolled.

and judiciously had it been framed that nearly every western state has since patterned after this admirable law. Provision is not only made for the establishment and maintenance of public libraries by taxation, but also for their proper management. The law recognizes the fact that such collections are for the public good, and as such may be justly established and maintained at the expense of the tax payers.

It is not possible to give more than a passing glance at the

ART INSTITUTE—MAIN ENTRANCE HALL.

Public Libraries.

Prior to the great fire Chicago had no public library, and there was no law, either state or municipal, authorizing the establishment and maintenance of such institutions. The nucleus of the present system and the one great incentive to the upbuilding of the public library of today was the contribution by the people of London, England, of some 5,000 volumes immediately after the destruction of all existing collections here by the fire above referred to. Following this magnificent donation the Chicago Public Library sprung into an active existence, Germany, France, Bohemia and other foreign countries contributing many and valuable works. In 1872 the Legislature passed the public library act, and so wisely

public libraries of Chicago in this article. There are within the limits of the city many libraries that rank among the best of their class in the United States, and but few cities can number so many fine collections of books of every kind open to the people without money and without restriction, save such as are wisely intended for the preservation of the works.

The Public Library stands at the head of the local list; it has the greatest home circulation of any library, over one million books having been withdrawn in a single year. Manchester, England, Boston, Mass., and Birmingham, England, rank next in order in this respect, a showing especially creditable to Chicago as indicating the literary aspirations of those so generally believed to be engrossed entirely with the details of trade and commerce.

DISTRIBUTING ROOM, CHICAGO PUBLIC LIBRARY.

The edifice, occupying the site of Dearborn Park, is one of the most imposing, well arranged and costly of public library buildings. Free delivery stations to the number of 50 are maintained throughout the city, and from them 744,995 volumes were circulated during 1898. The scope of the library is very comprehensive, constituting rather a library for the people than one for the scholar.

Classical in its composition, this beautifully reared pile of marble is one of which Chicagoans all are justly proud. The foundations were laid in 1893, and the greater part of four years were spent in bringing the structure to completion, at a cost of $2,125,000. It is the opinion of experts that this library is the most economically constructed of any in the city. The cost per cubic foot enclosed is 48 cents; the average office building costs from 35 to 40 cents, and one, at least, in the city, ran to 55 cents, while the average cost of the government buildings is as high as 65 cents per cubic foot.

The building is on Michigan Boulevard, between Washington and Randolph Sts. There are two entrances to the building; one leads into the lobby and staircase and the other into the G. A. R. memorial corridor and staircase, both being done in pink and white marble. The marble quarries at Carrara and Sienna were worked for six months to fill the orders necessary for the lobbies and two grand staircases. Throughout the structure are 10,000 sq. ft. of glass mosaic—the greatest area of glass mosaic placed in a building since the time of Constantinople's Sancta Sophia or the famous cathedrals of Italy.

Many characteristics make it comparable only with the Congressional library at Washington. It is certainly one of the best things of which Chicago can boast, as being genuine and artistic. There is no painted wood in it. Where it was necessary to use wood of a cheaper grade than mahogany, the best of American woods was used, and in such cases there is no sham in the matter of stains and varnishes. All that looks marble is marble; all that seems bronze is bronze, and all the iron looks like iron. In constructing such an ideal building, it was a matter of infinite care on the part of Architect Coolidge, who also planned the Art Institute, to keep all the small points in keeping with the large features. There were over 1,200 drawings made in the architect's office, in addition to almost innumerable sketches and studies. This took the time of twenty-five draftsmen for a year.

The ground upon which the library stands dates from the time of the Indians; the building from about 16 years ago. It was really started in 1883, when a committee from the Grand Army posts and the board of directors went jointly before Congress and sought the passage of an act giving them the right to erect a building as a soldier's memorial, an academy of design and a library. They asked this right, because they wanted to use as a site a part of the Fort Dearborn reservation—the particular part which had been fixed by the lettering of the first plat as "public ground forever, to remain vacant of buildings." Congress, however, did nothing for nearly 10 years.

There is no doubt but that Chicago has builded for the future in its library. It is estimated that at least 2,000,000 books can be housed under its roof without trespassing upon the reading rooms.

NEWBERRY LIBRARY.

DELIVERY DESK, CHICAGO PUBLIC LIBRARY.

CHICAGO HISTORICAL SOCIETY BUILDING.

as now arranged, although there are now 300,000 volumes on the shelves and at the disposal of the student and bookworm. The delivery room, a picture of which accompanies this sketch, extends clear across the building, being 130 x 49 ft.

Ranking next in importance is the Newberry Library, located on Walton Place, facing Washington Square. The building, composed of steel and granite, was erected 1891-93, and has at the present time an estimated capacity of one million volumes. Ultimately the building is to cover the entire block, and will then accommodate about three million volumes. This institution was founded July 1, 1887, under a provision of the will of the late Walter L. Newberry, whose name it bears. It is maintained as a library for reference exclusively and a specialty is made of music, medicine and religion. The number of books consulted daily is in excess of one thousand.

By the will of the late John Crerar, who died Oct. 19, 1889, the sum of $2,500,000 was devoted to the establishment of the library which bears his name. It is a library of specialties, like the Newberry, and treats of the natural, the physical and the social sciences. The Crerar building has not yet been erected, and for the present the collection occupies the entire floor at 87 Wabash Ave.; it numbers some 50,000 volumes.

The library of the University of Chicago is an adjunct to that celebrated institution of learning; it was founded in 1891, and already has 300,000 volumes, for the most part works on biblical literature, church history, homiletic and systematic theology, political economy, sociology, history, science and ancient classics.

The Chicago Historical Society Library is devoted to books, manuscripts, charts and collections bearing in the main on local history. Twice since its foundation it has been entirely destroyed by fire, but is now housed in the beautiful home of the society at Ontario St. and Dearborn Ave.

The Chicago Law Institute Library, consisting now of more than 30,000 volumes, was also entirely destroyed in the fire of 1871, losing at that time over 7,000 volumes, valued at $30,000.

The Armour Institute Library consists of about 15,000 volumes, chiefly works of reference, and is maintained, as is the college, by the founder, Mr. P. D. Armour.

NEWBERRY LIBRARY.

GRAND STAIRCASE—CHICAGO PUBLIC LIBRARY.

The library connected with the Chicago Academy of Sciences, twice destroyed by fire, is now safe from further like calamity, in its present home the handsome structure standing in Lincoln Park

Other prominent free libraries of Chicago are the Theological, Hammond, McCormick Seminary, Jesuit College, with many smaller collections in all portions of the city.

The University of Chicago.

In the fall of 1888, Mr. John D. Rockefeller conferred with Prof. William R. Harper regarding a new university for Chicago, finally entering into communication on the subject with the American Baptist Education Society, which immediately took steps toward the founding of a well equipped college. This was made possible through a proposition on the part of Mr. Rockefeller to subscribe $600,000 toward an endowment fund, conditioned on the pledging of $400,000 additional before June 1, 1890. This was accomplished, and the nucleus of what is now known as the university, was obtained. Further liberal donors, including Messrs. Marshall Field, Charles T. Yerkes and others, added to its permanency by their generous subscriptions. The total endowment is in excess of $7,000,000. Sept. 10, 1890, the university was incorporated and at the first meeting of the board of trustees Prof. William Rainey Harper, of Yale, was elected president, entering on his duties July 1, 1891.

Before any particular building was projected, however, a general plan was prepared of the entire group, as it would appear after all the buildings should be erected, and in consequence the erection of the first building was not commenced until Nov. 26, 1891. The recitation buildings, laboratories, chapel, museum, gymnasium, library—the public buildings of the institution—are the central figures of this plan, while the dormitories are arranged in quadrangles on the four corners. The material used in construction for the entire group is blue Bedford stone.

Oct. 1, 1892, the doors were first opened to students. The first year more than 900 matriculated; the second year in excess of 1,100. The third year the attendance rose to 1,750, and the fourth year to above 2,000.

The University grounds front south on the Midway Plaisance, having Ellis Ave. on the west and Lexington Ave. on the east, and comprise about 35 acres. The location is one that but few cities the size of Chicago could offer; the Midway is a beautiful lawn, terminating at the east in Jackson Park and at the west in Washington Park, both of them almost within a stone's throw of the University.

Cobb building is the gift of Mr. S. B. Cobb, for many years president of the Chicago City Ry., and the Yerkes Observatory, which with its building and equipments (located at Lake Geneva, but belonging to the University) and costing $1,000,000, was the gift of Mr. Charles T. Yerkes. Five other buildings and halls on the campus bear the names of persons who have been largely interested in Chicago surface lines, showing the interest street railway people have taken in the institution. The donations of Mr. Rockefeller, however, equal those of all others combined.

UNIVERSITY OF CHICAGO—SOME OF THE BUILDINGS.

Armour Institute of Technology.

The Armour Institute of Technology dates back only to Sept. 14, 1893, when it was first opened to students. For several years previously, however, Mr. Armour had been planning for an institution of its character. Mr. Armour is believed to have gained his inspiration from the mission which his brother, the late Joseph F. Armour, endowed in 1881, with a bequest of $100,000.

The task of carrying out the latter's purpose in establishing the mission was intrusted to Philip D. Armour, to whom the greatest measure of praise is due. Since 1886 the sum of $3,000,000 has been added to the original bequest, and the scope of the institute has been wonderfully enlarged. The mission was built at 31st and State Sts. in 1881, and so marked was its effect on the neighborhood that Mr. Armour was led to erect the buildings known as the Armour flats. These apartments drew a better class of people to the vicinity of the mission, and a school was planned, which would give to boys and girls a practical industrial training at a nominal cost.

Mr. Armour thereupon placed at the disposal of the Institute $1,500,000, this sum being represented by the apartment buildings and their revenues, and the institute building itself. The original plan, which partook more of the manual training school idea, soon developed into the technological institute as it stands today. Preparatory to the working out of the scheme, Rev. Frank W. Gunsaulus, D.D., then pastor of the Plymouth Congregational Church, was made president of the Institute in 1892. Dr. Gunsaulus drew about him the members of the original faculty.

The original plan of the Institute included some higher tech-

nical training, the scope of which was not at first precisely defined. But the importance to the community of this branch of education was strenuously urged by persons whose opinions were entitled to consideration, and demonstrated by the many applications for extended courses of engineering which were received as soon as this purpose of the Institute became known. Accordingly, full four-year courses were planned, and in 1895, after the Institute had been in successful operation for two years, its corporate name was changed from "Armour Institute" to Armour Institute of Technology. In 1898 the course in science was added, and this year civil

ARMOUR INSTITUTE.

engineering was included. The courses now offered in mechanical engineering, electrical engineering, architecture, science and civil engineering are leading to the Bachelor of Science degree.

The growth of the Institute is on a parallel with that of Chicago. When the school was launched in 1893 there was naturally much speculation on the part of those interested as to the number of applicants for admission, and estimates of from 300 to 500 were deemed extravagant. During the first year 2,500 applications were received, and 1,050 students enrolled; the second year there were 1,087; the third, 1,122, and the fourth year, 1,200 students.

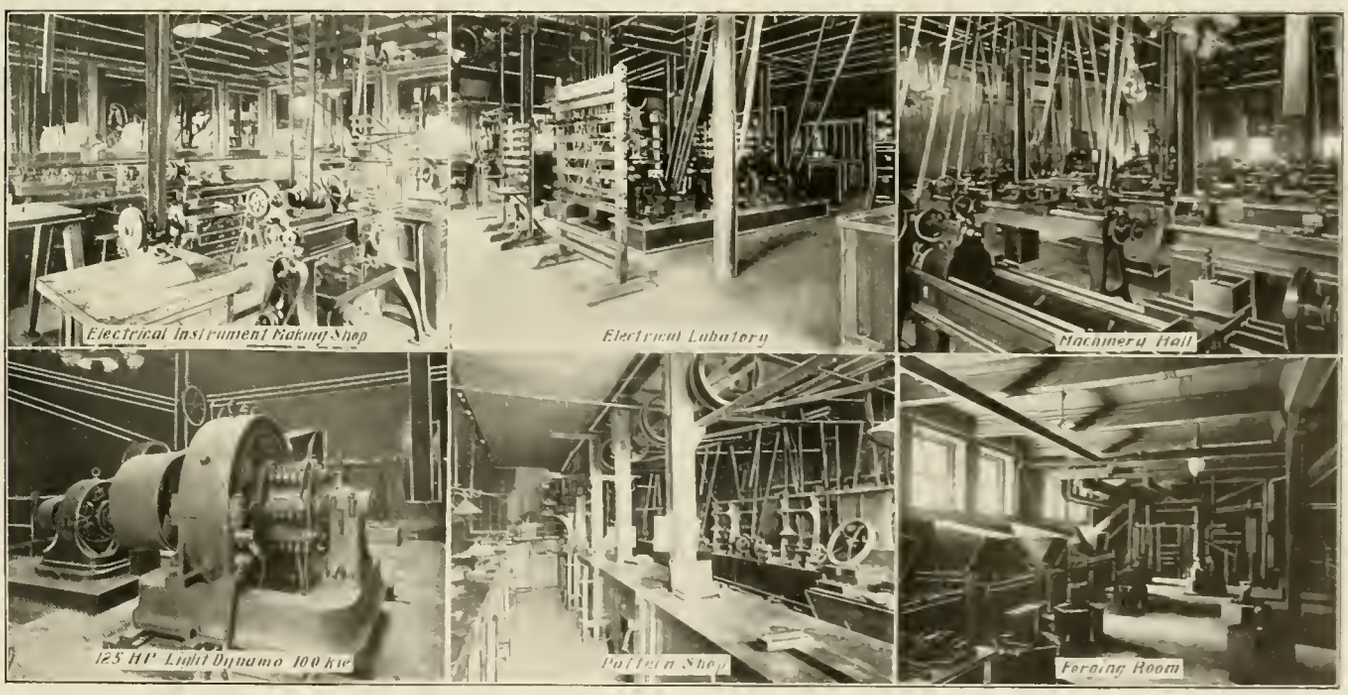
River, Bridges and Viaducts.

The Chicago River, one of the best known in the country, though only a few miles in length, is both serviceable and notorious. It was once little more than a good sized creek draining the marsh lands upon which the city has been built, but the millions of dollars which have been expended in its improvement and for structures along its banks have given it a commercial value of great importance. The river divides the city into three divisions, north, west and south, although none of the branches anywhere near approach the corporate limits. It is as much a created river as the foundations upon which the city stand are artificial.

The Chicago River is celebrated for its density and odor, and for the curious habit it has of flowing "up stream" one day and out into the lake the next. This is occasioned by off shore winds, which lower the lake level, or by the work of the pumps at the end of the south branch, where the water is lifted and poured into the Illinois Canal. When the Drainage Canal is in operation a constant volume of pure water will flow through it from the lake. While the river will not support a person who tries to walk upon its surface, its appearance would often justify the belief that it might. During the past summer the river was on fire and burned fiercely for several hours, requiring several steamers and fire boats to extinguish the flames, which destroyed some $6,000 worth of piling and bridge approaches. All the shipping which comes into Chicago proper is unloaded along the river, and its commercial value to the city has been inestimable. Numerous plans have been proposed for filling it up and either laying railroad tracks or making streets. The Drainage Canal has, however, settled such ideas. The river is lighted with arc lights by the city, and movements of vessels are directed by a boat dispatcher, who is a city official. During the rush hours, morning and night, when thousands of suburban passengers are crossing to take their trains, the bridges are kept closed.

The river is spanned by 61 bridges, whose length aggregate 2 1-3 miles, and no other city has so extensive a system of bridges and viaducts as Chicago. Thirty-seven bridges and viaducts cross railroad tracks to accommodate team and pedestrian travel. The length of these is 3½ miles.

While the river itself, as a highway for commerce, is under the jurisdiction of the Federal Government, the bridges spanning it are erected and maintained at the expense of the city. There is a Division of Bridge and Viaduct Construction, under the immediate management and control of a bridge engineer, who is an official of the Bureau of Engineering, and also a Division of Bridge and Viaduct Maintenance.



INTERIOR VIEWS, ARMOUR INSTITUTE OF TECHNOLOGY.

TYPICAL CHICAGO SKYSCRAPERS.

By reason of the extension and growth of the street railway systems of this city in recent years they have required, in many instances, the use of bridges and viaducts where the original structure was not substantial enough to meet the needs of this additional service. They have, in consequence, met all, or a considerable portion, of the expense required to place the structure in proper condition. The Lake St. Elevated has utilized one of the bridges by laying tracks on top of the original structure, it having been strengthened.

The most modern of the bridges of the city is the one at North Halsted St. It is of the Scherzer rolling lift type, similar ones having been constructed at Van Buren St. and for the Metropolitan Elevated road. The North Halsted St. structure with a 50-ft. plate girder deck span constitutes the continuation northward of the Chicago Ave. and Halsted St. viaduct. The bridge is 34 ft. between centers of trusses, with two 6-ft. sidewalks. The trolley tracks are in the center of the roadway, with team space on both sides. It is operated by electricity and compressed air and combines the most advanced and modern ideas in bridge construction.

The department of bridges has under its supervision 1 lift, 2 bascule, 40 swing, 2 jack knife, 1 pontoon and 15 fixed bridges. All of the more important of the heavy movable bridges are being equipped with electricity, as a motive power in turning, as rapidly as possible.

The opening of the Drainage Canal, confidently set for December 1st of the present year, will eventually necessitate the removal of all center piers from the river, and there is little room to doubt but that the bascule will be the type of bridge universally adopted when this great highway that is to connect the lakes with the Mississippi River is ready for operation. The cost of the North Halsted St. bridge was about $114,000, of which amount the city paid 75 per cent, and the North Chicago Street Railway Co. paid 25 per cent.

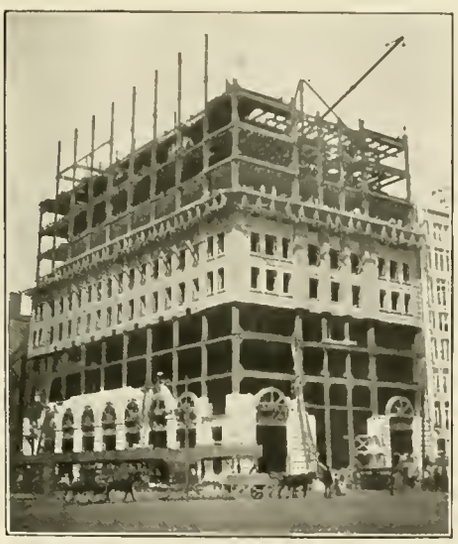
Another recent and modern structure of great public utility is the South Halsted St. viaduct, the entire expense of building which, $83,594, was paid by the Union Stock Yards & Transit Co. and the Chicago City Railway Co. This viaduct spans the tracks of the Union Stock Yards & Transit Co. at 40th St. and consists of three double roadway spans 60 ft wide; two spans 136 ft. and one span 100 ft. Perhaps the most important viaduct in the city is that at Clark and 16th Sts. This is a double roadway plate girder over

the depressed railroad tracks, and was opened to traffic Nov. 16, 1898. It was built by the Joint Track Elevation Commission, and the total cost of the work was paid by the railroad companies interested. When a crossing at grade, as it was before the construction of the viaduct, it was, perhaps, the most dangerous in the city, if not in the United States, and fatal accidents were frequent. This viaduct is used by the Chicago City Ry.

A City of Skyscrapers.

The skyscrapers no longer cause wonder, and in all parts of the country they have gone soaring heavenward, in the effort to get as many acres as possible under one roof, and incidentally to outdo some other city. But it was here in Chicago that the skyscraper received the seal of approval and where the example was set. Most of the tall buildings in Chicago are built upon piling, but in some instances a platform of railroad iron and I beams laid up cob house fashion and filled in with concrete was built, this platform resting on the clay subsoil.

Allowance is made for these buildings to settle and the plans adopted to ensure uniform settlements are often very interesting. The new Great Northern Building adjoins the old Great Northern on one side, while on the other are comparatively small structures. Thus a portion of the ground was compressed by the tall building already erected and it was to be expected that the settlement of the new one would be quite uneven, accordingly one side of the new structure is carried on a set of jacks which can be moved and so keep the building plumb. The rapidity with which many of these



IN PROCESS OF ERECTION.

tall buildings have been erected is really surprising. In one instance by the use of electric light 15 stories were put up in as many days, and one story in two days is frequent. The shell or outside cover of the framework is generally of terra cotta, and this often is of different styles for different parts. It often occurs that the material for say the first three or four stories fails to arrive as soon as that for the stories above, but this does not delay the work, and several times it has occurred that a building has been completed so far as the exterior was concerned in all above the third story, and from a distance the appearance was given of having begun to build from the top down. One office building has over 6,000 tenants, representing in numbers the population of a good sized town, and the business force of quite a large city. We illustrate several of these structures.

Fire and Police Departments.

The costly lesson of the great fire resulted in providing against a repetition of a like calamity by creating a department which is second to none in the world, either in equipment or efficiency. It has 18,000 fire hydrants, with all Lake Michigan to draw from. In its equipment are 92 steam fire engines, 5 fire boats, 2 water towers, 25 chemical engines, 4 hand engines, 52 hose wagons, 26 hose carriages, 30 hook and ladder trucks, 9 chemical extinguishers, 101 portable pumps and almost 200,000 ft. of hose. At the opening of the current year the department owned 475 horses, the best that money could buy, and highly trained to the difficult service. The

FIRE BOAT "ILLINOIS."

buildings, land and apparatus of the department, as shown by the report of the chief for 1898, were of a total valuation of $1,979,385. The entire force consisted of 1,126 uniformed men. The city is divided into 16 battalion districts, the companies in each district comprising a battalion in charge of an assistant fire marshal. The expense incident to the maintenance of the department for 1898 approximated $1,500,000, a per capita tax on the inhabitants of Chicago of about 84 cents.

In 1898 the number of alarms responded to was 6,581, which involved 5,048 fires. The value of the buildings and contents was $91,922,210. The loss was $2,651,735. The loss over insurance only amounted to $105,270.

Chief Dennis Swenie is considered the most experienced fire-fighter in the world, having spent his entire life in the department, and is now past 60 years of age, but as active as ever.

The police department numbers 3,304 members; 77,440 arrests were made last year and $372,034 worth of stolen goods recovered. To run the department cost $3,360,601. The ambulance division is well officered; it cared for 9,584 persons last year, traveling 53,000 miles in doing so.

Both the fire and police departments are under civil service and all appointments below commanding officers are made on the merit system, thus taking these public servants as much out of politics as possible. Each department maintains a pension fund and members are retired after 25 years of service with one-half pay of the rank held at the date of retirement, and families of deceased members are taken care of where the death occurred in the line of duty.

Service stripes—one for each five years—are worn on the arm.

"ILLINOIS" IN ACTION.

Parks and Boulevards.

Few of the other great cities compare favorably with Chicago in the matter of parks and boulevards. To the 38 parks located within the limits of the city there is given over 2,232 acres. The parks are divided among the three divisions of the city as follows: North side, 8 parks, with a total of 324 acres; west side, 17 parks, covering 625 acres, and the south side, 12 parks, contain 1,281 acres. The parks in each division of the city are under the management and control of a separate board of park commissioners, who are appointed by the governor of the state. The cost of the maintenance of these places of public resort is paid out of state funds, the city being thus relieved of a large annual expense. There

FLORAL PIECE.

are, however, 18 small plots of ground dignified with the name of parks, which remain under city control, and although comprising only about one acre each, on an average, they cost by way of annual maintenance in excess of $10,000.

The largest and most prominent of the parks of Chicago are as follows:

North side, Lincoln Park, 320 acres.
West side, Humboldt Park, 200 acres.
West side, Garfield Park, 185 acres.
West side, Douglas Park, 179 acres.
South side, Washington Park, 371 acres.
South side, Jackson Park, 586 acres.
South side, Lake Front Park, 210 acres.

Vast sums of money have been expended in bringing the parks to their present state of beauty and attractiveness and that they are appreciated by the residents of the city is shown when on holidays and Sundays during the summer months tens of thousands of the people of all classes and conditions seek their shade, rest and quiet. To the visiting stranger they are shown with pardonable pride, and the time expended in viewing them is well spent and amply repaid. The Lake Front Park adjoins the business center of the city on the east and has been, for the most part, made by filling in the lake. It is as yet uncompleted, but the progress made and the promises of the South Park Commission lead to the belief that it will be unsurpassed for beauty. The Art Museum stands on the grounds of this park, and ultimately the Field Columbian Museum is to find a home within its confines. In quite a number of the public parks of the city the skill of the landscape gardener and the ingenuity of the decorative florist seem to have been exhausted. Many fine statues adorn the parks, noticable among which are those of Lincoln and Grant in the park named for the former, in which is also located a well selected and quite extensive zoological garden. The collection of wild animals from all quarters of the globe form an interesting feature, and one of which the public seems never to tire. An unusual fact in such collections is the constant breeding of wild animals not usually multiplying in captivity, the sale of the young of which constitutes a large source of revenue, providing means for the constant expansion of the collection. One feature of special interest is the herd of American bisons, improperly called buffaloes, which is one of the very few droves of this almost extinct animal now in existence. Jackson Park, the scene of the never to be forgotten World's Columbian Exposition, presents a scene of rare beauty, enhanced by its extending along the lake front and containing several mementoes of the great fair.

The boulevard system of Chicago is admittedly the most extensive and finest of any of the large cities of the world. The principal parks are connected by a continuous system or chain of boulevards, and a drive of about 35 miles completes a visit to every one of importance. Within the city, and under the direct control of the several boards of park commissioners, are 43 different boulevards, aggregating more than 66 miles in length.

Of these the most important are Lake Shore Drive, Sheridan Road, Diversey Ave. and Ridge Ave. on the north side; Humboldt, Washington and Jackson Boulevards on the west side, and Michigan Ave., Grand, Drexel and Garfield Boulevards on the south side. The first named, Lake Shore Drive, follows the very edge of the lake for over two miles, and strong efforts are being exerted by citizens of both Illinois and Wisconsin to have it made a connecting boulevard driveway between this city and Milwaukee, 80 miles.

SCENES ON CHICAGO BOULEVARDS.

The Street Railways of Chicago.

The street railways of Chicago (and under this head are included the elevated roads as being within the definition, "railways laid in, on, under or over, streets to facilitate the use of those streets by the public") comprise nearly 1,100 miles of track, with nearly 6,000 cars and are operated by 15 companies. Of these 15 companies only three have histories, or had predecessors which have histories, extending back prior to 1889. One of these is the South Chicago City Ry., which was chartered in 1883; the other two, the Chicago Union Traction Co. and the Chicago City Ry., operate systems which had their beginnings over 40 years ago.

Chicago City Railway Co.

The first street railway franchise granted by the council was in 1856 to Roswell B. Mason and Charles B. Phillips for street car lines in both the north and south divisions of the city; 1857 was a panic year, no money could be raised, and the franchise was allowed to lapse. In 1858 another ordinance was passed by the council, but not until the promoters had bought four horse cars and hauled them from the station to the corner of Randolph and

D. G. HAMILTON.
President Chicago City Railway Co.

States Sts. over the corduroy roadway which laid in the middle of State St. to enable Frank Parmelee's buses to ply in that very muddy thoroughfare. Mr. Parmelee had started his first bus line (the Parmelee transfer system still continues) in 1853; this was originally intended for the transportation of passengers between the hotels and railroad depots, but later a bus line was operated on State St. between 12th and Randolph. After the four street cars had stood for a short time as an object lesson and evidence of good faith the council, Aug. 16, 1858, acted and Frank Parmelee, Henry Fuller and Liberty Bigelow received a grant to operate street cars on State St., Cottage Grove Ave., Archer Ave. and Madison St. Ground was broken Nov. 1, 1858, Henry Fuller and William Bross using a pick and shovel to inaugurate the work.

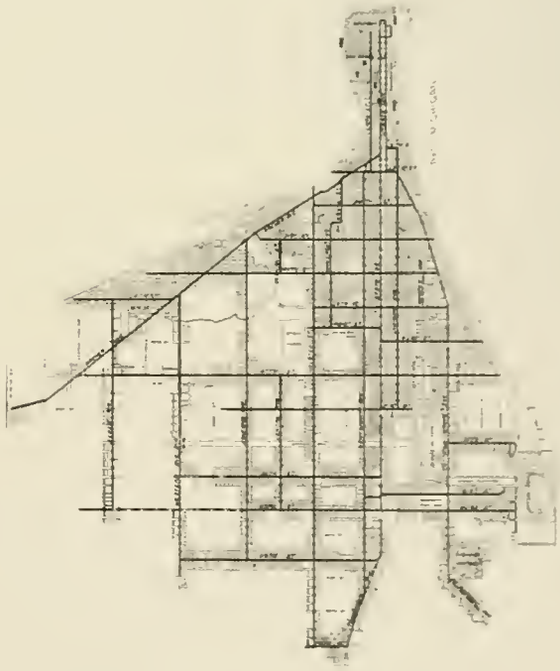
In April, 1859, the four cars mentioned began running over a single track of strap rails spiked to the planks of the corduroy road in State St.; by April 25th the line extended as far south as 12th St. The grant of the city council was confirmed by a special act of the legislature, approved Feb. 14, 1859, and the Chicago City Railway Co. was incorporated, by the three gentlemen mentioned and David A. Gage. The grant was for 25 years, and covered the south division of the city.

Mr. Parmelee withdrew his State St. omnibuses when the street car line was finished, but rival omnibus companies were organized, and rate wars cut the prices of rides from 12 for 50 cents to 40 for a dollar, or less. In the end the street cars won and the competing omnibus lines ceased operating in 1864.

It would be tedious to enumerate the extensions made from time to time, as the horse car lines kept pace with the growing city. The Madison St. line of the Chicago City Railway Co. and other West Side lines built under a franchise granted May 23, 1859, were about Aug. 1, 1893, sold to the Chicago West Division Railway Co., and the Chicago City has since continued in operation to the South Side.

Chicago was the second city in the country to build cable roads. The first cable road here was in the State St. line from Madison St. to 39th St., four miles of double track of the Chicago City Railway Co., the portion thus rebuilt had been the first street car line that the company built. In the language of Mr. C. B. Holmes, who was at that time president of this company, Chicago claims no credit for the invention of the system, that belongs to San Francisco, which had for nearly 10 years experimented with cables for climbing the steep hills in that city; but Chicago did undertake the serious task of demonstrating that the system was practicable in a region of severe winters with deep snow and intense cold and that it was an economical means for moving heavy traffic.

Work on the Chicago City's first cable line, four miles of double track, was commenced Aug. 12, 1881, and the line opened for traffic Jan. 28, 1882. The first train consisted of 10 cars drawn by a single grip car, and carried over a thousand passengers from the down town terminus at Madison St. to the company's general offices at 20th St. This first construction cost $105,000 per mile of single track; the company raised the street grade 3 ft. on that portion of the cable line north of 12th St. and lowered it 18 in. south of that point. The construction was attended with engineering difficulties of the most extreme character. Blocks of streets were open for months at a time, and it became necessary to invent machinery for facilitating the work. At certain points thousands of wagon loads of rock and gravel went into apparently bottomless pits, and it required intense energy and courage on the part of the president to bring the work to completion. Months before the line was finished it seemed as if nothing could save the company from complete bankruptcy. When the line was opened, however, engineers from all parts of the world came to Chicago by hundreds to study the new motive power. Even after the cable cars started troubles continued. The manufacturers



LINES OF THE CHICAGO CITY RAILWAY CO.

of wire ropes had never had experience in making cables for such severe service, and for two years there were frequent "strandings" of the ropes, which caused shut-downs for several hours at a time. On such occasions horses from the other lines were rushed out and drew the cars until the rope could be spliced. For the past 10 years such delays have been of very rare occurrence.

ROBERT McCULLOCH,
General Manager

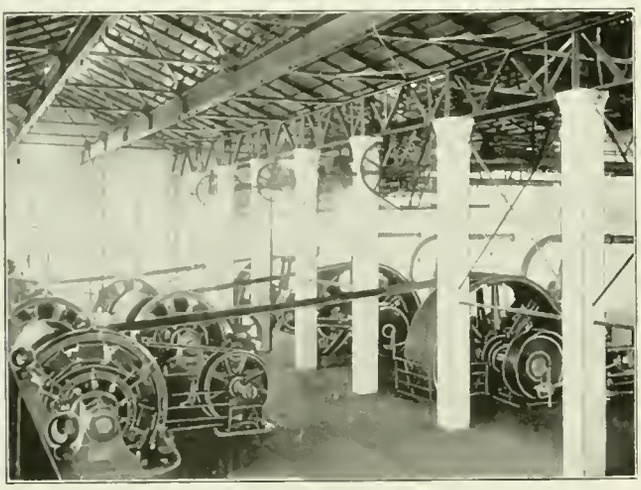
GEO. O. NAGLE,
Asst. Gen. Mgr. and Supt.

FRANK R. GREENE,
Secretary.

C. N. DUFFY,
Auditor.

Immediately upon the construction of the first line another was laid in a similar manner on Wabash and Cottage Grove Aves., from Lake St. to 39th St., making, with that built the previous year, 20¼ miles of cable track, and all operated from one central power station.

During the summer 1886, the State St. line was extended to 63d St., making a continuous double track cable line over seven miles



52D ST. AND WABASH AVE. STATION, CHICAGO CITY RY.

in a straight line, and adding six miles to the cable system. This new line was, however, operated from a power station situated midway between 39th St. and 63d St., and was also converted from a horse line to cable.

In 1887 the Wabash and Cottage Grove line was extended south to 71st St., with a branch running east to Jackson Park in 55th St.; the next spring the main line was extended a few blocks farther to give more ready access to Oakwood Cemetery. This addition increased the total cable mileage to 34.75 miles measured as single track.

The first franchises for electric traction were secured in 1892, and all except the cable lines equipped as rapidly as possible; at the present time the company's lines comprise 196.85 miles, measured as single track, 157.36 electric, 34.75 cable and 4.74 horse.

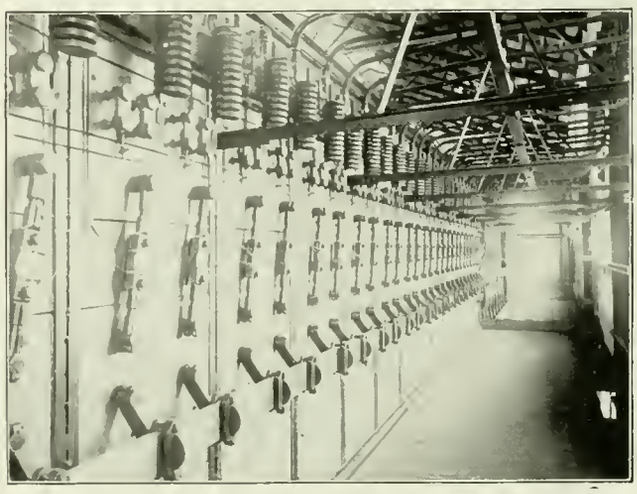
The company has five power houses—three cable and two electric. The first cable station is that at 21st and State Sts., which was built in 1881. Its equipment comprises 10 boilers aggregating 2,800 h. p., and six engines aggregating 3,900 h. p. From this station are driven four cables: North on State St. 26,400 ft.; south on State St. to 39th St., 23,800 ft.; Wabash Ave., north, 24,300, Cottage Grove Ave., 27,500 ft. During the past summer foundations under one of the engines and the cable driving gear have been rebuilt; solid have been substituted for differential drums, and the foundations were moved so that fewer gears and pinions are required to transmit motion from the main line shaft to the cable drums.

The other two cable stations were built in 1887. That at 52d and State Sts. has two 500-h. p. engines and three Hazelton vertical boilers, but they are used only in winter; during the summer a 600-h. p. Westinghouse motor operated by current from the electric power station at 52d St. and Wabash Ave. is used instead. Two cables are driven from this plant; one from 39th to 52d St., 19,175 ft. long, and one from 52d St. to 63d, 14,500 ft. long.

The cable station at 55th St. and Cottage Grove Ave. has two 1,200-h. p. engines and three 500-h. p. boilers. It drives three cables: 39th St. to 55th St., 21,300 ft. long; 55th St. to 71st St., 22,400 ft.; on 55th St., 12,800 ft.

The first electric power station built by the Chicago City Ry. is that at 52d St. and Wabash Ave., which was completed in 1893 in time to furnish power during the World's Fair, and enabled the company to carry millions of passengers that it could not otherwise have handled. This building is 130 x 147 ft., of red pressed brick, with terra cotta and stone trimmings. The boiler room is 56 x 128 ft., with 19 tubular boilers 72 in. by 18 ft., rated at 200 h. p. each. They are all equipped with Murphy smokeless furnaces, which are fed with coal from a bin overhead. The stack is 175 ft. high, with a 10-ft flue. Between the stack and engine room are two 1,000-h. p. Baragwanath feed water heaters. The coal conveyor built by the Link Belt Engineering Co. was illustrated in the "Review" for July last.

There are 10 improved simple engines, with 24 x 48-in cylinders designed to run at 100 r. p. m., with 100 lb boiler pressure. Each pair of engines has an 18-ft. built-up fly-wheel weighing 25 tons, which is connected to a 72-in. pulley by a 21-wrap compound wound rope drive. The driven pulley is between two 700-h. p. Westinghouse generators, which are driven through friction clutches. The driven pulley has grooves for 32 wraps of rope, 21 of these passing around the engine fly-wheel, and 11 around the "compound multiple winder," which is 72 in. in diameter and situated between the engine and generator; the tightener is overhead. This winding is a combination of the Dodge, Hitzroth, Williams, Macdonald and Hoadley patents. The pulleys in this plant were made by the



REAR OF SWITCHBOARD

M. B. STARRING,
Acting General Counsel.

G. W. KNOX,
Electrical Engineer.

C. E. MOORE,
Master Mechanic.

C. J. REILLY,
Chief Engineer.

Dodge Manufacturing Co., of Mishawaka, Ind., and the clutches by the Eclipse Clutch Works, of Beloit, Wis. The switchboard is equipped with Weston instruments.

Interesting data on the performance of this station were published in the "Review" for November, 1893.

The second electric plant of the company was built in 1896 at 49th St. and Oakley Ave. under the supervision of Robt. J. Hill, who was at that time the company's chief engineer. The building is built of brick, but with a steel frame; in general arrangement it is similar to the Wabash Ave. station. At the present time only one-half the equipment it was designed to receive is installed.

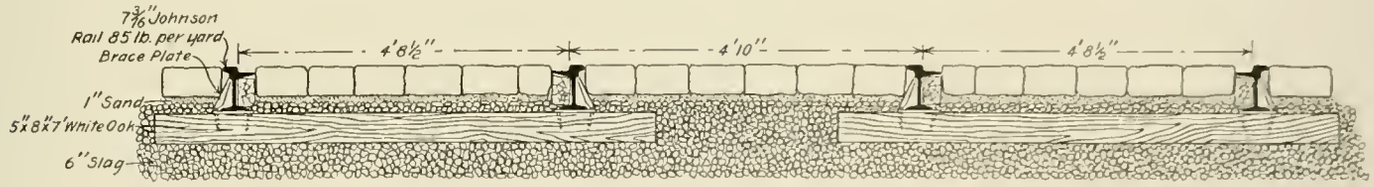
The boiler room is 99 x 266 ft. with 24 return tubular boilers 78 in. by 20 ft., rated at 300 h. p. each. Coal is delivered to tanks running the entire length of the boiler room by conveyors made by John A. Mead & Co. All the boilers are fitted with smokeless furnaces. There are three 2,000-h. p. Baragwanath feed heaters in the station.

In the engine and generator room are three pairs of 36 x 60-in. simple engines. Each pair of engines has a 20-ft. fly-wheel connected to a short jack shaft by means of a rope drive. Sweet separators are used. On each end of each jack shaft is an 800-kw. Walker generator. The switchboard was built by the Walker Co. and the design contemplated 112 feeder panels. The instruments are all Weston and among them is a 20,000-ampere ammeter.

The foundations in this plant were built by Clift Wise, who has also done much of the other construction work for this company.

The company has the following car barns: At 39th St. and Wabash Ave., a two story building, with capacity for 331 cars; at this barn is a stable with 40 double and 16 box stalls. At 39th and State Sts., a three story building, with capacity for 310 cars. At 61st and State Sts a three story building, with capacity for 398 cars, and stable room for 26 horses. At Archer Ave. and Putney Ct., a building partly one and partly three stories high; only the ground floor is used for storing cars, and has capacity for 134; a portion of the second floor is used as club room by the employes. At 69th St. and Emerald Ave., a one story building, with capacity for 195 cars. At Cottage Grove Ave. and 39th St., a one story building, with capacity for 415 cars and stable room for 35 horses.

The car equipment comprises 409 open motor cars, 522 closed motor cars, 258 grip cars, 303 closed trailers, 375 open trailers and 2 mail trains of a grip car and trailer each. These were built by the Brill, Stephenson, St. Louis, Wells & French and Pullman companies, and in the shops of the Chicago City Ry. These cars



CROSS SECTION OF STANDARD ROADBED—CHICAGO CITY RY.

are from 26 ft. to 30 ft. over all, except grip cars, which are 19 ft. The company has 503 double equipments, of Westinghouse 3, 12 and 49, G. E. 800, and Walker 5 motors, which are mounted on McGuire and Moore trucks. The latter trucks, designed by C. E. Moore, were built in the company's shops. The motor cars are all to be equipped with the Price momentum brake, designed by W. G.

26TH ST. AND FT. WAYNE TRACKS.

22D ST. AND INDIANA AVE.

A. C. HEIDELBERG,
Assistant Superintendent.

GEO. I. BERGEN,
Purchasing Agent.

LEON JEWELL,
Superintendent Time Tables.

JOHN J. O'KEEFE,
Chief Supervisor.

Price, formerly the company's mechanical engineer and now with the Peckham Co. The cars are heated with Columbian stoves, made by the McGuire Manufacturing Co. Meaker fare registers are used exclusively.

The Chicago City employs about 3,500 men.

The shops of the Chicago City Ry. are at 21st and Dearborn Sts., directly in the rear of the power station and office building. The building has two floors, with an area of 45,000 sq. ft. each, and a monitor third story, having an area of 20,000 sq. ft. The shop machinery is driven by a 75-h. p. engine, taking steam from the power station across the alley. A 13 x 13-in. Ideal engine drives a Brush 50-lamp and an Excelsior 45-lamp machine used for lighting; there are 350 incandescent and 88 arc lamps in the building. The building is heated by exhaust steam from the cable station. In the shop power plant is also a Pedric & Ayres double air compressor, with a capacity for 120 cu. ft. per minute. A pressure of 80 lb. is carried in the storage tanks and a piping system carries the air to all parts of the building, where it is used for various purposes.

The machine shop contains 7 engine lathes, 1 turret lathe, 6 drill presses, 1 turret drill, 1 planer, 1 shaper, 1 milling machine, 1 boring machine, 1 hydrostatic press, 1 car wheel grinder, 1 Q & C cold metal saw, 1 power hack saw, 1 tool grinder and 4 air lifts. In the wood room are 1 planer, 1 jointer, 2 molding stickers, 2 rip saws, 1 cross cut saw, 1 band saw, 2 shapers, 2 mortising machines, 1 tenoning machine, 1 sandpapering machine, 1 turning lathe and 1 emery wheel. The blacksmith shop is especially well equipped with labor saving tools; there are 1 small Bradley hammer, 1 steam hammer, 1 belt-driven drop hammer, 3 furnaces and 8 forges. When there are more than 500 pieces of one kind to be made the foreman designs a swedge or die for forging them under the drop hammer. An elevator takes cars to the second and third floors; on the second floor 58 cars can be repaired at one time, and on the third floor 17. On the ground floor are five tracks for 12 cars, four pits and two extra ones for emergencies. On the third floor are the pattern shops and store rooms, the armature shop, armature testing room, upholstering department, etc.

Visitors to these shops will be particularly interested in the special machines, tools and other apparatus which have been designed by Mr. C. E. Moore, master mechanic. Among these are the armature coil taping machine, the washing machine, the cane splitting machine, the rail bender, the trolley wheel cutter and the cushion cleaning machine; all of these effect great saving in both time and labor. These machines, as well as the armature testing room have been described in detail in previous numbers of the "Review."

The standard roadbed construction of the Chicago City Ry. consist of 7 3-16-in. Johnson 85-lb. girder rails laid on 5 x 8 in. x 7 ft. white oak ties which are laid in slag, as shown in the cross section. There is, of course, a great deal of track laid with rails of other sections, but the 7 3-16-in. girder is used in new work.

All joints are cast-welded by the Falk process, the company having a welding plant and doing its own work. The first cast-weld joints were made in 1895; at the present time there are over 33,000 welded joints on the system. The breakage of these joints has been about one-half of one per cent per year and is growing less each year, which is taken to be an indication that defective casting has been the cause of the failures. The percentage of breakage has been less in unpaved than in paved streets.

The accompanying engraving is reproduced from a series of pho-

CAST-WELDED JOINTS AND MOLDS, CHICAGO CITY RY.

TABLE I CAST-WELDED JOINTS IN CHICAGO CITY RY.

No.	STYLE.	Length.	Rail.	Number on System.	Weight of Rail in Joint, Lb.	Weight of Cast Metal, Lb.	Total Weight Rail and Joint, Lb.
1	Plain 4½ in.	12 in.	4½ in. girder.	15,800	21	83	104
2	Repair 4½ in.	16 in.	" "		28	127	155
3	Plain 7 in.	14 in.	7 in. "	14,900	32	152	184
4	Plain 9 in.	15 in.	9 in. "	2,000	40	190	230
5	Groove 6 in.	14 in.	6 in. groove.		35	131	166
6	Rd. Bot. Groove 6 in.	12 in.	" "		30	100	130
7	Comb. 4½ 7 in.	15 in.	4½ in. girder. 7 in. groove.		36	106	142
8	Comb. 7 6 in.	14 in.	6 in. girder. 7 in. "	300	30	139	169
9	Comb. 7-9 in.	15 in.	7 in. girder. 9 in. "		38	215	253
10	Comb. 4½-9 in.	16 in.	4½ in. girder. 9 in. "		37	304	341
11*	T 5 in.	22 in.	5 in. T	75	49	263	312
12*	Jumbo 5 in.	30 in.	R. R. Crossings.	75	165	600	765

*Used only on railroad crossings.

MOLDS FOR CAST-WELDED JOINTS.

	STYLE.	Size of Rail, In.	INSIDE MOLDS. No.	Length Inside, In.	Length Outside, In.	Depth, In.	Weight, Lb.	OUTSIDE MOLDS. No.	Length Inside, In.	Length Outside, In.	Depth, In.	Weight, Lb.	Weight of Both Molds, Lb.
	Combination	4½ to 6	1 A	14¾	16½	7¾	59	1 B	14¾	16½	8¼	63	122
	"	4½ to 7	2 A	14¾	16¾	8	55	2 B	14¾	16½	9¼	59	114
	"	4½ to 9	3 A	16¾	18½	11¾	88½	3 B	16¾	18½	10¼	87	175½
	"	6 to 7	4 A	14¼	16¼	8¼	62	4 B	14½	16½	9½	71½	133½
	"	7 to 9	5 A	16½	18¼	10¼	91½	5 B	16½	18¼	11	94	185½
	"	4 T to 7	6 A	20½	22¼	8¼	108½	6 B	20½	22¼	10	104	212½
Table III.	Railroad	5 T	1 A	19	20¾	6	83	1 B	19	20¾	6	82½	165½
	R. R. Crossing	No. 3	2 A	19	20¾	9¾	96	2 B	19	20¾	7¼	97½	193½
	Crossing	7	3 A	17½	19½	10	77¼	3 B	17½	19½	10	77¼	154½
	R. R. Crossing	No. 2	4 A	25½	27¼	7½	155½	4 B	25½	27½	7½	156½	311½
	R. R. Crossing	No. 1	5 A	30¾	33	6½	191½	5 B	31	33	6½	192	383½
Table IV.	Plain	4½	1 A	12	14	6¼	43¼	1 B	12	14	5½	37½	81
	Repair	4½	2 A	16	18¼	6¼	53¼	2 B	16¼	18	5¾	51	104¼
	Plain	6	3 A	14½	16½	8¼	68¾	3 B	14¼	16¼	7¼	68½	137¼
	Cable Yoke	7	4 A	18¼	20½	6½	47½	4 B	18¼	20	6	48	95½
	Plain	7	5 A	14½	16⅜	9	76	5 B	14½	17¼	8¼	68¼	144¼
	Plain Boulevard	7 Boul.	6 A	14½	16¼	9	78½	6 B	14½	17¼	9½	78	156½
	Plain	9	7 A	15⅜	17¼	10¼	89½	7 B	15⅜	17¼	10½	82	171½

tographs taken in the track department museum of the Chicago City Ry. and shows the molds, rail sections, and finished joints, and the tables give the dimensions, weights and other data. It will be noted that two of these joints are used at railroad crossings only.

Another engraving shows views of two interesting pieces of track work; one is the crossing over the Fort Wayne railroad tracks at 26th St., and the other the new cable curve and crossing at 22d St. and Cottage Grove Ave., built by the Falk Co.

In its electrical construction the company uses the insulating material of the Albert & J. M. Anderson Co.

The presidents of the Chicago City Ry. have been as follows: Liberty Bigelow, Mar. 28 to Sept. 20, 1859; B. F. Carver, to Apr. 8, 1861; William H. Waite, to Aug. 11, 1863; D. A. Gage, to August, 1864; Samuel M. Nickerson, to Aug. 1, 1871; Albert Crosby, to Jan. 11, 1872; M. D. Hennessy, to Jan. 8, 1874; S. B. Cobb, to January, 1882; C. B. Holmes, to January, 1891; G. H. Wheeler, to January, 1898; M. K. Bowen, to April, 1899.

The present officers and operating staff are: President, D. G. Hamilton; vice-president, Joseph Leiter; secretary, Frank R. Greene; treasurer, T. C. Penington; general manager, Robert McCulloch; assistant general manager and superintendent, George O. Nagle; auditor, C. N. Duffy; chief engineer, C. J. Reilly; master mechanic, C. E. Moore; electrical engineer, G. W. Knox; assistant superintendent, A. C. Heidelberg; purchasing agent, G. I. Bergen; superintendent of time tables, Leon Jewell; acting general consul, M. B. Starring; chief supervisor, J. J. O'Keefe.

D. G. Hamilton, president of the Chicago City Railway Co., has for many years been prominently connected with street railway interests. He was born in 1843, in Chicago and has lived in his native city nearly all his life, a large portion of his considerable wealth being invested here. He began the practice of law, shortly after his graduation from college, meeting with unusual success in this profession. Of late years he has given much of his attention to real estate matters and the financiering of new projects of various kinds, but has always found time to devote to the interests of the Chicago City Railway Co., of which he has been a large stockholder and director for a number of years. Early in 1899 he was elected second vice-president of this system, succeeding Joseph Leiter, and on the death of M. K. Bowen, a short time ago, was made president. Mr. Hamilton was for many years president of the National Railway Co., of Chicago, which company owned extensive street railway properties in St. Louis. He is a prominent club man, a trustee of De Pauw and the Chicago Universities, and a director in a number of local enterprises.

Capt. Robert McCulloch, who became general manager of the Chicago City on September 1st., is probably better known, and has more genuine friends, than any other man connected with the street railway industry; for to know him at all, is to recognize at once those dignified, yet kindly and genial attributes that have always commanded the respect and honor of mankind. Descended from a sturdy Scotch ancestry, but reared and educated under the softening influences of a refined Virginia home, the finer qualities of the man have been developed to an extent not often reached by the average business man. Capt. McCulloch was born Sept. 15, 1841, in Rockbridge County Va., and was educated at Lexington, Va. At the opening of the civil war, he volunteered his services in the confederate cause. He went to St. Louis in 1869, and in 1871 entered the employ of the Bellefontaine Railway Co., of that city as superintendent, was afterward made secretary, and then vice-president and general manager. In 1889, he was made vice-president and general manager of the National Railway Co., leaving this office in August last.

T. C. Penington, who has held the office of secretary and treasurer of the company for the past 18 years, was born in Wilmington, Del., Sept. 14, 1844. His parents moved their home to Illinois in 1860, just before the war broke out, and Mr. Penington, although but 18 years old, enlisted in the 36th Illinois at the commencement of hostilities and remained in the service until peace was declared. He has been connected with the Chicago City Ry. continuously for the past 27 years, beginning as clerk and by his own efforts, securing promotion in a few years to his present position. He organized the splendid system now in operation on this road. Mr. Penington has acted as secretary and treasurer for the American Street Railway Association since 1895, and has brought into this work, the same systematic and satisfactory methods he has employed for so long in his official connection with the Chicago City Ry. This, together with his genial personality, has made his administration of the office, particularly pleasing to the members and executive committee of the association.

Frank R. Greene, secretary of the Chicago City, is a native of Newport, O., and was born June 8, 1859. He served in various capacities as bank clerk, bookkeeper and cashier, in Marietta, O., Indianapolis, Ind., St. Paul, Minn., and Chicago, until in April, 1890, he was made auditor of the Chicago City Railway Co. He was appointed secretary in January, 1891.

C. N. Duffy, auditor of the company and one of the best-known authorities on methods of street railway accounting, was born Aug. 14, 1859, at St. Louis. In 1873 he accepted a position as shipping clerk in a mercantile establishment, and at once commenced the systematic study of the theory of keeping accounts, which he has continued all his life. He remained in the mercantile line for 12 years, but in May, 1886, was chosen secretary and treasurer of the Union Railroad Co., of his native city, and since that time has devoted himself exclusively to the perfecting of a system of accounts suited to the requirements of street railway companies. His efforts in this line have been most successful and the aid he was able to give in the recent work of the Street Railway Accountants' Association, has won for him the gratitude of the entire fraternity. When the Union R. R. was absorbed in 1889, by the National Railway Co., Mr. Duffy was made secretary and treasurer of the entire system. This position he held until shortly after the recent consolidation of all the lines in St. Louis, when he resigned to become auditor of the Chicago City Railway Co. Mr. Duffy is chairman of the permanent committee on Standardization of the Street Railway Accountants.

George O. Nagle, assistant general manager and superintendent of the Chicago City Ry., is a native of Milton, Pa. He was born Dec. 31, 1868, and early in life moved to Lima, O., where he was educated in the public schools. Moving to Chicago in 1886, he attended the Chicago Atheneum for a short time and then entered the employ of the Cragin Manufacturing Co. He left this company in a few months and began work with the Chicago, Burlington & Quincy R. R., leaving this connection in February, 1891, to go with the Chicago City Railway Co., in its claim department. Six months later he was promoted to the position of private secretary to the superintendent, which he held until appointed superintendent on Jan. 18, 1898. Sept. 1, 1899, he was appointed assistant general manager.

Chicago Union Traction Co.

The North Chicago City Railway Co. was incorporated by the same act of the Legislature (Feb. 14, 1859) which incorporated the Chicago City Railway Co. The original incorporators of the North Chicago were William B. Ogden, John B. Turner, Charles V. Dyer, James H. Rees and Valentine C. Turner. May 23, 1859, the city council authorized the construction of tracks in a number of streets in the North Division of the city and within a few years the company was operating lines on Clark St., from North Water St. to Green Bay Road; on Division St., from Clark to Clybourn Ave., on Clybourn Ave. north of Division; on Wells St. from North Water to Division, thence west and north on Sedgwick to Green Bay Road, and on Chicago Ave., from Rush St. to the Chicago River. Extensions were made from time to time till in 1886 the company had 18 miles of track. The North Side lines were financially successful, as were all the city horse car lines, but the system, solely by reason of animal traction being used, had practically reached its limit of growth in 1886, when Mr. Yerkes secured control of it.

The officers of the North Chicago City Railway Co., were: John B. Turner, president from 1859 to 1867; V. C. Turner, secretary and treasurer from 1859 to 1865, vice-president from 1865 to 1867, president from 1867 to 1885; H. N. Towner, secretary and treasurer from 1865 to 1873; Hiram Crawford, secretary and treasurer from 1873 to 1885; Lucian Tilton, vice-president from 1875 to 1877; George Dunlop, vice president from 1879 to 1887.

The Chicago West Division Railway Co. was incorporated by special act of the Illinois Legislature on Feb. 21, 1861, the incorporators being Edward P. Ward, William K. McAllister, Samuel B. Walker, James L. Wilson, Charles B. Brown and Nathaniel P. Wilder. In 1863 this company bought the tracks which the Chicago City Ry. had built on Randolph and Madison Sts. The great fire of 1871 caused many people to move to the West Division of the city and the west side road found it necessary to make great extensions of its tracks. Keeping growth with the population the company in 1884 operated 75 miles of track, having a daily average of 3,246 horses in service. In 1885 there were 3,733 horses and 655 cars in service, the daily mileage being about 22,500. It is quite interesting to note that the number of round trips was 3,029, on an average round trip of only 7½ miles. The Chicago Horse & Dummy Railway Co. was incorporated Feb. 12, 1883, and secured franchises for west side streets; this company, which soon passed under the control of the Chicago West Division, changed its name to the Chicago Passenger Railway Co. Later the two properties were consolidated, both being leased for long terms to the West Chicago Street Railroad Co. The officers of the Chicago West Division Railway Co. before the lease to the West Chicago were: President, J. Russell Jones; vice-president, Benjamin F. Campbell; secretary and treasurer, George C. Webb; general superintendent, De Witt C. Cregier. In March, 1886, Charles T. Yerkes and other gentlemen of Philadelphia organized the United States Construction Co. and in its name bought a controlling interest in the North Chicago City Railway Co.

On May 18, 1886, Mr. Yerkes and his associates organized the North Chicago Street Railroad Co. and it acquired all the property of the old company, and formed the nucleus of the great Yerkes System which was developed in the north and west divisions of the city in the next 13 years.

Mr. Yerkes and his associates secured a majority of the stock of the west side companies and July 19, 1887, incorporated the West Chicago Street Railroad Co., and shortly afterwards the older companies leased their property to the West Chicago.

Immediately on securing the north side lines Mr. Yerkes set about providing better down-town terminals, and installing cables for operating the trunk lines. The La Salle St. tunnel under the Chicago River was rebuilt by the North Chicago Street R. R. in 1887 and the north side cable lines built; these cable lines comprise 17 miles (measured as single track) and were, together with the down-town loop, completed in March, 1888.

As soon as possible after the organization of the West Chicago Street Railroad Co. the work of improving the west side lines was

begun. The Washington St. tunnel was rebuilt in 1890 and the cable system installed on Madison and Halsted Sts. and Milwaukee and Blue Island Aves. In 1893 a tunnel under the south branch of the Chicago River at Van Buren St. was completed and that line cabled. The total cable construction for the West Chicago amounted to 30.24 miles (measured as single track) and included three down-town loops. What was 10 years ago called the "deadly trolley" met with bitter opposition in the city of Chicago, and no franchise for down-town electric lines could be secured until after nearly all the suburbs had enjoyed the advantages of the new motive power for several years. An ordinance permitting the equipment of the Yerkes lines was passed in April, 1894, and within 16 months 210 miles of electric roads had been completed. All of this work was done by the electrical department of the north and west side roads under the management of Mr. J. R. Chapman, and it established a long-distance record for quick construction of city lines. The electrically operated lines of these companies in 1898 aggregated 250 miles.

Over 200 miles more of electric street railways were built in the north and west divisions of the city and its suburbs as feeder lines, but the recent change in the management of the North and West Chicago lines makes it more proper to take up the feeder lines in connection with the Chicago Consolidated Traction Co. rather than with the system of which they originally formed a part.

On July, 1, 1899, the Chicago Union Traction Co. assumed control of the North Chicago and the West Chicago Street Railroads by virtue of leases executed the previous day. The officers and staff are: President, Jesse Spalding; vice-presidents, R. A. C. Smith, of New York, and Walter H. Wilson, of Chicago; secretary, J. C. Moore; treasurer, J. H. Eckles; assistant treasurer, M. B. Orde; auditor, F. E. Smith; general manager, John M. Roach; assistant manager, G. A. Yuille; electrical engineer, J. R. Chapman; division superintendent, T. A. Henderson; master mechanics, F. T. C. Brydges and John Millar; chief engineer in charge of West Side power stations, J. Z. Murphy, chief engineer North Side power stations, John Gleason.

The power houses of this company are 11 in number, of which nine are cable plants and two are electric stations.

For operating the north side cables three power stations were built; one at La Salle Ave. and Illinois St., just north of the river, for hauling the cable through the tunnel and around the down-town loop; one at Clark and Elm Sts., for the Clark St. and Wells St. lines, and one at Lincoln and Wrightwood Aves. All of these have been enlarged from time to time as the traffic increased.

The loop station was completed in 1887 and its present equipment comprises two engines, one 300-h. p. and one 250-h. p., seven boilers and one set of driving machinery, and a motor and two dynamos, one arc machine for the tunnel and one incandescent machine.

The North Clark St. cable station was built in 1887, an old building formerly used as a swimming school and skating rink being remodeled. In the engine room there were originally four 500 h. p. simple non condensing engines with 28 x 60 in. cylinders, but, in 1890 two of these were replaced by larger engines having 36 x 60 in cylinders. At this station is a Siemen Halske 500 volt motor driving a Siemen Halske 110 volt dynamo for lighting the plant; current for the motor is taken from a trolley circuit. The boiler plant comprises nine return tubular boilers 72 in by 18 ft. which carry steam at 100 lbs. Coal hoppers are provided above the boilers, but have not been used for several years, as oil is the fuel. The oil is delivered in the tank wagons of the Indiana Pipe Line Co.

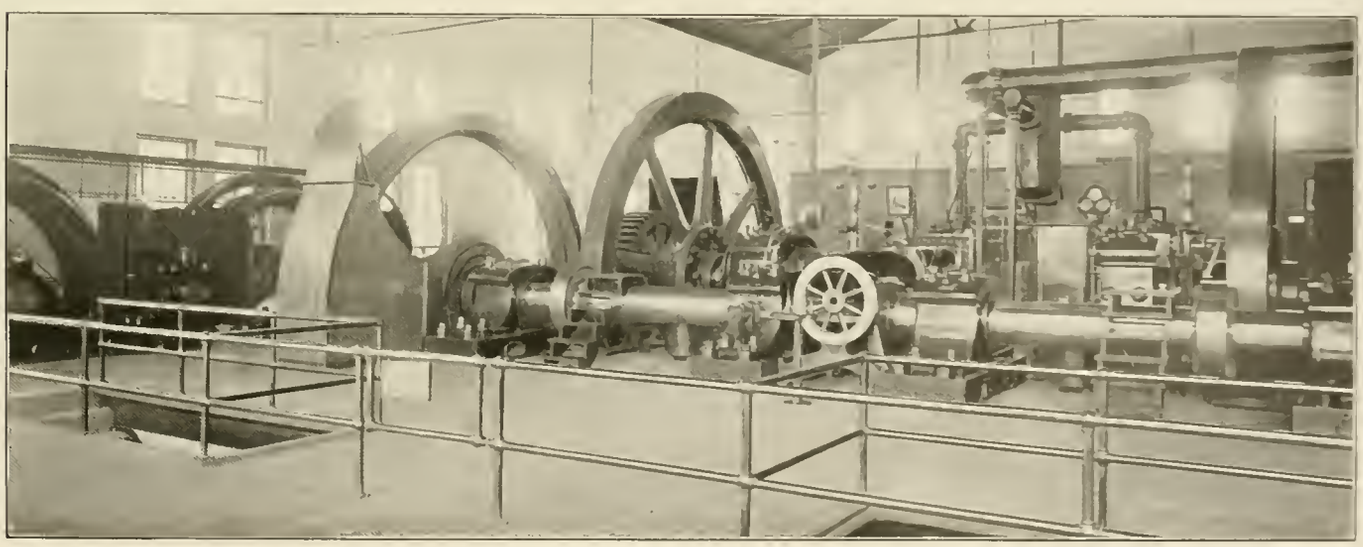
JOHN M. ROACH,
General Manager Chicago Union Traction Co., President Suburban Railroad Co.

and emptied by gravity into storage tanks which have an aggregate capacity of about 800 barrels. The pressure on the fuel oil piping system is about 10 lbs. The building is of brick, one story high, except at the north end; the stack is 125 ft. high above the grates.

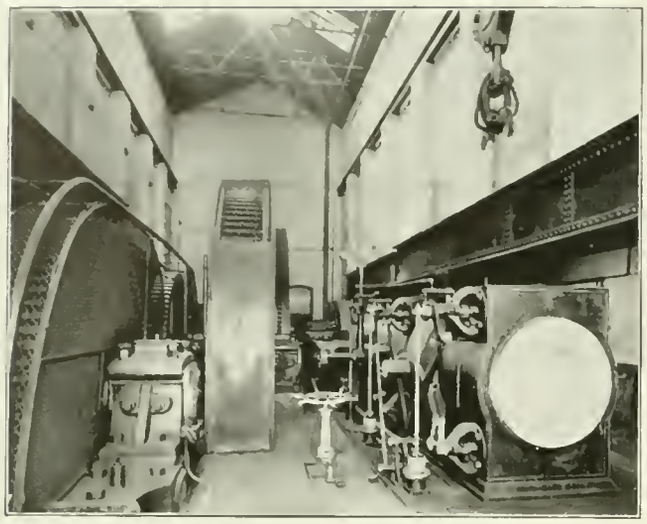
The Lincoln Ave. Station contains two 300-h. p. corliss engines, 4 boilers and 2 sets of driving machinery, and drives the cable, 18,000 ft. long, from Center and Clark Sts. to Wrightwood Ave.

On the West Side are six cable stations. Three of these were built to operate the Madison St. cable system which was installed during the summer of 1889, and are all of similar design.

The Washington St. cable station is located at the corner of Washington and Jefferson Sts., a portion of this building being



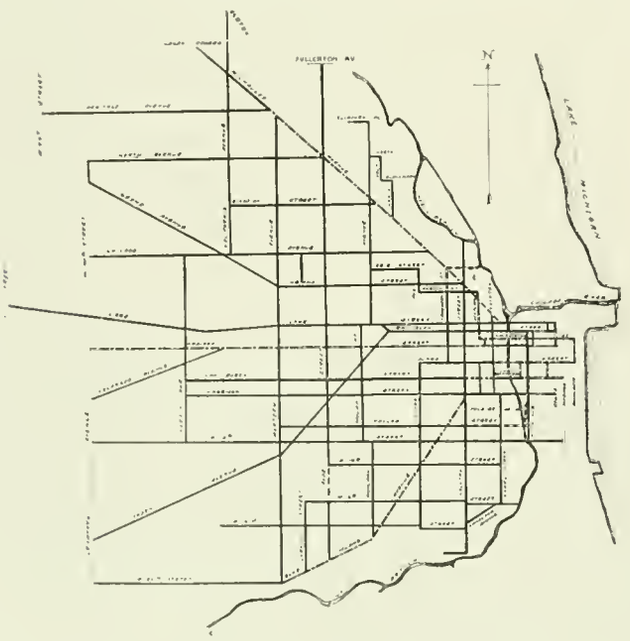
ENGINE ROOM, MILWAUKEE AVE. STATION, CHICAGO UNION TRACTION CO.



DESPLAINES ST. CABLE STATION.

formerly occupied by the general offices of the company. This station operates the down-town loop, and lights the tunnel and building. There are two simple non-condensing engines of the corliss type with 36 x 60 in. cylinders conected by a rope drive to the cable machinery. The engines are rated at 1,000 h. p. each; one is sufficient for the work. There are six horizontal tubular boilers 72 in. x 18 ft. The oil for fuel is stored in a 4,000 gallon tank in the basement. The lighting plant mentioned is in the basement and consists of two high-speed Russell automatic engines, 12 x 18 in., driving a jack shaft from which are driven by wire ropes three arc machines and three 135-volt, 135-ampere Siemens-Halske dynamos.

Adjoining this station is a very interesting plant, built as an auxiliary. It was desired to install an additional engine and the only land in the vicinity that could be bought was a lot 25 x 150 ft. The equipment comprises one 1,000 h. p. simple non-condensing Corliss engine, six vertical tubular boilers aggregating 1,200 nominal h. p. each and a complete set of winding machinery. This



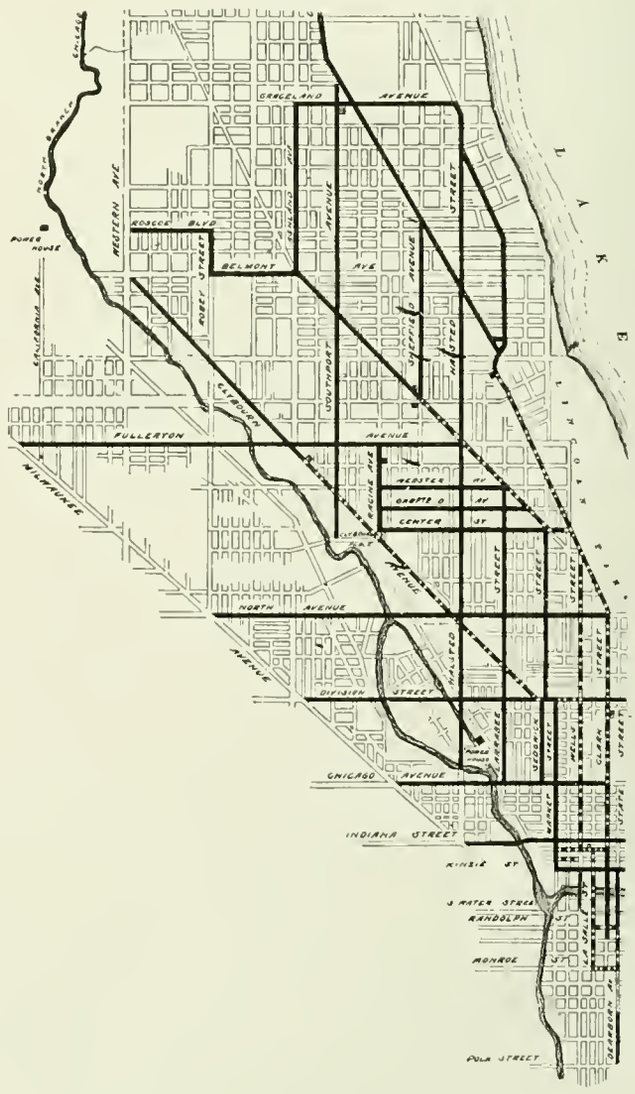
WEST SIDE LINES, CHICAGO UNION TRACTION CO.

is known as the Washington and Desplaines Sts. station as it fronts on the latter.

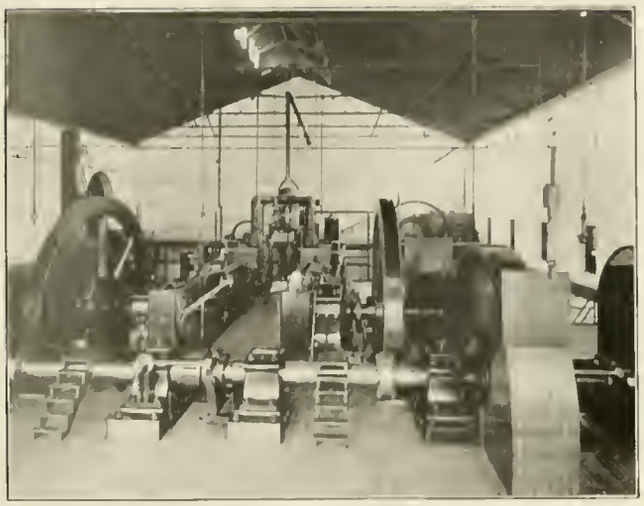
The second of the older cable stations is that at Milwaukee Ave. and Cleaver St. and drives two 1⅝ in. cables, each 21,000 ft. long; one has speed of 10 miles per hour and extends to the corner of Washington and Jefferson Sts. and the other with a speed of 12 miles per hour out Milwaukee Ave. to Armitage Ave. This building is of red brick 250 x 208 ft.; there are two simple non-condensing corliss engines with cylinders 30 x 72 in. built. The engines are of very massive construction and look heavy for their rating, which is 1,500 h. p. each; one engine suffices to drive both cables. The separators and piping are drained by Westinghouse steam loops. In the boiler room are eight horizontal tubular boilers 72 in. by 18 ft. carrying steam at 100 lb. Oil is now used for fuel. The stack is octagonal in section and 175 ft. high; the internal diameter is 7½ ft. At this station cement lined tanks are provided under the boiler room floor for storing a 30 hours' supply of feed water; this precaution was deemed necessary to guard against the possibility of a failure in the city supply. The Milwaukee Ave. station is still used, but the traffic on the line is light; trolley wires are strung over a considerable portion of the cable line on this division.

The third of the West Side cable stations which dates back to 1889 is that at Rockwell and Madison Sts. and it is an almost exact duplicate of the Milwaukee Ave. plant; it drives two cables 20,000 ft. and 18,000 ft. long respectively. There are two 1,500-h. p. Greene engines geared to the main shaft, one or both being used as may be necessary and a 150-h. p. corliss engine which is used to drive the cable for a loop encircling the power station which is used for turning a portion of the cars, traffic on Madison St. west of the power house being light. A 25-h. p. Russell automatic engine rope connected to a 25 arc light dynamo is provided for lighting the building. There are two batteries of four boilers each, similar to the boilers in the other cable stations mentioned; oil is used for fuel. The separators are drained by Westinghouse steam loops. The traffic on the Madison St. branch of this system is still heavy, electric lines not having seriously cut into it as yet.

The Blue Island cable station at Blue Island Ave. and 12th St. was built in 1893. It is of pressed brick with stone trimmings, and



NORTH SIDE LINES, CHICAGO UNION TRACTION CO.



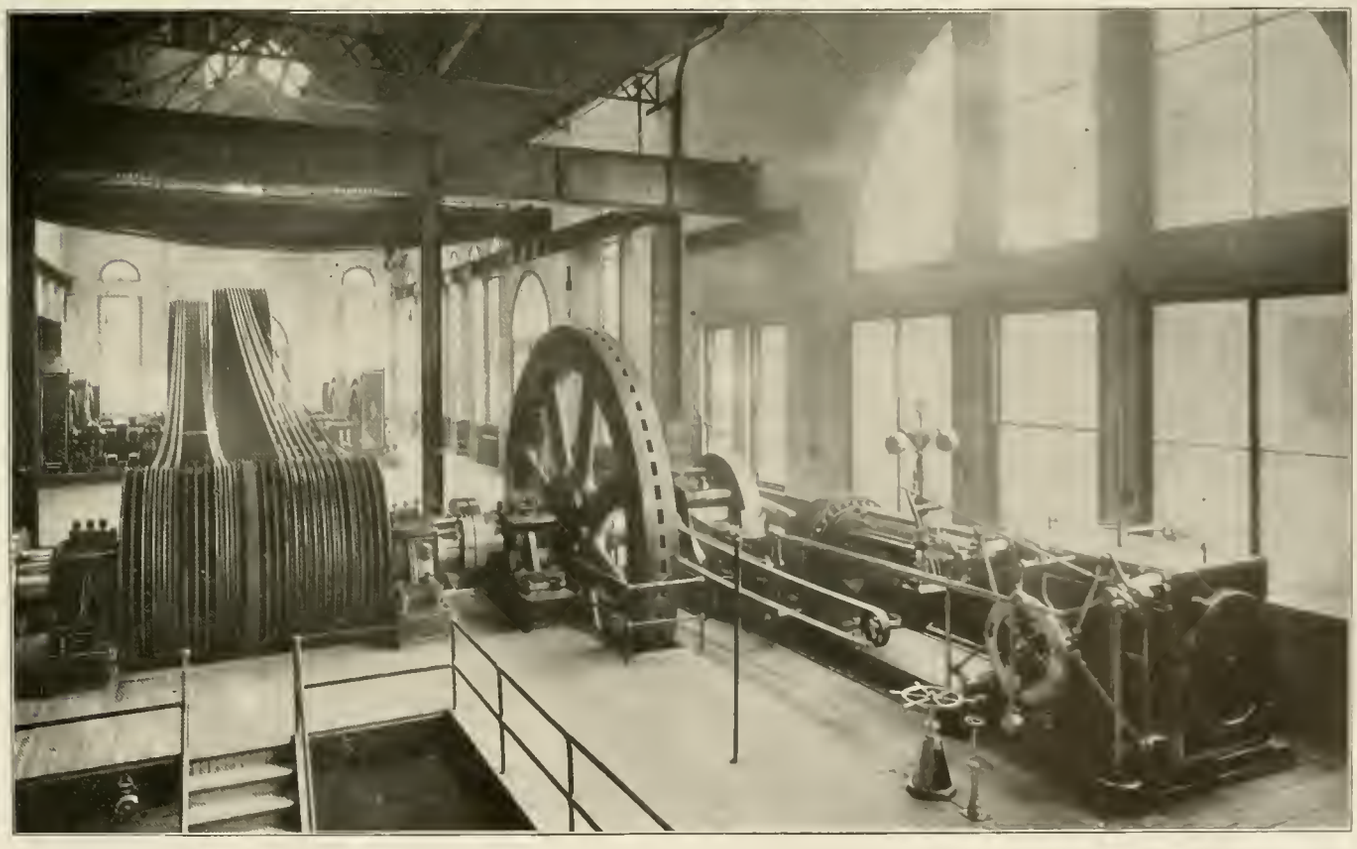
ENGINE ROOM, ROCKWELL AND MADISON STS.

includes as part of the structure a six-story office building. The portion where the machinery is located is 116 x 100 ft. In building the foundations quicksand was encountered and the excavations had to be carried down 40 ft. below the street level. Some 800,000 brick laid in portland cement were used in the engine foundations. Three cables are operated from the station. On Blue Island Ave. from 12th St. to Jefferson St., 12,400 ft.; on Blue Island Ave. from 12th St. to 26th St., 24,600 ft.; on Halsted St., 25,000 ft. All of these cables were made by the Roebling company and are 1 5-16 in. in diameter. In the engine room are two simple Allis engines with cylinders 40 x 72 in. rated at 1,800 h. p. with steam at 100 lbs. Each has a 24-ft. fly-wheel weighing 50 tons. These two engines are at either end of an 18-in. line shaft which carries the winding drums between them; pinions 5-ft. in diameter on the line shaft mesh with 14-ft. gears on the winding drums of which there are four, three 13½ ft. in diameter and one of 16 ft. In case of a drum breaking its cable can be shifted to the spare drum. One engine only is needed for operating the station, the second being held in reserve. There are eight horizontal tubular boilers 72 in. by 20 ft., in this station. The boilers are carried on iron columns, and the space underneath is utilized for the tension carriages; these are of the Root pattern, which are used in nearly all the cable plants in this country. A Westinghouse steam loop is installed at this station; the separator is beneath the floor.

The newest cable station in Chicago is that at Van Buren and Jefferson Sts., which was completed late in 1893. The building is 50 x 175 ft., of red brick, trimmed with Bedford stone. The marked feature of this plant is the rope drive, which is 75 ft. from center to center, being one of the longest in the country. The equipment comprises two simple non-condensing Allis engines, with 30 x 60 in. cylinders, and rated at 1,300 h. p. each. The fly wheels are 20-ft. in diameter and weigh 50 tons each. The boiler room contains eight tubular boilers of 225 h. p. each. A Westinghouse steam loop is used for draining the separator. The boilers are provided with grates for coal burning in case of emergency, though oil is the fuel commonly used. Two sets of cable driving drums are provided; one being always in reserve. The Van Buren St. loop cable is operated from this house; the rope is 1,300 ft. long.

The tunnel used by the Van Buren St. cable line was begun in 1891 and completed in 1894. It was built on private property at a cost of $1,600,000. It consists of one elliptical span of 30 ft., the length from entrance to entrance is 1,514 ft. and from portal to portal 920 ft. The east approach begins at Franklin St. and is 278 ft. long on a grade of 10 per cent; the western approach begins at Clinton St., and is 316 ft., with grades of 7.93 and 5.46 per cent. In order to construct the tunnel it was necessary to support adjacent buildings on jacks, while the foundations were undermined; the work was so carefully done that not even an elevator in any of the buildings was stopped. The two tracks through this tunnel are 15 ft. c. to c. The tunnel is built of brick in seven rings, giving a total thickness of 32 in.; the river section is concreted, covered with asphalt mortar and laid with flagging. At the time of its construction the arch of this tunnel was the largest ever built in tunnel work and we believe the distinction still holds good.

The electrical power houses of the Yerkes system have ever since their construction been considered among the most interesting

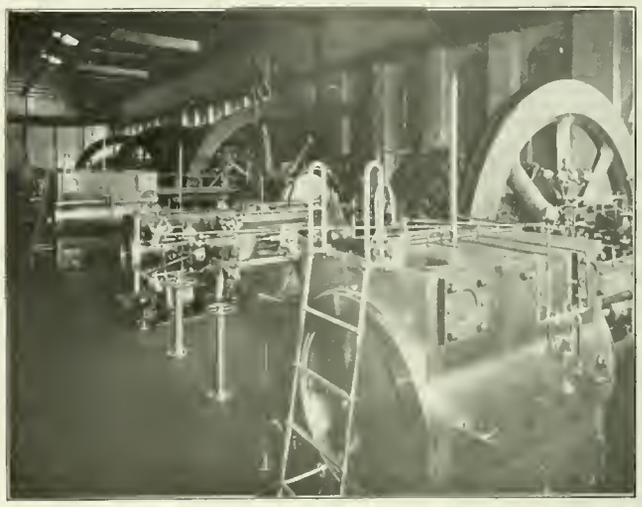


CABLE STATION, VAN BUREN AND JEFFERSON STS., CHICAGO UNION TRACTION CO.—ALLIS ENGINES.

of the power plants of Chicago, and it is quite safe to say that few engineers visiting the city have failed to inspect one or more of them. Those passing to the Chicago Union Traction Company are the ones known as the Western Ave. and the Hobbie St., or Hawthorne Ave. These stations supply the same lines as before the lease of the two roads to the Union Traction Co., the Union Traction and the Consolidated Traction renting power from each other.

The electrical power station of the West Chicago lines is at Western Ave. and Washington Boulevard, three miles west of

WESTERN AVE. STATION.



ENGINE ROOM, WESTERN AVE. STATION.

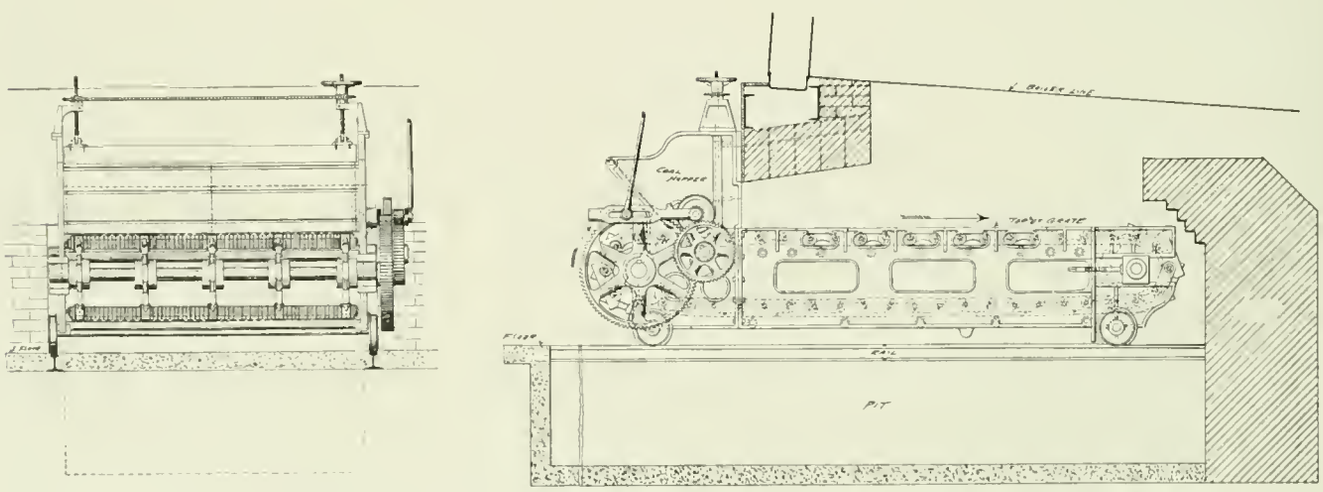
State St., quite near the center of distribution of the system. When designed it was intended that the ultimate capacity of this station should be 12,000 h. p., and it is interesting to note that it was then the largest electrical power house that had ever been designed. Construction was begun in 1894, and by the summer in 1895 it was supplying about 7,000 h. p.

This plant now contains five engine and dynamo units of 1,500 kw. capacity and one of 750 kw. The engines are cross compound. The cylinders of the 2,000-h. p. engines are 34 and 54 in. x 60 in. stroke. Those of the 1,000-h. p. engines are 26 and 40 in. x 48 in. stroke. The diameter of the fly-wheel is 25 on the 2,000-h. p. and 20 ft. on the 1,000-h. p. The 25-ft. wheel weighs 80 tons. The revolutions per minute are 75 on the 2,000-h. p. and 80 on the 1,000-h. p. engines. The generators were made by Siemens & Halske, and are the usual internal field type built by that company for direct driving. The armature winding consists of copper bars and the surface of the armature is turned off to form the commutator. These machines perform their duty in a very satisfactory manner, as is always the case with the large direct-connected units built by this company.

The engine room of this station is 57 x 250 ft., and has an iron floor and basement similar to the California Ave. plant, except that there are no condensers in the basement. As in the other station all piping and wiring is run under the floor so as to give full swing to operation of the two Walker 35-ton electric cranes which span the engine room. There are four steam loop and separator systems in this plant, which were furnished by Westinghouse, Church, Kerr & Co.

The switchboard is made up of General Electric panels. The feeder board in the gallery has 70 panels. The generator panels are on the main floor. Two Thomson recording wattmeters measure the output, one serving each half of the generator board. The generator panels have in addition to the regular General Electric apparatus a Siemens & Halske device for opening the shunt field circuit. This is an arrangement whereby the final break of the field circuit is made by gradually separating two carbon points until the arc gets so long that it breaks the circuit. This method, it is claimed, gets rid of the dangerous inductive kick when the field circuit it opened. All the feeders leave the station from one corner of the engine room basement. From the switchboard they pass straight down and then run along a rack on one wall of the basement to the manhole of the underground conduit on Western Ave.

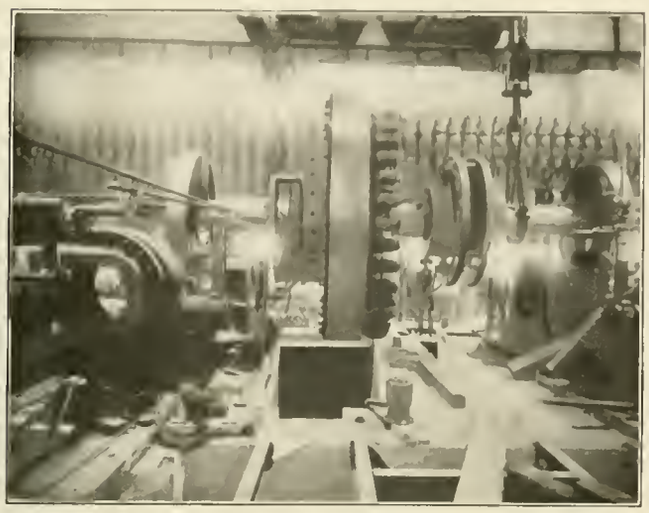
The boiler room contains 20 400-h. p. Stirling water tube boilers. This was said to be the largest single order of the kind ever placed at the time it was made. Oil was used as fuel and no provision made for burning coal until the present summer, when the company became convinced that coal would be cheaper, and contracted with the Green Engineering Co., of Chicago, to equip all the boilers with its traveling link grates.



GREEN TRAVELING LINK GRATE.

The accompanying illustrations show end and side elevations of

the type of grates which are now being installed. Each of the 20 grates is over 10 ft. wide, which is about 20 per cent wider than it has heretofore been possible to make traveling grates that would operate successfully, from 8 ft. to 8 ft. 6 in. being considered the limit. The effective grate surface is 84 sq. ft. for each boiler; 9 ft. long by 9 ft. 4 in. wide; each grate weighs about 3,500 lb. and the whole mechanism is mounted on wheels which run on a track as



ERECTING A 2,500-H. P. UNIT, WESTERN AVE. STATION.

shown in the drawing, so that when desired the grate may be rolled out of the furnace.

The elements or links of the grate are a little less than 12 in. long and the surface which forms a portion of the grate surface is about 7/8 in. wide, the web or body of the link being thinner. Through the web are two circular holes, 6 in. c to c., and these are slotted on the under side. The links are connected by transverse joining bars which are oval in cross section; the long diameter is such that they turn easily in the circular holes in the grate links, and the short diameter so that they slip through the slots mentioned. This design enables a defective link to be easily removed and a new one put in its place; it is only necessary to turn the two joining bars so that the slots may slip over them, remove the link, put a new one in place, and turn the bars again. The joining bars are held in a position such that the links cannot slip off by outside binder links, in which the holes conform to the cross-section of the bar; these binders are held in place by cotter pins. The links are spaced so as to give the desired air spaces (about 30 per cent) by the bosses which are cast around the holes in the webs of the links.

The arrangement of joining bars is one of the principal features of the design; a second important feature which permits the grate to be made of any width that may be desired is the supporting of the chain. The supports are made of heavy steel piping mounted in roller bearings at the ends; the bearings are housed and fully protected from dust and ashes.

The driving links are in pairs, the bosses on the two coming together and forming the "tooth" which meshes with the driving sprocket. The chains of driving links are placed 14 in. apart. The driving mechanism is at the front end, and is worked by a ratchet which is actuated by a rod from an eccentric on an independent shaft. In the Western Ave. station there will be two 20-h. p. motors installed to operate the driving shafts; one of these is ample for the work, the other being in reserve.

At the rear end of the furnace the grate is carried on sprockets on a horizontally adjustable shaft.

A coal hopper is included with the gate apparatus. The regulating gate is lined with fire brick and moves in vertical guides. The roof of the fire-box at the igniting arch is made of fire brick of special design, which slip over steel channel bars.

These grates may be adjusted to give a surface travel ranging from 3/4 in. to 5 in. per minute.

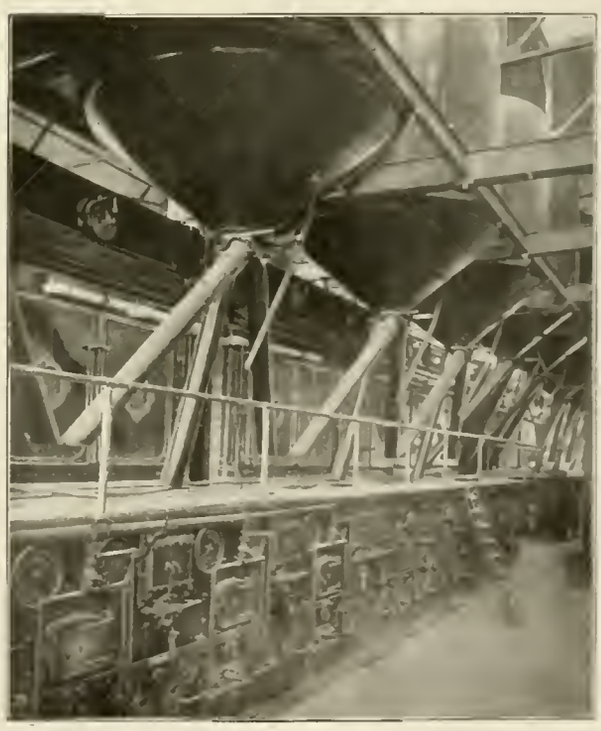
Six 2,000-h. p. exhaust steam heaters are ranged around the base of the stack, near which are also the two boiler pumps and the pumps for the fuel oil system. A simple gravity system of oiling is employed. The building is heated with exhaust steam. The main exhaust of the station is 40 in. in diameter, and passes up alongside the stack. The stack is 235 ft high, 10 ft. flue, 27 ft square at base and on a foundation 48 ft square

The third large electric house built for the Yerkes system is that at Hawthorne Ave and Hobbie St It is located on the Chicago River about two miles from the business center of the city.

It furnishes current for the North Chicago lines south of North Ave. and to the down town end of the Lake Street Elevated road It is without doubt the best located of the large stations in Chicago. It is on the river so that there is plenty of free water for condensing, and is on a railroad siding so as to get cheap coal It is also near the center of the district it supplies. The station is planned for a capacity of 4,000 h. p. in four units of 800 kw each. Three of these are now in place, leaving the fourth to be installed at some future date. The engines are cross compound condensing horizontal corliss, built by the E. P. Allis Co., of Milwaukee. The cylinder dimensions of these engines are 24 and 46 x 48 in. The speed is 80 r. p. m. The main shafts are 22 in. in diameter and each carries a 50-ton fly-wheel and the armature of an 800-kw generator. The generators are of the 10-pole railway type made by the General Electric Co. They were guaranteed to have 94 per cent efficiency and not to heat to exceed 50 C. above the room. The switchboard is in a gallery; it has 20 panels.

In the boiler room are 10 "Standard" water tube boilers of 350 h. p. each which supply steam at 130 lb. The boilers are all equipped with smokeless furnaces. There are automatic stokers and a complete coal and ash conveying apparatus made by the Link Belt Machinery Co., of Chicago. A hopper holding 5 tons is put over each boiler. The conveying apparatus is arranged so that coal can be taken in or ashes discharged at either end of the boiler room; that is, on the river side or on the switch track side.

The independent Blake condensers are from the Allis works, and a Reynold's feed water heater is operated in connection with them. The cold feed water is first put through these heaters, and then



BOILER ROOM, HOBBIE ST. STATION

through an exhaust heater, which is supplied from the exhaust of the condenser air pumps and boiler feed pumps. A Westinghouse steam loop installed by Westinghouse, Church, Kerr & Co., drains the separators and returns the water to the hot well.

The feed water is taken from the Chicago River, but is filtered before using, so that the heaviest of the sediment is removed There is not, however, as much sediment in the water as it comes

from the river as would seem from the surface appearance, and after being filtered through sand it has nothing more than a slightly milky appearance.

There is a basement under the entire building. The steam main is put under the boiler room next to the engine room wall. This leaves the engine room basement free for the condenser mains and piping. The steam main is drained by Westinghouse steam loops running straight up the wall between the engine and boiler rooms. The building and details are after the general plans of other power houses mentioned.

These electric stations which have just been described, and also those to be mentioned in connection with the Consolidated Traction Co. and the Union Elevated Railroad Co., were all designed and erected under the supervision of Mr. S. Potis, jr., for many years chief engineer of the North and West Chicago roads, and Mr. J. R. Chapman, head of the electrical departments. Both of these gentlemen are well known to the street railway men of the country by reason of their work in Chicago. Mr. Potis left Chicago in 1896 and went to Mexico, where he remained until last spring, when he returned to Chicago and became chief engineer for the Illinois Telephone Construction Co. Mr. Chapman is now at the head of the electrical department of the Chicago Union Traction Co.; his latest power house is that for the Northwestern Elevated; he is also electrical engineer of the Consolidated Traction Co.

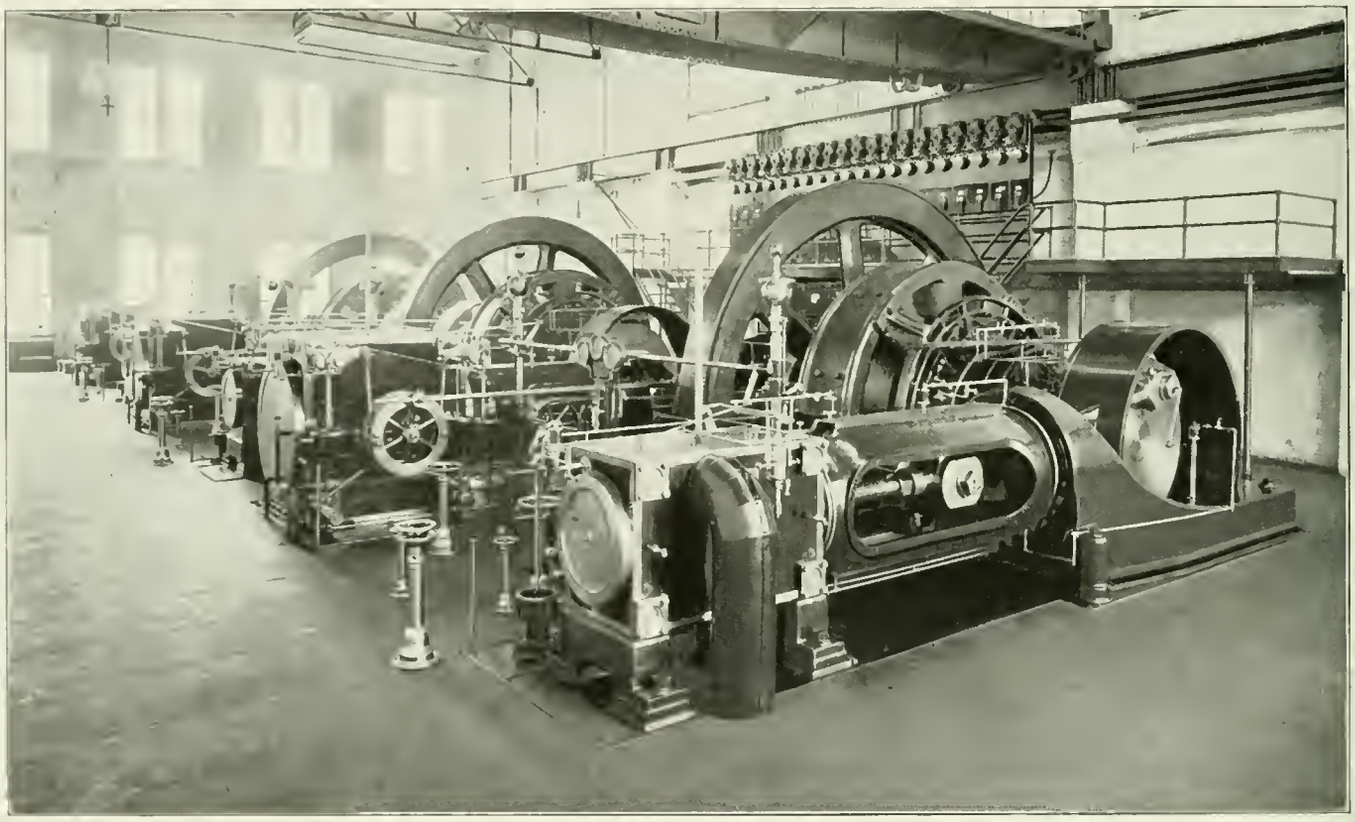
The lines of the Chicago Union Traction Co. comprise 249.68 miles of electric, 47.42 miles of cable and 6.6 miles of horse road, a total of 303.7 miles; of this two-thirds is on the west side.

The company has about 12,000 cast-welded joints in its track; part of which were made by the Falk Co. and part by the American Improved Rail Joint Co. Quite recently the company bought two of the Falk welding outfits and will, as soon as practicable, weld all of its tracks. So much has been said, pro and con, concerning the cast-weld joint as an electrical conductor that we are quite justified in again citing the testimony of Mr. Chapman on this point, published in our issues of January and May, 1898. In January, 1898, Mr. Chapman tested a new joint cast by the American Improved Rail Joint Co. and found that it had 97 per cent of the conductivity of the rail with a current of from 115 to 120 amperes per sq. in. of rail section. In May, 1898, another test was made after two years of service of a joint cast in 1895 by the Falk process; the drop in a 5-ft. length, including the joint with 500 amperes flowing was .048 volt, as against .040 volt for 5 ft. of solid rail; with 730 amperes the drop with the joint was .065 volt, and with 758 amperes without the joint, .069 volt. It is almost needless to say that in view of these tests cast-welded joints are not bonded.

No one standard type of overhead construction is found on the system of the Union Traction Co., different methods being employed in different portions of the city. On a number of the down town streets phosphor bronze wire is used for span work, with No. 0 trolley wire, while in the suburbs a large amount of galvanized steel span wire, with No. 00 trolley wire is found. Anderson insulation is used exclusively, however, and heavy iron poles have been erected throughout, the minimum weight for these being 913 lb.

The West Side car barns and storehouses are as follows: Storeroom for general supplies, Western Ave. and Warren St., two story brick, 125 x 96 ft.; car barn, Campbell and Armitage Aves., two story brick, 400 x 254 ft.; car barn, Division St. and Western Ave., 337 x 258 ft.; car barns, Grand Ave. and N. Leavitt St., two story brick, 295 x 296 ft. and 139 x 120 ft.; car barns, 12th St. and Ogden Ave., two story brick, 270 x 125 ft. and 125 x 235 ft.; car barn, Van Buren and Throop Sts., two story frame, 50 x 120 ft.; car barns, Western Ave. and Harrison St., two story brick, 125 x 296 ft. and 125 x 72 ft.; car barn, Rockwell and Madison Sts., power house, barn space, 120 x 247 ft.; car barn, Blue Island Ave. and Leavitt St., two story, 267 x 203 ft.; car barn, Clybourne Place and Wood St., two and three story brick, 438 x 266 ft.; car barn, Van Buren St. and Kedzie Ave., 234 x 326 ft.; car barn, O'Neill and Halsted Sts., two story brick, 255 x 244 ft.; car barn, Western Ave. and Washington boulevard, two story brick, 365 x 309 ft.; cable barn, West Madison St. and Crawford Ave., one story brick, 322 x 212 ft.; car barn, Lake St. and Park Ave., 114 x 162 ft.

The rolling stock of the West Side lines comprises 1,842 cars, 20 snow sweepers and 40 plows. Of the cars 400 are closed and 316 open motor cars, made by the American and Pullman companies, 258 grip cars, 863 trail cars and 5 mail cars. The grip cars were built by the Brill and American companies, except 50 combination cars, which were built by the Brownell company; the trailers



ENGINE ROOM, HOBBIE ST. STATION, CHICAGO UNION TRACTION CO.—ALLIS ENGINES.

were made by the American and Laclede companies. The motor cars are, for the most part, 21 ft. and 22 ft. bodies, with 4½ ft. platforms. The company has 400 double equipments of G. E. 800 motors and K2 controllers.

The snow sweepers were built by the J. G. Brill Co., each has two G. E. 800 motors for traction and one G. E. 800 for driving the brooms. The snow plows were made in the company's own shops.

The motor cars are mounted on Brill trucks, and the trail cars on American and Bemis trucks.

The minor car equipment includes 900 Lewis & Fowler improved

ENGINE ROOM, 12TH ST. AND BLUE ISLAND AVE.

fare registers, 200 Meaker fare registers, and cable car headlights. The cars on one line have self-oiling trolley wheels.

All the cars, except grip cars, have side bars made in the company's shops; another interesting safety device is the set of springs, invented by Mr. Roach, between the dashers of the grip and trail cars.

The shops of the West Side lines are located at Washington St. and Warren Ave., and comprise a carpenter shop, 332 x 125 ft.; wood working machine shop, 115 x 75 ft.; iron machine shop, 115 x 75 ft.; blacksmith shop, 64 x 32 ft.; brass foundry, 32 x 21 ft.; paint shop, 332 x 159 ft.; store rooms, 56 x 82 ft. and 33 x 52 ft.; office and stock rooms 58 x 33 ft.

The shops are equipped for general car repair and rebuilding work and constitute what are believed to be the largest street railway repair shops in the country, the total floor space under cover being nearly 1,600,000 sq. ft. In the wood machine shop are 3 circular saws, 1 shaper, 1 planer, 1 boring mill, 1 jig saw, 1 band saw, 1 molding machine, 1 router and 1 lathe. In the iron machine shop are 8 lathes, 2 boring mills, 2 drill presses, 3 planers, 2 nut and bolt machines, 1 punch and shear, 7 drills, 2 shapers, 1 wheel press and 1 Q & C rail saw. A large portion of this machinery was furnished by J. A. Fay & Egan.

A 50-h. p. 500-volt Siemens & Halske motor is installed for driving the iron working machinery and a similar motor for the wood shop. In the blacksmith shop are 9 forges, 2 blast furnaces and 2 steam hammers. Fans driven from the machine shop motor furnish air for the forges and furnaces. The brass foundry has four furnaces and here are made all the bearings and brass fittings used on the entire system. The tool room is very compact, and with the convenient checking system in use it is very easy to keep track of all the tools; the tool room is in charge of a man who makes light repairs and also electrical repairs.

All of the shops are lighted by electricity, except the paint shop, where gas is used; all of the buildings are heated by steam. The steam plant comprises four boilers and a 200-h. p. engine, which is not used since the motors have been installed.

Light running repairs are made at the operating car barns, of which there are 10, but all of these sub-stations are supplied with material from the main shops as occasion requires. This shop also makes all the power station machine repairs and supplies the labor and material for car house repairs. The track crossings used are also made here, but not the special work involving curves.

The superintendent of the shop is Mr. F. T. C. Brydges, who has designed a number of special tools and methods which enable work to be handled rapidly with a small force of men. An evidence of the efficiency of the management is the fact that only four men are required to make all the armature and field repairs in the 400 double motor equipment.

Recently the blacksmith shop has been kept busy making fenders. The method adopted for shaping the elements of the fenders is to heat the iron in the blast furnace and bend it around a former, where it is held in place by tongs till cool. Two men do this work very rapidly.

On the North Side there are six operating car barns and four storage barns. The operating barns are as follows: Clark St. and Sherman Place, Lincoln and Wrightwood Aves., Clybourn Ave. and Cooper St., Larrabee and Center Sts., Graceland and Southport Aves., Kroger and Center Sts. The storage barns are located at Center and Racine Sts., Sedgwick and Menominee, Belden and Racine and at the Clybourn Ave. station.

At the Larrabee St. barns is a gas plant, where the company makes the gas used for lighting its cable cars on the Pintsch system.

There are two repair shops, one at Fullerton and Sheffield Aves., occupying two buildings 246 x 150 ft. and 48 x 120 ft., and one near the Clark St. "Limits" station, at Clark St. and Dewey Court. The latter is the machine and iron working shop, where truck and motor repairs for the entire system are made. It is well equipped with the machine tools ordinarily found in shops, and in addition there are a number of special tools designed by Mr. V. T. Lynch, who has the supervision of this shop. Among these tools may be mentioned those for cutting and drilling gears and pinions, which are all made in this shop, and the key seating machine; these machines were illustrated in the "Review" for August, 1897. Visitors to these shops will also be interested in the cranes used for lifting motors from cars on the transfer tables. The equipment of these shops comprises: 6 drill presses, 1 planer, 6 lathes, 1 pattern lathe, 1 bolt machine, 1 milling machine, 1 shaper, 1 band saw, 2 gear cutting machines, 1 key seater, 1 armature testing machine for G. E. 800 motors, 1 7 x 12-in. air compressor, 1 fan, grindstones, emery wheels, etc. Much of this machinery as well as that in the wood shop was furnished by Fay & Co. The gear cutters, key seater and air compressor were made in the shop. The machinery is driven by electric motors.

The Fullerton Ave. shops comprise three buildings equipped with machinery for general carpenter work and car building; paint

BOILER ROOM, 12TH ST. AND BLUE ISLAND AVE.

shops and car washing and storage rooms occupy the lower floor of one building and the second stories of two. There is also a machine shop. The equipment comprises: 2 planers, 1 shaper, 1 band saw, 1 self-feed rip saw, 1 molder, 1 tenoning machine, 1 mortising machine, 1 cut-off saw, 1 double saw table in the wood shop; 4 lathes, 1 boring mill, 1 car wheel borer, 1 shaper, 1 bolt cutter, 3 drill presses, punch and shears, emery grinders, and air compresser in the machine shop; a complete outfit of tinsmith's tools in the tinshop; 3 forges and tools in the blacksmith shop and 2 furnaces in the molding room. There are four electric motors for driving the machinery; one 50-h. p. in the wood shop, one 40-h. p.

JAMES H. ECKLES,
Treasurer.

F. E. SMITH,
Auditor.

J. C. MOORE,
Secretary.

J. R. CHAPMAN,
Electrical Engineer.

in the machine shop, one 20-h. p. for the car elevator and one 1-h. p. for the blower.

The North Side lines have an equipment of 900 cars made by the Brownell, Stephenson, American, Wells & French and Pullman companies. There are 140 closed motor cars mounted on Brill and Peckham trucks and equipped with two G. E. 800 motors; 130 open motor cars mounted on Brill trucks with two G. E. 800 motors; 80 grip cars and 550 trail cars. The controllers used on the motor cars are the General Electric K2 and K11. Meaker fare registers are used.

There are some interesting pieces of special work to be found in the lines of the Union Traction, among which may be mentioned the double track acute angle crossing at Halsted and Clark St., which was built by the Johnson Co., and the loop at the "Limits" station, which was put in by the Paige Iron Works. At the corner of Washington and Jefferson Sts., two cable routes using the Washington St. tunnel diverge, and a switch operated by compressed air is installed; a single movement of a lever in the switch tower throws both the rail switch and the cable switch; this switch was built in 1890 by Wm. Wharton, Jr. & Co.; the compressor is driven from a shaft in the cable vault.

Jesse Spalding, who was chosen president of the Chicago Union Traction Co., in July, 1899, was born in Bradford County, Pa., April 15, 1837. His early life was spent in the lumber trade, first in rafting logs, then in buying timber for his employers, and finally in buying and shipping for himself. He was very successful in this business, soon acquiring considerable capital, which he invested in the formation of various lumber syndicates and navigation companies. In the counsels of the Republican party, Mr. Spalding has always taken a prominent part, and has several times been a candidate on the Republican ticket. He has also been closely connected with the mercantile and social interests of Chicago, is a director in the Commercial National, Garden City and Hibernian banks, and president of the Spalding Lumber Co.

John M. Roach, who has been the right-hand man of Mr. Yerkes in his many Chicago railway enterprises, needs no introduction to the street railway fraternity. For over a quarter of a century he has been associated with railway interests in Chicago, advancing rapidly from one position of trust to higher ones, until now he fills the office of manager of one of the largest and best developed systems in the country. He commenced his career in 1872, as a conductor on the North Chicago City Ry., but his ambition and ability allowed him to stay in this lowly position but a short time. His qualities were recognized at once by his superiors, and he was rapidly advanced to cashier, purchasing agent, superintendent and finally general manager. He has retained this office through all the change of administration, and as new extensions were built and new lines taken in by consolidation, they were at once put under his charge. He is now general manager of the Chicago Union Traction Co., and president of the Suburban Railroad Co.

Geo. A. Yuille, assistant general manager of the Chicago Union Traction system is a native of Wisconsin, born in 1861. He has been a resident of Chicago for 18 years, and associated with the West Side street railway lines since January, 1894.

F. E. Smith, auditor of the Chicago Union Traction Co., was born at Norwalk, Conn., Mar. 15, 1857. His first railroad experience was as chief clerk at the local freight station of the New York & New England R. R. at New Britain, Conn., in 1882. He afterwards filled positions as contracting agent of the Union Pacific Ry. in the Boston office; as auditor of the Connoton Valley Railway Co. at Canton, O.; as chief clerk in the auditor's office of the Cleveland, Akron & Columbus Ry. at Akron, O., and as auditor of the Zanesville & Ohio River Ry. at Zanesville, O. On May 1, 1894, he was appointed auditor of the Lynn & Boston Railroad Co., which position he occupied until this property was taken over by the Massachusetts Electric Companies. June 1st of this year he was appointed auditor of the Massachusetts Electric Companies, which position he resigned July 1st to accept his present duties. Mr. Smith was one of the prominent organizers of the Accountants' Association, and holds the office of 3d vice-president in that organization.

James R. Chapman, was born and educated in Boston, Mass. In 1872, having taken a course in civil engineering, he commenced his practical work, as rodman on the Portland & Ogdensburg R. R. He followed steam railroad construction for 16 years, but in 1888 went to Kansas City, and became interested in street railway work; in 1891 he went to Grand Rapids, Mich., to superintend the changing of the cable and horse lines to electricity. Mr. Chapman's Chicago career began in 1894 and since that date he has been very closely identified with the development of the transportation systems of the city, as chief engineer not only for the North and West Side surface lines, but also for three of the elevated roads. The electrical equipment of all these lines was installed under his supervision. He is now electrical engineer for the Chicago Union Traction Co., the Suburban Railroad Co., the Lake Street Elevated, the Union Elevated and the Northwestern Elevated.

MOUTH OF CHICAGO RIVER.

Chicago Consolidated Traction Co.

In developing the transportation systems of Chicago Mr. Yerkes found it convenient to prosecute the work by organizing a number of suburban companies. Eight of these companies were consolidated in February, 1899, and the properties are now operated by the Chicago Consolidated Traction Co. This company was chartered Jan. 28, 1899.

The companies thus consolidated have an aggregate of 203.97 miles of track and are:

The Cicero & Proviso Street Railway Co., chartered Feb. 15, 1899, which operated lines in the towns of Cicero and Proviso, connect

CHARLES T. YERKES,
President Chicago Consolidated Traction and Union Elevated Railroad Cos.

ing with the West Chicago at West 40th and Madison Sts., and also had lines on Lake St., Fifth Ave., Chicago Ave. and other streets in Chicago; this company had about 50 miles of track.

The Chicago & Jefferson Urban Transit Co., chartered Oct. 8, 1890, which owned lines from Canal and Monroe Sts. (just west of the river) to Fulton St. and Western Ave., and on Chicago Ave., between Kedzie and Crawford Aves., making in all 7.7 miles of track; this road went into operation March, 1896.

The Chicago North Shore Street Railway Co., chartered Apr. 15, 1891, to build a line from Chicago to Evanston; it owns 17 miles of track. The property was leased in October, 1894, to the North Chicago Electric Railway Co., the road was opened for traffic June 10, 1894, and connects with the North Side cable lines.

The Ogden Street Railway Co., incorporated Oct. 1, 1891, which operated 15 miles of track in the western part of the city connecting with the West Chicago at Madison and West 40th Sts., and Ogden Ave. and West 40th; this company had 36 miles of track.

The Chicago Electric Transit Co., chartered Apr. 26, 1893, and opened for traffic Dec. 26, 1894; this company owned 37 miles of single track electric lines in the northwestern part of the city.

The North Chicago Electric Street Railway Co., incorporated June 19, 1893, which had about 42.5 miles of track in the northwestern portion of the city. As stated, this company leased the Chicago & North Shore property.

The Evanston Electric Railway Co., incorporated Oct. 1895, which owned 2.75 miles of track in Evanston.

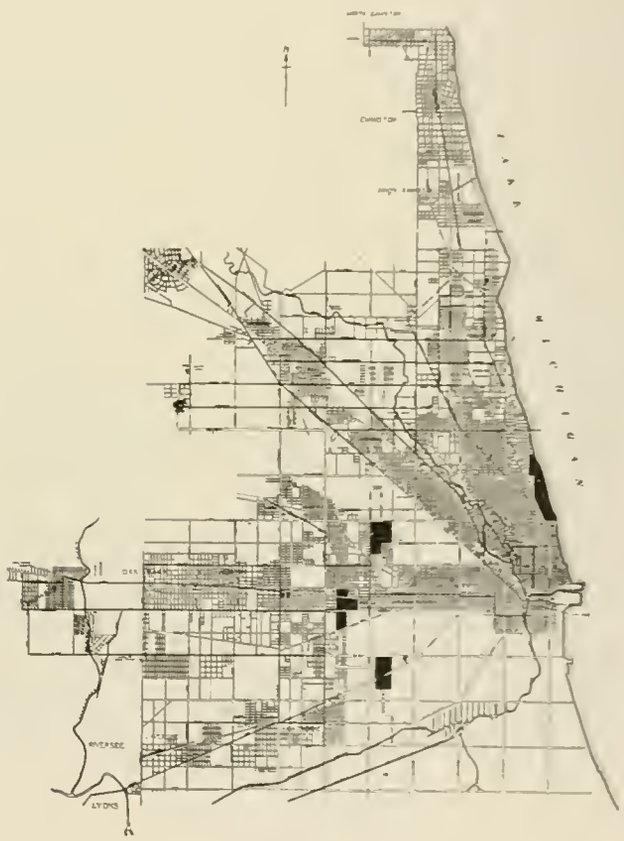
The North Side Electric Street Railway Co., incorporated Feb. 28, 1894, and began operating Jan. 16, 1896, which had 7.63 miles of track extending northwest near the Chicago River, from Kinzie St. to Clybourn Place.

The power houses of this company are three in number, the largest being the California Ave. plant at California Ave. and Roscoe Boulevard. This station was the first of the three large Yerkes electric power houses to be completed; work on it was begun in June, 1894, and current supplied to some of the North Side lines by January, 1895. This plant is 7½ miles from the heart of the city and supplies all the lines in the northwest portion of the territory covered, down to within three miles of the down town district. It was built by the Chicago Electric Transit Co., one of the subsidiary Yerkes companies, but now may be considered as belonging to the Consolidated Traction. It is the first direct connected electric railway plant built in Chicago. The building is a handsome brick structure, trimmed with stone and is fireproof. The roof is of corrugated iron; the boiler room is of concrete carried on brick arches and the engine room floor is of steel plates.

The main dimensions are 245 x 122½ ft., and it is 36 ft. from floor to eaves. Half the building is boiler room and the other half engine room, making the dimensions of each 245 x 61 ft. Originally there were four 1,000-h. p. direct connected engines. A 1,200-h. p. compound engine was removed from the power station of the Chicago North Shore road in 1898 and is now in this station, making five engines. There is room for one more unit.

The building has a basement 10 ft. deep under the entire floor, that under the engine room being taken up by pipes, wires and condensers, and that under the boilers receiving the ashes. The steam plant consists of ten 300 h. p. water tube boilers and these are equipped with 20 smokeless furnaces. In connection with the furnaces there are storage bins, conveyors and chutes, which deliver the coal into the furnace magazines from which it is fed automatically into grates, and the furnaces are so arranged that the ash and clinker is sifted and ground automatically into the ash pits which also are fitted with conveyors, so the process of supplying the coal feeding the furnaces and cleaning out the ash and clinkers is constantly going on automatically.

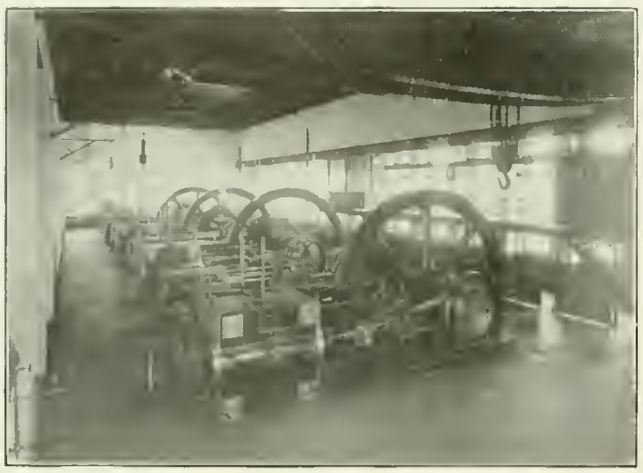
The coal conveying system was put in by the Borden & Selleck Co. of Chicago and is the first plant of the kind in the west. In connection with this a 2,000-ton coal storage house, 200 x 20 ft. and



LINES OF THE CHICAGO CONSOLIDATED TRACTION CO.

20 ft. high is built some distance back of the parallel with the boiler room. Each wagon of coal is weighed on entering the yard and is then driven to one corner of the coal storage house. Here arrangements are made for dumping it. The load when dumped takes one of two courses. It either is raised and distributed by conveyors along the length of the storage, or it is raised 20 ft. and taken across the alley and distributed in bins above the furnaces. From the

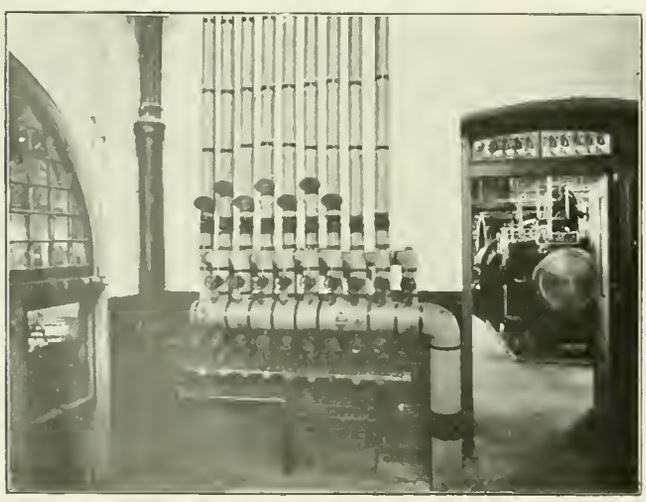
latter place it is fed by chutes to the furnaces. These bins have 400 tons capacity. Of course arrangements are made for conveying from the storage to the boiler room bins. The whole set of conveyors is run by a 40-h. p. electric motor. The capacity of the conveying system is 40 tons per hour. The Harrison noiseless conveyor is used.



ENGINE ROOM, CALIFORNIA AVE. STATION.

An oil burning equipment is also provided and there are tanks for storing 1,000 gallons of oil. To feed the boilers Admirality feed pumps are supplemented with Metropolitan injectors and exhaust feed water heaters. All steam piping is under the floor and 17 Westinghouse steam loops installed by Westinghouse, Church, Kerr & Co. act as separators, and return to the boilers water condensed in the steam piping. One of the illustrations shows the loop at the Cicero & Proviso station.

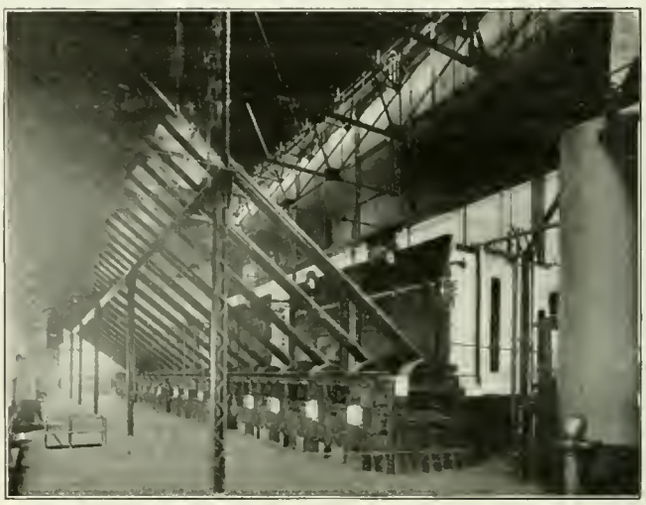
The station is located on the Chicago River and jet condensers are employed. There are four 1,000-h. p. cross compound condensing engines with 24 and 40 by 48 in. cylinders. They are direct connected to Siemens & Halske generators. The armatures of these machines revolve outside the fields. The weight of the armatures is 12 tons. The fly-wheel is 20 ft. in diameter. The piping is, of course, arranged to run the engines condensing or non-condensing and to run high pressure in both engine cylinders in emergency



WESTINGHOUSE STEAM LOOP MANIFOLD, CICERO & PROVISO STATION.

cases. The stack is 14 ft. square inside and 200 ft. high. As the Chicago River is a navigable stream at this point the feeders running east had to be put through a tunnel under the river. The tunnel is 12 ft. high, 6 ft. wide and 289 ft. long, the feeders entering it through the vertical shafts at each end. Feeders going south and west leave the station on very heavy overhead lines. The switchboard panels are the General Electric standard railway type. The generator board is on the main floor, and the feeder board of 40

Compressed air is also used for cleaning armatures and switchboard panels on a gallery. A 20-ton Walker hand power crane travels the length of the engine room. An automatic air pressure oiling system furnished by Wilson, Whiting & Davis, of New York, is used whereby the oil is forced to the bearings on the various machines by compressed air. One valve controls all the oil cups on a unit.



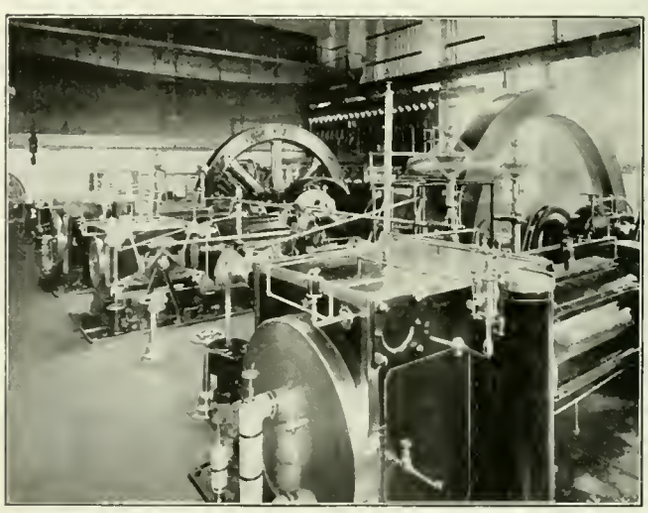
BOILER ROOM, CALIFORNIA AVE. STATION.

Air pumps made by the Crane Co. of Chicago furnish the supply.

The Cicero & Proviso station on the corner of Lake St. and Harvey Ave., midway between Austin and Oak Park was originally built in 1890 and was equipped with one 250-h. p. high speed engine and one 250-h. p. corliss belted to four 80-kw. dynamos; afterwards a 500-h. p. Corliss engine and two 200-kw. generators were added. This plant was soon outgrown and in 1894 a new building was erected adjoining the old one, and the latter no longer used. This station was built for an ultimate capacity of 5,000-h. p. There are now two 1,000-h. p. Allis compound engines with cylinders 24 and 40 x 48 in. These are each direct conected to 750-kw. Siemens-Halske generators.

There are eight 300-h. p. boilers set with smokeless furnaces. Feed water heaters are used.

The power house of what was formerly the Chicago North Shore



ENGINE ROOM, CICERO & PROVISO STATION.

road is located at Edgewater and was built in 1892. Originally three simple engines were installed; one of 600 h. p. with cylinder 24 x 30 in. running at 110 r. p. m. with steam at 80 lb., connected by a rope drive to a 300-kw. four-pole generator, and two 400-h. p. engines connected to one shaft on which is mounted a fly-wheel with rope drives to two 300-kw. generators. In 1896 a 1,200-h. p. compound engine with cylinders 24 and 48 x 48 in. was added, but in 1898 this unit was removed to the California Ave. station. This

engine is direct connected to a 12 pole Siemens-Halske generator.

The boiler room at this station has four water tube boilers. The boilers are fitted for using either coal or oil as fuel; which is used is governed by the market.

The outside dimensions of this building are 150 x 220 ft., the south portion of it is divided into two large rooms for the storage of cars. This station is now operated only on heavy days or in emergencies.

The track and overhead work of these lines, being under the direction of the same men is similar to that of electric lines of the Union Traction. The company has recently bought a cast-welding outfit from the Falk Co. and will weld all of its track.

The officers of the Chicago Consolidated Traction Co. are: President, Charles T. Yerkes; vice-president, L. S. Owsley; secretary and treasurer, Charles F. Marlow.

Charles T. Yerkes, who is perhaps, entitled to be called the foremost street railway financier of the world, was born in Philadelphia, June 25, 1837, of Quaker parents, and his early life was spent in that city under Quaker influences. Until 1881, he devoted his energies exclusively to a banking and brokerage business, but at that time, having opened a branch of his Philadelphia banking establishment in Chicago, he conceived the idea of gaining control of the street railway transportation systems of the latter city, the possibilities of improvement and extension appealing to him with irrestible force. In 1886 he succeeded in gaining control of the North Side lines and reorganized the company as the North Chicago Street Railroad Co. In spite of powerful opposition he carried out his plans for changing the motive power from horse to cable and also gained permission to use the—until then—almost useless La Salle St. tunnel, which he rebuilt to conform to the requirements of his cable system. Two years later he obtained control of the west side lines. Next came the substitution of cable and electricity for the horse on all trunk lines and the extension of lines out across the prairies. After these lines had all been completed and perfected, Mr. Yerkes still sought new fields to conquer, and turned his attention to the elevated roads. His fight for the elevated loop, which has given the residents of Chicago the finest service of the kind in the world, is unique in transportation annals. And these achievements are all the more remarkable when it is remembered that there is probably not a man in Chicago who has been so much maligned and opposed by the press and hindered in his work by political schemers as Mr. Yerkes. Hardly one of his projects for the improvement of the street railway facilities of the city has been allowed to go through without a storm of protest from press and public. Yet through all this Mr. Yerkes has maintained a dignified and unshaken position, quietly carrying his plans through, in spite of obstacles, and he now has the satisfaction of knowing that Chicago is beginning to realize what he has done for the city.

Charles F. Marlow, secretary and treasurer of the Chicago Consolidated Traction Co. and treasurer of the Suburban Railroad Co., was born in Philadelphia Jan. 15, 1864. In September, 1896, he came to Chicago, becoming associated upon his arrival with the Siemens-Halske Electric Co. as assistant secretary and treasurer. In December, 1898, he resigned to become auditor of the Yerkes system of surface and elevated lines, taking his present position with the Consolidated in February last when the consolidation of the various companies was effected. Prior to coming to this city Mr. Marlow had been for a number of years in the freight claim department of the Pennsylvania system at Philadelphia. In July last, owing to the resignation of Mr. L. S. Owsley as treasurer of the Suburban Railroad Co., he succeeded that gentleman.

L. S. OWSLEY,
Vice-President.

C. F. MARLOW,
Secretary and Treasurer.

Chicago General Railway Co.

The Chicago General Railway Co., was incorporated Oct. 21, 1893, under the general railroad law of Illinois and soon thereafter leased all the property of the West & South Towns Street Railway Co., which had been incorporated by the same parties Aug. 22, 1891, as the West & South Towns Horse Railway Co., under the horse and dummy law. In May, 1897, the two companies were formally consolidated.

The General Ry. at the present time owns 26½ miles of track (measured as single track), including the right, under leases, to operate its cars over the East 22d St. lines of the Chicago City Ry. and also the Stock Yards line south of Archer Ave.

The power plant, car house and shops are at 30th St. and Kedzie Ave.; the yards and buildings cover 6 2-3 acres and the buildings were all designed with the idea of providing for future as well as the present requirements. In the power house are two 400-kw. General Electric generators, Bates engines aggregating 1,200 h. p., boilers of 1,200 nominal h. p.

The rolling stock comprises 30 motor cars and 2 horse cars; of these 20 are mounted on single and 10 on double Peckham trucks. The company has 25 double equipments of 50-h. p. General Electric motors.

This company recently introduced a graded fare system by selling 12 rides for 25 cents on branch lines without transfer and 6 rides for 25 cents on all lines with transfer, the single fare being 5 cents.

The officers and operating staff of the company are: President, J. H. Witbeck; vice-president, Chas. L. Bonney; secretary, J. I. Jones; treasurer, Lawton C. Bonney; purchasing agent, C. L. Hull; electrician, Geo. W. Botham; engineer, John W. Ewald.

C. L. BONNEY,
Vice-President.

L. C. BONNEY,
Treasurer.

J. I. JONES,
Secretary.

Calumet Electric Street Railway Co.

The Calumet Electric Street Ry. is one of the most promising street railway properties in the country, as it covers a very large area in a portion of the city that is rapidly increasing in population. While we have classed the Calumet as an interurban line, out of compliment to Pullman, West Pullman, Washington Heights, South Chicago and the 24 other towns which it connects with 63d St., Chicago, nearly all the territory served by the road is within the present city limits of Chicago, except the town of Roby, Ind. The road may properly be called an interstate line.

The company was incorporated May 17, 1890, the organizers being N. K. Fairbanks, J. D. Harvey, Samuel E. Gross, W. V. Jacobs and O. S. Gaither, and acquired franchises for the principal streets south of 63d St. A great deal of construction work was done between 1892 and 1895, and the necessary bond issues were carried by the National Bank of Illinois, which at the time of its failure in December, 1896, held nearly all the outstanding obligations of the Calumet company. In April, 1897, John C. McKeon, receiver of the bank, was appointed receiver of the Calumet; in January, 1898, Mr. McKeon resigned both positions, and was succeeded by Gen. John McNulta, in whose hands the road now is.

The road has 80 miles of single track and leases three miles from the Chicago Electric Traction Co.; the territory covered is 65 square miles. It has 137 motor cars and 85 trail cars built by the American, Pullman, Lamokin and St. Louis car companies, 90 double motor equipments, G. E., T. H., Steel and Detroit, and 175 McGuire and 5 Peckham trucks; the minor car equipment includes New Haven double fare registers. For handling snow the company has a Brill plow and a McGuire sweeper.

The power house at 93d St. and Drexel Ave., has a capacity of 1,500 kw. The equipment comprises one Buckeye compound condensing engine direct connected to a General Electric 500-kw. generator and four Ball compound condensing engines belted to Walker 250-kw. machines. One of these machines is utilized as a booster when needed. The boilers comprise eight water tube boilers, five equipped with mechanical stokers and three with shaking grates.

For cooling condensing water for re-use there is a reservoir 80 x 200 ft. and 6½ ft. deep with wooden cooling tables, giving an area of about 25,000 sq. ft.

On property contiguous to the power house are three car barns which, with sheds adjoining, have capacity for all the cars. At the rear of one of the large barns is the repair shop with nine tracks.

The road connects with the South Side Elevated and the Chicago City lines at three points on 63d St. At one of these, Stony Island Ave., a large and handsome terminal station equipped with elevators for transportating passengers to the elevated road has been erected.

The officers and staff are: Receiver, John McNulta; president, John Farson; general manager, H. M. Sloan; secretary, H. B. White; auditor, E. H. Harrison; engineer, G. H. Binkley; master mechanic, W. A. Harding.

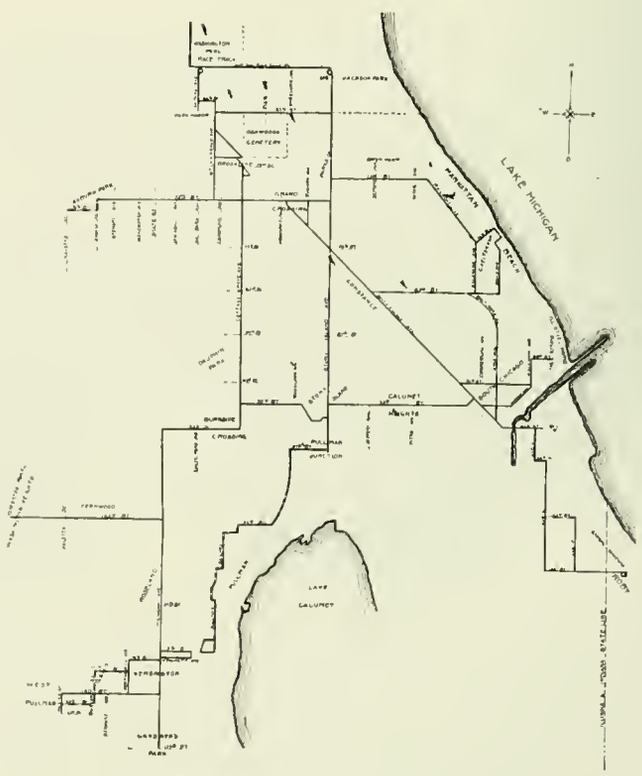
John Farson, president of the Calumet Street Railway Co., was born in Union City, Ind., Oct. 8, 1855. He went to Chicago in 1877 and studied law; was admitted to the bar in 1880, but soon gave up his practice and entered the banking business, accepting a place with Preston, Kean & Co. Mr. Farson remained with this firm until 1889, when he organized the firm of Farson, Leach & Co., of which he is now the head. He is a member of the Chicago Board of Trade and Stock Exchange, and a director and member of a number of prominent social and educational clubs.

H. M. Sloan, general manager of the Calumet Electric Street Ry., was born in 1857, at Pemberton, N. J., but his parents moved to Philadelphia when he was a child. He attended public schools until he was 18 years of age and afterward attended and was graduated from a Quaker seminary at Philadelphia. After graduating he entered the mill business, but in 1883, went west to Montana and engaged in cattle raising; while living in that state, he was elected to the legislature. In 1888 he went to St. Paul, accepting a position as inspector of cable road construction, and after this work was completed, he was made first foreman of cable lines, then assistant superintendent and then superintendent, which position he held when the road was equipped with electricity. Mr. Sloan left St. Paul when the systems in St. Paul and Minneapolis were consolidated and accepted an office with the street railway company at

JOHN FARSON,
President.

H. M. SLOAN,
General Manager.

W. A. HARDING,
Master Mechanic.



CALUMET ELECTRIC STREET RAILWAY.

West Superior, Wis., continuing this connection for 18 months, when in September, 1895, he became general manager of the Calumet Electric Street Railway Co.

William A. Harding was born in Bristol, England, in 1864, and was educated as a mechanical and electrical engineer in London. In 1882 he came to America and went into business in the Northwest Territory of Canada, in partnership with his father. A few years later he went to the Pacific Coast and engaged in electrical engineering work. In 1890 he became master mechanic and electrical engineer of the Calumet Electric Street Ry.

Suburban Railroad Co.

The Suburban Railroad is another of Mr. Yerkes' roads, a controlling interest having been acquired by him in July, 1897. The company was organized May 8, 1895, and a contract made with a specially organized construction company for building the road. Financial difficulties prevented the execution of this contract and the work was let to Naugle, Holcomb & Co., of Chicago, in November, 1896; this firm completed the construction of 17 miles of double track in July, 1897, and in the same month it was secured by the Yerkes' interests.

The company leased for 50 years from the Chicago & Northern Pacific R. R. 9 miles of double and 5¾ miles of single track and from the Wisconsin Central 1.7 miles of single track, which gives it two routes from the city west to the Desplaines River, and a line from the western terminal of the elevated roads southwest to the town of La Grange. A portion of the leased lines was equipped for electric traction and the company now operates 56 miles.

The future of this company is very promising, there being a population of about 200,000 people within easy reach of the road; there are three large cemeteries and a number of picnic grounds on the lines which further greatly increase the traffic. Power is supplied by one of the power houses of the Chicago Consolidated Traction Co. The company's own power house, which is not used at the present time, however, is at Harlem Ave. and 22d St.; the equipment of this station includes three 250-h. p. Stirling boilers, carrying steam at 125 lb., and two tandem compound condensing engines, 17½ and 33 by 48 in., and 12 and 22 by 48 in., direct connected to Walker generators of 250 kw. and 400 kw. capacity, respectively. The boilers are fitted with Mesner stokers. Deane jet condensors and pumps are used.

This station is the second street railway power plant at which a reservoir and cooling tables were installed to enable the condensing water to be used over and over again. The reservoir is 100 x 200 ft. and provides, including the tables, 36,500 sq. ft. of cooling surface. The water for the station is drawn from an 8-in. well, 185 ft. deep by a Pohle air lift; this is motor driven. The car house is near the power station and is a brick building 114 x 124 ft., with 10 tracks; at one end are the repair shops.

All of the new track was laid with 7 in. 70 lb. T rails in 60 ft lengths; cedar ties were used on tangents and oak ties on the curves. Much of the track is paved between the rails with cedar blocks, though it runs through open country. The trolley wires are No. 00 furnished by Washburn & Moen; the insulators, cars, etc., are all of the Ohio Brass Co. make.

The rolling stock of this road consists of 14 motor and 10 trail cars made by the Pullman company. The motor cars are 42 ft. 6 in. long, with closed vestibules at each end; the trailers are of the same dimensions, but not vestibuled. Each car has 24 double seats of the Hale & Kilburn walk-over pattern, spring-edged and rattan covered. The Gold hot water heaters are used.

The cars are mounted on McGuire No. 26 trucks with 5 ft. 6 in. wheel base, and 23 ft. between centers. The motors are Walker 50-h. p. one to each truck; the motors drive the forward axle of the forward truck and the rear axle of the rear truck. Each car has two trolley poles, the rear one only being used. The cars are equipped with air brakes and air compressors made by the Christensen Engineering Co., of Milwaukee; part are motor driven and part axle driven compressors.

C. S. LEEDS.
Secretary.

The officers of the Suburban Railroad Co. are: President, John M. Roach; secretary, C. S. Leeds; treasurer, C. F. Marlow; superintendent, J. J. Linden.

Chicago Electric Traction Co.

The Chicago Electric Traction Co. is the successor to the Englewood & Chicago Electric Railway Co., which was incorporated Jan. 11, 1893. In 1894 the company built about 1⅝ miles of track in 63d and 67th Sts., and connecting avenues, which is used jointly by the Calumet under a lease. Control of the bonds issued by the company was acquired by parties interested in the Electric Storage Battery Co., of Philadelphia, with the understanding that storage battery cars would be used. Nearly all the tributary territory is sparsely settled and the company became insolvent, and in January, 1897, G. Herbert Condiet, who had charge of the construction work, and later was general manager, was appointed receiver. The receiver operated the road until Oct. 12, 1897, when it was sold to J. S. Bache for $260,000; a reorganization was then effected under the name Chicago Electric Traction Co.

The company has 29½ miles of track, extending from South Park Ave. and 63d St., where it connects with the South Side Elevated and the Chicago City roads, south to Englewood, Washington Heights, Blue Island and Harvey, and a branch runs west from Morgan Ave. through to Morgan Park. There are several summer resorts and three cemeteries on the lines; a large summer traffic results from the former, and for the latter a special funeral car is operated. On the Morgan Park line is a grade of 9.3 per cent for 371 ft., and as this could not be surmounted with a 50-h. p. motor geared to one axle only, a Bronsdon counter weight system was installed similar to those at Providence and St. Paul, which have been described in the "Review."

The track was built by C. E. Loss & Co., and is of the very best construction, as this was essential to long life of the battery plates. The rails are 7-in. 80-lb. Johnson girders, laid on oak ties spaced 2 ft. c. to c. Tie plates are used; the joints are made with 6-bolt fish plates and a tie-rod is placed at every joint.

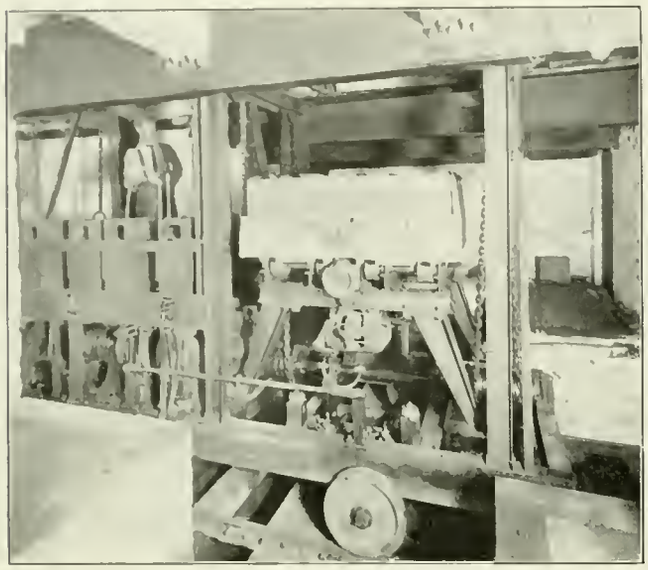
The rolling stock comprises 50 motor cars and 26 trailers, built by the St. Louis Car Co., and mounted on du Pont trucks, made by the Lorain Steel Co. Each motor car carries a battery tray containing 72 cells, 8 x 5 in. and 18 in. high; the batteries weigh 3½ tons, and can deliver 400 ampere at 150 volts. There is one 50-h. p. Walker motor suspended on the outside of the car axle.

The power station and car house are at 88th St. and Vincennes Road; this is convenient to the Rock Island tracks, over which coal is delivered to the station.

The car house first built is of brick, 175 x 102 ft., and at the front end is two stories high, the offices being on the second floor. Last summer a new car house of iron and steel construction, 100 x 100 ft., was built in the rear of the old one. The power station adjoins the brick car house, and is 73 ft long; the engine room extends across the front side of the building, and is 30 ft. wide; the boiler room back of it is 37 ft. wide.

The plant differs from other street railway stations in that the generators are not all of the same voltage, as it is necessary to have three circuits of different potential to charge the batteries properly. Four 6-pole, 190-kw. shunt wound Walker generators, with a variable voltage between 160 and 190 were installed. This

is the ultimate dynamo capacity of the station, the fourth machine being held in reserve. The dynamos are direct connected to two 250-h. p. Willans engines, built by the Bullock Manufacturing Co. These two engines are at either end of the room, and the design contemplated a third one, of 500 h. p. in the center. To give the most flexible arrangement the Arnold system, invented by Bion J.



BATTERY ELEVATOR.

Arnold, president of the Arnold Electric Power Station Co., was adopted. A solid shaft with couplings extends from one engine to the other. The armatures of the generators are fixed to quills, which are free to rotate about the solid shaft. This makes a very complete and compact engine generator installation, a 1,000-h. p. plant occupying a floor space only 12 x 50 ft. Each engine has two sets of cylinders, the cranks being at 180 degrees. The steam, entering the high pressure cylinder, from the steam chest, expands through the hollow piston rod into the receiver space below, ready to act on the following piston. An air cushion takes up the momentum of the moving parts and permits a speed of 380 r. p. m. without excessive noise or vibration. The speed is regulated by a throttle valve in the steam pipe controlled by a centrifugal shaft governor.

Just to the rear of the power units is the white marble switchboard, consisting of five panels, one for each generator and the

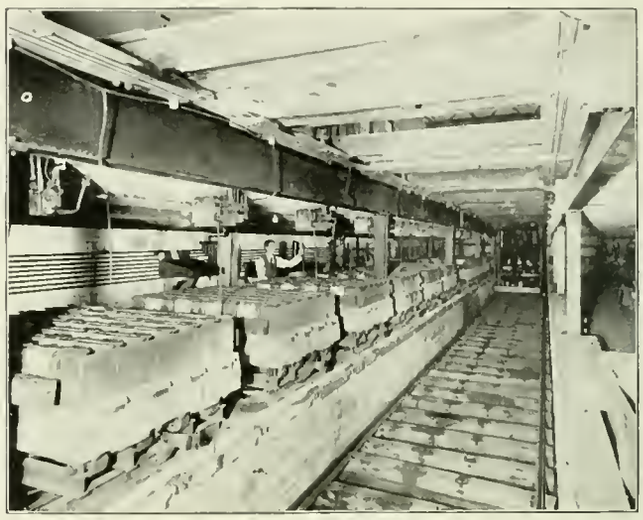
E. R. GILBERT,
General Manager.

A. E. DAVIES.
Superintendent.

fifth for the motor and auxiliary switches. There are four bus bars, the three lower ones being for the high, medium and low voltages and the top one the common negative bar.

Each panel has two switches, one for the negative lead of the generator after it has passed through a recording ammeter and circuit breaker, and the other switch can be turned through a semicircle making connection with any of the three positive bus bars. Weston illuminated dial ammeter and voltmeter and a resistance box for controlling the voltage are attached to each generator panel.

In the boiler room are three 200-h. p. Heine boilers fitted with Roney stokers; there is room for three more. A Green economizer with 102 tubes is installed. A Worthington cooling tower 12 ft. in diameter and 30 ft. high is located near the stack; in warm weather a large fan driven by a Siemens-Halske motor is operated in connection with the tower.



CHARGING TABLES.

One of the most interesting features of this road is the method of handling the car batteries. The charging tables are located in the basement of the car house; a traveling carriage with an elevator at each end runs in an alley way between the two charging tables. The elevators, the carriage and the shifting rolls for moving the battery trays about are driven by electric motors and the whole operation of removing a discharged battery and placing a fresh one under a car can be done in 50 seconds.

Each battery cell has nine plates 7¾ in. wide by 14⅜ in. long; five of these are negative of the "Chloride type, ¼ in. thick, and four positive of the "Tudor" or "Manchester" type 5-16 in. thick. The battery tray is covered by a loose fitting rubber crate, which prevents the electrolyte from splashing out of the jars. In charging the discharged battery is first connected to the 160-volt main with a current of 150 amperes flowing. The current decreases as the counter electro-motive force increases, and when the current diminishes to 30 amperes the battery is switched into the 172-volt circuit. The current jumps to 150 amperes and diminishes again, and then the terminals are transferred to the 176-volt circuit. This operation can be accomplished in about 40 minutes, although a slightly better battery efficiency is shown when the time is longer. For a more detailed description of this plant and data on performance see St. Ry. Rev. Feb., 1898, p. 73.

A sub-station was recently built at the Harvey terminus of the line, which is 13 miles from the 88th St. power station. The round trip of 26 miles is more than the batteries should be required to make in regular service, and the sub-station is for partially charging them at Harvey. This plant comprises a 50-h. p. Nash gas engine, using gasoline, a 40-kw. Eddy generator and a station battery. In the basement are charging tables and elevator.

The operating expenses of this road for 1898 were reported as 8.75 cents per car-mile, and we are advised that this figure has not shown any increase for the nine months of 1899.

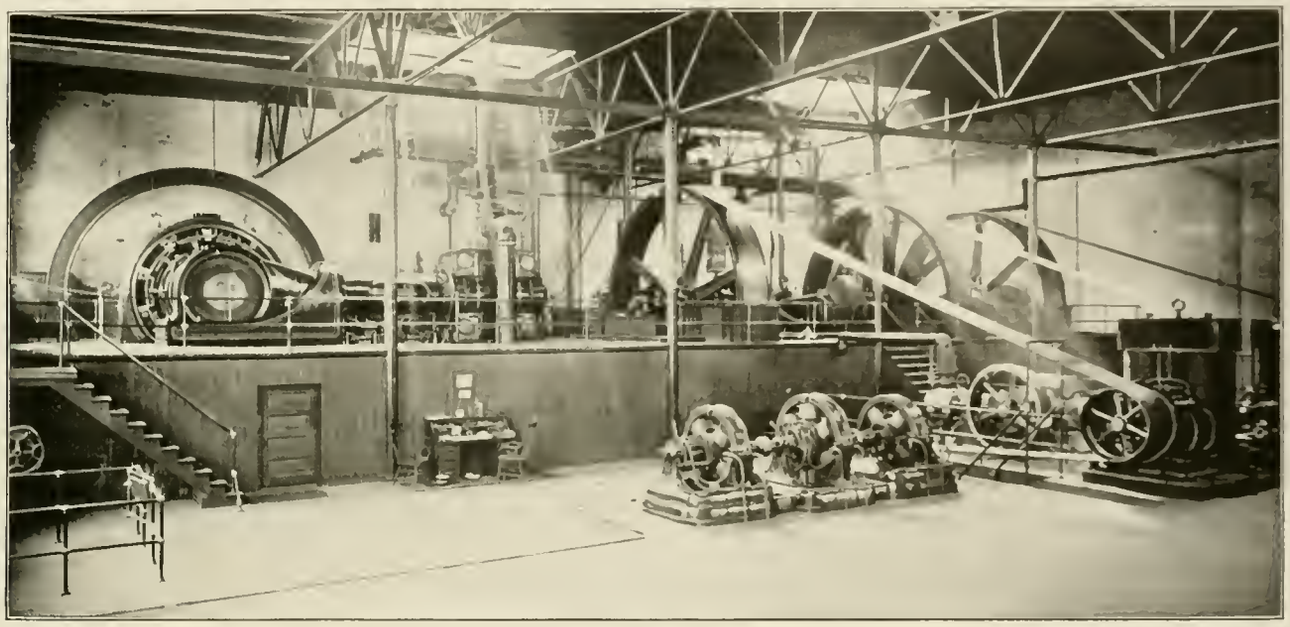
The officers of the company are: President, I. L. Rice; vice-president, H. Atkinson; general manager, E. R. Gilbert; treasurer, J. S. Bache; superintendent, A. E. Davies.

E. R. Gilbert, general manager of the Chicago Electric Traction Co., has been connected with electric street railways almost from the beginning of his business career, paying particular attention in recent years to the application of storage batteries to street car locomotion. He began work as a shop hand in the factory of the Eddy Electric Manufacturing Co., of Hartford, Conn., his native city, but soon pushed himself forward to more responsible positions. He was finally made manager of the Boston office of this

concern. Receiving an offer from the Hartford Street Ry., he resigned from the Eddy company, taking up the duties of purchasing agent for the Hartford system, and continuing in this capacity until asked to go to Philadelphia as manager of the Holmesburg, Tacony & Frankford Electric Street Ry., which he did. When Mr. Conduct resigned as manager of the Englewood & Chicago Electric Railway Co. Mr. Gilbert was called to Chicago to fill his place with the reorganized company, and has remained in this position ever since, the road under his management enjoying a period of marked prosperity.

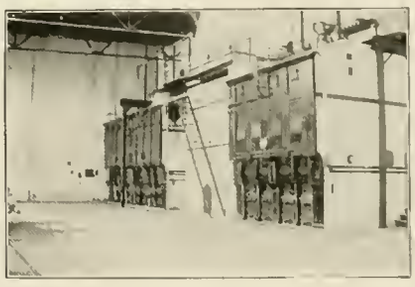
South Chicago City Railway Co.

The South Chicago City Railway Co. was incorporated May 31, 1883, as the Ewing Avenue Horse Railway Co., the name being changed in 1885. The old company had a few miles of track in South Chicago which was operated by horses until permission to use electricity and also franchises for a large number of other streets were secured in 1891 and 1892. This company now has 35 miles of electric road with a northern terminus at 63d St. and Madison Ave. where connection is made with the Chicago City and the South Side Elevated; its principal line runs from 63d St. to Roby, Ind., eight miles, and is quite close to the lake shore.



ENGINE AND DYNAMO ROOM—SOUTH CHICAGO CITY RAILWAY CO.

The Hammond, Whiting & East Chicago Railway Co. was chartered in 1892, to build an electric road connecting these Indiana towns; 12 miles of single track was built, including a line from Roby to Whiting. In 1896 a controlling interest was bought by parties controlling the South Chicago City road, and the two have since been operated as one.



BOILER ROOM.

The combined mileage of these two companies is now 57½ miles, all operated from the power house of the South Chicago City company at South Chicago. This plant is on Ewing Ave. near the 92d St. Bridge, and is equipped with three Allis engines, 22 x 48 in. belt connected to three Edison 200-kw. generators, one compound engine, 20 and 48 x 48 in., direct connected to a 500-kw. Westinghouse generator and one Ideal engine direct connected to a 65 kw. Mather generator; in the boiler room, which is 60 x 100 ft., are three 350 h. p. Stirling boilers. The large engine has jacketed cylinders and a superheating receiver, all of them, except the Ideal, have belted condensers. Between the low pressure cylinder and condenser of the compound is a closed feed water heater. There is also a Green economizer. There is also an interesting booster installation at this station; two 50-kw. General Electric multipolar, series boosters are direct connected to a 150-h. p. multipolar shunt-wound motor. These three machines are well shown in the illustration. The Hammond end of the line is 9½ miles from the power station.

The rolling stock comprises 74 motor and 53 trail cars built by the St. Louis, Brownell and Pullman companies. The motor cars are mounted on McGuire and Peckham trucks and fitted with Westinghouse motors.

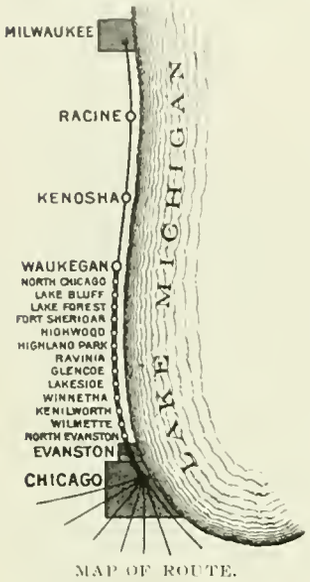
WILLIAM WALMSLEY.
Superintendent.

EDWIN JOWETT.
Chief Eng'r of Station.

The officers and staff of the company are: President, D. F. Cameron; vice-president, D. M. Cummings; secretary, treasurer and purchasing agent, O. S. Gaither; superintendent, William Walmsley; chief engineer of power station, Edwin Jowett.

The Chicago & Milwaukee Electric Railway.

The opening a few weeks ago of the entire section of the Chicago & Milwaukee Ry. between Evanston and Waukegan, a distance of 27 miles, marks the introduction of a new system of electrical distribution for long-distance interurban railways combining both direct and alternating current transmissions and auxiliary storage batteries to take care of the temporary heavy loads. This system was worked out by Mr. Bion J. Arnold four years ago while acting as consulting engineer for a long-distance, high-speed line, and may be summarized as follows: The road is divided into sections and at about the middle of each section, except that one contiguous to the power house, is located a sub-station containing an equipment of transformers and rotary converters and a storage battery auxiliary. These sub-stations receive their energy through a 3-phase transmission line from high tension alternating current generators in the main power house, which also contains sufficient direct current machinery to feed the section of the road adjacent to it. This arrangement presents so many economies over the ordinary direct current system of distribution for long distances that when Mr. Arnold was called in as consulting engineer for the Chicago & Milwaukee Electric Railway Co. he advised this system, and the first section of the road, which was built between Highland Park and Waukegan, by C. E. Loss & Co., was equipped according to this plan. For this section a power house was built at Highwood containing one 5,500-volt alternator, and a sub-station at North Chicago containing one rotary converter and without a storage battery. The equipment of this first section was of a temporary nature and was more or less incomplete. The line was about 15 miles long with a single track, but it proved successful and thoroughly convinced Mr. Arnold of the advantages of this system.



MAP OF ROUTE.

With the extension of the railway to Evanston and the completion of the plans came a change of management of the road, and considerable opposition to the alternating current was evinced by the new management, and in order to complete the work along the lines originally laid out the Arnold Electric Power Station Co. submitted a proposition to carry out the work under a guarantee that the operation of the road would reach a certain specified efficiency. It was under this condition that the Arnold company was awarded the contract for the extension of the road with the exception of the rolling stock and track.

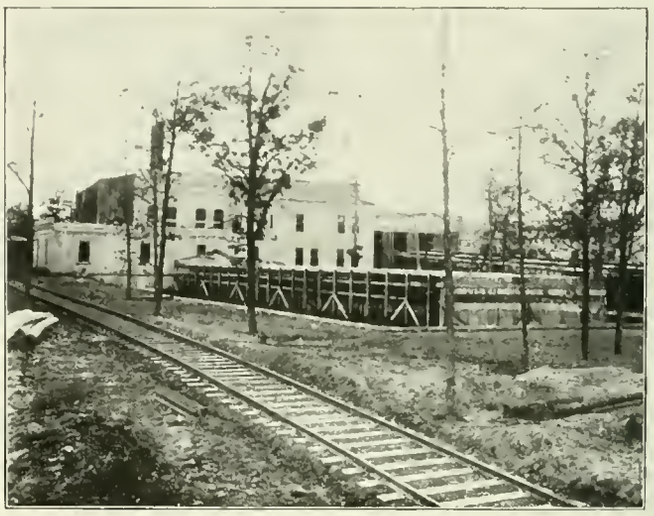


FIG. 1—POWER HOUSE, HIGHWOOD.

This included engine, batteries, direct current and alternating current generators, switchboards, transformers, rotary converters, economizer, pumps, mechanical draft apparatus, condensers, piping, cooling table and reservoir, power house building, two sub-station

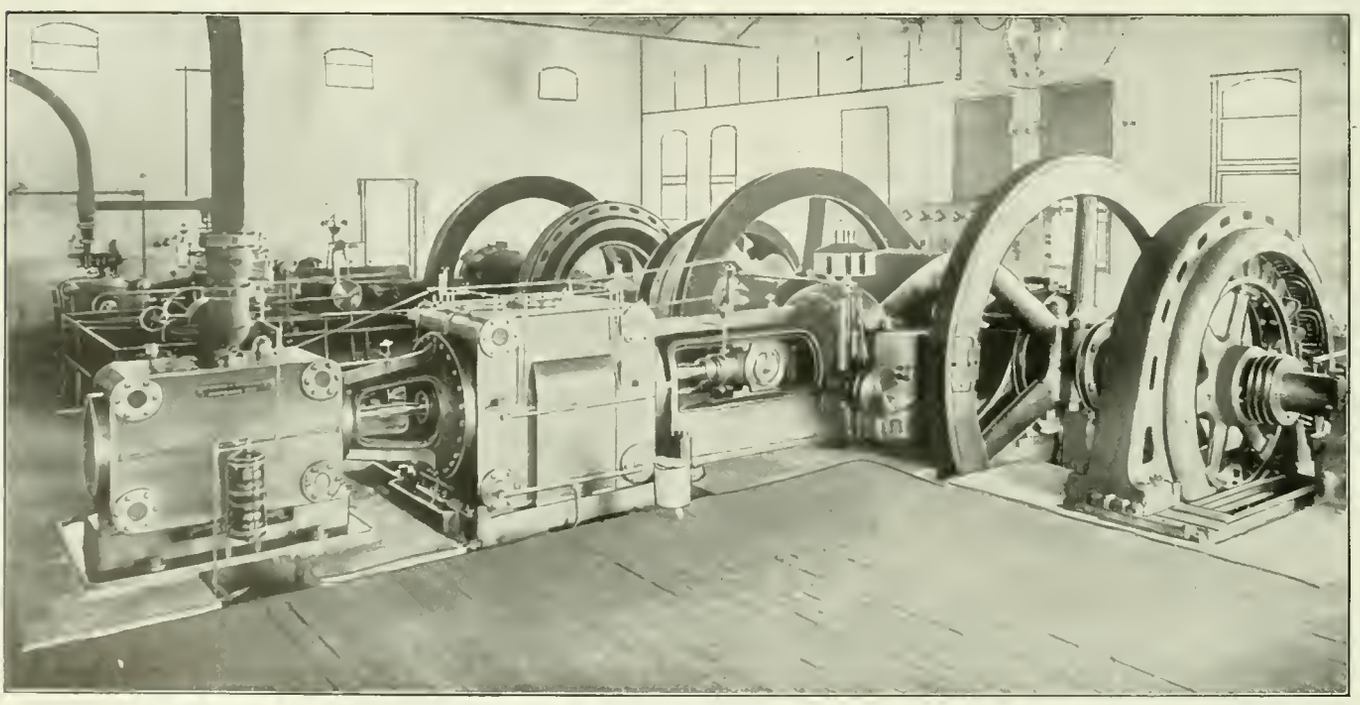
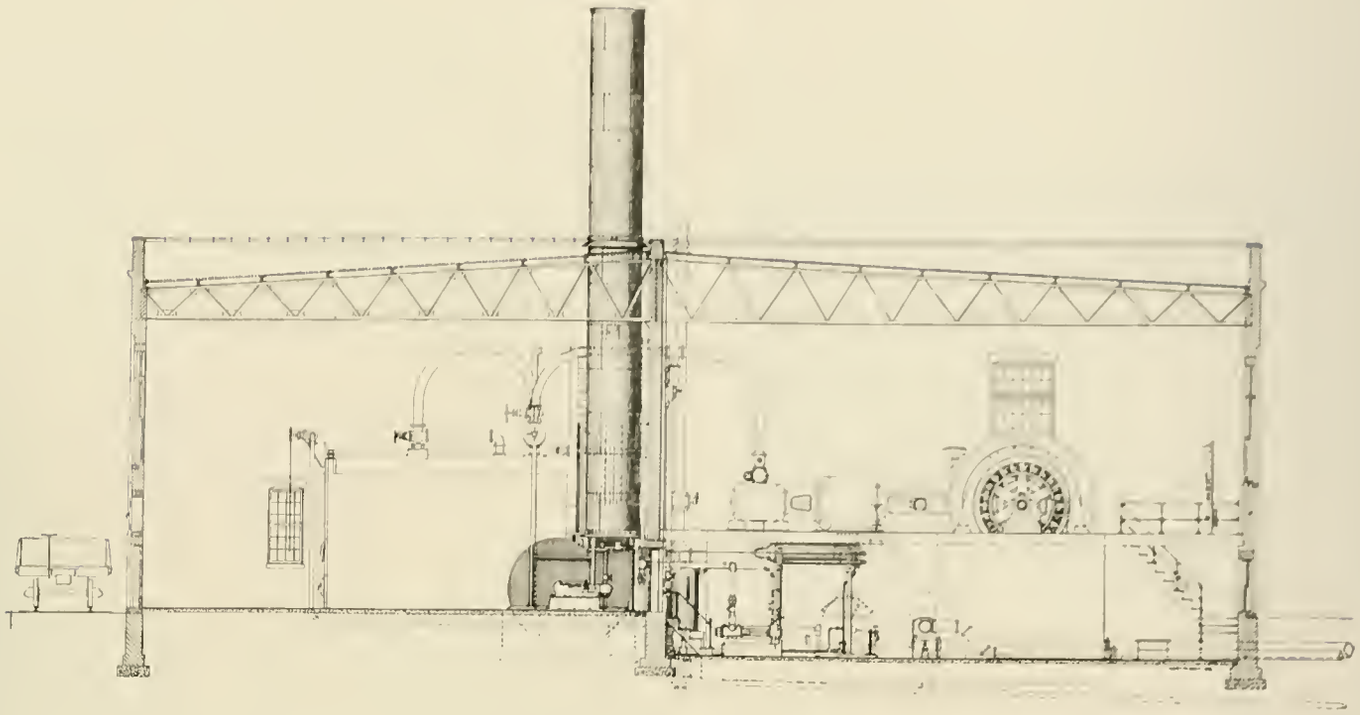


FIG. 3—ENGINE ROOM, HIGHWOOD—FILER & STOWELL ENGINES.



CROSS SECTION OF POWER STATION.

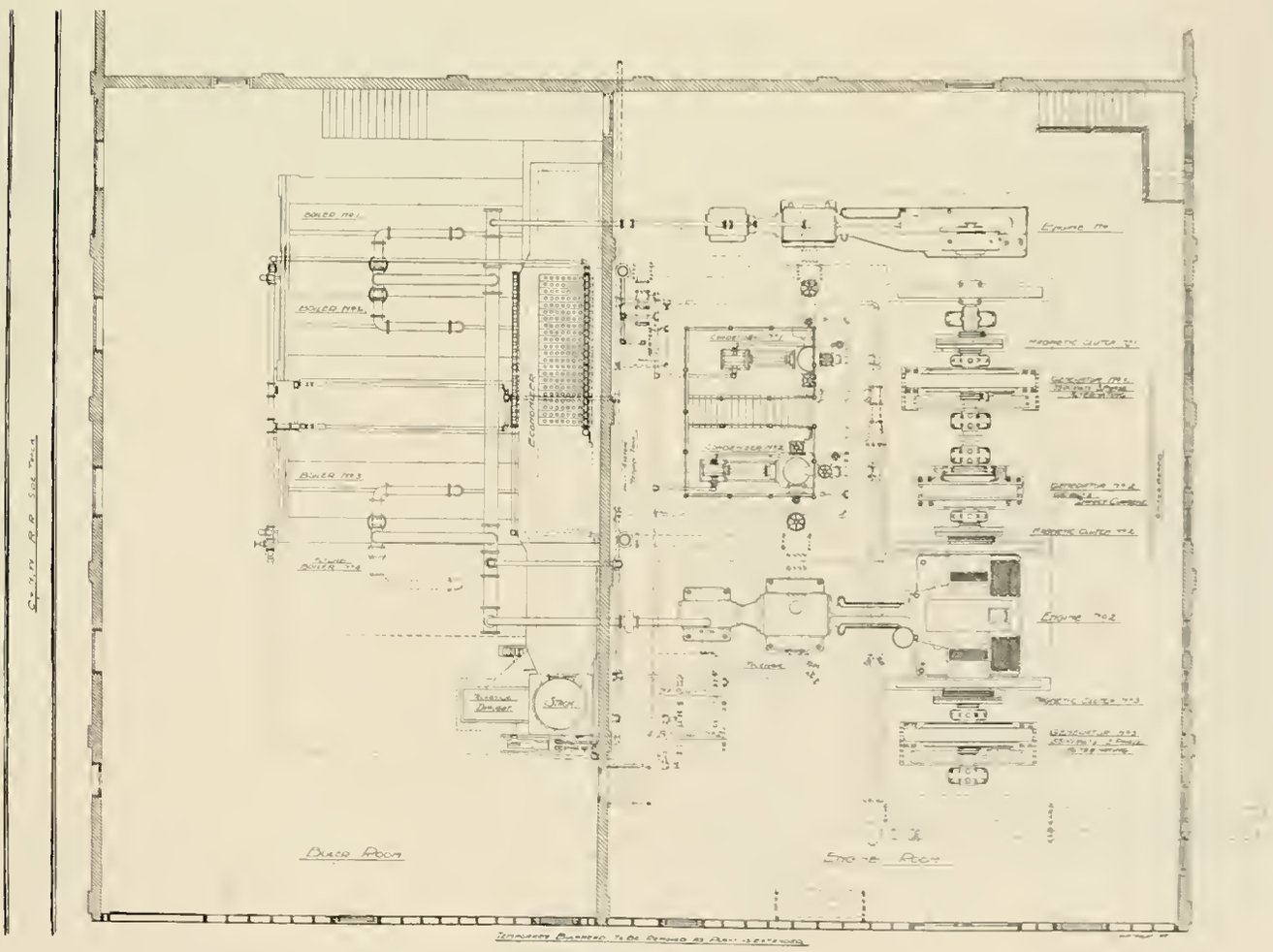


FIG. 2 PLAN OF POWER STATION AT HIGHWOOD.

buildings, car barns, offices and overhead equipment, all to be complete ready for operation.

The policy of the Arnold company of working out its own solution of the engineering problems and submitting plans and specifications with its proposition, together with an economy guarantee covering the entire installation, makes this contract a notable one;

and it is to be remarked that throughout the work upon this road the most pleasant relations have existed between the officers of the road and the Arnold company.

The route of the Chicago & Milwaukee road runs through a chain of charming suburban towns and country residence districts lying along the lake shore north of Evanston. Starting at the latter place the line runs practically north throughout its entire length, and after reaching Wilmette, the first town north of Evanston, the road makes a detour to the west where it approaches the tracks of the Chicago & Northwestern R. R. and from here passes over its private right of way through Kenilworth, Winnetka, Lake Side, Glencoe, Ravina and Highland Park, at which place it emerges upon the public highway. This section is double tracked and comprises the extension which has recently been completed. Continuing from Highland Park the single track line passes through Highwood, Fort Sheridan, Lake Forest, Lake Bluff, North Chicago and Waukegan, its present terminus, the entire line closely paralleling the tracks of the C. & N. W. R. R.

The roadbed was built by the North American Railway Construction Co., of 65 lb. rails of the American Society of Civil Engineers' section, laid upon wooden cross ties, except in passing through the towns, where girder rails were required. The rails are joined with 4-hole 24-in. fish plates and are connected with Atkinson rail bonds. The turnouts on the 15 miles of single track are provided with spring switches.

The overhead work is span wire construction on the double track section and bracket construction on the single track line. In passing through the towns the franchises which were secured required the use of iron poles. These are made of pipe 5, 6 and 7 inches in diameter of the different sections and are set in concrete. The remainder of the poles are wooden and carry 4-pin cross arms, three of the insulators carrying the wires of the 3-phase system and the fourth insulator the direct current feeder. The insulators are the ordinary double petticoat glass pattern and no trouble has developed with their use for the high tension lines. The trolley wire is a No. 00 B. & S. gage hard drawn copper wire furnished by the American Steel & Wire Co., and is fed from a No. 0000 feeder, which runs almost the whole length of the road. The general arrangement of the wiring is as follows: From the power house at Highwood near the center of the road three lines of No. 4 wire run south to the sub-station at Winnetka and three lines of No. 8 wire run north to the sub-station at North Chicago. These lines carry the high tension 3-phase currents. The road is divided into six sections of 4½ miles each, two sections being fed from each station. The two middle sections are fed from the power house by a direct current from the station generator and the two sections opposite each sub-station are fed by the current from the rotary converters. The direct current feeder is tied into the trolley line at five points in every mile, except that there are no connections to this feeder for one mile each side of the station in order not to obtain too high a voltage at this point. Each of these sections is separated by section insulators which in cases of emergency permit any section of the road to be cut out, but by-pass switches are placed on the poles opposite the section insulators which permit the current to shunt around them, and in general they are closed so that the current from the rotaries is connected in parallel with the direct current generator at the power house. From this description it will be seen that the direct current feeds nine miles in the center of the road and each sub-station feeds nine miles at each end of the road. The line material was furnished by the H. W. Johns' Manufacturing Co.

POWER HOUSE.

The general arrangements of the power house and sub-stations of this road have already been outlined in the "Review" for August, 1898, page 500, but with the completion of the system additional data are available which will make a more detailed description of the plant of interest. The power house at Highwood is built of yellow pressed brick and its general appearance is shown in Fig. 1. The plan and elevation in Fig. 2 show the details of the building and the location of the machinery. The engine equipment consists of two Filer & Stowell tandem compound condensing engines of the corliss type, one having cylinders 17 and 30 x 36 in. and the other 22 and 38 x 42 in. Both engines run at a speed of 125 r. p. m., which is a rather unusual speed for engines of this type. The generators are three in number, two being alternating and one a direct current machine, and these are direct connected to the engines by means of the "Arnold System." The large engine normally drives one alternator and the direct current generator, and the small engine the other alternator, but the quill system permits considerable flexibility in the connections of the machines.

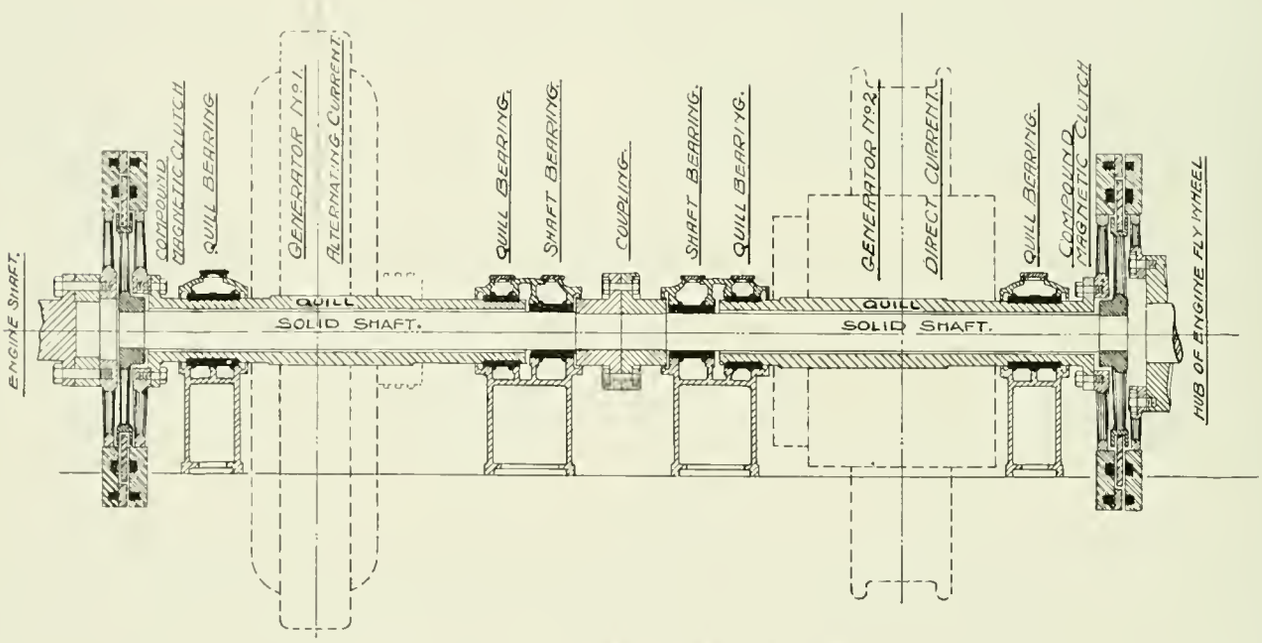


FIG. 4—CROSS SECTION OF "ARNOLD SYSTEM."

The alternators have 24 poles and have a capacity of 250 kw. They generate a current of 5,500 volts initial pressure and of 25 cycles. The direct current generator is a 6-pole machine of 250 kw. capacity and generates a current of from 600 to 650 volts pressure. All of the electrical equipment is of the General Electric Co.'s manufacture, and a general view of one of the alternators and the large engine is shown in Fig. 3.

The small engine is provided with a special arrangement of piping by means of which its capacity may be doubled in case of a break down of the large engine. A separate high pressure steam pipe is connected to the low pressure cylinder of the small engine

so that the low pressure cylinder can take high pressure steam through a reducing valve. When this is done the high pressure cylinder is arranged to exhaust directly into the condenser instead of into the low pressure cylinder. By means of this arrangement the small engine, would be able to temporarily run the road in case of accident to the large one, while the latter is of sufficient capacity to economically run the road alone. The engine and boiler room piping is fitted with Crane valves.

From the diagram, Fig. 2, it will be seen that the basement of the engine room forms an open pit between the engines in which two Deane jet condensers are situated, each being sufficient in capacity for the engine to which it is adjacent. These condensers are furnished with water from a cooling table and reservoir in front of the building, shown in Fig. 1. The table is 132 ft. long by 30 ft. wide and contains three shelves, one above the other about a foot apart. The table stands over a reservoir 150 ft. x 60 ft. in area and 8 ft. deep. Hot water from the condensers is discharged onto the top shelf of the table near the building and runs to the further end where it falls onto the second shelf and back along this to the third shelf, from which it falls into the reservoir at the further end, the intake pipe for the condensers being near the building and at the op-

FIG. 5—SUB-STATION, WINNETKA.

posite end of the reservoir from that in which the hot water from the table falls. The bottom of the reservoir is built of cinder concrete from which the sides slope upwards at an angle of 45 degrees for 4 ft., this part being built of stone concrete. On top of the slanting walls is a vertical brick retaining wall which brings the height of the reservoir up to 8 ft. An important feature of the engine room is the system of connecting the generators and engines referred to above as the "Arnold System." This device is shown in the plan in Fig. 2 and also in detail in Fig. 4. In this system each generator is mounted upon a quill or hollow shaft having a solid shaft inside with a half inch of space between them. These hollow shafts are held in position in the bearings into which they enter half way. Magnetic clutches are attached to the engine shafts which may be connected to either the solid shafts or the hollow shafts by means of switches upon the switchboard. By means of this system the large engine usually drives an alternator on one side and the direct current generator on the other side, while the small engine drives the other alternator. The large engine, however, may be connected to drive all three generators or the small engine may drive an alternator and the direct current machine. As the two middle generators may be driven together or separately from either engine the system has much more reliability than an equal number of independent units. It has in fact all the advantages of a belted countershaft connection without the corresponding friction and belt losses.

The switchboard is of blue Vermont marble and is in the front of the engine room as shown in Fig. 2. It consists of nine panels. The first two panels to the left are feeder panels, each containing a circuit breaker, an ammeter and a single pole feeder switch. Next is a battery panel with two single pole switches and a 1,000-ampere double reading ammeter with readings each side of zero according to whether the batteries are being charged or discharged. One direct current generator panel contains a circuit breaker, ammeter, two single pole switches for the generator circuit and one lighting switch for the building. One exciter panel is equipped with an am-

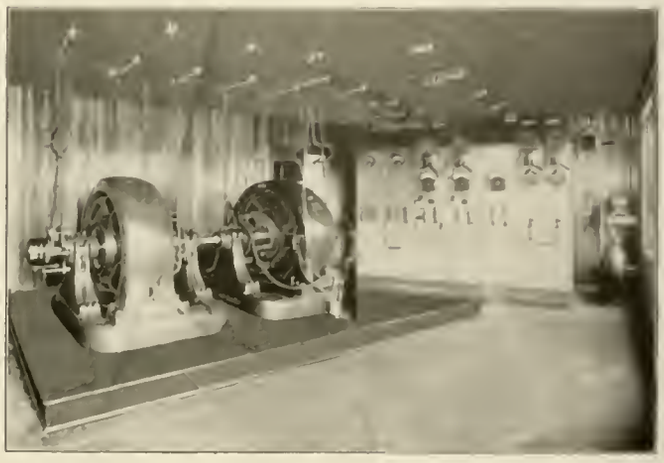


FIG. 6—ROTARY CONVERTER ROOM, WINNETKA.

meter and a voltmeter, two field switches (one for each exciter) and a rheostat. The four remaining panels are one alternating and a No. 1 sub-station panels and the second alternating and a No. 2 sub-station panels. The two alternating generator panels are alike and each contains one Thomson inclined coil ammeter and an inclined coil voltmeter, one 3-pole snap switch working in oil on the rear of the board with the handle in front, one 2-pole single throw switch for the field circuits of the alternators, and one field rheostat. There is also a synchronizing set consisting of a pilot lamp and switch and six plug connections for reading the voltage on the different legs of the 3-phase line.

The two sub-station or line panels each contain one 3-pole switch, one inclined coil voltmeter and one inclined coil ammeter.

At present the fields of the alternators are run from two exciters, belted to the main shaft, which are wound for 125 volts, which is the standard practice for the General Electric alternators. This arrangement was adopted temporarily to get the road running on time and the fields of these machines, however, are to be rewound for a 600-volt circuit and will then be energized from the storage batteries, doing away entirely with the exciters and all belted connections. The switchboard equipment is all of the General Electric

FIG. 7—STORAGE BATTERY ROOM, WINNETKA.

manufacture, except the direct current instruments, which are of the Weston type.

The boiler room is situated directly in the rear of the engine room, from which it is separated by a brick partition wall, as

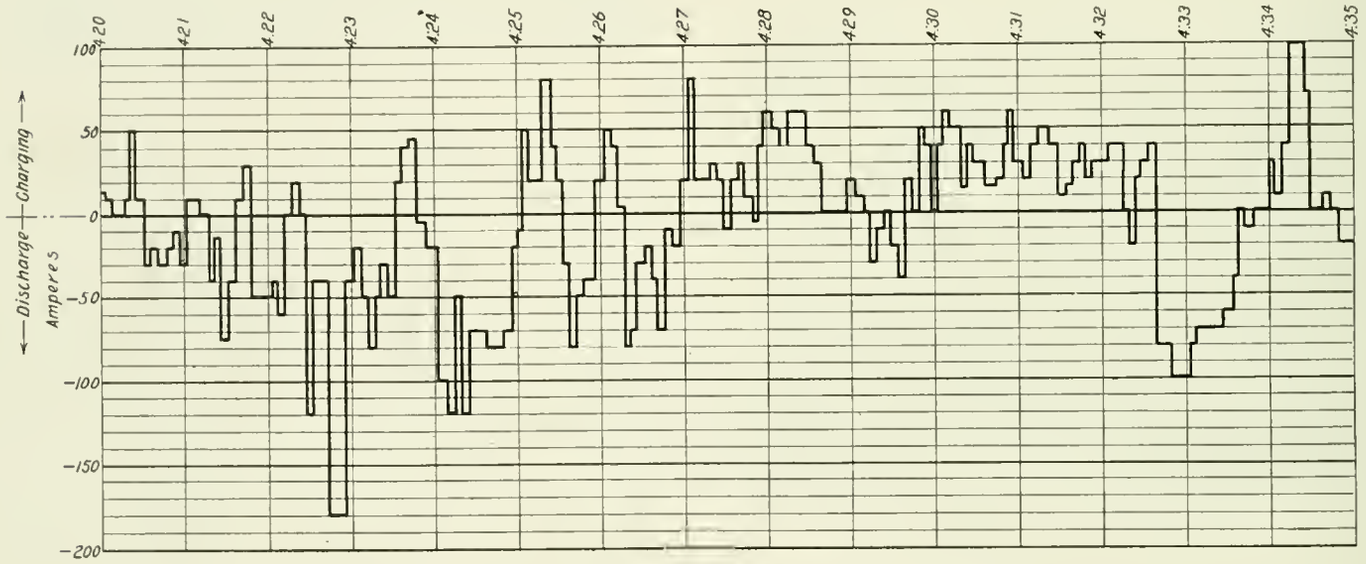
shown in the diagram, Fig. 2. This room contains three Cahall boilers of 250-h. p. capacity each, made by the Aultman & Taylor Machinery Co., and fitted with down-draft furnaces. The firing is done by hand labor. At the back of the room and over the rear of the boilers is located a Green fuel economizer of 750 h. p. capacity, which will deliver the feed water at 275° F. An induced draft is also provided by means of a Sturtevant fan, and the arrangement of the draft is such that the gases from the furnaces may be delivered to the stack either with or without passing through the economizer and with or without the use of the induced draft. Indiana egg coal is used in the boilers, and this is delivered directly to the boiler room floor from a spur track from the C. & N. W. R. R., which runs close to the side of the building, making any special coal handling devices unnecessary.

There are two Deane feed water pumps, 5 in. and 4 in. x 9 in. provided for feeding the boilers.

Directly in front of the power house is a long, narrow building containing the company's offices in front and a storage battery room in the rear. The front portion has two stories, both floors being devoted to the clerical force of the company, while the storage battery room is only one story high. The storage battery

static transformers and convert it into a direct 600-volt current. The machines are 4-pole, with one armature, taking the alternating current on a collector at one end and delivering the direct current at the commutator at the other end. Carbon brushes are used at the commutator end. The rotaries are self starting, and will operate when the current is turned on at the power house without attendance, but as an attendant is always at the sub-station, having a six room living apartment over the converter plant, a switch is provided for starting these machines. The rotaries run at a speed of 750 r. p. m.

The location of the switchboard is shown in Fig 6. It comprises seven panels, and is built of marble. At the left are two alternating current panels, each containing three single pole switches, one Thomson alternating current ammeter and a pilot lamp and switch, which constitute the synchronizing set for starting the machines. The third panel is for the storage batteries, and is equipped with two single pole switches and a 1,000-ampere double reading ammeter. Two feeder panels each contain an ammeter, two single pole switches and a switch for lighting the building. The two direct current panels each have a 600-ampere ammeter, one field switch, two single pole switches, one rheostat, one circuit breaker and one



POWER HOUSE STORAGE BATTERY RECORD, JULY 4, 1899, 4:20 TO 4:35 P. M.

rooms at the sub-stations and at the power house are all alike, and will be described together.

SUB-STATIONS.

Sub-station No. 1 is located at Winnetka, a general view of the building, which is 100 ft. x 30 ft., being given in Fig. 5. This station is divided into three rooms, one for the static transformers, one for the rotary converters and switch board, and one for the storage batteries. The static transformer room is a narrow room, 8 x 19 ft., containing six General Electric static transformers arranged in a row along the front wall of the building. These machines receive the 3-phase current from the power house at 5,500 volts, and reduce it to a tension of 380 volts. Each transformer has a capacity of 42 kw., making the total capacity of the sub-station 252 kw. On the partition wall opposite the transformers are six single pole switches which control them. These are arranged in two rows of three, each switch being surrounded by an open marble box about a foot deep to avoid the possibility of arcing. The six transformers are connected in two multiple series of three each, and the six switches are connected one to each end of the two primary coils in series. When all of these switches are closed a delta connection of the three phase circuit is made, or by opening the two switches connected to one primary circuit the load will be carried on the two other sides of the system.

Directly behind the transformer room is the rotary converter room, 19 x 24 ft., a view of which is given in Fig. 6. This room contains the rotary converters and the sub-station switchboard. There are two rotaries on one side of the room, each of 125 kw. capacity, which take the 380-volt alternating current from the

voltmeter. At one side of the switchboard is a 1-h. p. induction motor, which operates a small blower. This is used for forcing air through the static transformers under about ½ an ounce pressure for cooling purposes. The storage battery plant occupies the remainder of the ground floor of the sub-station.

Sub-station No. 2 is located at North Chicago in a building identical with that at Winnetka, except that it contains an extension along one side, 30 ft. in width, which is used for a car barn. The interiors of the two sub-stations are also identical, both having been built after the same plans and specifications. The equipment at North Chicago is only one-half of the capacity of that at Winnetka, but as the apparatus and its arrangement is the same in both cases no description of this station is necessary. It contains but three static trasformers and one rotary converter.

STORAGE BATTERIES.

The accumulator plants of which there is one at each station form an important adjunct of this equipment. The three batteries are the same in each case except that the number of plates varies, the cells at Winnetka containing 15 F plates, those at the power house 11 F plates and at North Chicago 7 F plates, all of the type made by the Electric Storage Battery Co., known as chloride accumulators. A general view of the Winnetka storage battery room, which is identical in appearance with the other two, is shown in Fig. 7. Each battery contains 288 cells, which are arranged in rows of two cells, with wide aisles between the rows, giving easy access to any point in the room. The room is also of ample size, well lighted and has excellent provision for ventilation. The cells are of glass and are considerably larger than is

needed for the present number of plates used, the idea being to allow for a considerable increase in the capacity of the battery by adding extra plates. These cells are set on the standard insulators of the Electric Storage Battery Co., which are two part glass insulators, the bottom part forming a flat tray containing oil, in which the upper part stands. The batteries are in constant service, being charged when the load is light and discharging on the heavy loads. The operation of the batteries is shown on the double reading ammeter on the battery panels of the switchboard described above. The rate of discharge is shown on a scale one side of the zero point, and the rate of charging on the other side of the scale. The accompanying diagram made from the ammeter readings showing the operation of the battery during a heavy load was taken between 4:20 and 4:35 p. m. on July 4th, the area of the curve above the zero line showing the periods of charging and the area below zero the periods of discharging of the battery. The battery either charges or discharges according to the voltage of the line, thus equalizing the load on the engines, which in this case are probably about one-third less in capacity than would be required without the batteries. The energy delivered by the batteries during heavy load periods and stored by them during light loads is clearly shown in the diagram. The amount of charge in the batteries is told approximately by hydrometer readings of the specific gravity of the electrolyte in the cells. During the readings given there were 263 cells in series.

The rolling stock consists of 20 motor cars and 18 trails cars, built by the J. G. Brill and Pullman companies. The cars are all vestibuled and have center aisles with cross seats, the seats extending about two thirds of the length of the car. The remainder of the car is partitioned off, making a baggage room and smoking compartment at one end, having side seats and sliding doors on the side for receiving baggage. The car bodies are mounted on Peckham trucks, of which there are eight of the 14 A type, extra strong. These are double trucks, and each car is equipped with two General Electric 50-h. p. motors. Each car is also fitted with Christensen air brakes, for which the air is supplied from a rotary air compressor driven by an electric motor.

The company also has one Ruggles rotary snow plow, made by the Peckham Co., and has recently ordered a McGuire sweeper.

Since the opening of the road over its entire route the traffic has been most satisfactory, and on several occasions it has taxed the entire rolling stock to handle it. The engineering details have also proved entirely effective, and it is confidently expected that the efficiency test, which will soon be made, will fully meet the expectations of the engineers. The road is run more on the style of a steam road than a street railway, as the company now owns considerable private right of way along its line and is acquiring more from time to time, as it can be purchased.

The officers of the Chicago & Milwaukee Electric Ry. are: President, G. A. Ball; vice-president, A. C. Frost; secretary and auditor, George M. Seward; treasurer, J. W. Maneck; general superintendent, R. S. Ives.

The Elevated Railroads of Chicago.

The elevated railroads of Chicago that are in operation aggregate almost 75 miles and the Northwestern Elevated, of which a considerable portion is already completed will bring the total up to 100 miles. The territory covered by the five elevated roads is well shown by the accompanying map.

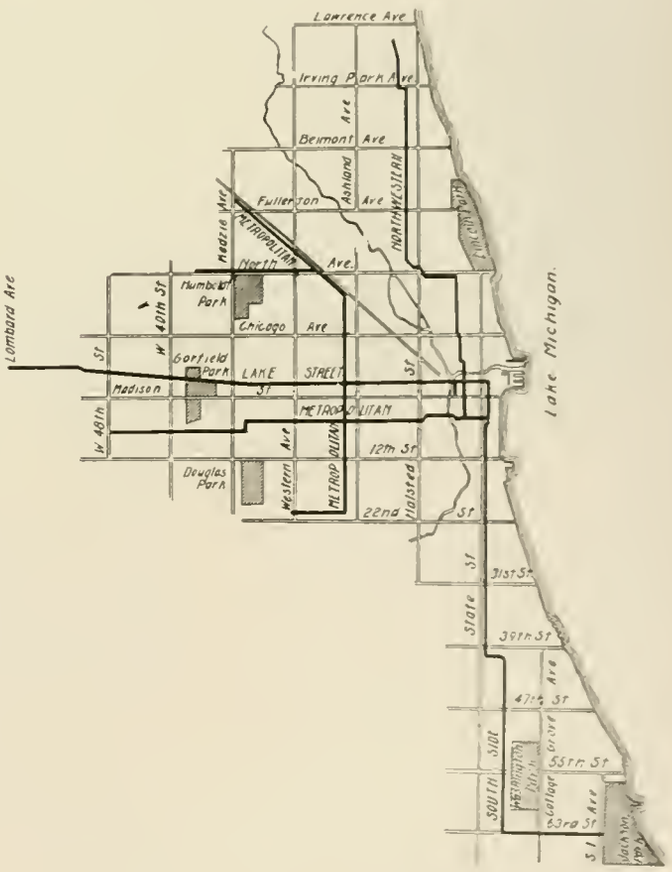
South Side Elevated.

The South Side Elevated, which is known also as the "Alley L" from the fact of its being built on a private right of way adjacent to the alley between State St. and Wabash Ave., was opened for regular traffic to 39th St., June 6, 1892, and to Jackson Park on May 12, 1893. The Chicago & South Side Rapid Transit Railroad Co. was incorporated Jan. 4, 1888; after many financial difficulties, the construction company having the contract to build the road turned the property over to the railroad company in December, 1892, and the latter completed the road to Jackson Park. This road, then operated by steam locomotives, handled an enormous traffic during the World's Fair, but early in 1894 it became evident that it could not earn fixed charges. The surplus from 1893 carried the company so that no default was made on bonds till 1895. In September, 1895, foreclosure proceedings were instituted by the trustee for bondholders and Marcellus Hopkins was appointed receiver. Mr. Hopkins operated the road as receiver until January, 1897, when a reorganization was effected, and the South Side Elevated Railroad Co., assumed control. Oct. 10, 1897, the company began operating its cars around the Union loop and there was at once a 50 per cent increase in the traffic.

This road is particularly interesting for the reason that it is operated on the Sprague multiple-unit system. The first six cars to be equipped with this system, were taken from service and shipped to Schenectady, June 11, 1897, to have the necessary electrical apparatus placed in position. These were returned October 17th of the same year, and were immediately put in operation on the Metropolitan Elevated for the purpose of thoroughly testing them and remedying any defects that might develop. These cars ran on the Metropolitan until June 5, 1898, when they were transferred to the South Side Elevated. During 1897 the Electrical Installation Co., was given the contract by the Sprague Co. to equip 114 additional cars belonging to the South Side Elevated R. R. with the Sprague system and this work was carried out at the shops of the Wells & French Co. The last cars of this lot were delivered Mar. 19, 1898, and on May 15, 1898, the first regular passenger train was run with current taken from the third rail. The elevated company during the last three months of 1898 equipped in its own shops 30 more cars.

Since January, 1897 the company has been paying 3 per cent on its stock and it is believed will soon be put on a 4 per cent basis.

The Sprague system as installed on this road has been fully described in the "Review" but the essential features may be briefly recapitulated. For the most part each car is independently lighted, heated, driven and braked; there are some trail cars. But all the



THE CHICAGO ELEVATED RAILROADS.

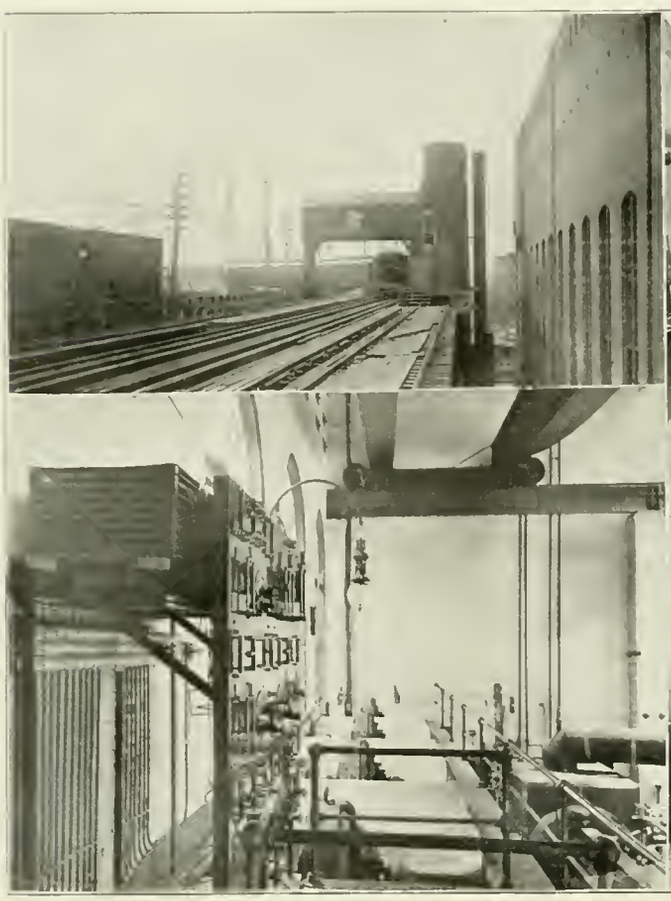
cars in a train are controlled by one motorman. The apparatus comprises a "master" controller on each end of each unit; master controller and train line cables; removable sections of the train line, called jumpers, which correspond to the air hose couplings used with air brakes; the main controller, which consists of relays and a throttle, pilot motors with automatic limits, a rheostat cylinder, and a reverser.

The equipment of the road includes 150 motor cars and 30 trailers. The motor cars are the passenger cars of the original steam equipment; under one end of these cars the old truck was retained, but at the other end a motor truck was added. The McGuire Manufacturing Co. furnished the first 120 motor trucks which are fitted with a swing bolster, and the Peckham Truck Co. the last 30. Each motor truck has two G. E. 57 motors of the ironclad four pole type with single reduction gears. The cars are all equipped with the Christensen air brake system, each car having a Christensen motor-driven compressor; the motors have the General Electric automatic regulators. The Gold electric street car heaters are used on all cars.

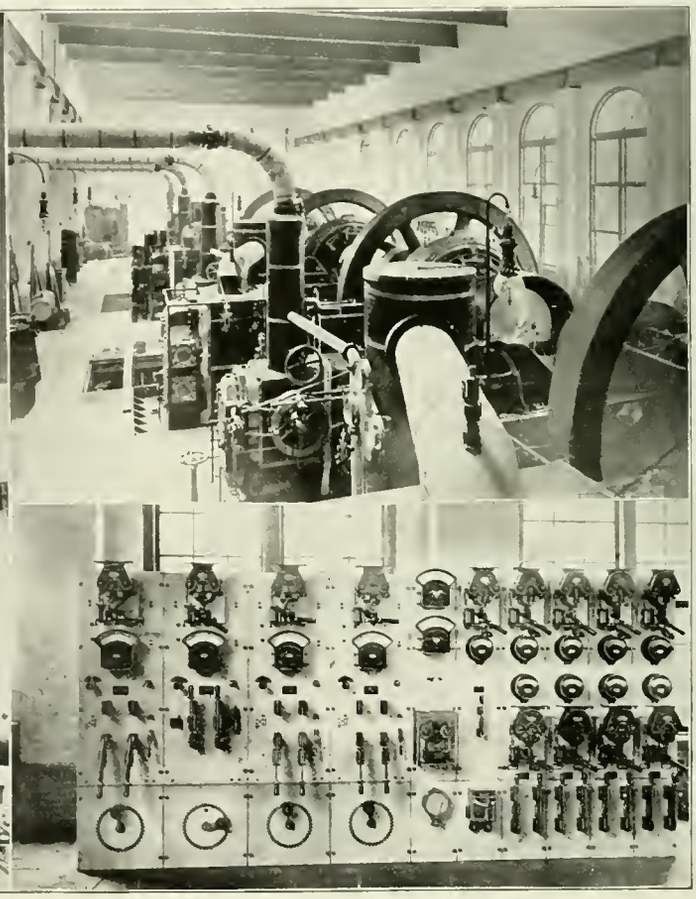
The power house is located at 40th and State Sts., on the line of the Lake Shore & Michigan Southern, and was designed by Messrs. Sargent & Lundy, consulting engineers for the company.

The building is 200 ft. long and divided lengthwise into large rooms; the engine room is 59 ft., and the boiler room 48 ft. wide. The engine equipment comprises four cross compound, condensing Allis-Corliss engines with cylinders 26 and 54 x 48 in.; speed 80 r. p. m. Each engine will develop normally 1,200 h. p., but will carry a 66 per cent overload. The direct connected Westinghouse generators are of 800-kw. capacity, giving 1,280 ampers at 625 volts, although the generators are capable of running under temporary overloads of 100 per cent. A Reynolds condenser receives the exhaust steam from each engine. Water is taken from a tank under the cooling tower outside the station and discharged into the top of the tower through a 20-in. pipe. Five motors drive 10 fans for the cooling tower. These motors are 6-pole, 600-volt and run at 150 r. p. m. A 30-ton electric crane spans the engine room and is equipped with General Electric motors. Piping from the compressed air system extends to each generator for cleaning the armatures, etc., the air being furnished from a Westinghouse air pump. Oil is supplied by a gravity system, pipes running to all the bearings from a tank placed near the roof of the station. After being used the oil is filtered and two pumps return it to the tank.

The switchboard is of white marble and is unusually compact for so large a station. The four panels to the left are each for a generator. Each panel has a General Electric circuit breaker and switches, a 2,500-ampere Weston ammeter and field rheostat controller, the resistance of which is under the floor. The next panel to the right receives the entire current of the station and is designed to carry 8,000 amperes. It has a 750-volt voltmeter and an 8,000-ampere ammeter, a General Electric wattmeter, and a Bristol recording voltmeter. The next panel supplies current to the station. This goes to the five cooling tower motors, the two motors running the coal handling machinery, the crane motors, 200 incandescent lamps and 20 enclosed arc lamps. A recording wattmeter keeps a record of all the energy so used. The four panels to the right are for the eight feeders running out of the station. Each panel has two single pole switches, two circuit breakers with the two ammeters between them.



STRUCTURE AT 40TH. ST.
FAN MOTORS AND SWITCHBOARD.



ENGINE AND GENERATOR ROOM.
MAIN SWITCHBOARD.

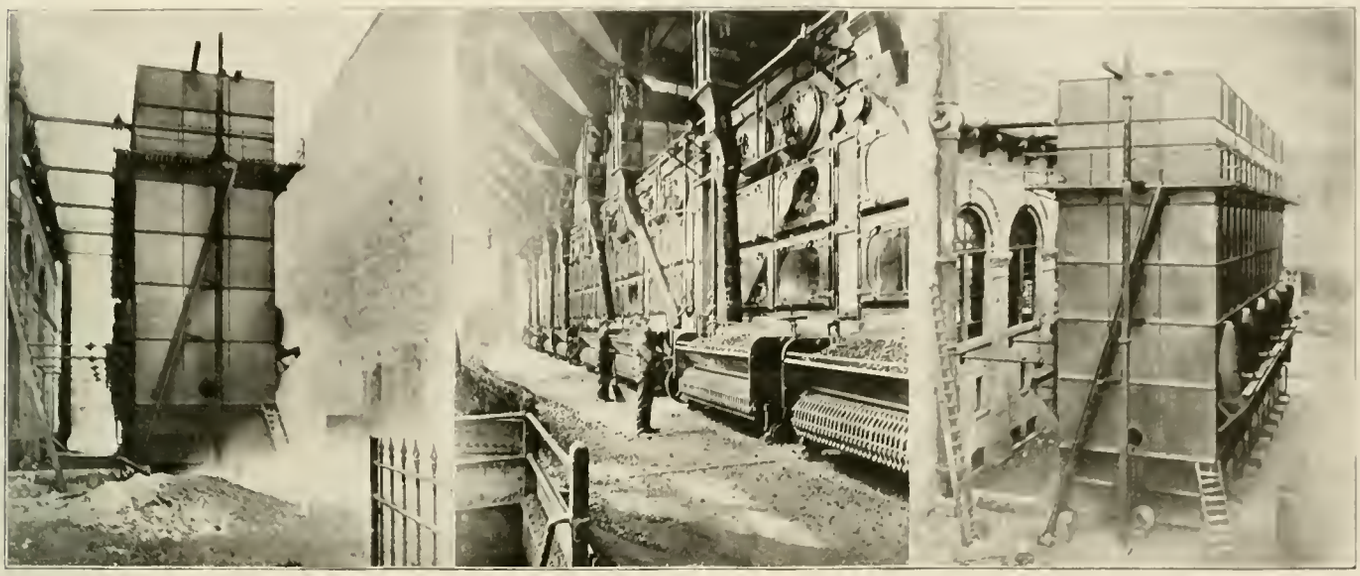
The five motors mounted in the engine room are connected by shafting to the 10-ft. fans of the Barnard cooling tower, which is notable for its great size; it is 64 ft. long, 16½ ft. wide and 34 ft. high; beneath it is a tank 6 ft. deep.

There are 12 Babcock & Wilcox water tube boilers tested for a pressure of 300 lbs., the pressure of the station being only 160 lb. All the high pressure steam valves were furnished by the Crane Co. Two vertical oscillating engines drive the chain grates, the exposed furnace surface of each being 7 ft. 6 in. x 8 ft. 6 in.

The boiler feed water is pumped by three Blake compound feed pumps, 10 and 7 x 12 in. from either the city mains or the condenser discharge. Each boiler has a hot water meter attached and two meters register the water which is supplied to the station

from the city water mains. The steel plate stack is 200 ft. high and 13 ft. 8 in. internal diameter at the top. The plates are ½ in. at the bottom and ¼ in. at the top, with a fire brick lining from 9 in. to 4½ in. built up in the interior. There are two flues extending from the boilers to the stack, one containing two Green fuel economizers, the hot gases being drawn into this one from a point near the middle of the bank of boilers. This flue is closed when the economizers are not in use.

The station has complete equipment of coal and ash handling machinery. The coal is delivered from the cars into a hopper



COOLING TOWER. BOILER ROOM. COOLING TOWER.

and passes through a motor driven crusher. It is delivered by a McCaslin conveyor, made by the John A. Mead Co., New York, to a second conveyor, and is carried to the coal bins and tanks above the boiler room. The coal is delivered from the tanks to the mechanical stokers as shown in the interior view of the boiler room. The ashes are collected by the same conveyor that handles the coal. They drop into a pit beneath the boiler and are dampened before removing. There are three feeders extending north of the station, two of 1,000,000 c. m. cross section and one of 500,000 c. m. To the south there are two of 1,500,000 c. m., two of 1,000,000 c. m. and one of 500,000 c. m., cross section.

At two points on the line, at 61st St., where the shops are located, and at 12th St., the last passenger station north before entering the business district, storage batteries have been installed for the purpose of acting as equalizers for the central station, reducing the drop in potential on the line, adding to the reliability of the power supply, and to some extent they carry the peak of the load. Each of these two batteries consist of 248 "chloride" cells made by the Electric Storage Battery Co., of Philadelphia; each cell has 26 pairs of plates, with room in the tanks for 26 pairs more. Each battery has a capacity of 535 kw. h. at the hour discharge rating and may be discharged 60 per cent above this with safety. With the batteries connected in multiple it is found that the morning and evening generator load peaks are from 500 to 1,500 amperes lower than without the battery. The peaks occur at 8:15 a. m. and 5:45 p. m., and the low points in the load curve at 1 p. m. and 3 a. m. The current consumption for motors and lights on this road is about 2.1 kw. h. per car-mile.

The hardest test on the capacity of the system was on Oct. 19, 1898, when the car-mileage was increased 80 per cent above the normal. With 148 cars and a total trackage of nearly 20 miles, 240 cars per hour were sent into and out of the loop for several hours. This load was carried by six 400-h. p. boilers with two men in the fire room.

The shops and yards of the company are located at 61st St. and Calumet Ave., the former occupying a rectangular two story building, having a frontage on 61st St., of 152 ft., and on Calumet Ave., 162 ft.

The main machine shop where all the machine work for the entire system is done, is on the ground floor, and is 50 ft. square. Here is found a full set of metal working tools and labor saving devices for turning out work expeditiously and economically, the collection including: 1 bolt cutter, 1 saw lathe, 2 large lathes for turning up armature bearings, commutators, shafting, etc. One of these has a 33 in. swing and takes work up to 9 ft. 6 in. in length; the other has room for a 20-in. swing, and takes work 6 ft. in length. One lathe for truing up wheels. This machine has 44 in. swing, 8 ft. between centers. One "Universal" milling machine. One grinder, for grinding tools used on the milling machine. Two ball-bearing drill presses, one with a 25-in. table, made by J. A. Fay & Co., of Cincinnati, and one with 16-in. table. One planing machine. One grind stone. One Featherstone emery wheel. A number of these machines were purchased through J. A. Fay & Co., as agents. All of the tools are run by belting from shafting, which is driven by a 25-h. p. motor, taking current from the line circuit.

In the machine shop is also placed a large Smith-Vaile pump for furnishing water for fire and other purposes throughout the shops and yards. This has a capacity of 720 gallons per minute, and from the end of a 3-in. pipe 1,200 ft. long, supplied with a three-way nozzle, has thrown three streams at once to a height of 75 ft. The pump is direct connected through gears to a 75-h. p. motor. All current taken from the line for power purposes in the shops first passes through a storage battery, thus preventing fluctuation in the line voltage from affecting the speed of the tools.

J. F. MORRISON,
Superintendent.

The shafting in the shop is supported on upright timbers entirely independent of the walls. In this way vibration of the building is avoided, and even when all the tools are running full speed the noise cannot be heard in the next room. Five machinists and two helpers take care of all the work in this department.

Opening from the machine shop is the blacksmith shop, where two forges, supplied with a motor driven fan are in operation. Two smiths and a helper do all the blacksmith work required on the road. In the same room with the forges are two Heine safety boilers for operating the heating system. From these, direct steam is led through mains to all parts of the buildings and yards.

Adjoining the machine shop on the south is a large "general utility" room. At one end of this are benches for mending rattan

seats, and floor mats, varnishing blinds, repairing air brake valves, etc. One man repairs all the rattan seats on the system, weaving in new pieces where holes have been made, and thus often avoiding the expense of an entire new covering. This would cost from $2.00 to $5.00, but by the present arrangement the seat is made practically as good as new in two hours by a man who receives 15 cents an hour. One man also does the regrinding and repairing of all the Westinghouse air brake valves.

In the center of this general room is a small air compressor, driven by belting from the same motor that drives the pump in the machine shop. The compressor has a capacity of 210 cu. ft. free air per minute, and is provided with an automatic device for cutting out the compressor valves when the pressure in the storage tanks reaches about 75 lb. per sq. in. This enables the compressing piston to work without load until the pressure falls below the predetermined point, when the valves are again cut in and the pressure raised. The air is stored in nine cylinders, having a capacity of 21 cu. ft. each. Pipes lead from these to the yards for cleaning out the cars with compressed air, and to the motor repair shop on the floor above for operating a pneumatic armature lifting jack.

A small room adjoining this larger one is devoted to armature winding and repairing. Here the 300 railway motors, all pump motors, pilot motors and fields are kept in order, and in addition considerable work is done for the 40th St. power house. But two winders and two helpers are employed. This speaks well for the small amount of repairs necessary.

The rest of the ground floor is taken up with store rooms, of which there are two; one for iron and steel in bars and other rougher supplies, and one for the smaller and more expensive parts. In these two rooms are kept everything that is likely to be called for by the men in the different repair and inspection departments.

An electrically driven elevator runs from the ground floor to the second story for raising all heavy parts and apparatus. This has a capacity of 10,000 lb., and is operated by a 15-h. p. motor.

The oil room is situated in a separate building, apart from the shops to avoid risk from fire. All lamps are cleaned and filled in the same building.

The second floor is divided into paint and carpenter shops, motor repair room and offices for the foremen, assistants, etc.

The paint and carpenter shop will accommodate 12 cars at a time and here 20 cars are thoroughly overhauled, repaired and repainted every month.

The motor repair shop has three tracks, holding two cars each, or six in all. This room is well equipped with labor saving devices, including two cranes and a pneumatic lifting jack, designed by Mr. Allen, the general foreman, for removing and shifting armatures. This latter apparatus is mounted on a truck, and with it a damaged armature can be taken from the motor, carried to the elevator and the new one picked up and placed in position in a very few minutes.

The motor repair shop opens directly onto the elevated yards, where cars are cleaned and stored. The third rail in the yards is in sections, and knife switches are placed at convenient points for cutting out any section upon which men may be working. This avoids the possibility of accident from touching the live rail, while the employes are at work.

In one corner of the yards is placed one of the most important features of the whole system. This is the testing building. In this place, every car on the road is thoroughly examined and tested in every detail once every three days. Trucks, motors, car bodies, controllers, etc., are gone over step by step by men assigned to special lines of inspection. Thus there are two men looking after controllers alone, one man on platform switches and reversers, two men on motors, a man on oiling, one man on resistance boxes and cables, three men on air brakes and adjustments and a man on relays. These men also make minor repairs. The building is about 400 x 35 ft., with large windows the entire length of each side. The walls and ceiling are whitewashed and the floor is covered with lime to absorb the waste grease. There are two pits, each accommodating eight cars. Advantage is taken of the time required to inspect the rolling stock to clean windows, transom lights, etc.

The officers and heads of departments of the South Side Elevated are: President, Leslie Carter; vice-president, A. A. Carpenter; general manager, Marcellus Hopkins; superintendent and master mechanic, J. F. Morrison; purchasing agent, Alonzo Nelson; general foreman, in charge of motive power, Andrew J. Allen; chief engineer of the power station, Alex Hadin.

J. F. Morrison, superintendent and master mechanic, was born in 1860, and his railroad career commenced in 1878, when he entered the service of the Manhattan Elevated R. R. of New York as train dispatcher. He continued in the employ of this company until 1892, when he resigned to accept the position of superintendent of transportation for the South Side Elevated R. R. of Chicago. In 1893 he was appointed to his present position.

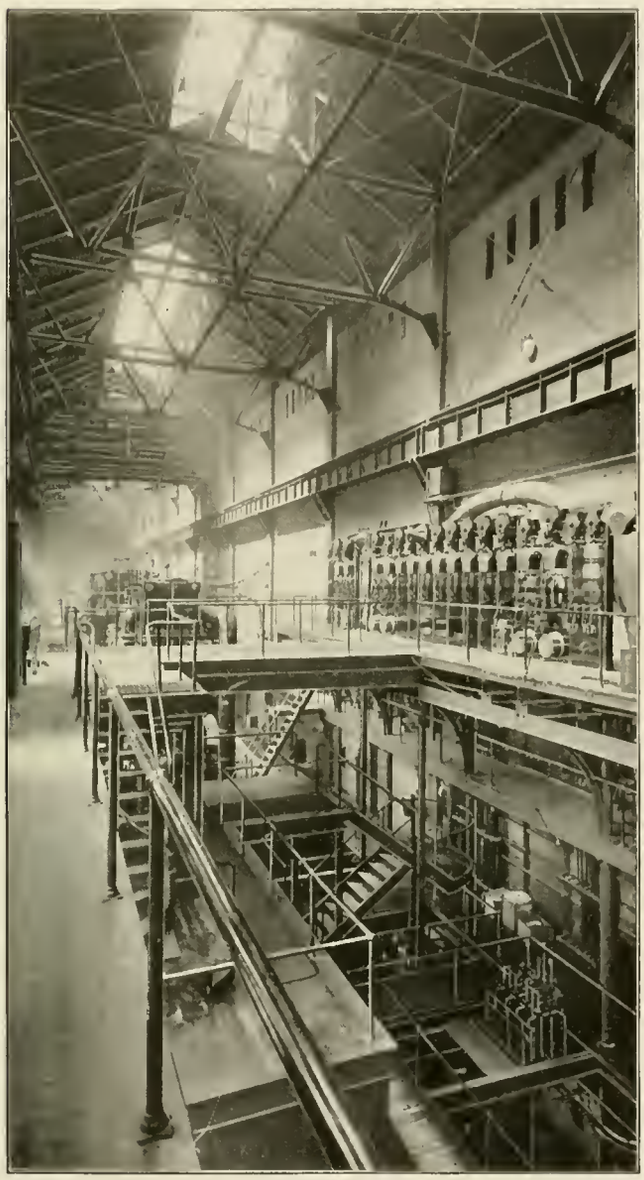
The Metropolitan Elevated.

The Metropolitan West Side Elevated Railroad Co. was incorporated Mar. 9, 1892, being organized by A. F. Walcott, who was then at the head of the construction company building the South Side Elevated. The capital was subscribed by London, New York and Boston capitalists. The company bought outright its entire right of way save, of course, at the street crossings. The construction work was done by the West Side Construction Co., of which E. W. Eckart was chief engineer. The territory served by this system is shown on the map. From the Union Loop to Market St. is a double track structure; from Market St. to a point

SCHERZER ROLLING LIFT BRIDGE—METROPOLITAN WEST SIDE ELEVATED.

1½ miles west of the river is the main line, with four tracks; from this latter point three double track lines diverge, to the south, west and north; the northern branch again divides into two double track branches. From Market St. to each of the terminals is about six miles; the total of (single) track is 30 miles. Trains were started from Canal to Robey St. May 6, 1895; from Franklin to Robey St. May 15th; from Franklin St. to Logan Sq. May 25th; on the Garfield Park line June 19th; on the Humboldt Park line June 29th; on the Douglass Park line August, 1896.

The success of the Intramural Ry. at the Columbian Exposition led the Metropolitan to adopt electricity as the motive power



INTERIOR OF METROPOLITAN POWER HOUSE.

and Mr. W. E. Baker, general manager of the Intramural, was made general superintendent of the Metropolitan. The General Electric Co. received the contract for all the electrical apparatus June, 1894. The example of the Metropolitan was followed by the other elevated roads in Chicago and they are all now electrically operated.

The structure was designed to carry 30-ton locomotives and was the heaviest built up to that time. The minimum height above the street is 14 ft., the usual height being 15 ft. The girders are of the plate type 4 ft. deep, and vary from 30 to 50 ft. in length. The posts rest on foundations of concrete 8 ft. square and 7 ft. deep. The most notable feature of the structure is the Scherzer rolling lift bridge over the Chicago River; this consists of two double track bridges placed side by side. The span from center to center of bearings is 114 ft. There are also three notable viaducts, the longest spans a clear space of 254 ft. over the Chicago & Northwestern tracks near Paulina St.; at the Union Depot yard is a viaduct of two spans, one of 227 ft. and one of 178 ft.; the third viaduct is at Rockwell St. over the tracks of several railroads.

The running rails are of 5-in. 80-lb. T-section rolled by the Illinois Steel Co. The conductor rails are 42-lb. and the feeders are 75 lb. rails made by the same company. The conductor rail is supported at one side of each track, 7 in. above the running rail, by insulating blocks. The conductor rail is fastened to these supporting blocks by clips. The conductor rail bonds are flexible copper

DICKINSON MACALLISTER.
President Metropolitan Elevated.

strips 3-16 in. thick and as wide as the rail base plate under the joints and riveted to the lower flanges. The feeders are 75-lb. T-rails laid between the tracks and boxed over. At a few points there was not sufficient room to use feeder rails and copper wires were hung under the structure. These wires and the copper for joining the feeder rails were furnished by the Washburn & Moen Co., the Simplex Electrical Co., and the John A. Roebling's Sons Co. For the return, the track rails are bonded to the structure near the middle point of each rail. At the river, where the continuity of its structure is broken by the bridge four Simplex rubber and lead covered, armored submarine cables of 500,000 c. m. and 14 of 235,000 c. m. capacity were laid on the river bottom.

A complete system of interlocking signals was installed by the National Switch & Signal Co.

The power house is located on the main line a short distance east of the intersection of the east and west and the north and south lines. It was originally 305 ft. long by 90 ft. wide, two tracks of the structure passing on each side of it; during the last year an addition was built, making the building 450 ft. in length.

When the station was built there were four vertical cross-compound engines, built by the E. P. Allis Co. Two of these have cylinders 36 and 72 x 48 in. and are direct connected to General Electric 1,500-kw. generators; they are guaranteed to work satisfactorily with a load of 3,100 h. p. each. The two smaller engines are direct connected to G. E. 800-kw. generators. This summer two additional Allis engines were installed; each is a vertical cross-compound, with cylinders 38 and 76 x 48 in., and is direct connected to a 1,650-kw General Electric generator.

Each of the engines has a separate governor controlling a butterfly valve in the main steam pipe. An electric crane, made by the Morgan Engineering Co., travels the entire length of the engine room.

The boiler room is on the north side of the building and now contains 20 Babcock & Wilcox boilers in batteries of two each; 12 of these constitute the original installation. Green economizers are used in this station. The coal handling machinery in this station is very complete. Coal is thrown into storage bins in front of the boilers by being dumped through doors in the roof from

cars on a siding of the elevated structure which passes directly overhead, or it can be hauled by teams to the alley in front of the boiler room and thrown in through the window. Coal cars can be run up onto the structure at the terminus of the Garfield Park line where it connects with the Chicago & Western Indiana Belt line. The boilers are all equipped with Babcock & Wilcox automatic stokers. Ashes fall into a conveyor in the basement of the boiler room.

the motorman's cabs. "Straight" air brakes made by the New York Air Brake Co. are used; an electrically operated air pump placed in one of the cabs furnishes the air for the train. Each motor car has electric headlights and markers, or destination signs.

The trail cars are 47 ft. over all of the standard elevated railway type; all cars have electric heaters made by the Central Electric Heating Co., of New York. The car couplers used were made by the W. T. Van Dorn Co., of Chicago.

H. M. BRINCKERHOFF,
Assistant General Manager.

GEO. HIGGINSON, JR.,
Secretary and Treasurer.

A. S. JONES,
Superintendent of Transportation.

A 5 ft. tunnel extends to the power house from the Chicago River and water for condensing is drawn from this source.

The switchboard is in a gallery which is level with the elevated structure.

The first car equipment consisted of 55 motor cars built by the Barney & Smith Car Co., Dayton, O., and 100 trail cars made by the Pullman Car Co. The company now has 65 motor and 168 trail cars.

The motor cars are 47 ft. 2¾ in. over all, and 40 ft. over the sills; the width at the sills is 8 ft. 7 in.; the roof is 12 ft. 10 in. above the rails. The motorman's cabs occupy two corners of the car, half of the cab being within the car and half on the platform. These cars weigh 40,000 lb., exclusive of the motors, and about 62,000 lb., including everything when loaded to their maximum capacity. They are used as smoking cars, and have side seats only.

The motor cars are mounted on swing bolster trucks, with 34¼-in. steel tired wheels, made by the Baldwin Locomotive Works, after designs of the Metropolitan company. The motor cars are equipped with two and four G. E. 2,000 motors and with two G. E. 55 motors.

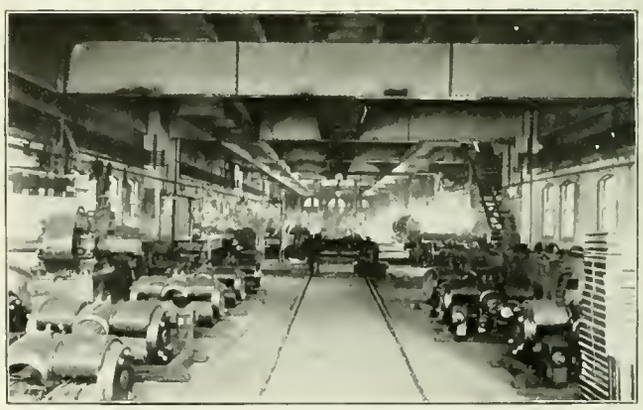
The motors are operated by series parallel controllers placed in

The company's shops are in a two story building adjacent to the structure and lying between Throop St. and Center Ave. The second floor is on a level with the tracks; all work on the car bodies and light repairs are made on this floor. For heavy repairs the trucks and motors are taken to the lower floor on a hydraulic elevator.

On Feb. 1, 1897, the company defaulted on its bonds, and foreclosure proceedings were at once instituted, Dickinson MacAllister being appointed receiver. In 1898 a reorganization was effected and the Metropolitan West Side Elevated Railway Co. took charge of the property in February, 1899.

The last two years have shown a very large increase in the traffic of this road, and the daily average of passengers carried increased from 44,434 for January and February, 1897, to 77,200 in December, 1898; the increase for July, 1899, was 26 per cent over July, 1898. For 345 days in 1897 the total of passengers was 16,085,547; for 365 in 1898 it was 23,887,667.

EXTERIOR METROPOLITAN SHOPS.



INTERIOR METROPOLITAN SHOPS.

The officers of the company are: President and general manager, Dickinson MacAllister; secretary and treasurer, George Higginson, jr.; assistant general manager, H. M. Brinckerhoff; superintendent of transportation, A. S. Jones; auditor, C. W. Hillman; purchasing agent, D. L. Budd; chief engineer, William S. Menden.

Lake Street Elevated.

The Lake Street Elevated Railway Co. was organized in April, 1888, under the Elevated Ways and Conveyers act, and the first sections of the structure were set at Lake and Clinton Sts., Dec. 18, 1889. There was a great deal of litigation connected with the early history of this company; it had to fight five other companies before it secured franchises, and financial difficulties compelled

the suspension of work after three miles of the structure had been completed. In 1892 the Illinois Supreme Court rendered a decision which cast doubt upon the sufficiency of the incorporation, and a new company, called the Lake Street Elevated Railroad Co., was chartered, its stock being exchanged for that of the old company. Messrs. F. L. Underwood and Willard R. Green, the contractors for the structure, secured control of the company in 1892 and negotiated its securities so that the road could be pushed to completion. At this time ex-Mayor John A. Roche was president of the company and Col. M. H. Alberger, the principal subscriber to the stock of the old company, was general manager.

The road was first opened for traffic Oct. 28, 1893; the formal opening was Nov. 4, 1893, when five trains of four coaches each carried a large party of invited guests from the down-town terminus to Homan Ave. and back.

The operation at this time was by steam locomotives. The company had 25 two-cylinder compound locomotives built by the Rhode Island Locomotive Works, and 125 passenger cars built by the Gilbert Car Co., Troy, N. Y. The locomotives weighed 60,000 lb. each; the drivers were 44 in. in diameter; the cylinders were 13 and 21 x 18 in.; steam pressure, 180 lb.

One of the most interesting features of the structure is the bridge crossing the Chicago River. Working jointly with the city, the old bridge at Lake St. was rebuilt with an upper deck on the draw span. The structure is 48 ft. wide, posts being set at the curbs, and was designed for three tracks. Up to the present time only two tracks have been laid, save where a third one was needed for car storage or switching purposes; it is intended to complete the third track from W. 52d St. to Campbell Ave. at an early date, and give an express service making no stops between those points.

In 1895 the Lake Street road was equipped for electricity, the third rail and feeder systems being installed under the direction of Mr. J. R. Chapman, electrical engineer for the Yerkes system. The work was under the immediate charge of Mr. C. E. Collins. The third rail on this road is supported on insulators placed 6 ft. apart. These insulators are made up of three pieces; a base casting bolted to the ties, a bolt covered with insulating compound screwed into the base, and a cast top piece with flanges to grasp the rail. The only machine work done on the insulator was cutting threads for the joint between the bolt and the base; a tight joint between the bolt head and the rough cast cap was made with sulphur. This insulator was designed by Messrs. Chapman and Hanson; the insulating compound was furnished by Albert & J. M. Anderson Manufacturing Co. The rails are protected by wooden guards.

The feeders are 1,000,000-c. m. and 1,500,000-c. m. copper cables made by the John A. Roebling's Sons Co. They are held in place by iron brackets, lined with Anderson insulating compound bushings, spaced 100 ft. apart. At intervals of 10 ft. between the iron brackets are clay insulators made by the H. B. Camp Co., of Aultman, O., which serve as supporters for the feeder cables.

Since September, 1896, the road has been operated by electricity, though the first trial of electric traction was in June of that year.

The rolling stock consists of 37 motor cars and 87 trail cars, these being the passenger cars of the original equipment. The motor cars are mounted on trucks made by the Baldwin Locomotive Works; each truck has one G. E. 57 motor. The controllers are of the General Electric L 4 type. Westinghouse air brakes are used, an electrically driven pump in the cab of the motor car furnishing the air for the train.

The elevated structure extends from the northwest corner of the Union Loop out Lake St. a distance of 7 miles, a spur in Fifth Ave. used as the terminal before the completion of the Loop, and the third track bring the total trackage up to 17 miles, measured as single track.

D. H. LOUDERBACK,
President Lake Street Elevated and Northwestern Elevated.

West of W. 52d St. there is an incline to the surface, and Lake St. trains run out to the junction of Wisconsin Ave. and Randolph St. in Oak Park, a distance of 9½ miles from the Loop.

The company has no power house of its own, and buys power by meter from the Union and the Consolidated Traction companies. Power is furnished from the Hobbie St., the Western Ave. and the Cicero & Proviso stations. For the month of July, 1899, the average power per car-mile run was 1.95 kw. h.; the motor cars weigh 52,000 lb. and the trail cars 32,000 lb.

The shops and car house are at Lake St. and Harding Ave. The building is on the surface level and is 450 ft. long and 60 ft. wide. Four tracks extend the entire length of the buildings; cars are brought down from the structure over an incline 550 ft. long on a grade of 2¾ per cent. The machine shop occupies the south

INCLINE OF LAKE STREET ELEVATED AT WEST 52D ST.

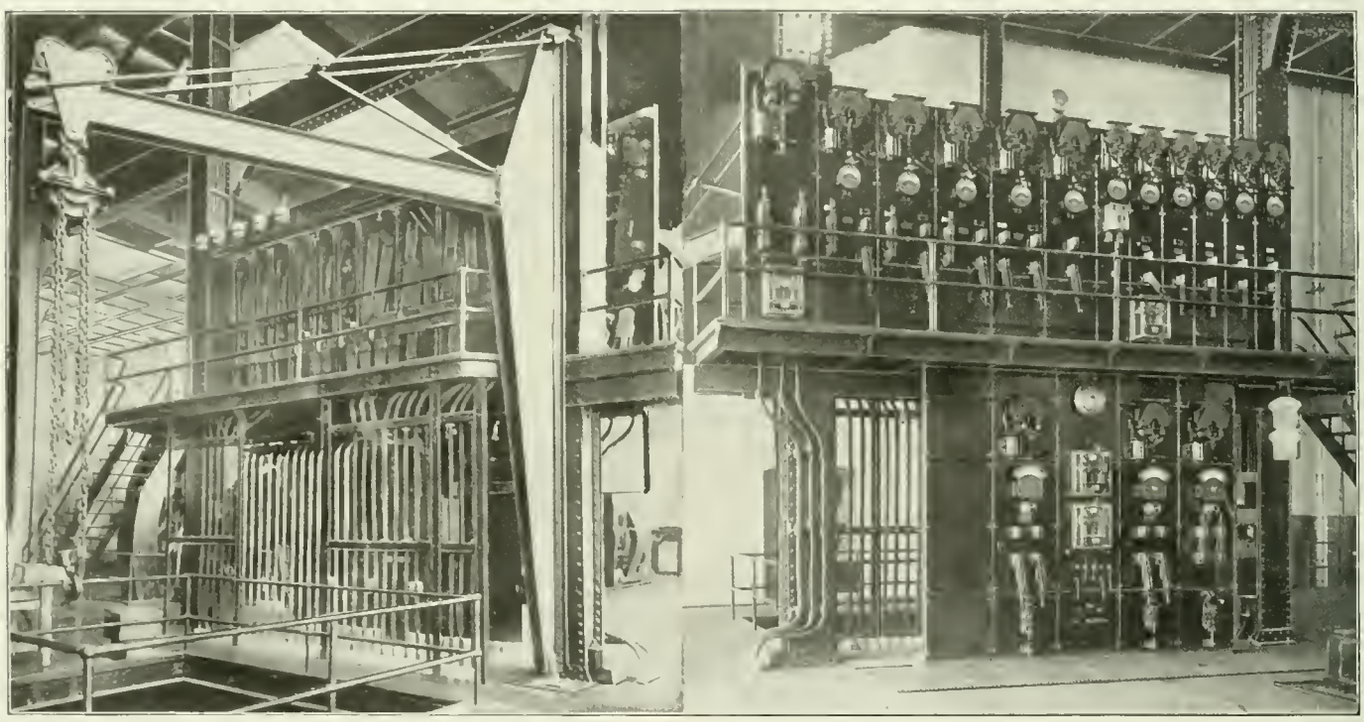
end of the building. An electric crane, made by the Wm. Sellers Co., of Philadelphia, runs along the west half of the building.

The operating offices are in rooms on the second floor of the shop buildings, and the general offices in the Royal Insurance Building.

The officers of the Lake Street Elevated Railroad Co. are: President, D. H. Louderback; vice-president, A. S. Littlefield; secretary and treasurer, Howard Abel; general superintendent, Frank Hedley; engineer, Charles V. Weston; electrician, J. R. Chapman.

The Union Elevated.

The Union Elevated Railroad Co. was incorporated in November, 1894, by Mr. Yerkes and his associates for the purpose of building a down-town loop terminal for all the elevated roads in the city. The Loop is a double track structure, 11,150 ft. long, with 11 stations. By a lease dated Oct. 1, 1897, the road is granted to the four elevated railroads for their sole use for so long a period as under present franchises or extensions thereof they may be permitted to operate; the lessees pay the Union company a guaranteed minimum rental of $250,000 and all expenses, but pay one half cent for every paying passenger carried on their respective lines, and in addition pay all the expenses of operation and maintenance, including taxes and ground rent of the power station building when the ½ cent compensation amounts to more than $250,000 and expenses. The Union company pays the city a per centage of the net earnings, after deducting $250,000 a year bond interest; the payment to the city increases from 5 per cent prior to 1902 to 25 per cent after 1933.



SWITCHBOARD, UNION LOOP POWER HOUSE.

Work on the Loop was begun during the winter of 1895 and completed in the summer of 1897. The Lake Street began using the Loop tracks as far as the Adams and Wabash station in October, 1896, and to make the complete circuit Oct. 10, 1897; the Metropolitan began using the Loop Oct. 11, 1897, and the South Side on Oct. 19, 1897. The effect of the loop connection in increasing traffic on the roads using it has been little short of marvelous, the figures for the month of September, 1897, and September, 1898 for the South Side and Metropolitan are:

	1897.	1898.
Metropolitan	1,144,096	1,813,464
South Side	902,010	1,397,280

The road is operated on the third rail system, the conductor rails being placed between the two tracks, at the sides of the wooden box carrying the feeders along the center of the structure. The feeder box is covered and serves as a footpath for employes. The method of supporting and insulating the conductor rails and feeders does not differ from that employed on the Lake Street. The insulators were made by the Albert & J. M. Anderson Co., of Boston, after the design of J. B. Chapman, the electrical engineer of the Loop, who designed the electrical equipment. For feeding purposes the Loop is divided into four sections, the north and west and the east and south sides of each track constituting the sections. There are 11 feeders carried from the power house to the structure through a conduit laid in Market St. Each of these feeders is of stranded copper and has an area of 1,500,000 c. m. At stations and special work the bare cables are replaced by insulated cables carried under the structure. While the feeder system in general outline is very simple, the detail drawings showing connections to the conductor rails at special work resemble geometrical puzzles. In spacing the contact rails at crossovers and switches, the method of making the car bridge the two connections was adopted.

About 1,100 32-c. p. lamps are required for lighting purposes, and they are all on the same circuit, the cables being carried in the feeder box. A 30-pair telephone cable is carried around the structure and connected to switchboards in all the stations and signal towers. A very complete interlocking switch and signal system has been installed.

A great deal of special track work was necessary and it was all done by the Paige Iron Works, Chicago.

The company has no rolling stock, but owns a large power plant on Market St. opposite Congress St. The building is of brick and irregular in shape, the longest dimensions being 142 ft. front and 164 ft. deep. It is a double-deck station, the boilers being placed in the second story; a hanging floor below the boiler room floor carries the smoke flues and provides room for coal and ash handling machinery.

There are 16 Babcock & Wilcox 400-h. p. water tube boilers arranged in batteries of two; they are all equipped with grates and "Acme" automatic furnaces for coal burning and with fuel-oil circulating apparatus installed by the National Supply Co. Oil is received at the station in tank wagons. As oil is used for fuel the

coal handling machinery contemplated in the original design has not yet been put in place.

All the steam accessories for this plant are placed in the basement. Three Wheeler surface condensers with marine type air pumps, are installed. The water for condensation is obtained from the river, the circulating pumps being of the centrifugal type. The water for boiler feeding, however, aside from that obtained from the condensers, comes from the city mains. It is expected that the early completion of the drainage canal will so improve the river water that it may be used for the boilers. The feed-water pumps were made by the George F. Blake Manufacturing Co., and are vertical, duplex and piston packed. The feed water passes through horizontal heaters located between the low-pressure cylinder and condenser of each engine; thence it passes into vertical heaters supplied with exhaust steam from the auxiliary machinery, and from these heaters it goes to the boilers at a temperature of about 210 degrees. All the heaters were made by the Wheeler Engineering Co.

The steam piping is arranged so that the risk from damage on account of breakage is reduced to a minimum. Three main vertical supply pipes from the boiler room to the basement pass through the engine room, back of the engine cylinders and close to the brick wall, and these are the only steam pipes to be seen on the engine-room floor. The separators are located in the basement, as well as the reheating receivers, operating valves, grease extractors, etc. The return of all water of condensation is effected by a Holly return system. All piping from which any heat could be lost is covered with the H. W. Johns asbesto-sponge material.

The engine room is on the first floor, and contains three cross-compound condensing slow speed engines, with cylinders 30 and 60 x 60 in.; mounted on the main shaft of each engine is a Siemens & Halske internal-field type of generator. The generators have 16 poles and turn at 75 r. p. m., the nominal capacity of each being 1,500 kw. The engine shafts are hollow-forged, fluid-compressed steel made by the Bethlehem Steel Co. For handling machinery in the engine room there are two hand operated overhead traveling cranes made by Pawling & Harnischfeger, of Milwaukee, and three post cranes over the basement hatchways.

The switchboard is built between two of the steel posts supporting the girder for the overhead cranes; it is of slate and two sections high.

The generator panels are on the level of the engine-room floor and the feeder panels are on the gallery above, which is provided with a railed balcony on all sides. The leads from the generators are laid under the floor to the switchboard, and the feeders from the latter are conducted from the power house to the elevated structure in ducts underneath the surface of Market St.

Five panels make up the lower board—a wattmeter panel in the center and two generator controlling panels on each side. Each generator panel has a positive and a negative switch, having a carrying capacity of 3,500 amperes. Beside these large switches there is a Weston ammeter, a General Electric circuit breaker, and a Siemens field switch on each generator panel. The wattmeter panel carries two instruments, each of 7,000 amperes' capacity, and also the switches controlling the lighting circuits in the building. Two voltmeters are mounted on an insulated swinging frame on one side of the board.

The feeder panels in the gallery are as follows: Four, of 3,500 amperes' capacity each, for the Loop proper; one, of 700 amperes, for the lighting surface on the structure, including lamps for ticket stations, platforms, street intersections, signal towers, etc.; five, of 800 amperes each, with wattmeter, that may be used for supplying current to surface electric railway lines controlled by Mr. Yerkes and operating in the business district. In addition to the 10 panels named a special "emergency panel" has been recently installed. It is equipped to carry 5,000 amperes to supply the South Side Elevated beyond the Loop in case of interruption of that company's power from its station at 40th St. For this purpose a special emergency feeder is in position on the Van Buren St. side of the Union Loop. Each of the feeder panels has a Weston ammeter and a General Electric circuit-breaker.

BOILER ROOM, UNION LOOP POWER HOUSE.

The maximum load on the Loop station up to the present has not exceeded 4,000 h. p. Ordinarily one unit is sufficient for the midday load, while there is a light load for two engines during the rush hours. The variation in load is from a maximum of 6,000 amperes at 6 p. m. to as low as 250 amperes in the hours after midnight. The fluctuations in load are excessive, a swing from 250 to 3,000 amperes having been observed at 4:30 p. m. within a period of 20 seconds.

This station was built after the designs of Mr. Potis and Mr. Chapman.

The Loop is also connected with the Hobbie St. station of the Union Traction Co., and with the power stations of the Metropolitan and South Side roads. The equipments of the latter stations are such that in summer when there is no current required for heating it is more economical to operate the Loop from them and shut down the Loop station. The north and east sides of the Loop take current from the South Side station, and the others from the Metropolitan. The result is that these two stations have a better load factor, giving a lower cost for power, and the lessees save the expense of operating the Loop station.

The officers of the Union Elevated Railroad Co. are: President, C. T. Yerkes; vice-president, J. Charles Moore; general manager D. H. Louderback; secretary and treasurer, Howard Abel.

The Northwestern Elevated.

The Northwestern Elevated Railroad Co. was organized in October, 1893, Mr. Yerkes being the moving spirit, for the purpose of building an elevated road through the North Division of the city. The work of construction began May 19, 1895, and the first of the superstructure was placed Jan 27, 1896. After 3¼ miles of structure had been built the financial panic of 1896 caused a suspension of the work which was not resumed until the spring of the present year; during the past summer the progress has been rapid, and it is confidently expected that the line will be in operation by March, 1900. In all there will be 25.45 miles of track, of

WORK ON THE NORTHWESTERN ELEVATED.

which 23.92 miles will be used for running trains, and the rest for car storage.

From Institute Place to Wilson Ave., a distance of a little more than 5½ miles, the road will be four track, and it will be two track from Institute Place to its connection with the Union Loop at Fifth Ave. and Lake St. Express trains will be run, which will make stops only once in each mile between Wilson Ave. and Institute Place. These trains will run from Wilson Ave. into the heart of the business district in a little more than 25 minutes. The contract for the rails, ties, special work and everything above the structure was let to the North American Railway Construction Co., of which A. S. Littlefield is president.

The terminal station will be at Wilson Ave. This building is to be constructed of brick and steel, and will be 400 x 65 ft. in size. It will have a capacity for housing 40 motor cars, which will be put in operation when the line is open for traffic. The work on the viaduct at Wells St. was recently completed.

The Pullman company has the contract for building 147 cars for this road, and nearly half of them have been completed. These cars are 46 ft. long over the end plates, and 8 ft. 7 in. wide at the sills. As the road is to be operated left handed the motorman's cabs are at the left forward corners of the motor cars. The cars are to have Hale & Kilburn seats, covered with rattan of small mesh, and "Pantasote" curtains, with Forsyth fixtures.

Trucks for the motor cars are to be of the swing bolster type, with 6-ft. wheel base, designed by Mr. Hedley, general superintendent of the Lake Street Elevated, and made by the McGuire Manufacturing Co.

The power station building, at Fullerton and Southport Aves., is well under way. This is the latest of the stations designed by Mr. Chapman, and embodies all the improvements that his extensive experience with the Yerkes lines could suggest. The plant is about midway between the two extremities of the road, and is a little over half a mile west of the line. The building now erected is 112 x 255 ft.; it occupies less than half of the lot, the design contemplating an addition of 175 ft. to the present building, so that the ultimate capacity of the station will be 14,000 h. p.

The first equipment will comprise 12 Babcock & Wilcox boilers, arranged in batteries of two, equipped with Murphy automatic smokeless furnaces and four engine and generator units, besides the auxiliary apparatus. There are three 30 and 60 x 60-in. cross-compound Allis engines direct connected to 1,500-kw. Siemens & Halske generators, operating at 75 r. p. m. The smaller engine is of the same type, with 23 and 46 x 48-in. cylinders, operating at 80 r. p. m. and direct connected to a 750-kw. Siemens & Halske generator.

For handling coal, there are to be storage bins, chutes and conveyors of the gravity bucket type.

There is a basement 12 ft. 4 in. high under the entire building; on the engine room side are steam and exhaust piping, receivers, separators, and the electrical cable connecting with the switchboard; on the boiler room side are the ash conveyor, the smoke flues and the feed and blow-off piping systems. The boiler feed pumps are three in number, of the Admiralty type, made by the Henry R. Worthington Co.; the feed is taken through one of two 2,000-h. p. heaters.

The steam header, carried overhead in the boiler room, is of wrought iron pipe, 28 in. diameter, with welded flanges; the maximum boiler pressure in the station is to be 160 lb.

The station has a Weiss counter-current type of central condenser built by the Southwark Foundry & Machine Co., which will condense the steam from all the engines in the station. The condenser vessel has a capacity of 14,000 h. p. The condenser pumps comprise a dry air pump for removing the air from the system, and a Bibus rotary pump for supplying the cold injection water; these two pumps are driven from the same engine, the air pump tandem and the circulating pump belted. The hot water flows from the condenser through a "water leg," which is merely a barometic column, the lower end of the pipe being submerged The action of the circulating pump is positive, and the amount of water it handles automatically regulated according to the load, because of the speed of the auxiliary engine being governed by the action of the air pump.

C. V. WESTON,
Chief Engineer.

Condensing water is taken from a 12-ft. brick tunnel built by the city, extending from the lake to the river, which is laid in Fullerton Ave., in front of the power house.

The stack at this station is at one side, opposite what will be the center when the building is extended. It is 27 ft. square at the base, 203 ft. high above the street, and has a 10-ft. flue; it rests on a pile foundation topped with concrete 31 ft. square and 5 ft. thick.

The officers of this company are: President, D. H. Louderback; vice-president, C. D. Hotchkiss; secretary and treasurer, Howard Abel.

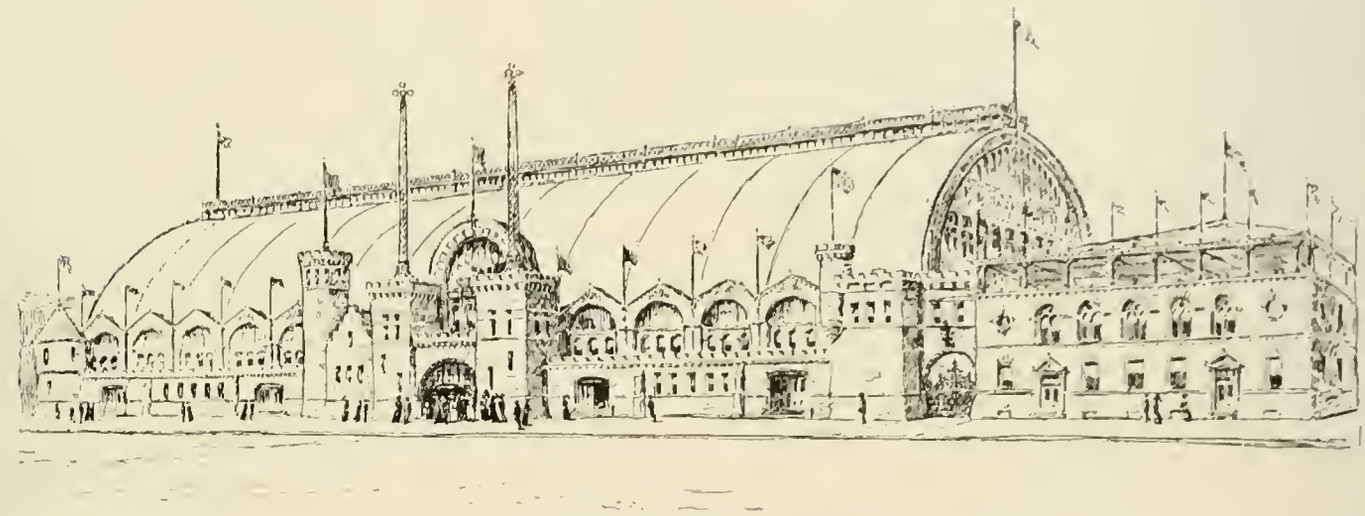
NO MUNICIPAL RAILWAY FOR DETROIT.

The street railway fight in Detroit is ended, at least so it is announced. Elliott G. Stevenson, Eli B. Sutton, J. G. Hutchins, Tom L. Johnson and R. T. Wilson held a long conference in New York on September 9th, relative to the reopening of the Detroit municipal street railway campaign, and after the meeting Mr. Stevenson stated that as a result of the conference the entire street railway deal contemplated under the McLeon act and later under the plan proposed by the Municipal Railway Co., is permanently and absolutely abandoned. The reason given is that Mr. Wilson refused to tie up his property with another option, and that he also increased the asking price of the roads from approximately $15,000,000 cash to $17,000,000.

THE CONVENTION HALL.

The convention will be held in the buildings known as Tattersalls, which extends from 16th St. to 17th St., between State and Dearborn. It is reached from the down town hotels by taking any car on either the Wabash Ave. or State St. lines of the Chicago City Ry. Passengers should alight at 16th St. and walk west, (away from the lake) the one or two blocks.

Chicago, much to its discredit, has not at present any suitable or adequate building for gatherings of this kind. The immense Coliseum at 63d St., with a seating capacity the largest in the country, burned about two years ago. During the present year a strong company was organized, and had in process of erection a magnificent building, both as to its capacity and appointments. It was to be the finest of the kind in the United States. While Tattersalls was selected for the convention on the visit here of the executive committee, it was confidently expected then that the new Coliseum would be far enough along so that the meetings and exhibits could be held there. Up to August 31st work was progressing rapidly day and night, and arrangements were practically closed to transfer the convention to the new structure, which it



PROPOSED CHICAGO COLISEUM.

CHICAGO COLISEUM WRECKED AUGUST 31ST.

was promised by the builders, would be ready by the time required. On the date named, however, a terrible disaster occurred in which nine workmen were killed by the falling of the immense trusses which formed the arch of the roof. It is an occasion of deep regret and disappointment to the local committees, that they are obliged, after all, to locate the meeting in a building which, while perfectly safe, and of fairly good size does not possess the interior appointments they would gladly have secured were another building of sufficient size to be had. They have, therefore, been obliged to make the best of an unfortunate and unexpected situation, which they are powerless to help.

The new Coliseum would have been 382 ft. long by 172 ft. wide, which is 69 ft. longer and 41 ft. wider than Madison Square Garden. We illustrate the design of the Coliseum as it would have been, the accident, to show what we expected to offer our guests. We also desire to express the great disappointment of the local committee.

BUREAU OF INFORMATION.

This important feature of the Exhibit Hall is in charge of an active committee, whose title is that of Publicity and Information. The office of this committee will be found at the main entrance of the building. Here are provided telephone and telegraph facilities, railroad time tables of all roads running into Chicago, diagrams of the theaters, city and railroad directories, and other general information usually desired at such times.

A force of stenographers will be provided, with machines, to handle dictation of guests promptly and accurately. Complete facilities also are provided for checking garments or packages which visitors may not wish to carry with them in the building.

Another feature which is new and which will be greatly appreciated by the exhibitors, especially, is the post office department. A special carrier will be detailed from the Chicago post office and stationed at the Bureau during the entire convention week.

Mail addressed care Tattersalls will be delivered promptly to the proper person in his exhibit space, and six deliveries per day will be made. Mail for delegates will be carried to convention hall with the same promptness. Stamps and postal cards will also be provided.

The committee has prepared an extremely complete reference book of pocket size, which is a miniature Chicago directory specially compiled with reference to the wants of street railway people.

The Bureau will open at 8 a. m. and remain in operation until late at night.

"REVIEW" HEADQUARTERS AT TATTERSALLS.

The headquarters of the "Review" at the convention hall will be found at the first space on the right of the main entrance to the exhibit hall—Space No. 2.

We invite visitors to drop in and rest, or use it for office or meeting purposes. There will be an abundance of comfortable chairs and a hearty welcome.

PLAN OF EXHIBIT HALL, AMERICAN STREET RAILWAY ASSOCIATION CONVENTION.

LIST OF EXHIBITORS.

No. of Space.	Exhibitor.	Sq. Ft.
1.	C. F. Orr & Co.	100
2.	"Street Railway Review"	215
3.	Street Railway Journal	215
4.	K. McLennan & Co.	100
5.	W. R. Garton Co.	125
6.	Electric Railway Equipment Co	400
7.	Electrical Review Publishing Co.	150
8.	The Railway World	150
9.	Safety Insulated Wire & Cable Co.	125
10.	Novelty Tufting Machine Co.	100
11.	Mica Insulator Co.	200
12.	Manville Covering Co.	300
13.	R. D. Nuttall Co.	300
14.	Chas. N. Wood	100
15.	American Protected Rail Bond Co.	100
16.	Creaghead Engineering Co.	200
17.	Ohio Brass Co.	500
18.	Consolidated Car Heating Co.	200
19.	Gold Car Heating Co.	200
20.	Haywood Bros. & Wakefield Co.	300
21.	American Rail Joint & Mfg. Co.	100
22.	A. & M. Brake Shoe Co.	100
23.	Hale & Kilburn Manufacturing Co	100
24.	Pantasote Co	100
25.	E. T. Burrows Co.	100
26.	Curtain Supply Co.	100
27.	Adams & Westlake Co.	200
28.	General Electric Co.	1,600
29.	Harold P. Brown	200
30.	Standard Paint Co.	200
31.	Central Electric Co.	200
32.	Garton-Daniels Electric Co.	200
33.	Westinghouse Electric & Manfacturing Co.	1,600
34.	The Falk Co.	400
35.	American Steel & Wire Co.	400
36.	The Consolidated Car Fender Co.	600
37.	Dearborn Drug & Chemical Works	200
38.	American Mason Safety Tread Co.	100
39.	Standard Underground Cable Co.	100
40.	American Car & Foundry Co.	100
41.	Adam Cook's Sons	100
42.	Leschen, Macomber & Whyte Co.	100
43.	Albert B. Herrick	100
44.	Continuous Rail Joint Company of America	100
45.	American Railway Supply Co.	100
46.	International Register Co.	200
47.	Ohmer Car Register Co.	200
48.	R. Bliss Manufacturing Co.	100
49.	Meaker Manufacturing Co.	200
50.	Barney & Smith Car Co.	500
51.	Garl Electric Co.	50
	James L. Howard & Co.	50
52.	Paige Iron Works	100

53.	Milwaukee Rail Joint & Welding Co.	100
54.	Watson-Stillman Co.	100
55.	G. P. Magann Air Brake Co.	500
56.	Christensen Engineering Co.	700
57.	McGuire Manufacturing Co.	800
58.	Standard Air Brake Co.	250
59.	Pennsylvania Steel Co.	460
60.	Griffin Wheel Co.	200
61.	W. T. Van Dorn Co.	232
62.	Pennsylvania Car Wheel Co.	300
63.	Lorain Steel Co.	1,300
64.	Dorner Truck & Manufacturing Co.	300
	Taylor Electric Truck Co.	400
65.	Hipwood Barrett Car & Vehicle Fender Co.	600
66.	Cling Surface Manufacturing Co.	150
67.	Wm. Wharton, jr., & Co.	300
68.	Charles Scott Spring Co.	165
69.	H. M. Stiles.	100
70.	American Brake Shoe Co.	100
71.	Ironsides Co	100
72.	Siegrist Lubricator Co.	150
73.	Morris Electric Co.	675
74.	Crane Co. and Ludowici Roofing Tile Co.	250
75.	Cylindorama Railway Co.	100
	Star Brass Works.	100
76.	American Vitrified Conduit Co.	150
77.	New Haven Car Register Co.	100
78.	Chapman Valve Manufacturing Co.	100
79.	U. S. Rocking Grate Bar Co.	100
80.	J. R. McCardell & Co.	150
81.	Baltimore Car Wheel Co.	150
82.	Miller-Knoblock Co.	100
83.	Major Cement Co.	100
84.	Weber Rail Joint Manufacturing Co.	100
85.	Joseph Dixon Crucible Co.	100

CURB SPACES. WEST SIDE OF BUILDING.

Taunton Locomotive & Manufacturing Co....90 ft. x 10 ft.
McGuire Manufacturing Co.....50 ft. x 10 ft.
Taylor Electric Truck Co.....10 ft. x 10 ft.

HOME OF THE "STREET RAILWAY REVIEW."

The "Review" will be pleased to have its readers visit its establishment at any time during convention week, and to have its friends make use of its office.

The business and editorial offices of the Windsor & Kenfield Publishing Co. occupy the thirteenth floor of the Monon building. In the adjoining building are our mechanical departments. The "Review" is one of the few trade and class journals which operates its own printing establishment. This is divided into two departments: the composing room, where a battery of typesetting machines operate day and night; and the press room. The latter contains five presses, three of which were built to order specially for high grade printing. Two of these presses are among the largest and fastest of their class in the city. Our friends are invited to call and inspect the operation of these machines. Our establishment is convenient to all the down town hotels by a few minutes' walk, and the street number is 324 Dearborn—near Van Buren. In telephoning call for Harrison 754.

Announcement is made by an official of the Grand Rapids & Indiana Ry., a steam road running from Richmond, Ind., to Mackinac, Mich., that if the proposed electric line is built from Grand Rapids to Kalamazoo, to compete with its service, it will immediately equip its division between those two cities with electricity.

LAKE SHORE AND ROCK ISLAND DEPOT.

LOCATION OF RAILROAD DEPOTS IN CHICAGO.

We give for guidance of visitors a list of the railroad depots, some of which are used by several roads. Also the convenient means of reaching them from Wabash Ave. and Jackson St., which is a central down town point easily determined.

CENTRAL STATION: Lake Front and 12th St.; reached by Wabash Ave. cars going south.

NORTHWESTERN DEPOT: Fifth Ave. and the river. Take Dearborn St. car, so marked.

UNION DEPOT: Adams St. and Canal (just across the bridge) take Adams St. cars bearing depot sign.

LAKE SHORE and ROCK ISLAND DEPOT: Van Buren and Sherman Sts., four blocks west of Wabash. Walk, take cab or Lake St. Elevated.

POLK ST. DEPOT: Foot of Dearborn St.; Wabash, State or Dearborn St. cars.

GRAND CENTRAL STATION: Harrison and Fifth Ave.; cars so marked from Van Buren and State Sts., or cab.

SPECIAL TRAIN FROM THE EAST.

A special train to the Chicago convention will be run from Boston over the Boston & Albany, and from New York over the New York Central, merging at Albany and from there continuing over the New York Central and Lake Shore & Michigan Southern. It will be a vestibule train of Wagner sleepers with dining car. Fare is one and one-third for the round trip. Passengers taking train at New York or points on New York Central should address Milton C. Roach, general eastern passenger agent, N. Y. C. R. R., 413 Broadway, New York. Passengers from Boston and points on the B. & A. communicate with J. L. White, passenger agent, B. & A. R. R., 266 Washington St., Boston.

Leaving time from principle points is as follows:

Lv. Boston	B. & A.	10:30 a. m.	Sunday, Oct. 15.
Lv. Worcester	B. & A.	11:42 a. m.	Sunday, Oct. 15.
Lv. Springfield	B. & A.	1:14 p. m.	Sunday, Oct. 15.
Lv. New York	N. Y. C	1:00 p. m.	Sunday, Oct. 15.
Lv. Albany	N. Y. C.	4:35 p. m.	Sunday, Oct. 15.
Lv. Utica	N. Y. C.	6:52 p. m.	Sunday, Oct. 15.
Lv. Syracuse	N. Y. C.	8:15 p. m	Sunday, Oct 15.
Lv. Rochester	N. Y. C.	10:05 p. m.	Sunday, Oct 15.
Lv. Buffalo	L. S. Ry.	12:00 midnight.	Sunday, Oct. 15.
Ar. Chicago	L. S. Ry.	2:30 p. m.	Monday, Oct. 16.

OFFICERS A. S. R. A.

President, Charles S. Sergeant, second vice-president Boston Elevated Railway Co., Boston, Mass.

First Vice-President, Henry C. Moore, president Trenton Street Railway Co., Trenton, N. J.

Second Vice-President, Ernest Woodruff, president Atlanta Railway & Power Co. and Atlanta Railway Co., Atlanta, Ga.

Third Vice-President, Walton H. Holmes, president Metropolitan Street Railway Co., Kansas City, Mo.

Secretary and Treasurer, T. C. Penington, treasurer Chicago City Railway Co., Chicago, Ill.

Executive Committee, the president, vice-presidents and—

Albion E. Lang, president Toledo Traction Co., Toledo, O.

G. A. Yuille, assistant general manager Chicago Union Traction Co., Chicago, Ill.

Frank Jones, vice-president and manager Memphis Street Railway Co., Memphis, Tenn.

John I. Beggs, general manager Milwaukee Electric Railway & Light Co., Milwaukee, Wis.

Ira A. McCormack, general superintendent Brooklyn Rapid Transit Co., New York.

A complete list of the cities where the conventions have been held and the presiding officer is as follows:

Boston	Moody Merrill	1882
Chicago	H. H. Littell	1883
New York	William H. Hazzard	1884
St. Louis	*Calvin S. Richards	1885
Cincinnati	Julius S. Walsh	1886
Philadelphia	*Thomas W. Ackley	1887
Washington	Charles B. Holmes	1888
Minneapolis	George B. Kerper	1889
Buffalo	Thomas Lowry	1890
Pittsburg	Henry M. Watson	1891
Cleveland	John G. Holmes	1892
Milwaukee	D. F. Longstreet	1893
Atlanta	Henry C. Payne	1894
Montreal	Joel Hurt	1895
St. Louis	H. M. Littell	1896
Niagara Falls	Robert McCulloch	1897
Boston	Albion E. Lang	1898
Chicago	C. S. Sergeant	1899

*Deceased.

PROGRAM.

TUESDAY, OCTOBER 17th.

10 a. m. Meeting called to order by President Sergeant.
Address of welcome.
Calling of the roll.
Invitation extended to join the Association.
Address of the president.
Report of the executive committee.
Report of the secretary and treasurer.
Paper: "Investments in Street Railways: How Can They Be Made Secure and Remunerative?" By Charles T. Yerkes, president Chicago Consolidated Traction Co. and Union Elevated Railroad Co.
Reception at Auditorium Parlors, 8:30 p. m.

WEDNESDAY, OCTOBER 18th.

Convene at 10 a. m.
Paper: "Maintenance of Car Equipment." By J. H. Vanderveer, Brooklyn Heights Railroad Co.
Paper: "Modern Street Railway Shops; Their Design, Machinery and Shop Practice." By B. L. Kilgour, electrical engineer, Cincinnati Street Railway Co.
Appointment of Committee on Nomination of Officers and selection of next place of meeting.
1:30 p. m. Trip to Drainage Canal. Train leaves depot at 1:30 sharp; return at 5 p. m.

THURSDAY, OCTOBER 19th.

Convene at 10 a. m.
Paper: "Construction and Maintenance of Street Railway Track." By Edward Butts, Metropolitan Street Railway Co., Kansas City, Mo.
Paper: "Tram Service and Its Practical Application." By Ira A. McCormack, general superintendent Brooklyn Heights Railroad Co.
Election of officers for ensuing year.
1:45 p. m. Tallyho ride through Jackson Park.
2:00 p. m. Trolley ride to stock yards. Attendants will be on hand to show all the points of interest.
8:00 p. m. Theater party. Tickets will be distributed at the hotel. Those intending to go will make up their own parties and get tickets accordingly.

FRIDAY, OCTOBER 20th.

The entire day to be given to the examination of exhibits.
Ladies will be taken to the principal stores, the Art Institute and Lincoln Park; carriages will be in waiting at the hotel at 10:00 a. m.
7:00 p. m. Banquet at the Auditorium.
Installation of officers-elect at the banquet.

LOCAL COMMITTEES FOR CONVENTION.

Following are the local committees on arrangements for the convention:

GENERAL COMMITTEE.

John M. Roach, chairman
Geo. A. Yuille, secretary and treasurer.
H. M. Sloan. — Geo. O. Nagle.
F. L. Fuller. — H. H. Windsor.
T. C. Penington. — J. R. Chapman.

EXHIBITS.

James R. Chapman, chairman.
Geo. W. Knox. — C. E. Moore.
F. T. C. Brydges. — John Millar.
W. F. Carr. — A. C. Heidelberg.
N. C. Noe. — W. A. Harding.

ENTERTAINMENT.

J. M. Roach, chairman.
Frank R. Greene. — T. M. Henderson.
Geo. C. Bailey. — A. S. Littlefield.
Geo. A. Yuille. — Harry Keegan.
F. W. Edmunds. — F. S. Kenfield.

HALLS AND HOTELS.

Geo. O. Nagle, chairman.
A. S. Littlefield. — T. M. Henderson.
F. H. Clark. — H. A. Higgins.
W. H. Forsyth.

TRANSPORTATION.

F. L. Fuller, chairman.
W. W. Bean. — Wm. Walmsley.
T. D. Miles. — W. J. Cooke.
J. M. Atkinson. — J. J. O'Keefe.
Clift Wise. — H. W. Falk.

BANQUET.

J. M. Roach, chairman.
M. B. Starring. — D. G. Hamilton.
H. H. Windsor. — B. E. Sunny.
G. C. Bailey. — C. S. McMahon.

FINANCE.

Geo. A. Yuille, chairman.
J. C. Moore. — C. R. Penington.
H. B. White. — W. S. Bell.
F. H. Fitch.

RECEPTION AND LADIES.

H. M. Sloan, chairman.
L. S. Owsley. — F. L. Fuller.
C. K. Knickerbocker. — T. P. Bailey.
G. A. McKinlock. — J. C. Moore.
C. N. Duffy. — Robt. McCulloch.
T. C. Penington. — F. E. Smith.
F. R. Greene.

OFFICERS OF THE AMERICAN STREET RAILWAY ASSOCIATION.

C. S. SERGEANT,
President.

T. C. PENINGTON,
Secretary.

HENRY C. MOORE
First Vice-President.

ERNEST WOODRUFF,
Second Vice-President.

WALTON H. HOLMES,
Third Vice-President.

A. E. LANG,
Executive Committee

G. A. YUILLE.

FRANK JONES.

JOHN I. BEGGS.

IRA A. McCORMACK.

Members of the Executive Committee.

LADIES' RECEPTION COMMITTEE.

Mrs. J. M. Roach.	Miss Maude Pennington.
Mrs. Frank R. Greene.	Mrs. C. R. Pennington.
Mrs. J. Chas. Moore.	Mrs. Z. E. Knapp.
Mrs. J. W. Buell.	Mrs. W. J. Cooke.
Mrs. M. B. Starring.	Miss M. E. Cooke.
Mrs. J. R. Chapman.	Mrs. Clay Crawford.
Mrs. W. A. McGuire.	Miss Estelle Johnson.
Miss M. A. McGuire.	Mrs. Geo. A. McKinlock.
Miss E. B. McGuire.	Mrs. W. Worth Bean.
Miss M. Willowby.	Miss Keith Bean.
Miss Frances Byrne.	Mrs. F. S. Kenfield.
Mrs. H. H. Windsor.	Mrs. J. N. Hobbs.
Mrs. J. Samuel Sheahan.	Mrs. R. E. Richardson.
Mrs. Clift Wise.	Mrs. H. A. Marsh.
Mrs. R. H. Prince.	Mrs. H. M. Sloan.
Mrs. Robt. McCulloch.	Mrs. W. A. Harding.
Miss Bessie Felton.	Miss Edna Kimmell.
Mrs. George A. Yuille.	Mrs. G. W. Knox.
Mrs. Theo. P. Bailey.	Mrs. C. N. Duffy.
Mrs. B. E. Sunny.	Miss Clara Cunningham.
Mrs. T. C. Penington.	Mrs. J. C. Shainwald.

PUBLICITY AND INFORMATION.

H. H. Windsor, chairman.

A. L. Tucker.	J. J. O'Keefe.
J. A. Hanna.	C. J. Reilly.
Arthur Hartwell.	C. A. Brett.
D. B. Dean.	C. S. McMahon.

CHICAGO STREET RAILWAY MAIL SERVICE.

The street railway mail service on the Chicago lines is quite important. Four railway post office routes were established Nov. 11, 1893, and were operated by the railway mail service bureau of the Post Office Department until recently when they were placed under the jurisdiction of the Chicago post office.

During the fiscal year ending June 30, 1898, the Chicago & North

FIRST STREET RAILWAY POST OFFICE IN CHICAGO.

Clark St. route, 3.61 miles, with two cars and four clerks, made 22,996 miles, and handled 24,320 pieces (estimated) of mail matter per day; the Chicago & Milwaukee Ave. route, 3.07 miles, two cars and three clerks, made 34.64 miles, and handled 10,800 pieces per day; the Chicago and Madison St. route, 4.07 miles, two cars and five clerks, made 34,701 miles, and handled 24,320 pieces per day; the Chicago & Cottage Grove Ave. route, 7.73 miles, two cars and four clerks, made 53,971 miles, and handled 20,060 pieces per day. The first three routes are over the Chicago Union Traction lines, and the last over the Chicago City Ry.

The opening of an extension of the Cleveland & Chagrin Falls Electric Ry. and the completion of the Cleveland & Eastern Ry., makes a through electric line from Cleveland to South Newbury, a distance of 30 miles.

OFFICERS STREET RAILWAY ACCOUNTANTS' ASSOCIATION.

President, J. F. Calderwood, auditor Twin City Rapid Transit Co., Minneapolis, Minn.

First Vice-President, E. R. L. Tighe, accountant Brooklyn Rapid Transit Co., New York.

Second Vice-President, R. Lancaster Williams, treasurer Richmond Traction Co., Richmond, Va.

Third Vice-President, F. E. Smith, auditor Chicago Union Traction Co., Chicago, Ill.

Secretary and Treasurer, W. B. Brockway, secretary Toledo, Bowling Green & Fremont Railway Co., Toledo, O.

Executive Committee, the officers and—

H. L. Wilson, auditor Boston Elevated Railway Co., Boston, Mass.

H. C. Mackay, comptroller Milwaukee Electric Railway & Light Co., Milwaukee, Wis.

H. E. Babcock, auditor Elmira & Horseheads Railway Co., Elmira, N. Y.

J. D. Fraser, secretary and treasurer Ottawa Electric Railway Co., Ottawa, Canada.

PROGRAM.

MONDAY, OCTOBER 16th.

7:30 p. m. Annual meeting of the Executive Committee.

TUESDAY, OCTOBER 17th.

10:00 a. m. Meeting room in Tattersalls.
Address of welcome.
Annual address of the president.
Annual report of the executive committee.
Annual report of the secretary and treasurer.
Appointment of convention committees.

WEDNESDAY, OCTOBER 18th.

10:00 a. m. Meeting room in Tattersalls.
Report of Permanent Committee on "A Standard Classification of Accounts." By C. N. Duffy, auditor Chicago City Railway Co., Chicago, Ill.
Paper: "Car Mileage." By H. C. Mackay, comptroller Milwaukee Electric Railway & Light Co., Milwaukee, Wis.

THURSDAY, OCTOBER 19th.

10:00 a. m. Meeting room in Tattersalls.
Report on the Department of Blanks and Forms. By W. B. Brockway, secretary Toledo, Bowling Green & Fremont Railway Co., Toledo, O.
Paper: "How Should Supplies Accounts be Kept?" By W. M. Barnaby, chief accountant Brooklyn Rapid Transit Co., New York.
Unfinished business.
Report of convention committees.
Election of officers.
Adjournment.

FRIDAY, OCTOBER 20th.

Devoted entirely to the examination of the exhibits.

POST OFFICE AT CONVENTION HALL.

The Bureau of Information will provide excellent post office facilities at Convention Hall. A special carrier will be detailed from the Chicago post office, who will deliver direct to exhibitors or delegates in the building, all mail matter addressed in care of Tattersalls. Exhibitors who in past years have not found it convenient to return to their hotels during the day can get their mail with least possible delay by having it addressed as stated. Frequent collections of mail will be made, stamps and postal cards will be provided, and the convention post office will be made as effective and complete as possible.

The new Detroit, Rochester, Romeo & Lake Orion Electric Ry. was opened September 26th.

OFFICERS OF THE STREET RAILWAY ACCOUNTANTS' ASSOCIATION OF AMERICA.

E. R. L. TICHE,
First Vice-President.

JOHN F. CALDERWOOD,
President.

F. E. SMITH
Third Vice-President

H. L. WILSON,
Executive Committee.

W. B. BROCKWAY,
Secretary.

H. C. MACKAY,
Executive Committee.

H. E. BABCOCK,
Executive Committee.

JAMES D. FRASER,
Executive Committee.

ENDORSEMENT OF THE STANDARD SYSTEM OF ACCOUNTS.

The Accountants' Association has good reason to be pleased with the endorsement which the Railroad Commissioners have given its standard system of accounts. Chairman Duffy recently received the following letter from the Connecticut Railroad Commissioner:

Dear Sir: Mr. Seymour has received a communication from Commissioner Cole in which he advises that he presented the report in relation to street railway accounting; that it was received with marked favor, and was adopted unanimously upon the reading of the preliminary report of Mr. Seymour. This is about all that is now necessary, I believe, to warrant us in going ahead and having the necessary number of copies printed, and I would therefore thank you to forward to me at your convenience the copy I last sent you, making such notations thereon as will enable me to place your order.

Mr. Cole adds (and I take a great deal of pleasure in communicating the same to you out of courtesy to Mr. Seymour):

"You were also complimented twice during the proceedings for having prepared and presented so complete a report—the only complete report upon any subject, except that upon legislation, which was presented by Mr. Brown of Pennsylvania. It was a great convenience to the delegates to have your report printed in pamphlet form, and that fact was also commented upon by members on the floor as well as by the chairman, officially."

With kind regards, and trusting to hear from you in due season, I am,

Yours truly,

HENRY F. BILLINGS

Hartford, Conn.

THE Street Railway Review

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Delegates and others attending the convention will find in the Daily Edition of the "Street Railway Review," to be issued during convention week, full information concerning the program for the day and an account of the previous day's sessions of the two Associations.

The present tendency toward concentration and consolidation is probably nowhere more marked than among the street railways. Chicago furnishes a good example; a year ago there were 17 operating street railway companies in the city and suburbs; by the two consolidations of the Yerkes interests this number has been reduced to nine.

This year the American Street Railway Association holds its annual convention in Chicago for the second time, the first visit of the Association having been in 1883. That meeting was nominally the second, but in reality was the first convention, the previous meeting at Boston in 1882 having been only for the purpose of organizing. Each of the sixteen years that have elapsed since 1883 has seen the Association broadening its scope and increasing its influence as its growth kept pace with the expansion of the street railway industry, and at no time has the Association been in a more prosperous condition. Last year we published the membership statistics, which showed an increase from 35 members in 1882 to 205 in 1892; from 1892 to 1896 there was a decrease to 160 due to consolidations; since 1896 there has been an increase in numbers, to 161 in 1897, 165 in 1898 and 171 in 1899.

This convention promises to be an unusually interesting one; every effort has been made by the officers and executive committee to provide an excellent program, and the street railway men of Chicago have through their committees prepared for the reception and entertainment of the delegates and other visitors.

It is somewhat amusing to note the seriousness with which the public in some of the English cities have anticipated difficulties in connection with proposed electric railway construction. And yet these fears are evidently sincere and honest. We refer to questions which were once live issues here, but which have been proven years ago to be unfounded. At present the Liverpool public are greatly exercised over the interference with vehicular traffic which the proposed tramways are to induce.

When the cars are once in operation the demonstration will be both effective and satisfactory. The same anxiety was general here in Chicago in 1880, when it was proposed to install the cable system, and objectors were loud in their predictions that the presence of cable cars in the streets would cause confusion and practically drive teaming from the streets so occupied. The cables had been in operation scarcely a week before these fears were found groundless. Instead of chaos it was seen that the mechanically operated cars gave to the moving mass upon the street a definite current which moved up one side and down the other, and that instead of being any detriment, it was a positive advantage. There is no reason why the rule which has prevailed in this country upon the introduction of cable and electric cars should not be found to work the same in foreign cities.

Two years and seven months ago the Street Railway Accountants' Association of America was organized at Cleveland with 25 companies as members, and one of the best indications of the necessity of such an association for the accounting officers of street railways is the growth in the membership roll. Nov. 25, 1897, after the Niagara Falls Convention, there were 52 companies reported as members; Oct. 1, 1898, after the Boston Convention, there were 76; Mar. 31, 1899, there were 93, and since then six other companies have joined, making the total at the present time 99. The many consolidations effected during the past year will no doubt cause a marked reduction in the number of members of this Association, just as consolidations in the past have affected the roll of the A. S. R. A. But this will not detract from the influence of the Association, but rather increase it because the same interests will be represented but controlled by fewer men. The name of this Association has not prevented British companies from desiring to avail themselves of its work, and two of the recent additions to the roll are the Glasgow Corporation Tramways and the Central London Railway.

At Cleveland, at Niagara Falls and at Boston, papers on various subjects of interest to accountants were presented, but the most important work of the Association has been that done through its committees looking to a standard system of street railway accounting. The scheme and classification recommended at Boston, with a few minor changes, in August last, received the official endorsement of the Convention of State Railroad Commissioners, as was noted in our August issue. It has been the policy of the

Association to work in harmony with the Railroad Commissioners or other state officials to whom reports must be made, and, as we have seen, the result has been most satisfactory.

Second only to the standard system of accounts is the Department of Blanks and Forms, and the records of this department when exhibited at the convention will be a great surprise to those who have not kept in close touch with this work. Secretary Brockway has had the blanks arranged in large scrap books, and the collection now comprises the forms used by over 80 per cent of the companies which are members of the association. There are 15 books, 20 x 30 in. and 1 book, 30 x 30 in.; the collection has a complete index so that one may turn instantly to any particular forms he wishes to inspect.

It is seldom that so young an organization can show so much in the way of results accomplished, and the increasing attention given to street railway accounts leads us to predict an even more rapid growth of this Association in the immediate future.

It is the function of associations of all kinds to promote in every way the interests they represent, and the presidents of such associations often (and, we may say, generally) recognize that one of the best means to that end is to encourage the younger members by pointing out to them what great things have been done and the path they must follow to reach the goal. This position of the president in such matters has been so long recognized, and his chair is so hedged about with dignity, that he can afford to laugh with the rest when a little fun is poked at him, as was done by Mr. J. W. Alvord in his interesting paper on "Getting Jobs," which we publish in another part of this issue.

Mr. Alvord is a distinguished member (perhaps one less eminent than he would not have written the paper) of the engineering profession, which the presidents point out has for its work that of "harnessing the forces of Nature." The author, believing that the literature treating of "how to harness" will be well taken care of by his professional brethren, devotes his paper to showing how the "hostler" gets his job.

The engineer who has successfully withstood the ordeal of having his ribs poked will enjoy the distinctions between theory and practice that Mr. Alvord so aptly states; the one who is undergoing the operation will keenly appreciate if he does not enjoy. The whole paper should appeal to everyone because the three rules laid down are equally sound for one who aspires to be a commercial "robber baron" or a traction "magnate" or anything else.

It is sixteen years since the American Street Railway Association met in Chicago. This city at that time had but three street railway companies and the aggregate of their lines was about 160 miles measured as single track; at the present time there are nine surface roads in Chicago, including the interurban lines, which operate almost 1,000 miles and elevated roads with 100 miles more. In 1883 horses furnished the motive power for all the street railways in the city except the then recently completed cable lines of the Chicago City Railway Co. Today nearly all of the well-known systems of street railway traction may be found in Chicago. Leading the list is the overhead trolley with about 875 miles; then come the cables with over 80 miles, the storage battery road with 35 miles, and horses with 11 miles. The third rail system has been in successful operation on 75 miles of elevated road for several years and the Northwestern Elevated with 25 miles more will soon be completed. The South Side Elevated is operated on the multiple unit system—every car being a motor car; the Metropolitan and the Lake Street use trains having a single motor car and trailers.

The electric street railways here present interesting examples of different methods of current distribution; the Calumet and the South Chicago City have boosters for feeding their longest lines, the Chicago & Milwaukee is the latest installation employing a three-phase transmission line and sub-stations with static transformers and rotary converters.

The owl-car problem on the cable lines is solved in two ways, horses and compressed air furnishing the motive power. Apropos of animal traction probably every visitor to Chicago is greatly surprised to see horse cars in the down-town district; this is the fault of the city and not of the companies, which would be very glad to operate trolley cars in Dearborn and Adams Sts., were they permitted to do so.

In the power houses of the various lines there is a wide difference in practice. In the cable stations of the Union Traction simple non-condensing engines are installed, and horizontal tubular boilers with the exception of the auxiliary station at Desplaines St., which has vertical tubular boilers; there are three methods of connecting the engines to the cable driving machinery, belts, gears and rope drives, the latter method being used in the Washington and Jefferson and in the Van Buren and Jefferson stations. The Chicago City cable plants have simple non-condensing engines; the engines in these stations are belted to jack-shafts which drive the cable drums through gearing.

The eight large electric power stations have nearly all been built within the last six years and with two exceptions we find the equipment comprising compound engines and water tube boilers. Four of these stations have horizontal cross-compound condensing engines direct connected to the generators; another one is so situated that condensing water was not convenient and has no condensers. The Metropolitan Elevated power house is the only large station with vertical engines, having vertical cross-compound condensing engines direct connected to the generators; water is brought from the river through a tunnel.

In marked contrast to the other stations comparable in size, the two electric power houses of the Chicago City Ry., one built in 1893 and one in 1896, have simple non-condensing engines connected to the engines by rope drives and return tubular boilers.

Only one of these larger stations, the South Side Elevated, has a cooling tower, though a cooling tower is used at the power plant of the storage battery road, and three companies, the Calumet, the Suburban, and the Chicago & Milwaukee, have reservoirs and wooden cooling tables.

On the whole, it is doubtful whether another city in the country offers such an opportunity as does Chicago for managers who desire to examine and compare the different systems of electric traction.

The Roadmasters' Association of America at its convention in Detroit last month discussed the relative merits of 30-ft. and 60-ft. rails, and went on record as opposed at the present time to a greater length than 33 ft. An abstract

of the committee's report will be found on another page. The three principal objections to long rails are: They are not properly straightened at the mills. They require more labor to properly maintain the track than where shorter lengths are used. They require an increased opening at the joint to allow for expansion. The advantages claimed for long rails are: The reduction in the number of joints, a smoother riding track and decreased cost of maintenance.

The first of these objections is doubtless a serious one for the steam railroad man because the majority of rail mills were designed for rolling 30-ft. to 33-ft. rails, and 60-ft. lengths can be handled only with greatly increased trouble and cost. In street railway work the 60-ft. rail has almost come to be the standard length, and the mills which make a specialty of rolling street railway rails have overcome any difficulties that may have at first been experienced in handling the longest rails. The experience of street railways in cities with long rails has been most satisfactory and within the last two years a considerable portion of the interurban electric lines, which are built more in accord with steam road practice, have been laid with 60-ft. rails, with, we believe, equally satisfactory results. More care in loading, unloading and laying the longer rails is required, but the advantage of reducing the number of joints one-half more than compensates for this.

As to the second objection, that the cost of track maintenance is greater with long than with short rails, the testimony of the members of the Roadmasters' Association is conflicting, and it cannot be taken as established.

In discussing the proper allowance to leave at joints for the expansion of the rails, the Roadmasters' committee presented some data of experiments made by it which showed that the linear expansion by heat of 56-lb. T-rails was nearly twice that of 85-lb. T-rails; also that the linear expansion per degree difference of temperature was nearly twice as much between — 20° F. and + 5° F. as between + 5° F. and + 70° F. The committee explained its work in a modest manner and expressed the regret that more exact methods could not have been employed, closing with the recommendation that further experiments be made.

One of our contemporaries takes occasion in reporting this convention to sneer at the methods and results and rejoices in its "faith in the permanence of physical constants." We believe that the sneer is ill-timed, and that though the results may at first seem a little startling, it is by no means certain they are incorrect.

Messrs. Lavoisier and Laplace found the coefficient of linear expansion between 32° F. and 212° F. to be about 15 per cent greater for steel tempered yellow than for untempered steel. It is the practice, in some mills at least, to roll all weights of rail from ingots of the same size and it is quite possible that the different amounts of work done on the different sections may affect the coefficient of linear expansion in a manner similar to the tempering.

Messrs. Dulong and Petit found the cubical dilation of iron between 0° C. and 100° C. to be .00003546 per degree, and between 0° C. and 300° C. to be .00004405 per degree, so that it does not appear that the different coefficients for different temperatures found by the Roadmasters are necessarily wrong.

Neither is there anything essentially absurd in 30-ft. and 60-ft. rails when in the track having different coefficients of linear expansion.

This question of the openings to be left at joints to allow for the expansion and contraction of rails is one which has ceased to be of importance to the management of a street railway having its tracks altogether in paved streets—the continuous rail, either with cast-welded or electrically-welded joints is the best solution for such cases. When the continuous rail was first suggested it was predicted that it would kink in summer and break in winter; after the experiment was made and this prediction turned out to be false two reasons were found to explain the facts; these were that the rail being nearly all underground the changes in temperature were not as great, and the skin friction prevented the movement of the rail longitudinally and the lateral support of the pavement prevented kinking. Experiments made by Mr. A. J. Moxham, who communicated his results to the American Street Railway Association in a special report at the Pittsburg meeting in 1892 (see Proceedings, p. 195) showed that for all practical purposes the whole of the rail may be taken as being at the temperature of the air. Mr. Moxham had a piece of track 1,160 ft. long laid with 78-lb., 6-in. girder rails; these were on ties spaced 11 to 30 ft. and held to gage by tie-rods spaced 10 ft. apart; the joints were made with fish plates 13⁄4 x 4 x 64 in. with 18 bolts 1 1⁄4 in. in diameter; the bolt holes were drilled and reamed and the bolts turned to make a driving fit. The roadway was of macadam. Observations extending over a period of several months with a range of temperature from 10° to 81° F. showed no motion of the rails.

This experience has been repeated on a number of street railways—the track does not kink in summer and does not break in winter. In May, 1897, we described a section of track one mile long with cast-welded joints laid by the Chicago City Railway in an unpaved street; the rails were 7-in. girders weighing 83 lb. per yard and were laid on ties 28 in. between centers with tie-rods every 7½ ft. This track, after a year's service, was in excellent alinement, although the soft mud could have given the rail but little lateral support. We understand that this company has found the percentages of broken cast-welded joints to be smaller in unpaved than in paved streets; in the paved streets the breakage is believed to be entirely due to faults in the casting, as the number of breaks decreases each year.

In August, 1898, we published an illustration from a photograph of the tracks of the street railway at Ft. Wayne, Ind., which showed the rails very badly kinked, the track having been uncovered on a a hot day. We have recently been advised that this track did not kink until it had been jacked up.

The late Mr. M. K. Bowen, after his experience in welding the tracks of the Chicago City, was of the opinion that the rails should be welded when they were at a comparatively high temperature, thus putting them in tension and not compression by heat changes.

To managers of interurban electric roads, however, the questions discussed by the Roadmasters are as important as to the steam road men, and the results of the proposed investigation would prove interesting.

The "I Will" design on our first page has generally been adopted as the most characteristic of Chicago, and was the design for which a valuable prize was awarded by the Daily Inter-Ocean.

The Marinette (Wis.) Gas, Electric Light & Street Railway Co. has commenced laying pipes for the purpose of furnishing heat to the City Savings Bank and other buildings. A new 200 h. p. engine is being added to the power station equipment.

FUEL ECONOMY OF RAILWAY ENGINES.

BY PROF. R. C. CARPENTER, CORNELL UNIVERSITY, ITHACA, N. Y.

(This paper was prepared for the Ithaca meeting of the New York State Street Railway Association, but owing to the unavoidable absence of Prof. Carpenter, was not presented at that time.)

In the following paper are given the results of 35 tests of electric railroad power stations, which have been made during the past eight years under my supervision, by especially trained students in advanced work in Cornell University.

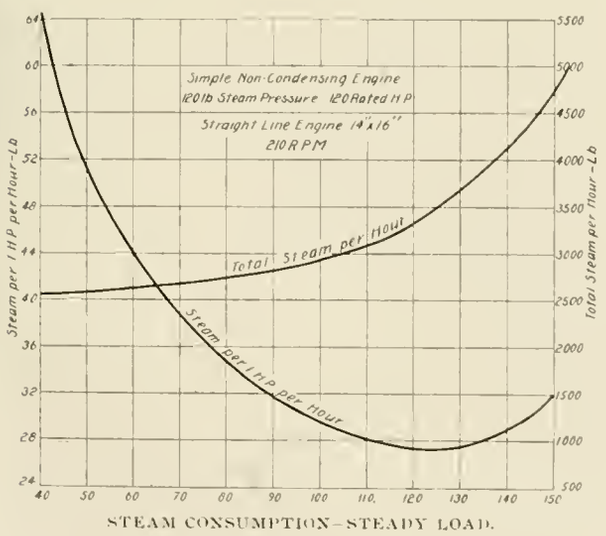
The tests which are cited were made under the ordinary conditions of operation peculiar to the system referred to. In every case the results were doubtless affected by the machinery employed, the method of operating the station and by the varying and continually changing load produced by irregularities in loading and moving of cars.

The tests show the fuel consumption of several classes of engines, operating under the usual condition of power house work. There is shown a variation in the fuel economy by engines of the same class, operating in different stations, which in some instances is of considerable amount. This is probably to be expected, for it is well known that the economy is affected to a great extent by variation in load, since an engine fully loaded is in general much more economical than one partly loaded; no duty throws on an engine a more variable load than street railway work. A certain amount of the variation in coal per horse power as shown by the tests, may be accounted for by individual differences due to poor or good firing; this may and often does make 20 per cent or more difference in fuel economy, and this condition affects the uniformity of the results about in the same proportion. The effect of employing different classes of engines is also well marked. The fuel consumption of different classes of engines is doubtless the most interesting and practical part of the investigation. If we can learn from the tests the probable fuel consumption of each class of engine, we can draw conclusions as to the saving which might be produced by change of power, and we can also predict with certainty the fuel charges for different classes of stations.

SIMPLE NON-CONDENSING ENGINE—SLIDE VALVE AUTOMATIC.

The summary of the tests of the simple non-condensing engine shows on the whole an economy of steam and coal nearly equal to that usually attained with engines of this class in any work. The most probable values indicating an average consumption of 34.3 lb. of steam and 4.63 lb. of actual coal per i. h. p. per hour.

In tests made by the writer, with an engine of this class operating with a steady load, the best result at the normal load corresponding to about ¼ cut-off, was slightly over 27 lb. of steam per i. h. p. per hour; the steam consumption was greater either with a lighter or heavier load. As an illustration, the following diagram



STEAM CONSUMPTION—STEADY LOAD.

exhibits the results of a series of tests made on an automatic slide valve engine running non-condensing. Each test was continued sufficiently long at a given load to obtain the water consumption for that condition. The results are shown in the accompanying diagram, by employing horizontal distances to represent horse power, and vertical distances to represent steam used per horse power per hour. The scale on the left corresponds to the curves showing steam, that on the right to curves showing total steam per hour.

The curves show graphically how the steam used changes with change in load. When the load is light the steam per horse power per hour is very great, when the load is normal the steam consumption is lowest, when very high, the steam consumption per i. h. p. is increased. The total steam per hour increases faster than increase of load. The curve indicating steam per i. h. p. per hour shows slightly over 27 lb. at 120 h. p., nearly 30 lb. at 150 h. p., 44 at 60 h. p. and 64.3 lb. at 40 h. p.

Thus it is seen that a comparison of the results of the tests of the automatic simple non-condensing engines in actual power house work with those obtained under best conditions, is in many respects favorable. The average results of all the tests show a steam consumption only about 25 per cent higher than obtained with this class of engine working under most favorable conditions. This corresponds, by the diagram, to the results obtained with the engine tested at about 80 h. p. or at two-thirds its rated capacity. The average load as compared with the capacity of the engines in the various power house tests, was 54.2 per cent, which would correspond by the diagram to a steam consumption of 31 lb. per horse power.

The following shows in tabular form the results of the tests of simple engines in a power house.

TABLE I.

SUMMARY OF TESTS OF SIMPLE NON-CONDENSING SLIDE VALVE ENGINES.

No.	H. P. of Engine	Steam per i. h. p. hour	Actual coal per i. h. p. hour	Mean observed i. h. p.	Per cent observed h. p. to capacity	Boiler Evaporation per lb. combustible from and at 212°	Kind of coal
6	200	34.8	4.47	110	55	11.50	Pea A
1	405	34.5	a 6.54	257	63.4	a 9.11	Culm, East
7	1975	35.7	4.60	862	51	9.46	Ohio
11	300	37.3	4.49	90	44	12.20	Bit. W. Pa.
11	300	34.3	4.72	95	46.7	10.20	Bit.
24	1000	31.8	b 5.38	717	71.7	b 9.15	Bit. Ill.
31	c 270	41.5	c 5.50	126	47.5	c 10.60	Bit.
33	270	31.6	4.61	147	54.5	10.70	Ant. Buck.
							Ant. Pea
Average		35.1	5.07		54.2	10.24	
Neglecting c		34.3					
Neglecting a. b. c.			4.63				

Engine in test (31) in bad condition.

Probable average coal per i. h. p. hour, when using anthracite or eastern bituminous, 4.63 lb.; anthracite culm, 6.54; western bituminous, 5.38.

Coal per kw. h. output averages 50 per cent higher or 6.94, 9.81 and 8.07 respectively.

Probable error for any given case not over 10 per cent.

Steam pressure 90 to 120 lb.

NON-CONDENSING SIMPLE CORLISS ENGINE.

Three stations only were tested which were using non-condensing simple corliss engines. These three stations show fairly uniform results, both as to steam and coal consumption, and as was the case with the simple slide valve engine, the results closely approximate the best results to be obtained with that class of engine. Thus, while this class of engines might produce a horse power under favorable conditions of loading for an expenditure of 23 to 25 lb. of steam used, the tests show an average steam consumption of 28.3 lb. of steam per i. h. p. per hour, the average load being slightly over one-half of the rated capacity.

The coal per i. h. p. per hour average 3.45 lb., the evaporation per pound of combustible varied considerably, which was due in part to the variation in calorific value of the coal used. The summary of the results of the test is shown in the following table:

TABLE II.

Summary of Results of Tests of Simple Non-condensing Corliss Engine

No.	H. P. of engine	Steam per i. h. p. hour	Coal per i. h. p. hour	Mean Observed i. h. p.	Per cent observed h. p. to capacity	Boiler Evaporation per lb Combustible	Kind of coal
17	300	30.1	3.09	139	46	11.45	Clearfield Bit.
19	150	26.9	3.5	90	60	9.73	Ant. Buck.
22	350	28	3.77	153	44.7	8.55	Ohio Bit.
Average		28.3	3.45		50.3		

NON-CONDENSING COMPOUND ENGINE.

The data obtained relating to this class of engine are limited, and probably insufficient to draw any general conclusion; four tests of power stations were made in which such engines were used, these tests are numbered respectively 2, 4, 21 and 24.

The power house tests Nos. 2 and 4 were made when both simple and compound engines were running; the results do not differ essentially from those obtained with simple engines and previously recorded.

Tests Nos. 21 and 24 were made on non-condensing compound engines, working under fairly favorable conditions. Test No. 21 does not show better coal or steam consumption than many of the tests recorded for simple non-condensing engines; compared with No. 24 it shows a better coal record due principally to the fact that in test No. 21 the coal used was from western Pennsylvania, while that used in test No. 24 was from Illinois. The difference was due principally to the quality of fuel used.

It would hardly be safe to draw a general conclusion from the results in the table regarding the compound non-condensing, as compared with the simple non-condensing engine for railroad purposes, but such conclusion as could be deduced would be but slightly in favor of the compound non-condensing engine.

Some additional information was obtained on this question by a test (24) which was made on both simple and non-condensing compound engines, each kind being tested separately and so as to give an opportunity of comparison. The test on three simple engines showed an average steam consumption of 31.8 lb. per i. h. p. per hour and a fuel consumption of 5.38 lb. of coal. The test on one compound non-condensing engine, 24 x 48 x 48 in., 1,200 h. p., showed a consumption of 30.37 lb. of steam and 4.93 lb. of coal per i. h. p. per hour. The actual evaporation per pound of combustible from and at 212 degrees being in the test of compound 7.75 and in the tests of the simple engines 7.83 lb. of steam. Reducing the results for uniform evaporation, the two tests would indicate that the compound as compared with the simple non-condensing was 0.4 per cent more economical in use of coal, and about 5.5 per cent more economical in use of steam.

The compound non-condensing engine is much less economical, as shown by these tests, when employed in power house work where the load is variable than when used for a steady load. Thus I have tested a compound non-condensing engine of this class working with a steady load and with about the same steam pressure as in the cases cited and found a steam consumption under the best conditions of loading of 22 to 23 lb. of steam per i. h. p. per hour, which is nearly 33 per cent better than shown by the same class of engines in power house work.

TABLE III.

Summary of Results of Tests of Compound Non-Condensing Engine.

No.	H. P. of Engine.	Steam per i. h. p. per hour.	Coal per i. h. p. hour.	Mean observed i. h. p.	Per cent observed h. p. to capacity.	Boiler evaporation, lb.	Kind of coal.
2	1000	30.5	4.22	603.5	60.3	9.03	Bit.
4	1250	36.8	4.33	674	53.8	9.92	3 parts Ant. Culm 1 part Bit. slack.
21	400	34.20	4.17	205.	51	10.23	Bit. Pa.
24	1200	30.37	4.93	754	62.7	9.01	Bit. Ill.
Ave. 21 and 24		32.28	4.55				

Test No. 2 was made on three simple engines 150 h. p., one cross compound 250 h. p. and one triple 300 h. p.

Test No. 4 was made on three simple engines 250 h. p. each and one compound of 500 h. p.

Steam pressure 100 to 125 lb.

We have seen that the simple non-condensing engine performs its work in a railway power house under conditions of varying load with an average steam consumption only about 25 per cent higher than the best average record for its class of engines with a steady load. The compound non-condensing engine requires on the other hand, however, nearly 40 per cent more steam than when working under best conditions with a steady load. From these limited data it would appear that the compound non-condensing engine is only slightly better than the simple non-condensing, and except under extreme conditions not sufficiently better to warrant its use.

COMPOUND CONDENSING SLIDE VALVE OR HIGH SPEED AUTOMATIC ENGINE.

The average results of the tests which were made in power stations using automatic engines of the slide valve type, show a steam consumption of 23.96 lb. and a coal consumption of 3.41 lb. per i. h. p. per hour. If we reject the three highest values as given in tests 3 (a), 18 and 21, and the lowest result as given in 8 (b) we shall have for the average 22.7 lb. of steam and 3.25 lb. of coal per h. p. per hour, which can doubtless be assumed to be most probably correct for this class of engine.

Most of the makers of engines of this class will guarantee them to produce a horse power hour for a consumption of 18 lb. of steam under favorable conditions of loading, and engines of this class have in several instances produced a horse power hour for less than 15 lb. of steam. It will be noted that the best results with engines of this class was 16.7 lb. of steam per i. h. p. per hour, and 2.4 lb. coal per h. p., which was obtained with an engine of 400 h. p. of the four valved type.

The effect of the variable load and other conditions due to railway work is to affect the economy adversely by 30 to 40 per cent, as compared with the best results with a steady load.

TABLE IV.

Summary of Tests of Compound Condensing Slide Valve or High Speed Automatic Engine.

No.	H. P. of engine	Steam per i. h. p. hour	Coal per i. h. p. hour	Mean observed h. p.	Per cent of mean h. p. to capacity	Boiler Evaporation lb.	Kind of coal
3 a	600	29.4	4.43	174	29	10.38	3 parts A 1 part Bit.
3	600	23.2	3.50	190	32	9.93	1 " "
8	400	20.2	3.14	154	38	8.29	Ohio Bit.
8 b	400	16.7	2.40	180	45	7.75	" "
13	250	24.6	2.95	86	34.5	10.51	Bit. Pa.
16	350	22.7	3.41	164	47	9.50	Ant. Pea
18	1200	25.6	3.61	904	75	10.58	Pea Pa.
21	400	29.3	3.81	188	47	10.23	Bit.
Average		23.96	3.41			9.64	
Ave. except 3a and 8b		24.26	3.40			9.82	
Ave. omitting 3a, 18, 21 and 8b		22.7	3.25				

Steam pressure 100 to 120 lb.

COMPOUND CONDENSING ENGINE.

The average results of the tests made on the compound condensing corliss engines and other engines with similar valve gear, including McIntosh & Seymour and Greene, show a steam consumption of 18.8 lb. and a coal consumption of 2.6 lb. per i. h. p. per hour. Omitting test No. 10, for the reason that the coal was of a poor quality, and the evaporation low, the average becomes 18.25 lb. of steam and 2.36 lb. of coal per i. h. p. per hour. The steam consumption of this class of engines working with a good load can safely be taken as 15 lb. or less per i. h. p. per hour, in

which case the actual results in power house practice exceeds the results when the load is steady, by slightly over 20 per cent.

A study of these latter tests shows a higher evaporation per pound of coal than was obtained in power houses using the cheaper grade of engines. This is probably to be explained by the fact that a better grade of engineers and firemen are employed to operate stations of this class, as compared with those using cheaper machinery, although it may possibly be an accidental variation, due to the fact that only a limited number of stations were tested in each class.

The average evaporation from and at 212 per pound of combustible was found to be as follows: For stations using the simple non-condensing engine, 10.26 lb.; for stations using the compound condensing slide valve engines, 9.82 lb.; for stations using corliss compound condensing engines, 10.54 lb. of steam. It is not easy to explain why the evaporation is better from stations using simple engines than from those using compound engines of the same class, as the average grade of employes is rather better in the stations using compound than simple engines; probably the variation is an accidental one, due to the limited number of stations of each class tested. The average range in the variation of results of the evaporation tests for the stations employing the three classes of engines does not exceed 7 per cent, and whether it can be accounted for or not, it will not seriously affect the conclusions.

TABLE V.

Summary of Results of Tests of Compound Condensing, Corliss, Greene, McIntosh & Seymour, and Similar Valve Motions.

No.	H. P. of engine.	Steam per i. h. p. per hour.	Coal per i. h. p. hour.	Mean observed h. p.	Per cent of mean h. p. to capacity.	Boiler evaporation, lb.	Kind of coal.
10	825	22.7	4.06	482	58.2	8.29	½ BitStack. ½ A. Culm
14	1000	21.9	2.56	277	27.7	10.96	Bit.
14	1000	20.0	.....	314	31.4	10.96	
28	350	16.64	2.10	182	52.2	11.80	Bit.
27	500	16.90	2.61	290	58	9.36	Bit.
30	2000	14.50	1.80	814	40.7	10.70	Bit.
34	200	17.30	2.91	145	72	11.14	Bit.
35	1600	20.50	2.18			11.14	Bit.
Average.		18.8	2.60			10.54	
		Evaporation 7.25 to 1 of coal.					
Average omitting No. 10.		18.25	2.36				
		Evaporation 7.78 to 1 of coal.					

Summary of results: A summary of the average results of these various tests is given in Table VI in such manner that the various classes of engines may be readily compared. The best results with each class of engine when sufficiently well marked is also given.

A column giving the proportional value of the engine on the basis of coal consumption with a corliss compound condensing engine placed at 100 is also given. A column giving the probable coal consumption per kilowatt-hour is also appended.

TABLE VI.

Summary of Average Results.

Class of engines.	Steam per i. h. p. lb.	Coal per i. h. p. lb.	Steam per i. h. p. lb. Best load.	Proportional value of engines.	Probable coal per k. w. h. lb.
(A Non-condensing.					
Slide valve simple, average	34.3	4.63	30	53.1	6.90
Best result	31.6	4.61			
Corliss simple, average	28.3	3.45	25	64.5	5.65
Best result	26.9	3.01			
Side valve, compound, average	30.37	4.17	22	60.2	6.12
(B Condensing.					
Side valve, compound, average	22.7	3.25	16	80.5	4.57
Best result	16.7	2.40			3.60
Corliss compound, average	18.2	2.36	15	100	3.64
Best result	14.5	1.80			2.70

RELATIVE ECONOMY OF VARIOUS TYPES OF ENGINES.

Assuming that the results of the tests which have been cited give average and best results for engines of the different classes tested when working under the conditions of street railway work, it is easy to compute the probable yearly cost of each class of engine and by this means determine the relative value from a financial standpoint.

From the table last given it will be noted that the steam consumption per i. h. p. per hour varies from 31.3 lb. to 14.5 lb. A boiler horse power under the conditions of steam pressure supposed to exist would be about 30.4 lb. of steam, although this amount would vary slightly, depending upon the temperature of feed water and upon the steam pressure. The computation would show that 1.13 boiler horse power would be required in case a simple slide valve non-condensing engine were used, while 0.6 of a boiler horse power only would be required for furnishing steam for the compound corliss engine or engines of its type in order to supply them with the same relative amount of steam. This indicates that a considerably less amount of boiler power would be needed for the more economical engine than for the more wasteful one, and this fact tends to equalize the cost of a power station on employing the different classes of engines.

From actual prices which have been quoted within the last six months the writer feels certain that an engine of 500 h. p. capacity, of good quality in its respective class can be purchased and, under ordinary conditions, can be erected complete on foundations for the figures which are given in the following table. A boiler horse power is considered as worth $12 when erected for each class of engines. In view of the recent rise in prices this may be somewhat low, but the results are comparatively true for each class of engine. The figures in the table do not consider real estate, building or chimneys, which would vary largely with different conditions. Despite the fact that engines, pumps, heaters and piping will cost more per horse power for the condensing than for the non-condensing engines, the total cost per horse power does not differ greatly for the various classes of engines employed; this is due largely to the fact that a smaller boiler plant is needed with the more economical engine.

Table VII shows the cost per horse power and also the total cost of the machinery for a power plant of 500 h. p. capacity. It may be remarked that the cost of engines of larger units would be somewhat less and the cost of those with smaller units somewhat greater per horse power than the results shown in the table.

TABLE VII.

Cost per Horse Power of 500-H. P. Plant.

	Boiler h. p. per engine h. p.	Cost per Horse Power					Cost for 500-h. p. plant
		Engine	Boiler	Pumps and heaters	Piping, etc.	Total per i. h. p.	
Non-Condensing Engines							
Simple slide valve	1.135	$8.00	$13.60	$2.00	$5.00	$28.60	$14,300.00
Simple Corliss	0.933	12.00	11.20	2.00	5.00	30.20	15,100.00
Compound slide valve	1.00	11.00	12.00	2.00	5.00	30.00	15,000.00
Condensing Engines							
Compound slide valve	0.75	11.00	9.00	4.00	6.00	30.00	15,000.00
Compound corliss	0.602	16.00	7.25	4.00	6.00	33.25	16,625.00

Taking the fuel consumption as shown by the average results and also the best results in the various tests mentioned, we can compute the yearly requirements in tons per horse power for each class of engine. This has been done in the following table, which is arranged to show the number of tons of 2,000 lb. each required per horse power per day for a day of 12 hours, of 18 hours and of 24 hours. The fuel cost at $2 per ton per horse power year for a day of 18 hours is taken as a basis of comparison of fuel costs of the various engines which have been tested. A day of 18 hours is believed to represent fairly well the average length of time which railroad engines are required to operate. It is also believed that $2 per ton is not far from the average price paid for coal by railway stations in New York state. If anything, it is rather below than above the average price and consequently lessens rather than exaggerates the proportional saving made by the most economical engine.

To the fuel cost of each engine must be added fixed charges of sufficient amount to cover interest and repairs and this has been assumed to be in each case 8 per cent of the cost. No account is taken of that portion of the operating expense chargeable to en-

ployes and oil for the reason that there is no known reason why such charges should be essentially different for the best or for the poorest engine. The following table shows these various quantities computed for the different classes of engines. The last column in the table shows the sum of fuel costs and fixed charges and is one which may be taken to represent the proportional yearly cost of each class of engine.

By a study of the results in the latter column some interesting conclusions may be deduced.

First, as to the saving due to condensing water; we have only two results which can be compared to show the value of the condenser; these results are the cost of the compound slide valve non-condensing compared with the average value for the compound slide valve condensing. The results are respectively, $20.54 and $23.76; the saving due to condenser is $5.78, which is 19.5 per cent of the cost of running a non-condensing and 24.4 per cent of the cost of running a condensing engine. The saving would seem to be nearly 20 per cent and, for reasons which have been already mentioned, would probably be more.

STREET RAILWAY LOAD CURVE.

Second, the average yearly cost of engines of the compound condensing type with the Corliss, McIntosh and Seymour, or Greene valve gear as compared with the simple slide valve engines, show a yearly saving of $14.69 per h. p.

The difference in costs of the power plant considered is $4.65, which is the excess in cost of the compound condensing corliss type over the simple slide valve non-condensing. The saving in fuel and fixed charges is thus seen to be sufficient in a single year to pay 3.15 times the difference in cost between the cheapest and best power plant. Comparing in the same way the average yearly costs of fuel and fixed charges for the compound slide valve condensing engine and the compound corliss condensing type, we find a yearly saving of 5.64 in favor of the better grade of engine. The difference in costs of the two plants is 3.25 in favor of the compound condensing slide valve engine. Thus, in a single year the saving on the fuel and fixed charges of the better engine as compared with the poorer will pay 1.73 times the difference in costs.

Third, these figures would show that no station can afford to purchase and operate the simple non-condensing engine of any type as compared with the compound condensing engine, and fourth, that the compound condensing engine of the best type and with improved valve gear such as the Corliss, McIntosh & Seymour and Greene, and one or two other makes, although costing somewhat more, is so much more economical to operate that, taking all things into consideration, it gives much better financial returns than an engine of any other class. These financial returns are so much in their favor that unless other conditions are exceedingly unfavorable these latter engines are the only ones which should be considered in purchasing machinery for power house work. This general conclusion, that the compound condensing engine of slow rotative speed and with the improved valve gear is much more economical to use than any other type for power house work, even when fixed charges are considered, is certainly the only one which can be adopted from the average results of the tests which I have quoted. This conclusion is noticeable from the fact that in a comparison of costs of different types of railway engines made by Dr. Charles E. Emery, he concluded that the compound condensing engine of the slide valve type and with cylinders arranged in tandem was, when fixed charges were considered, the more economical engine to use. The tests which I have referred to point to a different conclusion and indicate that the saving of the better type of engine will many times repay the extra expenditure of costs. In brief the tests indicate that the engines of the best class are much the better investment.

TABLE VII.

Fuel and Interest Charges for the Different Classes of Engines.

	Coal per i. h. p. lb.	Tons per horse power per year. Day 12 h.	Day 18 h.	Day 24 h.	Fuel cost per year, 18 hrs. per day, $2.00 per ton.	Interest and depreciation, 8 per cent.	Total cost per year per h. p.
Non-condensing Engines.							
Simple slide valve, av	4.63	16.14	15.21	20.28	$30.42	$2.29	$32.71
" " " best.	4.60	10.07	15.10	20.14	30.20	2.29	32.49
Simple corliss, av	3.45	7.55	11.33	15.10	22.66	2.42	25.08
" " " best.....	3.01	6.59	9.89	13.18	19.78	2.42	22.20
Compound slide valve	4.17	9.05	13.57	18.10	27.14	2.40	29.54
Condensing Engines.							
Compound slide valve, av	3.25	7.12	10.68	14.24	21.36	2.40	23.76
" " " " best	2.40	5.25	7.88	10.51	15.76	2.40	18.16
Compound corliss, av	2.36	5.17	7.74	10.33	15.48	2.64	18.12
" " " best.	1.80	3.94	5.91	7.88	11.82	2.64	14.46

BRITISH JOTTINGS.

From our London Correspondent.

The main incident of September in the British tramway world was the fixing of the contracts for the main engines for the power station of the Glasgow Corporation electric tramways. As is well known, with the exception of one route, all the lines in Glasgow are worked by horses. The decision to adopt electricity universally throughout the city was taken some time ago, and the municipality, which owns and operates the system, is now actively engaged in installing electric power and in making large extensions. When the work is completed the lines will cover about 55 miles of streets, nearly all double track; power is being provided to operate eventually 600 cars. All the generating machinery will be in one large power station, from which current will be distributed on the three-phase system to sub-stations, where it will be transformed and converted. It is calculated that by this method the voltage drop in the rails will never exceed 3½ volts, so that gas and water pipes should be very safe from electrolysis. Round the letting of the contract for the main engines of the power station, controversy raged during the latter part of August and the beginning of September, and the matter was finally fixed at a meeting of the Town Council on September 7th, when it was decided to give the contract for two of the engines to the E. P. Allis Co., of Milwaukee, and for the other two to John Musgrave & Sons, Bolton, England.

The engines, it should be mentioned, are vertical compound three-cylinder machines, each capable of developing from 4,000 to 5,000 i. h. p., and fitted with fly-wheels weighing about 100 tons each.

In August the Corporation's committee recommended that the offer of the Allis company be accepted for all four engines, the price to be £114,564—say $570,000. This excited a great deal of local feeling, as it was maintained that British engine builders could turn out as good machines as American firms, though it was admitted that the home manufacturers had not yet produced any large slow-speed engines for electric traction purposes. The

specification had not laid down dimensions of main parts as essentials, but certain leading dimensions were suggested as being considered about what was required. The British tenderers regarded these dimensions as excessive and unnecessary, and tendered upon their own ideas, which are based upon marine and mill engine practice. They said, however, if the dimensions suggested were to be regarded as essential they were prepared to conform to them. The suggested sizes were more in accordance with American practice, and the Allis company conformed to them.

The Town Council sent the matter back again to the committee and the latter body, after conference with representatives of four of the tendering firms, in which the British offerers expressed willingness to modify their designs, recommended that two of the engines should be given to the Allis company, at a total of £57,282, and two to the Musgraves, at a total of £47,788. Delivery within a specified time was made an essential, as the Corporation wishes to have as great a length of the tramways as possible working by electricity when the Glasgow 1901 exhibition opens. As already mentioned, the Council on September 7th confirmed this proposal. The result should prove of great interest, because it will give engineers and tramway people an opportunity of comparing the performances of engines built by two of the most noted engine-building firms of the world, one American and the other English.

The following were the contracts let at the same meeting of the Council:

Two main engines, E. P. Allis Co.	£57,282
Two main engines, J. Musgraves & Sons	47,788
Exciter engines, W. H. Allen & Co., Bedford	3,054
Boilers, Babcock & Wilcox Co.	21,280
Three-phase generators, British Thomson-Houston Co.	25,670
Anxiliary generators, British T. H. Co.	5,343
Exciter generators, British T. H. Co.	1,711
Transformers, Westinghouse Electric Co.	19,983
Rotary converters and boosters, Westinghouse Electric Co.	39,216
Surface condensers and air pumps, the Mirrlees Watson & Yaryan Co., Glasgow	15,000
Total	£236,327

Contracts were also let for centrifugal circulating pumps and boiler feed steam pumps with local firms, the amounts of which are not stated. The contract for auxiliary engines has not yet been let.

These are the largest electric traction contracts which have yet been given in this country.

The opening of new electric lines in various towns goes on merrily. In Dublin some additional routes will soon be ready. Coventry has just opened extensions of a track length of seven miles, making a total of 12¾ miles. Sheffield recently started up its electric lines to the extent of 12 miles of route, mostly double track, and it promises to go on till there will be 36 miles. The electric machinery in both these cases is of American make, the Westinghouse company having been successful in Coventry and the Thomson-Houston Co. in Sheffield. The electrifying of the Liverpool tramways is also being pushed rapidly forward. In Edinburgh the only example in this country of an extensive application of cable traction is nearing completion, and it is probable that a large proportion of the system will be running before the end of the year. The first route is to be opened early in October.

The report by the directors of the Glasgow District Subway Co. for the half year ended July 31st last, which has just been issued, is interesting because the line is the only underground cable railway in the country, if not in the world. It is roughly a circle 6½ miles in circumference and serves the central and western districts of Glasgow. It commenced operation in the beginning of 1897. Dividends were paid on the preference shares from the start, and six months ago the first dividend on the ordinary shares, 1 per cent per annum was declared. A similar distribution is now made for the past half year. As the line was expensive to construct, the capital is large in proportion to the total receipts, the capitalization being £1,300,000, and the amount raised by loans £177,000. Trains of two cars each are run, the train weighing empty 13¾ tons. The total receipts for the half year were £35,977, and the working expenses £17,520. The receipts per train mile were 15.78 d., and the expenses 7.68 d., giving a ratio of 48.67 per cent. The train-miles run were 547,083, and the number of passengers carried 6,505,221. The details of the expenses per train mile in pence and decimals were: Maintenance of way, works, etc., .82; locomotive power, 3.16; repairs and renewals of cars, .24; traffic expenses, 2.47; general charges, taxes, etc., .99; total, 7.68 d. The total is about a half penny higher than the average of previous half years, and the increase seems to be mainly on the items of coal and wages. The fares for passengers are a penny or twopence, according to distance, and there is one halfpenny stage.

In the latter part of September important decisions were reached by the tramway committees of the town councils of Manchester and Leeds. The former committee considered an offer by the Manchester Tramway Co. to pay £50,000 a year for the lines on a 10 years' lease instead of £23,333 a year which it has been paying on the lease now expiring. The committee resolved, having regard to the town council's decision, to municipalize the tramways and to the arrangements entered into with adjoining local authorities for the working of their lines in conjunction with the city tramways, that it could not contemplate the extension of company's lease. The committee subsequently decided to recommend the council to obtain borrowing powers for £250,000 for the construction of the permanent way, £150,000 for overhead equipment, £360,000 for the purchase of 600 electric cars, £90,000 for lands and car sheds, and £10,000 for preliminary expenses; total, £860,000. The lines which have hitherto been operated by the Manchester Tramway Co. comprise 100 miles of track on 80 miles of streets.

The Leeds town council tramway committee agreed to recommend the expenditure of £160,000 for the electrical equipment of all the lines in the city which have not already been electrified, namely 17 miles of street length, all double track. The existing electric lines extend to 12¾ miles, also double track. When the whole scheme is complete 200 cars will be required. The output of the plant already installed is 1,900 kw., and the consulting engineers (Messrs. Hopkinson & Talbot) recommend engines and dynamos to give 1,500 kw. more, making a total of 3,400 kw. A storage battery of 750 kw. h. capacity is to be provided to take care of the fluctuations in the load. The estimate of £160,000 covers boilers, engines, dynamos, boosters, switchboard, battery, overhead line work, laying underground feeders and 125 cars.

HOLLOW-FORGED STEEL SHAFTS IN CHICAGO.

It is not so very long ago since the first hollow-forged and annealed steel shaft was introduced in the West. Since that time, however, the superiority of this type of forging has become so well established a fact that at this date almost all of the street railways in Chicago have in their power houses shafts made of fluid-compressed open-hearth steel, hollow-forged on a mandrel and thoroughly annealed. In some instances, where a still higher quality of steel was required, the shafts have also been oil-tempered.

The methods and processes employed by the Bethlehem Steel Co., which owns the largest works in this country equipped for the manufacture of such forgings, are too well known to need discussion here. Suffice it to say, in brief, that a shaft made by the Bethlehem Steel Co. has undergone the following processes during its manufacture:

1. It has been made from an ingot approximately twice the diameter of the finished forging, in order that the metal might be worked properly.

2. The ingot has been subjected to hydraulic pressure, up to 7,000 tons if necessary, during the cooling process, thereby preventing blow-holes, piping and other defects apt to occur at this critical stage.

3. If a solid shaft, the ingot has been forged down under a hydraulic press, of which the Bethlehem Steel Co has several ranging in capacity from 3,000 to 14,000 tons.

4. If a hollow shaft, a hole has been bored through the ingot through which a mandrel has been placed; the ingot is then forged under a hydraulic press on the mandrel.

5. Every forging, before leaving the works, is carefully and thoroughly annealed to relieve it of forging and cooling strains. No forging is considered finished until after it has undergone this treatment.

As already stated, hollow shafts made by the Bethlehem Steel Co. can be found in almost all of the Chicago traction companies' power houses. To enable delegates in attendance at the convention to readily ascertain where these power houses are located, the Bethlehem Steel Co. has prepared a very interesting and elaborate souvenir for free distribution, giving the exact location of each of Chicago's power houses, with full directions how to reach it, a brief description of its engines, boilers, generators, etc. As this souvenir contains also the official program directory of the exhibitors, and is profusely illustrated, showing views of the Auditorium (the Association's headquarters), Tattersall's, exterior and interior views of Chicago power plants, etc., no visitor should fail to ask for a copy.

The main office and works of the Bethlehem Steel Co. are located at South Bethlehem, Pa., 89 miles from New York and 57 miles from Philadelphia. Its officers are: President, Robert P. Lindermann; vice-president, E. M. McIlvain; treasurer, C. O. Brunner; secretary, Abraham Schropp. The company has offices at 100 Broadway, New York City, in charge of Wm. H. Mitchell; at 421 Chestnut St., Philadelphia, in charge of R. R. Haydock, and at 1433 Marquette Building, Chicago, in charge of E. Nelson. The Chicago office was opened, shortly after the World's Fair, at 1025 Monadnock Block, by Messrs. Fischer & Porter. On November 1st, 1895, Messrs. Fisher & Porter having dissolved their partnership, H. F. J. Porter continued the Bethlehem Steel Co.'s Chicago office at 1433 Marquette Building, where it has been located since that time. The territory covered by this office embraces all states west, south and north of the Alleghany Mountains. In 1897, Mr. Porter was transferred to the main office and was succeeded in Chicago by his assistant, Mr. Nelson, who has been in charge of the office since then. The Chicago office employs a number of agents in western cities, including St. Paul, Minn., Cleveland, O., Cincinnati, O., St. Louis, Mo., and arrangements have recently been perfected with C. S. Burt Co., Ltd., 726 Gravier St., New Orleans whereby matters in the south will be efficiently looked after.

The product sold by the Bethlehem Steel Co. in the West consists in the main of high-grade steel forgings of every description. Builders of engines are not slow to grasp the fact that by using a stronger quality of steel they can reduce the dimensions of their forgings. Builders of marine engines and owners of navigation companies, especially, appreciate the fact that by using hollow forgings they secure not only a grade of forging which insures them immunity from breaking, but increase their carrying capacity as well. Consulting and designing engineers, having carefully investigated the product of the Bethlehem Steel Co., specify it. Railroads use nickel steel for their locomotive forgings such as crank pins, axles, connecting rods, side rods, etc. Broken shafts, made of wrought iron or hammered unannealed steel, are being replaced by forgings made of fluid-compressed open-hearth steel or nickel steel, hydraulically forged and thoroughly annealed. Chicago's water works are equipped with Bethlehem forgings, and they can also be found in a number of power plants of private corporations in Chicago, such as Swift & Co., Illinois Steel Co., Chisholm, Boyd & White Co., Armour & Co., and many others.

SOME RECENT ENGINEERING WORK.

Sargent & Lundy, engineers, at 1140 Monadnock Block, Chicago, have prepared the plans for some of the largest electrical plants installed during the past year. Prominent among these is the South Side Elevated R. R., of Chicago, the entire electrical equipment of which, including the power station, was in the hands of this firm. The success of this installation as regards low cost of operation and adaptability to conditions of traffic, is clearly demonstrated by the recent operating reports of the company.

Additional plants built under the supervision of this firm during the past twelve months are the new central station for the Cincinnati Edison Co. and the enlarged station for the Milwaukee Electric Railway & Light Co. An important installation now on hand is the power plant and line equipment of the Union Traction Co., of Anderson, Ind., owning 160 miles of track. This is a three-phase road, with one central station, containing three 1,000-kw. Westinghouse generators, and eight rotary converter sub-stations, containing 14 250-kw. Westinghouse rotary converters. Storage batteries will be placed at the central station and at each sub-station to carry the peak of the load. The line pressure will be 15,000 volts.

Sargent & Lundy are consulting engineers for the Boston Elevated R. R., Atlanta (Ga.) Railway & Power Co., United States Electric Light & Power Co., of Washington, D. C., Chicago Edison Co., Consolidated Street Ry., of Grand Rapids, Mich., South Chicago City Ry., and the Virginia Improvement & Development Co., of Richmond, Va.

Mr. Frederick Sargent, the senior partner, was formerly engineer for the Edison General Electric Co. of New York, and later chief engineer of the electrical and mechanical engineering work at the Columbian Exposition in 1893. Mr. A. D. Lundy, before his present connection, was chief engineer of the Sprague Electric Equipment Co.; later district engineer for the Edison General Electric Co., in the Southern States. The firm of Sargent & Lundy was formed in 1890.

THE W. R. GARTON CO.

This company was organized in 1898 and was recently incorporated; W. R. Garton is president and Ray P. Lee secretary. Mr. Garton is well known to the railway world as the inventor of the lightning arrester which bears his name. The company is exclusive territorial agent for a large line of important supplies made by some of the best concerns in the country; and as a large stock is constantly carried prompt shipments are made. In fact the large business which has been built up in a short time is in no small measure due to the policy of always shipping goods on the day promised. Among the houses represented by it may be mentioned: The Electric Railway Equipment Co., of Cincinnati, maker of all kinds of railway supplies, line material, tubular iron and steel poles and brackets; Billings & Spencer Co., Hartford, drop forgings, B. & S. commutator bars, Kelsey ratchet brake handle; the General Equipment Co., Camden, N. J., automatic circuit breakers; Keystone Electrical Instrument Co., Philadelphia, voltmeters, ammeters; Massachusetts Chemical Co., Boston, insulating paints, tapes, cloths, paper; the Multiplex Reflector Co., Cleveland, all kinds of reflectors and headlights; the Eureka Tempered Copper Works, North East, Pa.; the McLaughlin rail bonds; the Graphite Lubricating Co., Bound Brook, N. J., Bound Brook trolley bushings; Pittsburg Steel Holloware Co., pressed steel gongs; A. O. Schoonmaker, N. Y., all forms of amber and India mica; E. F. DeWitt & Co., Lansingburg, N. Y., common sense sand box; Miller Knoblock Co., South Bend, assembled commutators, refilled armatures, and armatures rewound; the Lea Manufacturing Co., all kinds of inclosed arc lamps; National Carbon Co., all kinds of carbons; Garton lightning arresters; Van Dorn & Dutton, gears, pinions and track scrapers. All these manufacturers will be represented at the exhibit of the W. R. Garton Co., at the convention.

PRIZES FOR EMPLOYES IN BIRMINGHAM.

As announced in the "Review" for January, 1899, page 47, J. B. McClary, general manager of the Birmingham (Ala.) Railway & Electric Co., at the beginning of the present year, offered cash prizes to the conductors and motormen keeping the cleanest cars and having the least number of accidents, the prizes to be distributed on July 1st and January 1st of each year. On July 1st, last, over $1,000 was distributed to the men, and the system has had such a marked effect in the decrease of accidents and in the neatness of the cars, that the company has decided to still further increase its scope. Hereafter prizes will be distributed once a month instead of every six months, as follows:

Motormen on cars having no conductors will receive $3.33 1-3 for keeping clean cars and $6.66 2-3 for avoiding accidents.

Motormen on cars having conductors will receive $6.66 2-3 for avoiding accidents.

Conductors on cars having motormen will receive $3.33 1-3 for keeping cars clean.

The prizes for the months of July and August were distributed on September 20th, and 90 per cent of the men received some amount over their regular pay, showing the interest manifested by them in the company's efforts to better its service.

The managers of the street railways in St. Louis report they are having great trouble in securing men for repairing tracks and laying new rails.

A SUCCESSFUL ELECTRICAL HOUSE.

If there is still a lurking doubt in the mind of any visitor to Chicago that the "times of orders" are really here, if he will but step into the headquarters of the Central Electric Co., at Nos. 264 to 270 Fifth Ave., he will very soon have that doubt turned into a full assurance that an era of business activity such as has not been known for years has come to at least a portion of the electrical trade. For here he will see a small army of clerks, each with a handful of the company's regulation order forms, hurrying to and fro, giving shipping instructions, asking at different departments for certain lines of goods, all in seeming confusion, but all following closely the rules of a well developed system for filling orders promptly and correctly; customers coming and going in an almost constant stream; and best testimony of all, if the visitor will glance into the shipping room, any further question that might still remain in his mind will vanish. The Central Electric Co., for one, is crowded with orders.

The supplies handled by this company need no introduction. They include such well known specialties as Okonite wire, Westinghouse lightning arresters and arc lamps, Westinghouse alternating fan motors, Wagner transformers and switchboard instruments, Hill switches and switchboards, and the products of the Central

SHIPPING ROOM, CENTRAL ELECTRIC CO.

Union Brass Co., Columbia Incandescent Lamp Co., The Bullock Electric & Manufacturing Co., and the Ziegler Electric Co. A large assortment of sizes and shapes is constantly on hand and the company numbers as one of its most valuable assets the good name it has with its customers for prompt shipments.

The business of the Central Electric Co. was established in March, 1887, at 38 and 40 La Salle St., but these quarters were quickly outgrown, and after various changes the present location was secured in 1898.

Geo. A. McKinlock, the president, and to whose energy and business ability the present prominent position of the company is due, was born in Oswego, N. Y., Dec. 27, 1857, and has been associated with electrical enterprises since 1877, when he was appointed manager and cashier of the American District Telegraph Co. at Detroit. In 1880 he became one of the incorporators of the Detroit Electrical Works, and remained with this concern until 1887, when he resigned to seek a wider business field. He went to Chicago and started the enterprise now known as the Central Electric Co. Charles E. Brown, the secretary, has been with the company for 10 years, and although still a young man, brings to bear upon his work an executive ability which compels success in anything he undertakes. M. M. Wood has charge of the street railway supply department, and is widely known to the trade, many of the specialties made by the Central Union Brass Co. and handled by the Central Electric Co., being of his invention.

PARRISH SIGNAL SYSTEM.

Although the Chicago & Milwaukee Electric Railway is now double tracking, it had an exceptionally fine system of block signals installed upon its line from Highland Park to Waukegan, protecting the single track line against head end collisions, as well as using it to insure the quick operation of the cars. The system used was the Parrish block signal system, made by the Parrish Signal Co., of Jackson, Mich. Although the newest in the field, it was one that has given splendid results and perfect satisfaction. The system is very simple, consisting of semaphores of the banjo type, placed at one end of each switch or turnout; the operation is by a trip contact operated by the trolley wheel, and the protection given is perfect. When a car enters upon a block the switch automatically gives a release signal to the motorman, showing that the track is clear and allows him to proceed, while at the same time a signal is given at the outlet of the switch, a mile or so in advance of the car, blocking that switch and preventing a car from entering in the opposite direction upon this stretch of track. Had the second car already entered the block, the first car would have found the danger signal set against it upon entering the switch.

The system gave great satisfaction, and upon all single track roads where protection and speed are desired the block signal system of this nature is invaluable. The maintenance of this signal costs practically nothing, a point that is important.

PAINTING STREET CARS.

The United Railways Co., of St. Louis, has decided upon yellow as the standard color for all its cars. This company was recently formed by the consolidation of all the street railway companies in St. Louis, and naturally had from the former roads a great collection of cars painted in over a dozen different colors and styles. To remedy this as much as possible and reduce all the cars on the system to a uniform standard, the entire rolling stock will be passed through the paint shops as quickly as possible, and the coloring and lettering altered to suit the new conditions.

The middle panel and all the upper part of the cars will be painted in Tuscan yellow, and the lower or concave panel and the dashboards in lemon yellow. On the sides in the middle panel in 6-in. letters of block character, will appear the name "St. Louis Transit Company." In the upper left-hand corner of the dashboards will appear the number of the cars, and on the left side of the platform door, 6 ft. from the floor will be painted the initials of the old company, as "L. R." for "Lindell Ry.," "C. R." for "Citizens' Ry.," etc. This is intended only for employes, and is simply a private mark to indicate to which branch of the system the car belongs. Aluminum leaf is used for lettering, this having been found less expensive than gold or silver leaf, and more durable.

In numbering the numbers in the even hundreds are given to open cars and in the odd hundreds to closed cars; different series of numbers are also assigned to different divisions, so that the number alone indicates to the employes the type of car and its location on the system.

The paint shops of the various systems have been consolidated, and there are now but three, namely the Lindell, the Union Depot and the Citizens.

CAR PLANT FOR SWITZERLAND.

Locomotive Engineering gives details of the formation of a syndicate to establish a large car and locomotive manufacturing plant in Switzerland. The works will be able to turn out annually, 600 locomotives, 1,000 steam railway passenger cars, 1,000 electric railway cars and 10,000 electric switches and signals. The officers will be: President, George Burnham, president of the Baldwin Locomotive Works; vice-president, John A. Brill, of Philadelphia; secretary, Werner Siemens, of the Siemens & Halske Co., of Berlin; treasurer, M. de Neuflize, director of the Paris, Lyons & Mediterranean Ry.; managing director, Corneille Barbey, general manager of the Yoverdam & Ste. Croix Ry.

PERSONAL.

LIEUT. FRANK J. SPRAGUE, of the Sprague Co., was a passenger on the first westward trip of the "Oceanic."

MR. CHARLES A. COFFIN, president of the General Electric Co., has returned with his family from an extensive European trip.

MR. EDWARD D. PAGE has succeeded Mr. Frank Brewer, resigned, as president of the South Orange (N. J.) & Maplewood Traction Co.

MR. ERNEST WOODRUFF, president of the Atlanta (Ga.) Railway & Power Co. and of the Atlanta Railway Co., was a caller on the "Review" last month.

MR. HENRY SCHNITZER, formerly superintendent of the Davenport (Ia.) & Rock Island Ry., now the Tri-City Ry., died at Oklahoma City, September 16th.

MR. E. C. FELTON, president of the Harrisburg (Pa.) Traction Co., has been succeeded by Mr. Edward Bailey, president of the Harrisburg National Bank and of Harrisburg Trust Co., and a director in the traction company.

MR. C. J. FIELD has severed his connection with the American Vitrified Conduit Co., and in addition to his practice as a consulting engineer, will devote his time to the management of the United States Motor Vehicle Co., of New York.

MR. H. S. COOPER, who was for many years superintendent of the Schenectady (N. Y.) Railway Co., has accepted a position with the Ithaca (N. Y.) Street Railway Co., as general manager.

MR. DON A. CLAY has been elected treasurer of the Haverhill (Mass.), Georgetown & Danvers Street Railway Co., in place of Mr. James F. Shaw, resigned. Mr. Clay is also treasurer of the Georgetown, Rowley & Ipswich Street Railway Co.

MR. J. S. HAMLIN sailed last week for Paris, where he will represent the Christensen Engineering Co. The demand for the air brakes of this company has become so large abroad a foreign office has become a necessity. His address is No. 50 Boulevard Hausman, Paris.

MR. W. WORTH BEAN, in addition to his duties as president and general manager of the St. Joseph & Benton Harbor Electric Railway & Light Co., is operating the Benton Harbor & Eastman Springs Electric Street Ry., running 2½ miles east of the former company's track in Benton Harbor, Mich.

MR. DANIEL A. HEGARTY has assumed his duties as general superintendent of the Railway Co., General, with offices in the Drexel Building, Philadelphia. Mr. Hegarty has held the position of superintendent of the Norfolk (Va.) & Ocean View Ry., and also superintendent and chief engineer of the Hestonville, Mantua & Fairmount Ry., of Philadelphia.

MR. H. WHITLEY, vice-chairman of the Borough Tramway Committee of Halifax, England, and Mr. H. F. Street, borough electrical engineer, called on the "Review" when in Chicago last month. They are particularly interested in securing information concerning three-phase transmission for electric railways and counterweight cable systems for heavy grades, and made an extended trip, visiting most of the important cities east of the Mississippi.

MR. F. L. FULLER, for the last six years general superintendent of the West Chicago Street Railway Co., and more recently superintendent of the west division of the Chicago Union Traction Co., has recently resigned from the service of that company and accepted a position as assistant to the president and general superintendent of the United Power & Transportation Co., of Philadelphia, with headquarters in Philadelphia. This system embraces about 400 miles of track, and the lighting plants of the cities of Wilmington, Trenton, Chester, Wilkes Barre, Reading, Lebanon, and also one Philadelphia line known as the Roxbury, Chestnut Hill & Norristown Street Railway Co. We have heard it remarked by a number of those who have had the best opportunity of watching Mr. Fuller's methods of discipline and management in connection with the West Chicago system, that they regarded him as one of the best operating men in the country, and his many friends congratulate him on his advancement to so responsible a position, and their best wishes go with him for abundant success in his new field of labor. The "Street Railway Review" joins in the good wishes, and congratulates the president and managers of the system on their good judgment in selecting one so competent to fill the position.

ELECTRIC CARS IN PLACE OF CABLE.

The first car propelled by the underground electric system over the 125th St. line of the Third Ave. road, New York, was run on Thursday, September 28th. The next day, Friday, 16 electric cars were put in operation, sandwiched in between the horse cars, which were all retained, on account of the extra traffic due to the Dewey parade, and on Sunday the full complement of 20 electric cars was put in operation.

The work of changing the cable line on Tenth Ave., to be operated by the underground trolley, will begin at once, and the line will be operated by horse cars while the change is being made, as was the line on 125th St., temporary tracks being laid outside the present cable track, on which to operate the horse cars.

It is expected that the Third Ave. line proper will begin operating by electric cars by the end of the present month. The work on the 42d St. system is also approaching completion.

The new 8-wheel cars which are to replace the cable cars on Third Ave. have been received from St. Louis and the bodies are being mounted on the trucks, which are of the Peckham make, and will all be equipped with the Standard air brakes, the operating cylinders being placed between the wheels as in locomotive practice.

STREET RAILWAY TRUCKS AT CORNELL UNIVERSITY.

Delegates and others in attendance at the New York State Street Railway convention at Ithaca last month were interested to note in the mechanical museum in Sibley College a number of street railway trucks of different types, made by the J. G. Brill Co. On inquiry it was learned that the authorities of the university, thinking that it would be of advantage to the students to have an opportunity to study the construction and design of trucks for electrical cars, wrote to the J. G. Brill Co., of Philadelphia, and suggested that the company furnish the university for use in the mechanical and electrical engineering department, different types of its latest pattern. The company considered the proposition favorably, and realizing the advantage it would be to both the students and to the company, shipped immediately three trucks, comprising one No. 27 "Perfect" passenger truck, one "Eureka" maximum traction truck, such as is the standard of the Metropolitan Street Railway Co., of New York, and also the standard of some of the Brooklyn roads, and one of the No. 21E solid forged frame trucks. These trucks occupy a prominent position in the museum among the numerous other machines and appliances, and furnish an interesting object lesson, so that students cannot help but be familiar with the general construction of street railway trucks, even from the superficial observation that would be given them during the years required for completing their course of study.

The new extensions of the Coventry, Eng., electric railways have been recently opened for public traffic.

Superintendent Duncan, of the Pottsvile (Pa.) Union Traction Co., a consolidation of several street railway lines, centering in Pottsville, has issued the following letter to all union employes on the system: "You are a member of a labor organization in Pottsville. If you want to remain in the service of the company, you must sever your connection with that organization at once."

ON THE THEORY AND PRACTICE OF GETTING JOBS.

Read before the Illinois Society of Engineers and Surveyors by J. W. Alvord, Chicago.

In recently looking over a mass of pamphlets in one of our society libraries for the purpose of ascertaining their relative values for preservation and indexing, I became impressed with the lack of attention to the very practical subject which I have chosen as the title of this paper.

It is a cause for congratulation to note the completeness and care with which professional brethren have been willing to lay before us, in all possible detail, the methods which they have adopted, the researches which they have made, and the conclusions to which they have arrived after long and laborious study, in the performance of jobs which they have already secured, but of the important and interesting problem, how to obtain such jobs, such writers are usually more than modest, and if perchance they hint at that phase of the subject at all, it is with the lightest and airiest touch or the breathing of some such unsatisfying and elusive ritual as:

"The committee having placed the matter in my charge," or "being consulted by the president of the company," or to use a still more common and unsatisfactory expression: "The writer being called in at this juncture to undertake the work," etc.

Now I have enjoyed reading such phrases as these for many years. They appeal to my imagination. In my mind's eye I could see a committee of solid and influential citizens after long and profound consultation coming to my professional brother's office in a body, and solemnly almost, one might say, reverently "placing" the matter in his charge unreservedly and fully, and with that simple and childlike confidence that in so doing they had by that one act fully insured the brilliant success of the proposed undertaking.

Or again, my imagination has pictured the aged and gray haired millionaire president asking for a consultation on some of the problems presented by the works, and gravely appearing at the office of my brother engineer at the appointed time followed by his own engineer with roll of plans, and patiently waiting his turn for admission to the inner sanctum.

Nor have I failed to catch the inspiration afforded by the seductive phrase, "Having been called in at this juncture." I could well see the anxious inquiries on the part of various members of the company as to whether we can get X to take this matter up, and the mutual friend making personal inquiries as to whether X's time was fully occupied just at present, and finally at the culmination of the diplomatic process when subterranean understanding had been duly reached, that X could afford the time and would "be willing" on certain captious and exacting conditions to take the matter up, resolutions being immediately passed at the meeting of the board of directors "That whereas," etc., the effect of which would be to duly employ X forthwith, without so much as ever mentioning the word "compensation," or even hinting but that any sum which X might name would be perfectly satisfactory. And indeed, the general tone of the resolution being to the effect that the company would consider it a perfect boon to be permitted to employ the said X at all.

In the course of years of anxious expectancy and fond yearning for jobs and more of them, I must admit that such delightful experiences as these have been somewhat few and far between in my own career, and when the remotest similarity to the examples given have actually occurred, the experience has left me in such a stunned and unnatural condition of mind as to be truly pathetic.

In earlier years I naturally felt with humility that I was only clinging to the outskirts of the profession, hanging on to its extremities, as it were, and when I lost my first important salary and tried to get another, I felt a good deal as a cat does when thrown out of an upper window, and goes down with a rush, clawing, yowling, and grabbing at everything in sight in vain attempt to ease the situation.

The inability at that time to get my claws into anything tangible made a serious impression on me, which has only deepened with the lapse of time and the accumulation of experience.

Now in the course of resulting reflections on the subject, it has often occurred to me to wonder how I came to be possessed of such high ideals on the art of job getting. I must admit that these ideals seem to come as much from my own wild flights of imagination as from the literature of my brother engineers. They always formed a bright and beautiful dream hovering just above, reality luring me with boundless hope. They always intensified too by the passing greetings of the profession. Who has not observed in the midst of the bitter struggle for existence the cheering influence of these passing greetings with our fellow engineer, especially with a rival in our own line of business. "Hello, Jones, how goes it," and then Jones grasps your hand and leads you to the curb to one and pours into your ears a glittering story of major success he has had of late; how he was chosen among twenty applicants at "Three Corners," what the mayor of Gingerville had said of the successful test of his latest water works. How busy he was, and how much work he had been obliged to refuse recently, perhaps mentioning in this connection in an airy way a job which you yourself might have just received after the hardest kind of work, and, if after listening to this optimistic account with growing envy and longing, you should venture, just as Jones starts, looks at his watch and mentions an important engagement with the harbor committee, if you should venture to detain him just a minute and tell him that you were not very busy and would like to help him in some of his work, how confidently Jones would explain that his practice just at present time was nearly all consulting matters and special reports, which really necessitated his own personal attention, that he would be glad when anything came along to remember you, etc.

It must be admitted that it certainly has a very wine like effect upon a man to actually get a job, but I have often thought that it would be well if men like Jones could go off somewhere after such an experience and secrete themselves for a day or two until they were fit to appear in public. I think the worst thing that can be said of them is that they age the rest of us rapidly. We unconsciously lose our freshness and trustfulness in meeting with them.

Quite the opposite in character are the men, young for the most part, I take it, who confide their disappointments to the correspondence column of the Engineering News. These letters from young men who have failed and tell about it, always fill me with great interest. They are so ingenuous and disinterested in relating their story of the business ignorance and general low practices of town councils, bridge commissioners or other trustees employing talent. We are all familiar with their treatment of professional ethics. They have been degraded by being forced into a competition by callous and unfeeling boards who give no thoughts to the advancement of the engineering profession at all, and after the applicants have named compensation (and possibly failed to verify their qualifications) they have been subjected to the mortification of seeing their professional knowledge weighed up and measured like a lot of hay or potatoes, and perhaps found wanting. It is indeed a cruel experience, this having the cold outside world size up our professional attainments instead of taking our own measure of ourselves for comparison, and the hard cruel fact that these worldly and greedy trustees are looking for the largest knowledge for the least money, comes upon a sensitive and confiding nature like the blighting breath of a simoon upon a gentle flower.

Possibly I am wrong in reading all this between the lines in such letters. What they actually tell makes an entertaining and often humorous story from a business standpoint. And the editors (shrewd fellows) know that it is "soothing reading" for most of us, and generally comment upon the letter in a comforting way.

Far be it from me either to suggest that such mournful stories are not often, too often based upon sad facts. Indeed, should I take occasion to doubt them, I am too often reminded of a worthy old uncle of my own who had conquered a living with arduous toil for many years among the rugged hills of western Connecticut. Upon a visit to him I confessed blushingly from time to time my many triumphs over the forces of nature. The old gentleman eyed me suspiciously for a day or two in the evident attempt to determine my species, and finally asked confidentially: "Now 'sn't this engineering business a kind of fancy business anyhow?" I doubt if the worthy man during his lifetime was ever fully convinced that I earned my living legitimately.

I do not wish in this paper to throw discouragement in the way of those who are about entering this noble profession of ours by the discussion of the subject I have undertaken, and if any of my professional friends in salaried positions feel that the world is yearning for an opportunity to push them to the front, by all means let them open an office and give the yearning world a chance. It is at this particular point that I desire to contrast the theory with the practice.

You open an office and insert your business card in the technical papers. Then you brace yourself for a flood of business. Your professional rivals drop in one by one to ask "how it comes on," and incidentally to see how much your office furniture cost you, and otherwise assure themselves that you are not likely in the remotest way to get a job away from them.

A few book agents vary the monotony of life, and once and a while a well-dressed life insurance agent makes your heart jump into your mouth as you lead him into the inner office with every nerve braced to keep the joy out of your face and assume a bored and indifferent air. I know of few more trying, soul wrenching moments than come with the disclosure of the life insurance man's business in that inner sanctum. It is for this, then, that those pumping engine details have been scattered over the table, and books on deep and abstruse subjects placed where they meet his eye. A man who can pass through these experiences without the freshness of his hope being perceptibly withered has fitted himself for a better land.

But yet the theory seems to be all right. You are a professional man. Your work is such as to require confidence in you on the part of your clients. Consequently it is indelicate on your part to push your claims to their notice. You feel competent to do their work. You have done it before over and over again successfully, but you must not intrude this fact to their notice, but wait for them to come to you.

These are the conclusions I have been led to after long years of perusal of engineering literature. I take delight in the theory. It accords with my own sensitive nature and my retiring disposition. I always read articles on the "Standing of the Engineer" and "Ethics of the Profession;" I am especially fond of "Presidents' Annual Addresses," I consider them delightful reading. I well remember seven years ago returning from a $75 trip to Braceville where I had been at my own expense to see another engineer receive a job, being much comforted by reading the annual address of our worthy president. It seemed to relax the strain of the Braceville episode to read of the great achievements of the engineer along the different lines of his profession throughout the world, and to know once more that his was the opportunity to "harness the forces of nature to the use of man."

I have been familiar with that sentiment for many years, but it never seemed to have the same weight and swing as it did on this occasion. It calmed my nerves and filled me with a glow of hopefulness. I felt once more a man. I think we cannot set too great a store on these presidents' addresses. I like to hear about the Forth bridge, the Nicaragua ship canal and the new battleships and realize that I belong to such a glorious fraternity who are truly conquering nature. It may be inferred from my reference to the Braceville episode that I have sometimes gone out after jobs. It is with some reluctance that I am compelled to admit here, confidentially, that once or twice I have "run over" to a town or two to see if there was any interesting and instructive work going on. I very well remember the first time I did this. I thought it a little singular that I should find near the bait the plain footprints of several distinguished professional brethren versed in that particular specialty. Some of them I was told had "stopped over" on their way to important work at other points further on. Some had been invited by a particular friend who was extremely anxious to see the important work in the proper hands. Nearly all happened to have fortunately with them some copies of testimonials of former work which they would leave. The engineering of this particular job was finally let on proposals. I remember that at the letting several of us who happened to be in town were interviewed by the council one by one behind closed doors, sized up, so to speak, much as racing men get out a trotter to see him make a turn or two, punch his ribs, feel of his legs, and look at his teeth. Perhaps the comparison is a little vulgar, but I felt less pleasant about it than the trotter probably does, as a usual thing. I also remember while waiting for my turn to trot, being called aside by a mysterious man with a wandering eye and a sinister smile, and being informed in a highly secretive manner, that the firm of Tripod & Sight-pole had three of the council for them, and there would be no show for me unless I would leave the matter with him, that he had a good deal of influence with the council and wanted to see me get that work. I remember being much touched by his sympathy and solicitude in my behalf, and saying to him earnestly that if awarded the work I would endeavor to do it well and faithfully, together with much more in the same strain, the net result of which, much to my surprise, seemed to cool his interest wonderfully. I noticed afterward that Messrs. Tripod & Sight-pole got the work, and I remember particularly being struck with the fact that there was a difference of some 3,000 per cent between the highest and lowest bid. It is natural to abuse the wily councilman for his lack of appreciation of engineering ability, but it is hard to see how he can form a very high opinion of a profession that has such a variable estimate of themselves.

After my arrival home, I watched eagerly for next week's technical papers. Now, thought I, we will have this disgraceful competition exposed by an able editorial on "the folly of treating brains as merchandise," or "low depths of ignominy to which some town councils are sunk." I was disappointed; after searching vainly all through the news columns, I found the following brief item in the next issue: "The services of Messrs. Tripod & Sight-pole, the well known engineers of Metropolisville, have been secured by the city of," etc.

After this my confidence in the theory of getting jobs began to wane. I laid the theory on the shelf, as it were, and found myself compelled by urgent necessity to discover the practice. In the course of a number of years of heartrending experiences I have, I think, discovered a few simple rules for getting jobs which, after much reluctance, I have concluded to give to the profession in absolute confidence. They have not always worked as well as I would like, but they at least give one a fair chance with other professional brothers, and they are as follows:

1. Find your job.

This is quite necessary. I have completely discarded the theory on which I started in, that your job should find you. It may work once in a while, but as a rule a needy engineer out of work is a great deal keener hunter than a lonesome job is. After you have found jobs for a good many years it is possible that some stray jobs may find you, but I wouldn't count on it. They are only the few bright beams Heaven sends to illumine our dreary pathway, and should be so considered and accepted.

2. Know a great deal more about how that job ought to be done than anybody else around.

There is no doubt at all but that this is a very important requirement indeed, in the practice of getting jobs, but it is one which I feel almost ashamed to mention, and indeed would have forborne to speak of had it not been that occasionally I have met enthusiastic and confident engineers eager and willing to lend a hand in the great work of harnessing the forces of nature, but a little uncertain as to the difference between the breeching and bellyband.

One enthusiastic friend of mine who had offered to design and construct a $25,000 waterworks for $25, confided to me that it was his intention to read up on the subject nights and get into that line of business. He seemed disappointed when the waterworks committee intimated their unwillingness to "place" the matter in his hands because he had heard of waterworks men who charged $50 per day and expenses, and thought it might be a lucrative business.

This delightful trait of ambition in our profession should be commended, could it only be turned into proper channels, but the greatest problem we have is how to direct the energies of such would-be members into ethical discussions on the standing of the profession or society resolutions upon the unsatisfactory condition of the remuneration of engineers.

3. Know the men who have the jobs to give.

This last rule seems also to be one of those delightfully simple propositions in theory which are found so difficult in practice. The theory of the thing is that an engineer's reputation ought to precede him everywhere. In practice he is usually exceedingly glad if it will only follow him at a respectable distance.

People with jobs to give want to see you, poke your ribs, and put you through your paces, as I have elsewhere intimated. And if you would like to be their "hired man," which is the plain but unused name for it all, it is best for you to go and submit yourself to the process as gracefully as you can.

I believe, however, that it is quite possible to do all this and still be modest. There is no money in being bashful, but to be suitably modest at the proper time and in the proper amount is an art whose worth to the fortunate possessor cannot be overestimated.

Long years of harrowing experiences have frayed the edges and removed the bloom from my own early attempts to be modest. Yet I can not refrain from referring with pride to one attempt, which, though disastrous to me at the time, may prove instructive in this connection.

In the first year of my apprenticeship the city directory man called at the office in which I was engaged and asked for my name and designation. Naturally I did not feel at that time that I stood more than upon the threshold of our great and noble profession, so I informed him simply that I thought I might be entitled to be called an "engineer's assistant." I am at loss to determine even to this day whether this was an act of true modesty or mere bashfulness, but this classifier at the central office of that directory evidently had no difficulty whatever in placing me. He had met pretentious people before in his line of business, and when the directory was duly printed and issued I was dumbfounded to observe the appellation of "fireman" following my name and address.

It is pretty evident that the business world makes but little allowance for ordinary modesty, but it doubtless has distinct difficulty of its own in designating and classifying a profession which expects a man to drive stakes in a sewer or paint landscapes in the office, corner the elusive bacillus in the laboratory, or throw off a literary gem in the shape of a financial prospectus between meals.

In closing this paper I cannot but regret that I have taken up so much time in elucidating the theory rather than the practice of getting jobs. I cannot help but feel, however, that if read between the lines the diligent enquirer in this interesting field will find some hints which if they do not guide him in his hard and toilsome pathway will at least cheer him with the reflections that it has been trodden before.

MERRICK AIR-ELECTRIC SYSTEM.

BY ASA L. MERRICK.

Why compressed air is used instead of electricity to propel a car may not at first be apparent. To some persons this combination may seem like folly when it is understood that in compressing air by electricity fully 25 per cent of the electric power is lost. But the advantages gained in using compressed air more than counterbalance this loss, and makes it possible to save a still larger percentage in other ways, thus saving that which is now wasted by the present system. It reduces the great wear and tear of the electric motor. It lessens the percentage of accidents, as this car is started and stopped with ease and rapidity, and it obviates the objectionable unbalancing of passengers who may be standing or walking in the car when it is started or stopped.

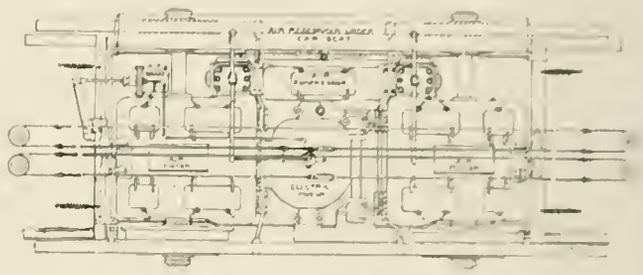
The device for starting and stopping is so simple and effective that the ordinary motorman can operate it instantly in times of need. There being but one crank instead of two the chances of confusion in cases of emergency are consequently lessened one-half. Where two cranks are employed, in the hurry to stop, there is sometimes failure to turn one in the right direction, thereby causing an accident. The air motors that propel the car are convertible, being arranged so that when the pressure is shut off from the cylinder (there being two in each motor), they are converted into air compressors, so that the momentum of the car can be utilized to compress air until the car is stopped.

The electric motor, which is used only to compress air, is not subjected to sudden strains, as is the case when connected to the axles of the car. The greatest strain on electric motors occurs when starting the car, and when power is suddenly applied they often burn out, causing a great expense for repair. Many electric railway companies have had a large experience in this line, and the cost of repairing electric motors and power plants is so great the problem of how to overcome this is a serious one.

By the application of an air compressor it is overcome effectually, for there is no resistance to be overcome at the instant current is turned on the electric motor. The instant power is shut off the piston of the compressor moves away from the end of the cylinder which is compressing air (for it has been released by shutting off the power) and the compressed air drives it back until the pressure has become equalized, or down to the atmospheric pressure, so the motor when started has no resistance until the piston is resisted by compressed air, which does not occur until the piston has traveled a portion of its stroke, and the interval which occurs between the starting and resistance allows the electric controller to be turned on at all times and under any conditions without the slightest injury to the motor. Thus there is no more expense attached to a railway plant under air system than there is to an electric light plant.

How to prevent the loss which is often occurs from the motorman applying the brake when the electric power is on in order to stop the car quickly is another question of importance. There being two independent forces which can be applied together intentionally or carelessly, the loss of electric power is therefore enormous. With our mechanism the difficulty is overcome for only one crank is used to start the car change the motors to compressors and operate the brake. By moving the crank through one eighth of the circumference of a circle the air pressure is shut off from the brake cylinder, which releases the brake and turns on the air power to the motor; a reverse motion of the crank reverses the operation.

When it is stated that we have four motor cylinders, whose combined piston area is 50 sq. in., that these cylinders are geared to the axle three to one, and are in combination with an air brake cylinder



AIR-ELECTRIC SYSTEM.

whose piston area is 33 sq. in., the air pressure ranging from 60 to 100 lb. per sq. in., it will be understood that we have a great force to stop the car in an emergency. This force is used only to avoid accidents. In ordinary cases the motor cylinder when converted into an air compressor will bring the car to an easy stop without any inconvenience to the passengers.

As electricity is the best and most convenient power that can be applied to railway service the device has been designed to overcome all objections to the present electric system, and reduce the running expenses as much as possible. The air motors are like ordinary types of steam engines, with convertible device attached. The air compressor is also the same as the ordinary compressor, except in the cooling device. Every part of this mechanism is simple and strong and will be found well adapted for hard and continuous service.

CINCINNATI, NEWPORT & COVINGTON.

For the months of August, 1899, and August, 1898, the receipts, expenses, etc., of the Cincinnati, Newport & Covington Street Ry. were as follows:

	1899.	1898.
Gross receipts	$70,144.55	$63,952.09
Operating expenses	24,383.20	28,312.91
Net earnings	45,731.29	35,039.18
Tolls, damages, taxes, etc	12,062.35	30,478.55
Net profit	33,668.04	839.37
Ratio of expenses to earnings, with tolls	45.25 p. c	54.27 p. c.
Ratio of expenses to earnings, without tolls	34.77 p. c	44.27 p. c.

For the first eight months of 1899 the gross receipts were $464,410.49, an increase of $31,272.98 over the corresponding period for 1898; and the operating expenses, $190,190.80, a decrease of $19,414.86. For this period the operating ratios are 53.30 and 40.95 per cent, as against 59.50 and 48.39 per cent in 1898.

Permission has been granted by the Secretary of War to the West End Traction Co., of Pittsburg, to lay a wire cable for ferry purposes in the bed of a branch channel of the Ohio River from a point about 2,000 ft., east of Chartiers creek, from the south shore to Brunots Island.

The South Park Board on September 13th passed an ordinance granting the Chicago City Railway Co. the right of way through Gage Park, thus enabling the company to continue its extension on Western Ave. The ordinance was passed on condition that grooved rails would be placed on boulevard crossings.

NEW INDIANA ROAD.

The contract for constructing the interurban road of the Indianapolis & Greenfield Rapid Transit Co. has been given to the Kirkpatrick Construction Co., of Greenfield, Ind. This line is to run from Greenfield to Irvington, a suburb of Indianapolis, where connection will be made over the Indianapolis Street Ry. into the heart of the city of Indianapolis. All financial arrangements have been made and preliminary steps taken to commence construction work. The road is to be completed Sept. 1, 1900. The proposed route is 17 miles long, passing through Irvington, Cumberland, Gem and Philadelphia, and there are practically no curves or grades throughout the entire length.

The officers of the company are: President, John J. Cooper, Indianapolis; vice-president, George C. Webster, Indianapolis; secretary, L. E. McDonald, Greenfield; treasurer, William C. Dudding, Greenfield. Mr. C. M. Kirkpatrick of Greenfield is president of the construction company.

THE AMERICAN STEEL & WIRE CO. MAKING ELECTRICAL GOODS.

The American Steel & Wire Co., contrary to the impression which might be created by its name, by no means confines itself to making iron and steel wires or their products. By the absorption of the Washburn-Moen Manufacturing Co., the larger organization secured one of the world's most important manufactories of bare and insulated copper wires in various forms and for all electrical purposes.

With the immense plant at Waukegan, Ill., only 35 miles north of Chicago, at which much of the copper wire is produced, the American company enjoys exceptional facilities for catering to the wants of the trade in the west, giving as it does to the organization the same prestige in occupying the western field that is enjoyed by the Washburn-Moen department at Worcester, Mass., in eastern territory.

We make these statements on the assumption that they will be news to many of our readers, the recent changes in the commercial and manufacturing world having been so numerous and kaleidoscopic that many, even among the large users of their products, have not become familiar with the new scope of their operations.

In every line of production certain names come to stand out in bold relief as synonyms for some forms of superiority or for some characteristics of excellence. In the production of electrical wire, bare and insulated, the introduction of improvements calculated to secure best results and in uniformity of excellence, no name has ever stood higher than that of Washburn-Moen. The merging of this company into the American Steel & Wire Co. means simply a further step in the lead whereby with unlimited resources, continued investigation and improvements and a still greater superiority are assured in the production of all forms of electrical wires, rail bonds, etc.

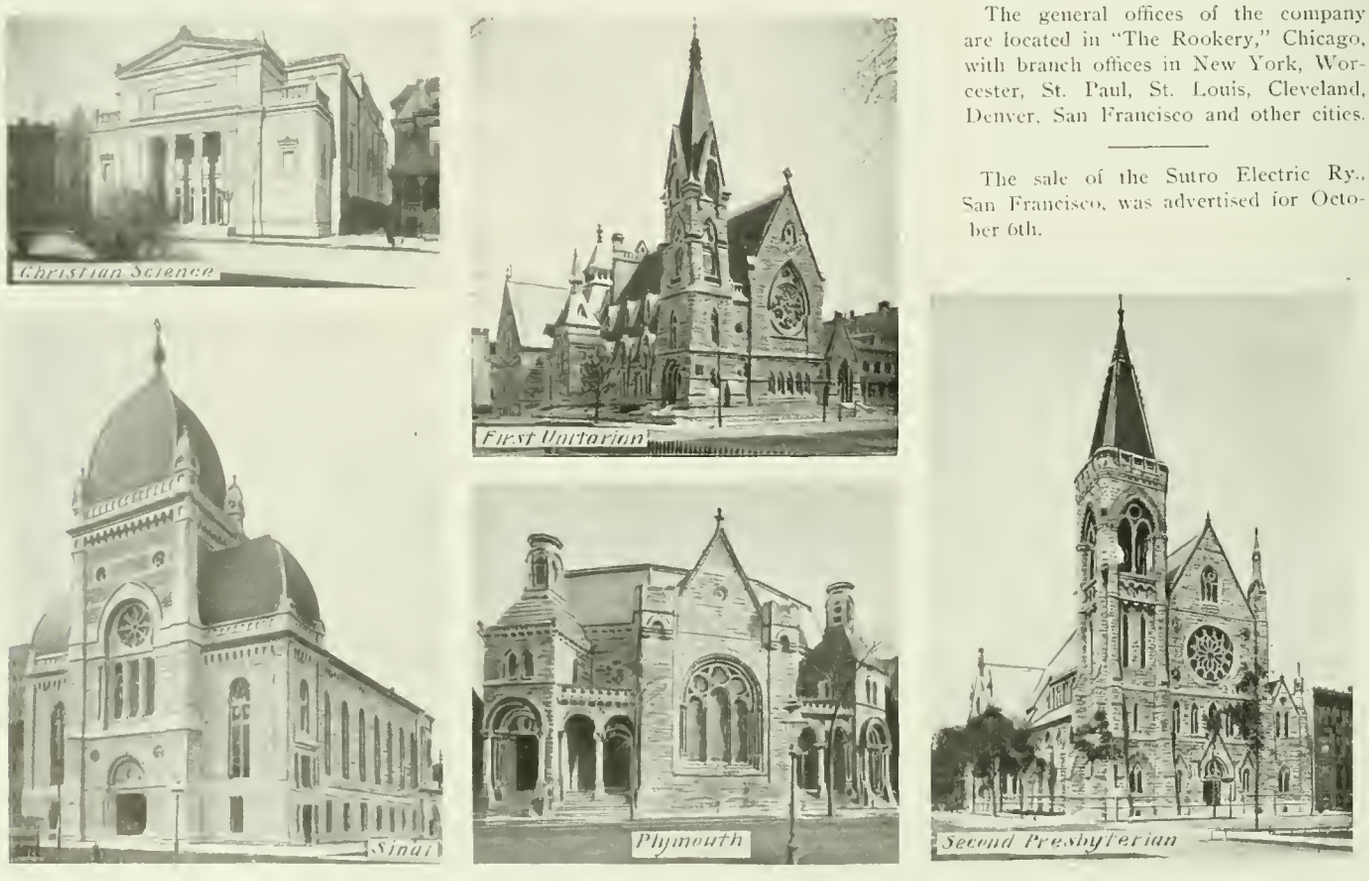
At the Waukegan plant special attention is given to the manufacture of the well known "Extra BB," and "Steel" telephone and telegraph wires and copper wires for electric lighting and street railway plants in all their various forms; and the system of tests at every stage of the manufacture of these goods is at once so unique and rigid that the high standard set for all the products of this company is always maintained. Purity, conductivity, tensile strength, finish and uniformity to gage, are all given due attention, resulting in the output of millions of pounds, distributed among all the nations of the earth in the operation of the great telephone, telegraph and electrical traction systems.

In the production of copper rail bonds, either solid or flexible, the prestige of the Washburn-Moen name has been increased since the formation of the American Steel & Wire Co., and the output of solid and flexible "Crown" bonds in a variety of patterns and for adjustment to the rails in various positions has been marvelous. This is equally true of the manufacture and sale of copper trolley wire, in which this company has earned a commanding position.

In the department of insulated wires, the entire line, including every form of magnet wire, office and annunciator wire, weather proof wire, feeder wires, lead encased wires and cables, and submarine cables is thoroughly covered, the rubber insulating, taping, braiding, lead encasing, armoring and weather proofing being carried on under the supervision of the most expert scientific skill and experience that can be secured.

The general offices of the company are located in "The Rookery," Chicago, with branch offices in New York, Worcester, St. Paul, St. Louis, Cleveland, Denver, San Francisco and other cities.

The sale of the Sutro Electric Ry., San Francisco, was advertised for October 6th.



WELL-KNOWN CHICAGO CHURCHES.

THE ARNOLD ELECTRIC POWER STATION CO.

The Arnold Electric Power Station Co. was organized in 1896 to make and sell the parts peculiar to the "Arnold System" of power station construction, and acting in this capacity it has supplied a number of plants with magnetic clutches, shafts, quills, box stands and coplings. Among these plants may be mentioned the Ft. Dodge Light & Power Co., Ft. Dodge, Ia.; Chicago Board of Trade; Englewood & Chicago Electric Railway Co.; Land Title & Trust Building, Philadelphia; University of Michigan, Ann Arbor, and W. B. Conkey Co., Hammond, Ind.

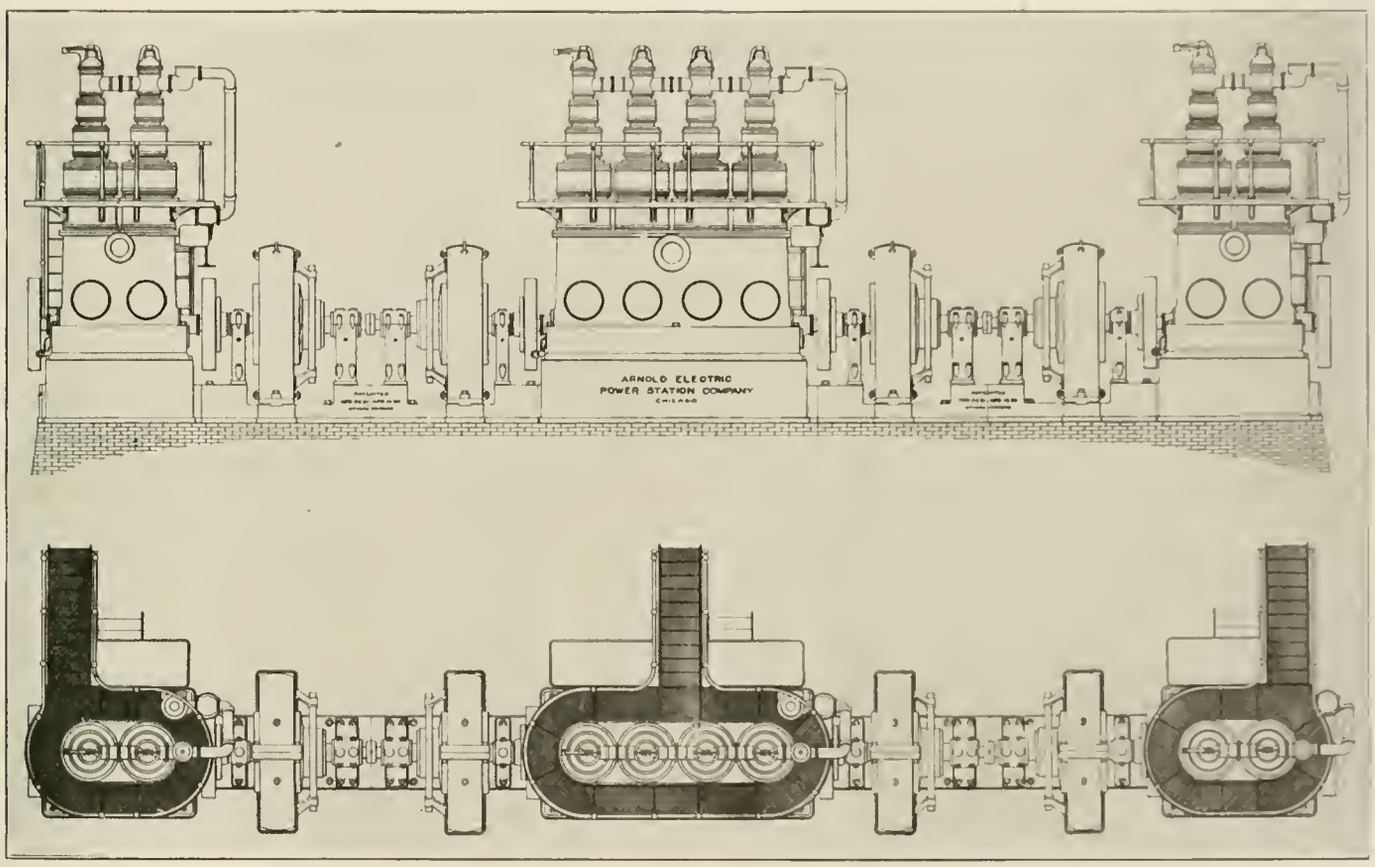
Through natural development this company has gradually broadened the scope of its work until it is now in position to make a proposition for furnishing and erecting in place entire electrical properties, and it already has an enviable record along this line.

Four years ago Mr. Bion J. Arnold, as consulting engineer, worked out a plan of electrical generation and distribution for a long distance high speed electric line, which comprised a central station containing direct current generators for supplying one section of the line, and alternators generating current at high potential for transmission to a number of sub-stations, each equipped with a storage battery and rotary transformers and converters. When the Chicago & Milwaukee Electric Railway Co. retained Mr. Arnold he advised the use of this system, and it was adopted for the first section, from Waukegan to Highland Park. A change in the management of the road resulted in some opposition to the alternating current system, but the Arnold company proposed to equip the road according to the original plans and guarantee the efficiency. The company received the contract for everything except the track and rolling stock, and the work has recently been completed, as described elsewhere in this issue.

The position of the Arnold company is unique among contractors; it works out the solution of the engineering problems involved in an undertaking and submits a proposal for doing the work, with guarantees as to the efficiency. Being in no way connected with any manufacturing concerns it is perfectly free to buy and use any make of apparatus.

The entire power plant and building of the Imperial Electric Light, Heat & Power Co., at St. Louis, Mo., was constructed by the Arnold company. The plant is a large central station, using 500 volt generators working in parallel with a storage battery auxiliary. By dividing this battery into two parts a distribution system was devised which allowed the use of 220 volt incandescent lamps, arc lamps, and power motors off the same mains—a decided departure from central station practice. This system has been adopted for another large central station since the erection of the Imperial plant.

The Arnold company was also given the contract for the complete light, heat and power plant erected in connection with the new railroad shops of the Chicago Great Western R. R. at Oelwein, Ia. This contract comprised not only the heating and lighting of the shop buildings, covering many acres from a central plant, but also the application of a large number of motors for various uses. This has been the first plant to adopt the Arnold magnetic clutch for line shaft work, though these clutches have been used for some time in connection with the three way couplings, which are a part of the Arnold system of power station construction.



THE ARNOLD SYSTEM AS DESIGNED FOR THE CHICAGO ELECTRIC TRACTION CO.

Another notable installation recently completed is the isolated plant for the Garrett Building, Chicago, which is occupied by a large wholesale grocery establishment. This contract included a complete system of lighting and power wiring for 45 motors, a storage battery auxiliary with booster and switchboard, and three generators connected by means of the Arnold system to two high speed engines. The plant is remarkable for the small amount of space occupied.

A history of the Arnold Electric Power Station Co. would hardly be complete without some reference to its energetic president, Mr. Bion J. Arnold. For 10 years Mr. Arnold has held a high place among electrical engineers. As technical representative of one of the large manufacturing companies he built a number of electric railway plants, which stand today as monuments of his skill. He has been connected with pioneer engineering work in more than one field. He was consulting engineer of the first electric elevated railway—the Columbia Intramural Ry. at the World's Fair, and also the first successful storage battery railway in the

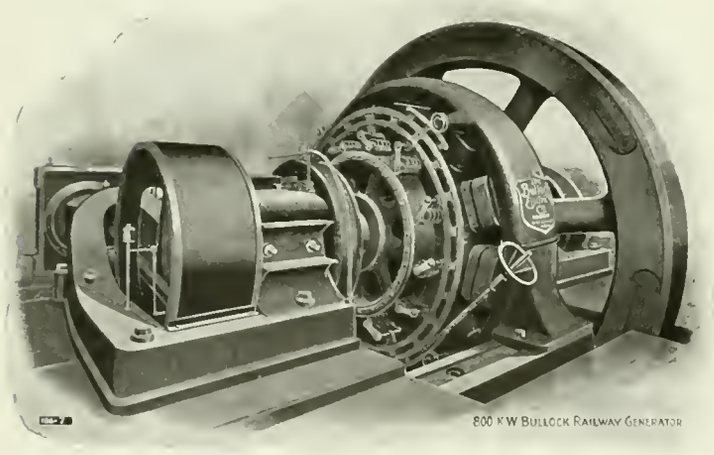
United States, now the Chicago Electric Traction. He was an early advocate of the use of the storage battery and backed up his judgment by entering into the manufacture of accumulators in such a manner as to gain considerable profit for the company which he formed for that purpose. Mr. Arnold has always had the courage to carry out his solutions of engineering problems, even when confronted with considerable opposition, and has had the pleasure more than once of seeing the methods which he has introduced become accepted practice. It is easy to predict that many railroads will be built upon the plan of the Chicago & Milwaukee Electric, and that the Arnold magnetic clutch and the Arnold system of power station construction will become well known features in power station work.

The advent into general electrical contracting work of the Arnold Power Station Co., prepared as it is with an organization capable of handling the largest contracts and willing to guarantee the operation and the economy of a completed plant or installation is a development which promises to bring about new methods in building extensive electric properties.

A NEW STREET RAILWAY GENERATOR.

The Bullock Electric Manufacturing Co., of Cincinnati, has, throughout the 10 years of its existence, faithfully adhered to the maxim that "what is worth doing at all is worth doing well," and the natural result has been the building up of a reputation which has made the Bullock generators famous for excellence at home and in many foreign lands. After a series of additions to the original plant it became necessary in 1898 to erect entirely new works, and although these buildings were not ready until January of the present year, the rapid increase in the business is such that further enlargement will be necessary.

The company has intended for a long time to bring out a railway generator which should embody all the excellent features of its smaller generators, and is now building railway generators up to



NEW STREET RAILWAY GENERATOR, BULLOCK ELECTRIC MANUFACTURING CO.

800 kw. Among the important features of these new machines may be mentioned a scheme for oscillating the brush holder mechanism in a direction parallel with the shaft. The movement is very slow and results in constantly changing the line of travel over the commutator face and thus removes all tendency to cut or groove the latter. The action is the same as secured by the end play of an armature in a belted generator or that produced by the electro magnetic device used at the end of shaft on rotary transformers, and which is recognized by engineers as a means of greatly prolonging the life of the commutator.

The pole pieces and coils may be removed without disturbing the yoke or armature, and with two of them removed, it is possible to remove one or more armature coils should repairs be necessary.

The armature coils are made of continuous bars of copper without joints between the commutator connections which materially adds to the life of the machine. These coils are all thoroughly insulated, pressed and baked before being placed on the core, no additional core insulation being necessary. All armatures are thoroughly ventilated by slots perpendicular to the shaft through which the air rushes when the machine is in operation. A liberal rating permits of constant operation at full load with low temperature rise.

One of the 800-kw. machines has been sold to the Oakland Rapid Transit Co., of Oakland, Cal., and is shown in the engraving. This machine operates at a speed of 80 r. p. m., and at this speed develops 550 volts at no load. It is over-compounded for a rise of 50 volts at full load, making the full load voltage 600.

Bullock railway generators are well worth the careful investigation of every railway manager, and full praticulars and details of construction will be found in the new Bullock catalog, No. 3434, which will be mailed anywhere on request.

WM. D. RAY.

Mr. William D. Ray, the general manager of the McGann Air Brake Co., Detroit, has been in the electrical business for the past 11 years. In 1890 he was electrician's assistant of the Cicero Electric Light Co., this city, then for two years electrician of the Grand Central station in charge of the lighting plant, and four miles of electric and block signals. In 1892 he became electric light inspector of the Chicago & Northwestern, and in 1893 was an inspector and foreman in the electrical department of the World's Fair. From here he became assistant consulting electrician of the Standard Electric Co., Chicago, leaving that position in November, 1894, to become superintendent and later manager of the Everett (Wash.), Railway & Electric Co. He is an associate member of the American Institute of Electrical Engineers, and Association of Railroad Air Brake Men.

W. D. RAY.

During the past year he has had the management of the McGann air brake, and has introduced this system on the following roads: Kansas City & Leavenworth, 10 equipments; Cleveland & Eastern, 8; Mahoning Valley, 3; Sandusky & Interurban, 3; Detroit, Rochester, Rome & Lake Orien, 6, and Detroit and Northeastern, 12.

Mr. Ray will have a fine exhibit at convention hall, and demonstrate the system he has been chiefly instrumental in bringing before the public.

ELECTRIC TRAMWAYS IN NICE.

U. S. Vice-Consul Piatti advises the State Department that the new electric tramways at Nice which were to be opened about October 15th will be operated until December 15th by horse power.

The reason given is that it was necessary to replace the existing overhead telephone wires by underground cables so that they might not be affected by the overhead wires of the railway, and that no concern could be found in France that was willing to contract for the delivery of the necessary cables before November 1st.

Mr. Piatti adds: "This, in itself, may not be a fact of paramount importance; but, reverting to the continuous attempts made by this consulate to induce our manufacturers to cultivate the very considerable opportunities offered by the port of Nice for a direct trade with the United States, it may not be out of place to say that in this instance an American firm might have competed with success in furnishing the necessary electric cables."

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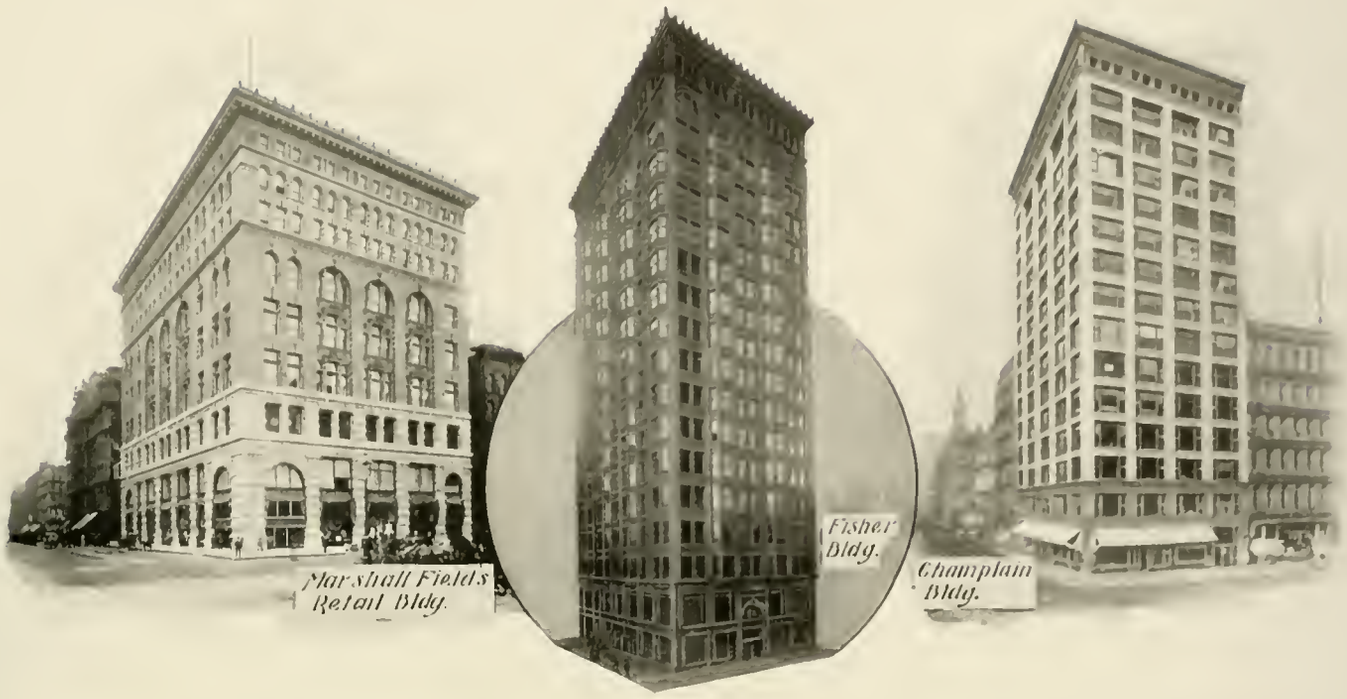


NORTH AMERICAN RAILWAY CONSTRUCTION CO.

One of the best known railway construction companies in the country, and which has executed very large and important contracts, is the North American Railway Construction Co., of this city. Its headquarters are in the Monadnock building, and its officers are widely known to street railway managers. They are: A. S. Littlefield, president; E. J. Evans, secretary and treasurer, and E. M. Fry, general superintendent.

The work at present under way includes some of the most important of the year in the entire country, foremost among which is that on the Northwestern Elevated of this city, where the contract includes all above the structure—timbers, ties, track and special work. This road is, for the most part, a 4-track line aggregating 25 miles of single track. As the rail is 80-lb. A. S. C. E. T-section in 60-ft. length, it will readily be understood that no small degree of skill is required to place this iron. To do this work special mechanical devices were necessary, and on another page in the description of the Northwestern Elevated will be found an illustration of the hoisting machine. The 60-ft. rail on the Union Loop was also laid by this company.

Another important contract is that at Indianapolis, where 25 miles of track are being entirely rebuilt. The new rail is 9-in. girder, made by the Lorain Steel Co., which is also furnishing all the special work of its "guaranteed" type. The track is being cast-welded by the American Improved Rail Joint Co.

At Kansas City the work involves a large amount of track work in which 103-lb. girder is being laid, some in concrete trenches and the balance with wooden tie construction. The Lorain Steel Co.'s "guaranteed" special work is also being used here, and the joints cast-welded.

Having completed the double track extension of the Chicago & Milwaukee Electric between Highland Park and Evanston, the North American forces are now engaged in completing the second track for the same company between Ft. Sheridan and Lake Forest; the rail used being standard T-section 65-lb. and 60-ft. long.

Altogether the year has been one of the busiest and most prosperous in the history of the construction company, which has had all the work it could handle to advantage.

Closely allied to the North American company in its work is the American Improved Rail Joint Co., the officers of which are the same as of the other concern, and whose cast welding of rail joints has been attended with great success. Among the important welding contracts of the year is the 25 miles at Indianapolis and several thousand joints at Kansas City.

Mr. Littlefield is also head of the firm of Littlefield & Mysenburg, who for years have had the general agency of the Johnsen Co., now the Lorain Steel Co., during which time they have sold hundreds of thousands of tons of girder rail. The sales of girder rail the past season has been the largest in six years, and the largest ever of Lorain special work. The firm also handle the Du Pont single and double trucks.

NEW CASUALTY COMPANY.

The Pennsylvania Casualty Co., with a capital of $100,000 and a surplus of $50,000, was recently organized.

The stockholders of the company, who are gentlemen prominent in financial and business circles in Scranton, Philadelphia, Mauch Chunk and elsewhere, elected the following board of directors: Thomas R. Brooks, coal operator, Scranton; William Connell, coal operator and president of Third National Bank, Scranton; A. C. Fuller, treasurer Scranton Stove Works, Scranton, Pa.; Fitch Gilbert, capitalist, Eau Claire, Wis; Alfred Harvey, silk manufacturer, Scranton, Pa.; Edward S. Jones, coal operator, Scranton Pa.; F. H. Johnson, superintendent Enterprise Powder Manufacturing Co., Gracedale, Pa.; John L. Kemmerer, attorney-at-law and capitalist, Scranton, Pa.; E. P. Kingsbury, vice-president Tribune Publishing Co., secretary and treasurer Enterprise Powder Manufacturing Co., Scranton, Pa.; Elmer H. Lawall, vice-president International Correspondence School, Scranton, Pa.; Thomas R Patton, vice-president Union Trust Co., Philadelphia, Pa; Thomas M. Righter, president Mt. Carmel Banking Co., and coal operator, Mt. Carmel, Pa.; W. C. Teter, insurance, Scranton, Pa; W. B. Whitney, Whitney & Kemmerer Co., Philadelphia, Pa.; Dr J. S Wentz, coal operator, Mauch Chunk, Pa.; James J Williams, president Merchants' and Mechanics' Bank, Scranton, Pa.; W. W. Watson, attorney-at-law and vice-president Traders' National Bank; C. H. Zehnder, president Dickson Manufacturing Co., Scranton, Pa.

The officers are: W. W. Watson, president; John L. Kemmerer, first vice-president; Thomas R. Brooks, second vice-president; F H. Kingsbury, secretary; E. P. Kingsbury, treasurer; W. C. Teter, general superintendent.

This company has been organized to carry on the business which the American Mutual Indemnity Co. has so successfully conducted during the past two years.

According to reports the Canadian Government is to subsidize electric lines, as it now does steam roads.

LONG RAILS.

At the annual convention of the Roadmasters' Association of America, held in Detroit last month, a report upon the "Advisability of Increasing the Length of Rails and Using Miter Joints; the Difference in Expansion of Light and Heavy Rails," was made, signed by Mr. V. T. Douglas, of the Chesapeake & Ohio, and Mr. G. W. Merrill, of the Norfolk & Western. We present the following abstract:

There are about eight railroads in the United States who have purchased and are using 45 and 60-ft. rails. The use of rails over 30 ft. in length was commenced experimentally about nine years ago, and while results in some instances have proven quite satisfactory, it may be said that not enough time has yet elapsed to fully develop either the advantages or disadvantages.

The advantages claimed for the 60-ft. rails are the reduction of 50 per cent in the number of joints, better riding track and that it is maintained with less labor. From the information gathered it appears that the objections to 60 ft. rails are:

First—That they are not properly straightened at the rolling mills. While this would seem to be a question of mechanical skill, yet the complaint is general, and indicates that the mills are not prepared and are unable to straighten 45 or 60-ft. rails as well as the 30-ft. rails.

Second—Complaints are made by trackmen that more labor is required on 60-ft. rails, in order to secure good surface, than on the same length of track laid with the 30-ft. rails; this on account of rails springing and not raising to a uniform surface.

Third—Another objection offered is the increased opening required to allow for expansion.

It may be mentioned that it is claimed by many track men that not to exceed 50 per cent more expansion is required for 60-ft. rails than for 30-ft. rails; but as few roads have used less than 50 per cent with satisfactory results, and not having been able to establish the fact scientifically, your committee cannot vouch for its truth.

Inquiries at the leading rolling mills in this country reveal one or two significant facts, namely:—That rails 45 and 60 ft. in length have not yet proven satisfactory, or that purchasers are still watching the results, as few roads have placed a second order for such rails. We believe that until a more perfect workmanship can be attained in the straightening of 45 and 60-ft. rails, they are not likely to be favorably received however satisfactory they may be in other particulars. We believe the subject a fruitful one, and one that should receive continued investigation, as the introduction of any means by which 50 per cent of rail joints can be successfully reduced will be a boon to railroads generally.

After careful consideration your committee can see no objections to 33-ft. rails, and would recommend their use. The advantages to be obtained are greater convenience in handling, transporting and maintaining, and a reduction of 10 per cent in joints.

While your committee recommends the use of 33-ft. rails, we have strong hope that further trial and improvement in manufacture and appliances may at no distant day render it practicable to recommend 45 and even 60-ft. rails.

Your committee regrets that from present information we cannot recommend miter-cut rails. The point of contact between wheel and rail is so slight that an opening at any practicable angle will cause a blow, and as the mitred points are unsupported by the web of the rail, we believe that the depression or flattening at the joints will be about as rapid as the square-cut rails.

Evidence from two prominent roads where mitred rails cut at an angle of 55 degrees have been in hard service for four and five years show fairly satisfactory results. Other roads, after nine years' trial, are not placing any orders for mitred rails. We are satisfied, from information gathered, that in some instances, at least, the unsatisfactory condition of the rails has been caused by too great expansion space having been allowed.

Your committee was under the disadvantage of having no means at hand of making entirely accurate measurements. Our experiments in determining the difference in expansion in different weights were made by constructing a timber platform (wood being used because little affected by extremes of heat and cold), and on this platform, when the temperature of the air registered 5 degrees above zero, were laid one 30-ft. 56-lb. rail, one 30-ft. 75 lb. rail and one 30-ft. 85 lb. rail, the length of each rail at that temperature being registered. At the temperature of 20 degrees below zero the lengths were again carefully taken, when it was found that the 56-lb. rail had contracted 3-16 in., the 75-lb rail had 2-16 in. and the 85-lb. rail 2-20 in.

At a temperature of 70 degrees above zero these rails were again measured, and it was found that between the temperatures of 5 degrees above and 70 degrees above zero the 56-lb. rail had expanded 1-12 in., the 75-lb. rail 1-16 in. and the 85-lb. rail 1-17 in. From this your committee concluded that heavy rails are less affected by the extremes of heat and cold than light rails, and in this we are borne out by the experience of practical trackmen.

The data, reduced to a more usual form of decimal coefficients per 100 degrees F. are:

Contraction from +5 degrees to —20 degrees F.		Expansion from +5 degrees to +70 degrees F.	
Rail.	Coefficient.	Rail.	Coefficient.
56-lb.	.00208	56-lb.	.00107
75-lb.	.00139	75-lb.	.00060
85-lb.	.00101	85-lb.	.00065

The importance of the work may be better appreciated when we take into consideration the fact that the amount of expansion space, to a great extent, determines the life of the rail. In view of the importance of determining definitely the space necessary to be allowed in laying rails of different weights, your committee would recommend that a committee be appointed with authority to employ methods and appliances necessary to make an accurate record and report of the expansion and contraction of rails varying from 60 to 100 lb. per yard, at temperatures of as wide range as practicable; also to ascertain definitely the difference in expansion of 30 and 60-ft. rails.

In the discussion on this report the three objections to long rails were dwelt upon. It appeared that the majority of mills cannot straighten 60-ft. rails save at the expense of much time and labor. Mr. P. E. Carhart of the Illinois Steel Co., believed that a 30-ft. rail could be straightened with fewer blows than any other length, and that consequently the steel was less injured. A number of members stated that long rails would not kink if properly loaded. Mr. D. Foley, of the Michigan Central, was of the opinion that, contrary to the report of the committee, 60-ft. rails could be surfaced with less labor than the same length of 30-ft. rails; on his road he had 500-ft. lengths made up rails riveted at the joints, expansion joints being placed every 500 ft., and believed these long lengths gave better results than 60-ft. rails.

On motion the Association went on record as opposed to the use of rails longer than 33-ft. at this time.

PRIZE FOR POPULAR FIRE COMPANY.

The park manager of the Wilmington (Del.) City Railway Co., in order to increase public interest in the company's theater at Shellpot Park, offered to present the sum of $100 to the most popular fire company in the city, the prize to go to the company receiving, during the month of August, the largest number of votes from patrons of the theater. The charge for all seats at matinee performances was 5 cents, but in the evening the orchestra row was 10 cents and the family circle 5 cents. Purchasers of 5-cent tickets had the privilege of casting one vote for their favorite company, and the 10-cent tickets entitled the holders to two votes.

The Phoenix Fire Co. came out ahead and immediately decided to use the $100 in placing rubber tires on its ambulance.

COMMUTATOR COMPOUND FREE.

Believing that a trial of the Gale commutator compound means an order for more and its continued use, the makers, K. McLennan & Co., 100 Washington St., Chicago, will send free to any street railway man on request, a sample of the compound. In sending for the sample readers are requested to mention the "Street Railway Review."

As the result of recent drouths the City Electric Co., of Austin, Tex., which depends entirely on water power for its operation, and which supplies current to the street railways of the city, has been compelled to shut down, with the result that all the car lines are tied up for an indefinite period.

THE OSHKOSH 3-PHASE ELECTRIC RY.

The Citizens' Traction Co., of Oshkosh, Wis., which has for several years operated an electric railway within the city limits, has recently completed an interurban line connecting the cities of Oshkosh and Neenah, which, following the trend of the most modern practice, is operated on the 3-phase alternating current system. The urban lines, which aggregate 16 miles of single track, are somewhat peculiarly laid out to serve the entire city, there being in the first place a belt line encircling the city and from different points on this belt branches run into the heart of

FIG. 1 ON THE INTERURBAN LINE.

the city, forming several loops, some of the belt line being included in each division. The interurban line is 16 miles in length, starting from the Athearn Hotel in the center of Oshkosh, and running out over what is called the north loop to the northern limit of the city, and from here there follows 10 miles of track without a curve, and the remaining 6 miles have but four slight curves, making an ideal road for high speed service. Figs. 1 and 2 show views along the interurban line, the former being a view of the straight track and the latter showing one of the curves near Neenah.

Oshkosh, within the last few years, has become a flourishing city, largely on account of the numerous manufacturing interests which have located there. It contains about 32,000 inhabitants, and is located at the mouth of the Fox River and on the shore of Lake Winnebago. The river banks within the city are lined with factories, which lend considerable business activity to the city, while the residence portions are handsomely built up with detached dwellings surrounded by well cultivated grounds. The traffic on the 16 miles of urban electric lines for last year amounted to 1,526,408 passengers. Neenah and Menasha, with which the new interurban line connects, contain about 17,000, making the population from which the future traffic of the road will be drawn about 50,000. The road between these cities runs through a highly cultivated farming district, from which considerable traffic will be realized, and the roadbed is located close to one side of the highway, so as not to interfere in the least with wagon traffic, and for the greater part of the way there are no road crossings. The lines, both urban and interurban, are single track, with turnouts, and this necessitates, especially in the city, a particular running schedule, which is closely adhered to. It is noticeable that, although entirely a single track and with cars running at frequent intervals, the schedule is so closely followed that delays at the turnouts are of rare occurrence. The turnouts are placed at intervals of 3,000 ft. along the road.

The road is laid with 60-lb. T-rails, made by the Illinois Steel Co., 30 ft. in length, laid on ties 6 x 7 in. and 7 ft. long, with 2 ft. between centers. The foundation for the roadbed is gravel, of which the company owns two pits along the line. The rails are held to gage by tie rods and are cross bonded every 300 ft. Within the city the company is required to pave between and 12 in. outside of the rails. The road is practically level, the maximum grade not being over 2 per cent.

The overhead work is upon cedar poles, 7 in. in diameter at the top and 30 ft. long, 6 ft. being in the ground. They are set 120 ft. apart, and with a 7-in. rake. In the city span construction is used, while most of the interurban line has side brackets. The trolley wire in the city is No. 00 B. & S. gage, and on the interurban No. 000 drawn to a figure 8 section. The trolley hangers and insulators are of the patterns made by the H. W. Johns Manufacturing Co., the Ohio Brass Co. and Albert & J. M. Anderson. The brackets are built of light angle iron. The feeders vary from 100,000 to 500,000 c. m. in section. Fig. 3 shows the methods employed for stringing the overhead wires. An old flat car was used on one end of which the platform for the wiremen was built, and arrangements were also provided for holding several reels of wire on the car, which paid out as the car was drawn along the track by a small engine. The construction work was all done by the Falk Co., of Milwaukee.

The company owns 15 open cars and 21 closed cars, including 6 cars 46 ft. in length, for use on the interurban line. The city cars are 22 ft. long, the closed ones having vestibules with side seats and center aisles, and have single trucks with double equipments of motors. The interurban cars are very commodious, and are plainly but neatly finished. They are vestibuled at each end, the vestibules having five drop sashes. They are equipped each with four motors and Christensen air brakes. The car and equipment complete weighs about 47,000 lb. The seats are rattan covered "walk-over" type, 12 on each side of the center aisle, giving a seating capacity for 48 persons. An air whistle is used instead of the usual gong, for a warning signal. The cars are heated with Baker hot water heating apparatus, the same as used on steam roads, and are lighted inside by 22 incandescent lamps. One end of the car is partitioned off by sliding doors, with glass sashes, making a smoking compartment, with seats for 10 persons. In some of the cars the space used for the smoking compartment is utilized as a baggage compartment, and the latter have outside sliding doors. The heater for the hot water apparatus is contained in this compartment. All the cars are equipped with fenders of the company's own make and with Van Dorn track scrapers. The company uses a McGuire rattan snow sweeper.

The car barns and power house are situated alongside of each other on the lake shore, at the mouth of the Fox River, and both are yellow brick buildings, the former being 40 x 160 ft. in dimensions and containing five parallel tracks. The power house is 73 x 42 ft., the front of the building containing the engine room and the rear the boiler room, the latter being 4 ft. lower than

FIG. 2 CURVE NEAR NEENAH.

the former, and the two separated by a brick partition wall. There are three boilers of the Babcock & Wilcox make, having 96 4-in. tubes each and drums 36-in. x 16 ft. The furnaces are 6 x 8 ft. and steam is generally carried at 140 lb. The boilers are fed by two Worthington pumps, 6 x 4 x 6 in. Coal storage for 75 tons is provided, and this room also contains the condenser and a Wheeler feed water heater. Water for condensing is pumped from a crib 240 ft. out in the lake.

There are two Hamilton-Corliss engines, made by the Hooven, Owens & Rentschler Co., located in the engine room, with 20 x 42-in. cylinders and running at 90 r. p. m. They have 16-ft. fly-wheels mounted on 12-in. engine shafts, each wheel weighing 16 tons. There are three generators in this room, two being 225-kw. direct current generators of 550 volts pressure, which are run in

tandem from one engine, one belt running on top of the other. The other generator is a 6,600-volt 3 phase revolving field machine of 300-kw. capacity, and is belted to the second engine. This is excited by a 4 pole 13½-kw. exciter, and the 3-phase circuit is led to six 50-kw. air blast transformers, three being at the power house and three at the sub-station on the line of the interurban road, 12 miles distant. The plant also contains two 4-pole rotary converters, one at the power house and one at the sub-station, each being 150 kw. capacity and of the G. E. type. The power house switchboard is located in the front of the building 5 ft. from the wall, is 15½ ft. long and made of white marble. It contains the standard G. E. equipment. The direct current machinery at the

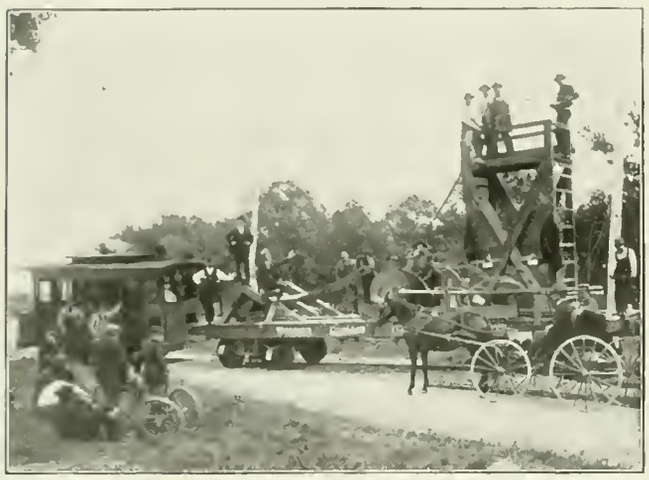


FIG. 3. STRINGING OVERHEAD WIRES.

power house ordinarily takes care of the urban portions of the road and the alternating current the interurban portion. In times of light load, however, both divisions of the road may be run together on either the direct or alternating machines, and in general the two parts of the road are electrically connected so that the generator current and the converter current are in parallel. The two divisions may also be kept separate by means of section insulators.

The sub-station is shown in diagram in Fig. 4. This is located on the line of the interurban road towards Neenah, and besides the room for the machinery contains dwelling apartments for the attendant. The converter room contains three static transformers, a 150 kw. rotary converter, a switchboard and a motor and blower

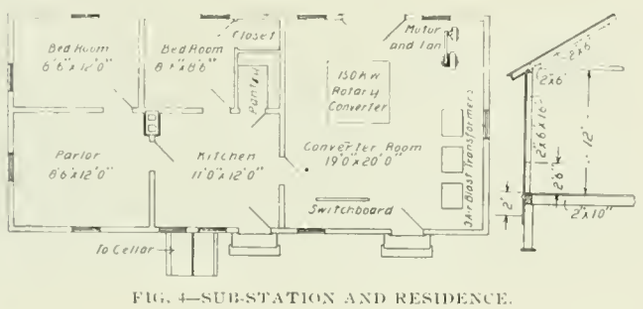


FIG. 4—SUB-STATION AND RESIDENCE.

for supplying air to cool the transformers. The current from this rotary feeds about one-half of the interurban line.

This line, which has just been opened to traffic, connects at Neenah with the Fox River Valley road running to Appleton, and which is to be ultimately extended to Green Bay. The Oshkosh-Neenah road will then form a link in the chain of trolley roads commencing at Green Bay and eventually running through Kaukauna, Appleton, Neenah, Oshkosh, Fond du Lac, Oconomowoc, Milwaukee, Racine, Kenosha and Chicago.

The Citizens' Traction Co. was organized, and the city lines were built in 1897, the capital stock of the company being $500,000. The officers are Geo. J. Kobusch, president; E. E. Downs, vice-president and general manager; Otto U. von Schrader, secretary and treasurer.

CINCINNATI STREET RY. AND THE EMPLOYES' ASSOCIATION.

September 6th the Street Railway Employes' Mutual Protective Association received the following communication from the Cincinnati Street Railway Co.:

Gentlemen—The directory of the Cincinnati Street Railway Co., desiring to show its appreciation of the benefits derived by the employes, and to assist in the support and maintainance of your organization, trusting it is, and believing it to be, in the interest of the employes members of the association, at a meeting of the board, held on Sept. 5, 1899, unanimously adopted the following resolutions:

Whereas, The Cincinnati Street Railway Co. is desirous of contributing to the relief of its employes and to aid in the support and maintenance of the association organized by the employes, believing said organization to be in the interest of the employes; now, therefore,

Resolved, That the sum of $5,000 be and same is hereby appropriated from the surplus of this company, and directed to be paid by the treasurer to the Street Railway Employes' Mutual Protective Association, which said sum is to be under the control of the management of said association.

Resolved that we recommend, subject to the discretion of your association, the following amendments to the constitution:

Article x, Section 1, to read as follows: Any member who shall become sick or disabled shall receive 75 per cent of his daily salary or wages for each day so sick or disabled, provided he has been a member in good standing for three months, and has fully complied with the constitution and by-laws.

Article x., Sec. 9. No benefits shall be paid for a fractional part of a week, or less than seven days. (To be repealed.)

Article xiv., Sec. 13. Every member shall pay to the financial secretary, at the first regular meeting of each month, 25 cents dues. (To be repealed.)

Check for the above amount is herewith respectfully enclosed.

The principal object of this donation is to enable you to lessen the burden and increase the benefit derived by your members. If this action is taken, members will be relieved from paying dues, and their benefits in case of disability will be increased and their families properly provided for; and, in case of death, their families will receive an amount that will place them above want. If these suggestions are concurred in by your association, it is the expectation that a similar amount will be annually donated by the Cincinnati Street Railway Co.

LARGEST IN THE WORLD.

The advertising in all lines on the North and West Sides in Chicago is controlled by the well known firm of George Kissam & Co., which is entering on its fifteenth year of occupancy, and reports business in its line as being good for the first time since 1893. This firm, the largest of its character in the world, is extremely popular with street railway officials by reason of its manner of conducting the street car advertising business, prompt payments of all rentals and a thorough understanding of street railway requirements.

All through the period of business depression subsequent to 1893, this firm went right along, though losing heavily, and that the personality and methods are popular is shown by the continuous occupancy of the car systems of Chicago and other large cities. Mr. George Kissam will be in attendance at the convention, not having missed one in 10 years.

An assistant from the Railway Post Office Department has been inspecting the system of the Ohio Central Traction Co., of Galion, O., with the view of establishing a mail service over the line between Bucyrus and Galion. It is probable such a service will be commenced in the near future.

Through electric cars between Milwaukee and Chicago are to be put into operation next year, unless present plans miscarry. There is practically a through line between the two cities, and the Milwaukee Electric Ry. & Light Co. has gone so far as to purchase sites for interurban stations along the route.

McGUIRE COMPANY'S SPECIAL TRAIN.

The McGuire Manufacturing Co., of Chicago, has arranged for the month of October, a rather novel method of advertising. It will have a special train of 43 platform cars, each car carrying one of its snow sweepers, decorated with banners and mottos. The train will leave Chicago during the convention, after being exhibited for one day on a side track at a point nearest the convention hall. It will then proceed on its way to New York via Washington, delivering sweepers enroute and stopping at places where the company thinks sweepers are likely to be sold, where a representative of the company will invite the railway officials of the place to review the train. When the train reaches Washington it will be reduced to 17 cars. Leaving 10 there for the Columbia Ry., it will proceed to New York, dropping one at Chester, Pa., and completing the trip by delivering six at New York City for the Metropolitan Street Railway Co.

This will undoubtedly be the largest train of this sort of freight that has ever been made up in any country. Sixty sweepers are now being constructed in the shops of the McGuire company for shipment in the month of October. To accomplish this and at the same time take care of the large truck business of the company, about 350 men are working night and day. It is an interesting fact that it has sold sweepers as far west as Portland, Ore., south to Augusta, Ga., and east to New York City.

IMPROVEMENTS AT ST. JOSEPH.

The St. Joseph & Benton Harbor Electric Railway Co., of St. Joseph, Mich., has in the last nine months completed an additional brick boiler room at its station, and has installed one 300-h. p. Babcock & Wilcox water tube boiler, one 250-h. p. tandem compound condensing engine, made by the New York Safety Steam Power Co.; one 120-light Brush arc dynamo; one 2,000-light G. E. alternator, and one 300-h. p. Worthington condenser. The rolling stock has been increased by the addition of six open trail cars, three open motor cars, each seating 50 persons, and one electric sweeper, and the company is now engaged in laying one mile of 13 lb. 7 in. Johnson girder rail. A 5,000 gallon water tank, 50 ft. high, with automatic sprinklers for fire protection at the barn, has also been erected.

This company has, within the past few months, secured a three year contract to light and heat the county court house and jail, situated about 300 ft. from its St. Joseph power house. The contract was granted after the street railway company had succeeded in demonstrating to the Board of Supervisors, from their own reports and figures, that the railway company could do the work for three years at $1,100 less than it would cost the supervisors to do it from the county's own private plant.

TELEPHONES IN RAILWAY SERVICE.

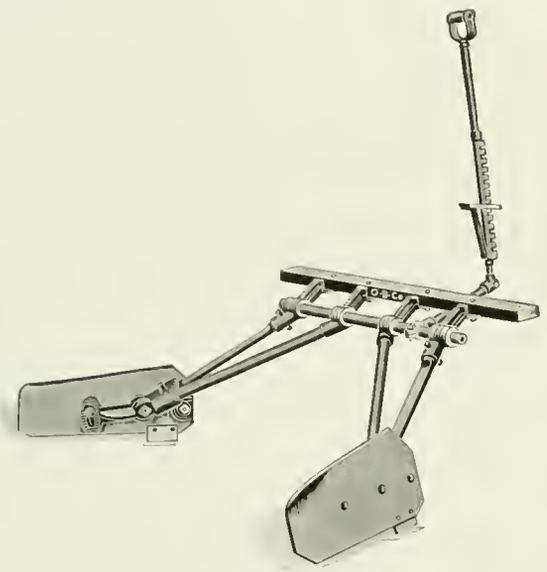
There was a time when telephones in street railway operation were looked upon more as a luxury than as having any real necessity. Now their efficiency and assistance are such that few roads can afford to do without them. The construction of trolley lines has also simplified the matter, as obviating the necessity of erecting special pole lines for the wires. Once used the manager would as soon think of running his road without gongs or head lights, as without telephones.

An excellent system of telephones designed exclusively for street railway work, is that manufactured by the Garl Electric Co., of Akron, O. For interurban work where it is desirable to have frequent telephoning points, and without the expense of installing as many complete telephones, a connection box is provided which can be attached to the poles and plugged into by the car crew using a portable receiver and transmitter. These connecting boxes are so constructed that the connections are 3 in. apart, which prevents short circuiting the line. Where it is desired the box may be placed above the reach of persons on the ground, in which case the employes cut in with a pole of suitable length. By carrying extra joints to the pole, connection may also be made without the connecting boxes by reaching to the telephone wires overhead and making contact with the two wires. This permits use of the line everywhere on the system, regardless of boxes or stations. The Garl company will have a complete exhibit, at Tattersalls, of its different telephone specialties.

SOME OF THE PRINCIPAL CHICAGO HOTELS.

THE MONARCH TRACK CLEANER.

Any article which has to do with keeping the track clear of ice and snow is of particular interest at this season of the year to nearly all the operators of electric railroads, and the track cleaner illustrated is no exception. This is distinguished from other scrapers by the name of "Monarch" and is the product of the Ohio Brass Co., Mansfield, O., which has recently made arrangements with the patentees for its exclusive manufacture and sale. This form of track cleaner has many points of originality which have given it a preference. A number have been in use for the past one or two seasons and have given universal satisfaction. It affords the greatest possible strength with the least possible weight, being one-third lighter than any similar device now on the market. It has a wide range of adjustment and adaptability to all styles of cars. All the wearing



MONARCH TRACK SCRAPER.

parts are quickly and inexpensively replaced. The cross bar and compression braces are made of gas pipe with connections and fittings of malleable iron, and the tension bar, which holds the blade in bearing upon the track, is made of the best quality of spring steel, which in turn is firmly clamped to the cross bar by malleable iron fittings. The two blades operate independently of each other, and both are under the entire control of the motorman by means of the handle and lever which adjust them either "on" or "off" the track at will. Ample range of adjustment to adapt the scraper to all heights of car platforms is obtained by special malleable fittings bolted to the blades, which act also as a substantial backing to resist the strains upon them. The blades are provided with steel shoes, which bear directly upon the rail and take all the wear. These may be readily replaced when worn out without removing the scraper from the car. They also serve to keep the scraper blades above the roadway or brick pavement and other obstructions. The features of this scraper which are peculiar to itself are covered by letters patent.

OIL TESTING DEVICE FREE.

A very neat, compact and serviceable oil testing device has been sent us by the Famous Filter Co., 316 North Main St. St. Louis. It is the same as is furnished with every Famous filter. With the aid of this microscopic device any minute impurities are easily detected in new oil, cylinder oil, and filtered waste oil. The company will send one of the indicators free to any manager, purchasing agent or engineer who, in writing for same will mention the "Street Railway Review." Full directions for its use—which is a simple matter—accompany each indicator.

A pleasant outing was enjoyed by the employes of the Bay Cities (Mich.) Consolidated Railway Co., at Wenona Beach on September 6th.

ROCKFORD RAILWAY, LIGHT & POWER CO.

By courtesy of Mr. T. M. Ellis, general manager of the Rockford Railway, Light & Power Co., of Rockford, Ill., we have received a statement of the operation of this company's electric street railway for the month of July, 1899, which is published herewith. This road comprises 22 miles of track; the rolling stock consists of 35 motor cars with double equipments of 15-h. p. and 27-h. p. General Electric and Walker motors. In the power house are 400 kw. of General Electric generators driven by Ball and Ide engines.

BALANCE SHEET.

Cash from passengers	$6,346.40
Ticket sales	1,055.00
	$7,401.40
Operating expenses	3,715.03
Net earnings	$3,686.37

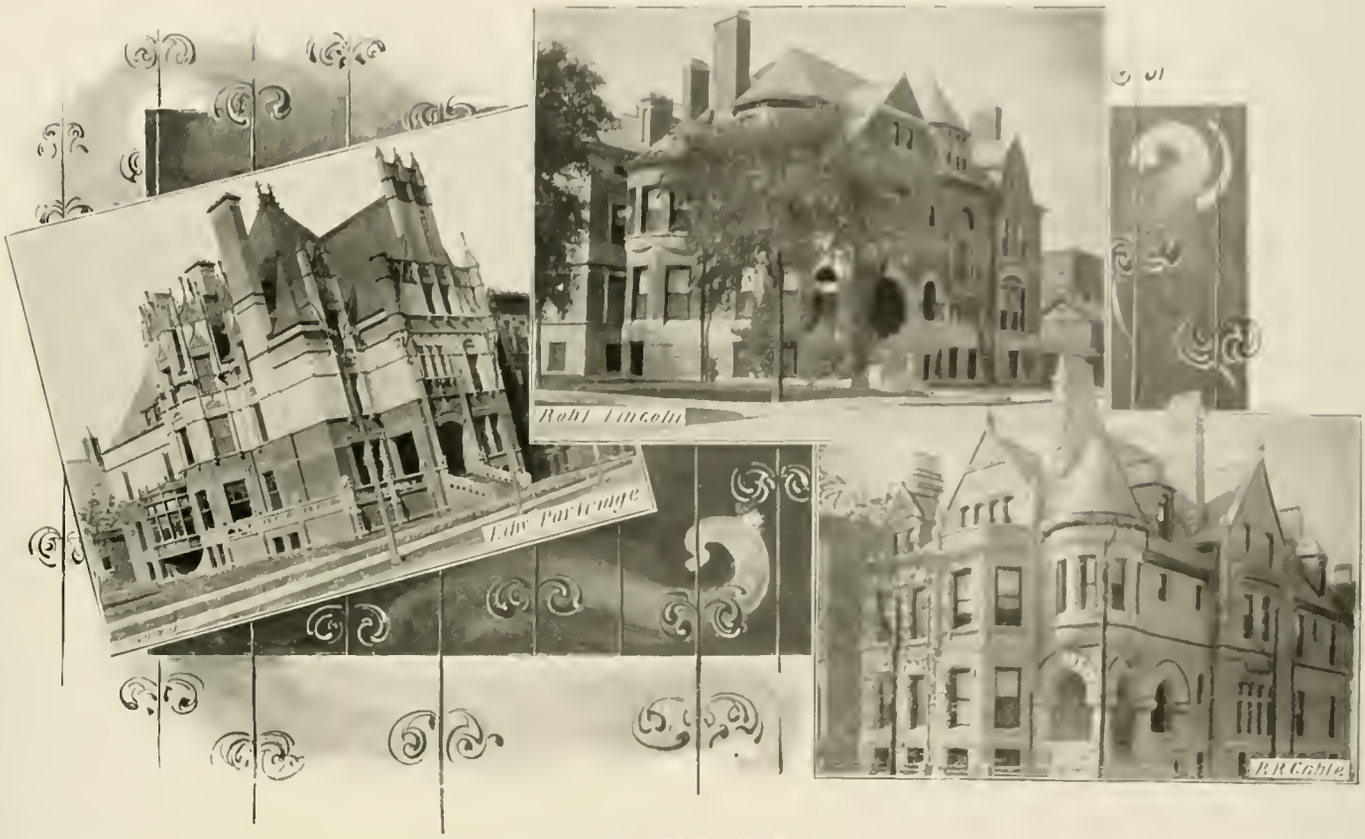
OPERATING EXPENSES.

General Expenses:	
Salaries of officers and clerks	$ 265.00
Stationery and printing	65.50
Legal expense	2.50
Feed, etc	38.27
Contingent expense	55.84
Park expense	167.01
Leased lines and buildings	50.00
Total	$ 644.12
Transportation:	
Wages, motormen and conductors	$1,452.48
Wages, power house employes	215.00
Lubricants and waste for cars	18.76
Fuel for power house	630.56
Water rents	22.81
Cleaning and sprinkling track	74.01
Miscellaneous	26.45
Barn expense	14.51
Total	$2,454.50
Maintenance of Way and Buildings:	
Repairs on track	$ 108.25
Repairs on poles and overhead line	49.50
Repairs on buildings	14.05
Repairs and renewals of paving	39.69
Total	$ 211.49
Maintenance of Equipment:	
Repairs on car bodies and trucks	$ 171.75
Repairs on electrical equipment of cars	150.02
Repairs on power house equipment	83.07
Total	$ 404.84
Total operating expenses	$3,715.03

SUMMARY.

Passengers carried	163,222
Average earnings per day	$238.75
Average cars operated per day	11¾
Earnings per car per day	$20.32
Operating expenses per day	$119.84
Operating expenses per car per day	$10.20
Total motor car-mileage	54,457.5
Mileage per day	1,756.7
Mileage per car per day	149.5
Earnings per car-mile	13.59 cents
Operating expense per car-mile	6.82 cents
Net earnings per car-mile	6.77 cents

It should be noted that the various items "repairs" include the labor necessary to do this work. The item for fuel is large because nothing but high-priced lump coal could be obtained.



CHICAGO RESIDENCES.

THE LORAIN STEEL CO.

The Lorain Steel Co., successor to the Johnson Co., which was the first manufacturer of rails to make a specialty of 60-ft. girders for street railways, has an immense business and the Johnson rails are known everywhere that street railways are operated. All of the Chicago surface railway companies have Johnson rails in their tracks and the standard roadbed specifications used for new work call for 60-ft. girders. The Du Pont trucks made by this company are used on the cars of the Chicago Electric Traction Co.

A LIQUID PRIMER AND SURFACER.

It is an axiom with the up-to-date general manager that his cars must be kept clean and attractive in appearance, no matter what the conditions. An unkept, unpainted street car not only does not encourage traffic, but it goes further and often keeps passengers from riding. Therefore a good paint that will hold its color and surface is an absolute necessity. But to secure such a paint has not been entirely easy. A passenger car operated in crowded streets is being continually run into and scraped by trucks and wagons of all kinds; it must run in all sorts of weather, and while on the road and in the car barn is subjected to rapidly changing temperatures and different degrees of moisture in the atmosphere. Therefore a paint, to meet street railway conditions, must possess superior qualities.

The Cartime Surfacer Co., of Chicago, has had on the market for some time a liquid primer and surfacer that, it is claimed, are perfectly suited to this severe service. These compositions are sold ready for use, and do not require oils or other additions. The claims made for them are: They fill the pores of the wood completely, permitting a fine finish; they produce a smooth and elastic surface; they will not crack, peel or blister; they enable a car to be painted in half the time required under the old methods, and are less expensive. Another strong point is they can be put on over old paint without burning off the old coating. The headquarters of the Cartime Surfacer Co. are at 1654 Monadnock Building.

Reports still come in from all parts of the country of work held up on new roads through inability to procure rails.

PIERCE & RICHARDSON, CHICAGO.

This well known engineering company divides its special work into five departments: electrical, mechanical, heating, ventilating and sanitary. Unlike many engineers, it confines itself to consultation, expert opinions, examinations and preparing plans and estimates, but does not undertake contracting. The company was incorporated in 1894, and the present officers are: R. H. Pierce, president; R. E. Richardson, treasurer, and S. G. Neiler, secretary. Among the complete plans recently prepared are those for the street railway plants at Natchez, Miss., and Jackson, Tenn. It is also consulting engineer for the Chicago City Ry., and laid out the work for the recent extensive renewals of the cable machinery at the cable station, 2020 State St.

Heating and ventilating of large buildings under difficult conditions has constituted a large share of the company's work the past two years. It also does a large amount of inspection and making examinations of roads and plants for eastern trust companies.

A NOVEL WHOLESALE ARREST.

A southern city recently was the scene of a most unusual wholesale arrest, when 40 drunken negroes, men and women, were made prisoners in a trolley car and taken in a body to the police barracks. The crowd had been visiting the city park, where they had raised a serious disturbance by firing off pistols. They finally took possession of a trolley car and started for the city. As soon as they boarded the car two policemen, with drawn pistols, stepped to each platform and told the mob they were under arrest. The prisoners offered but little resistance, and the motorman ran his car without stop through the city to the police station.

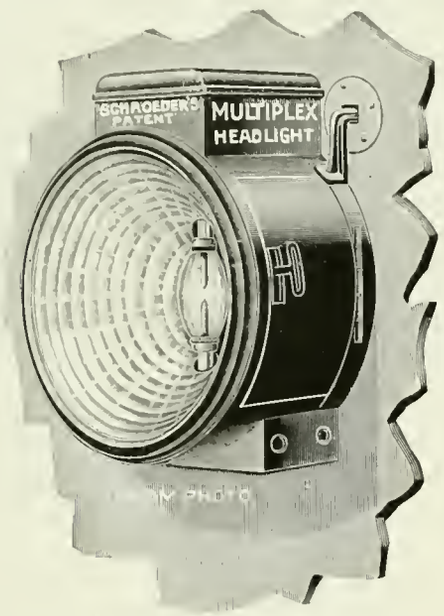
The Cataract Power Co. has purchased a controlling interest in the Hamilton Street Ry., the Hamilton Radial Electric Ry. and the Hamilton & Dundee Street Ry., of Hamilton, Ont.

The Cincinnati Street Railway Co. has been directed by the Board of City Affairs to remove the slot rails and yokes remaining from the old Vine St. and Walnut Hills cable roads.

A NEW FEATURE IN HEADLIGHTS.

An important improvement in headlights was accomplished when the Multiplex Reflector Co., of Cleveland, brought out its novel and original design for headlight reflectors. These are spun out of a heavy gage of brass, and their form consists of a series of convex or concave corrugations of shape, size and radius according to the kind of light to be used with it. They are polished, heavily silver plated and then burnished to maintain a lasting brilliancy. Each corrugation is not only a reflector, but the effect is cumulative, concentrating and intensifying the light to a remarkable degree. The beams from one corrugation merge with those of the next.

These reflectors can be applied to any form of headlight at



MULTIPLEX HEADLIGHT.

present in use by a railway company. The manufacturers, however, make and carry in stock a large variety of headlights complete. No. 75 B is a type which is inserted in a hole in the dash, with a front projection of only 1½ in. and a rear projection of 3¼ in. It has become very popular with the many roads using it. A special hood light and detachable dash lights are also made in several sizes and styles. The recent demand for arc headlights for interurban use where high speed is desired has been met with an excellent arc type, which is not only self regulating, but is not affected by any amount of jarring or vibration. Rheostats accompany each headlight, and the manufacturers will be glad to send a light of any size or type on trial without charge, their experience having been that where they are once tried an order is certain to follow.

STREET RAILWAY OPERATIONS IN THE CAUCASUS.

The municipal council of Tiflis, the chief city of the state of Tiflis, which is situated in Transcaucasia, Russia, has invited bids for the street railroad concession of the city and suburbs. The successful concessionaire must conform to the following conditions:

The concessionaires must pledge themselves to continue the exploration of the railway line, now being constructed by the Societe Anonyme Belge under the contracts of 1881 and 1885 of an approximate length of 21 versts (13.92 miles).

The concessionaires must agree, in addition, to construct and operate the new lines known as the Didoube, Sololac, Vardissoubane, Avlobare, Navellouge, Sadovia and Bazar Armenian lines, the purchase of the private properties along the new line to be made by the concessionaire. The Ortotchali line shall be prolonged to the government prison, and the Olguinskaia line three versts beyond the gardens of Vera. The total future length will be about 15 versts.

If the construction of these lines is found to be impracticable the concessionaire shall substitute other routes approved by the city. The construction of lines not mentioned shall be at the option of the city.

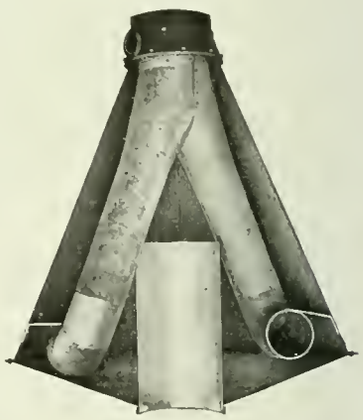
The concessionaires shall substitute upon all the lines electric for horse traction.

At the termination of the term of the convention all the lines of railway, with all material and appurtenances, shall become the property of the city, to which the concessionaire shall deliver them free and in good order.

All other conditions, such as the term of the concession (which shall not exceed 30 years from the day of the signing of the contract), the security offered by the concessionaire, the conditions of the possible repurchase of the railway by the city before the end of the term of the contract, the question of rates, etc., etc., shall be set forth in the application for the concession. The bids are to be handed to the municipal council not later than October 14th.

THE STURTEVANT EXHAUST HEAD.

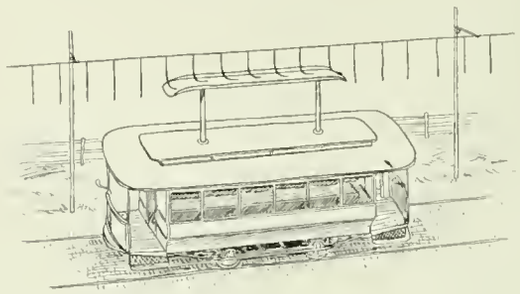
As indicated by the illustration, this exhaust head, built by the B. F. Sturtevant Co., Boston, is designed to separate by the utilization of centrifugal force. The head is attached directly to the end of the exhaust pipe from which the steam passes up to the branch pipes and is discharged tangentially within the case. It is thus given a vigorous whirling motion and the entrained water—likewise the oil—is thrown outward with great force, strikes the cool sides and trickles down to the outlet at the bottom. The steam, now perfectly dry, finds ready escape through the central opening above. As water weighs nearly 1,600 times as much as exhaust steam, and as centrifugal force is proportioned to the weights of the bodies in motion, it is evident that the force acting upon the water is nearly 1,600 times that exerted upon the steam, and that the action is both positive and absolute.



These heads are built in sizes to fit pipes from 1 in. to 20 in., all sizes above 10 in. being flanged. The case and pipes are of heavy galvanized iron, 16 to 20 gage, according to size, all external joints are riveted and soldered, and the internal pipes are double braced.

AN INSULATED TROLLEY LINE.

Among the startling inventions which appear from time to time in the electric railway field comes one from Ft. Myers, Fla., in the shape of an insulated trolley wire, which, according to its inventor, Capt. W. O. Rew, possesses manifold merits of the highest



THE REW INSULATED TROLLEY WIRE.

order, and which has elicited the most flattering comment on the part of electrical engineers and street railway men wherever the model illustrated herewith has been submitted to expert criticism.

On top of the car is a metal trough making contact with pendant wires from the overhead line; the pendant wires are to be insulated to within a few inches of the lower end.

THE SPEER CARBON CO.

The carbon trust will find a vigorous competitor in the Speer Carbon Co., of Saint Marys, Pa., whose new works are now completed and in running order. The business which has already come to this concern not only indicates the general desire to find relief from trust methods, but an appreciation of the quality of the product of the company. The concern is capitalized for $200,000

J. S. SPEER,
General Manager.

ANDREW KAUL,
President.

ANDREW KAUL, JR.,
Secretary and Treasurer.

and has erected a plant with all the latest and best facilities for this special work, and has placed the management in experienced hands, having secured the services of Mr. J. S. Speer, who was formerly a member of the firm and secretary and treasurer of the Partridge Carbon Co. He brings to the new company a highly qualified experience.

The Speer company not only has its own plant, but owns a

OFFICE OF THE SPEER CARBON CO.

private natural gas pipe line 25 miles in length. This secures the greatest possible economy in manufacture, and also that uniformity of heat in the baking ovens so desirable in carbon manufacture. Another great advantage lies in the ownership of its own coal mines, thus insuring the highest grade of coal for its raw product. The factory is fire proof and covers over half an acre. Nothing has been omitted nor any expense spared to make it the best equipped in the country.

The officers are all men well known in their own state, with a financial backing which provides an abundance of capital to push and increase the business. The president is Andrew Kaul; secretary and treasurer, Andrew Kaul, jr.; general manager, J. S. Speer; vice-president, Louis Streuber, and B. E. Cartright and J. G. Wertz are directors.

BEES HOLD UP A RAILWAY.

A queen bee with a numerous swarm of retainers recently established temporary headquarters in the box used by the flagman at the crossing of 16th and Curtis Sts. in Denver. The flagman was quickly routed and for an hour or more was constrained to do his signaling from the curbstone instead of from the middle of the street. The appearance of the bees at the most crowded corner in the city caused numerous unpleasant surprises. Several lines cross at this point and each passing car caused the bees to rise from the flagman's box which they had utilized for a hive. Men passengers pulled up their coat collars and women protected themselves from the swarming insects with handkerchiefs and parasols. A number of passing bicyclists inadvertantly ran into trouble at this point and were obliged to scorch vigorously to escape their undesirable companions.

Later the police were called upon and a policeman with a broom attempted to dislodge the swarm but was soon forced to retire precipitately. Meanwhile the crowd thickened to watch the fun. After

WORKS OF THE SPEER CARBON CO.

an hour and a half the bees began to thin out and a fall of rain aided in driving them away. By evening only a few straglers remained hovering around the flagman's station.

AN EXPERIMENTAL ROAD FOR RICHMOND, VA.

An experimental road is to be built in Richmond, Va., within the next two months which will be one-quarter of a mile long. It is to be equipped with the Jenkins underground trolley system, and is merely an experiment of that system with a view to demonstrating the feasibility and commercial value of Mr. Jenkins' invention. The details of this system are not yet made public.

WORKS OF THE SIEMENS & HALSKE CO.

The extensive works of the Siemens & Halske Co., of America, are located at the extreme western limits of the City of Chicago, near Garfield Park, on the site formerly occupied by the Grant Locomotive Works. The grounds are rectangular in shape, cov-

C. S. KNIGHT.

ering about 35 acres, and there are 12 acres of floor space in the eight buildings included in the plant. All of the shops are equipped with the latest tools and appliances, and the company is constantly adding new and improved machinery for increasing the capacity of the works and keeping them thoroughly up-to-date. The buildings are fitted with high windows, furnishing excellent light in day time; are heated by steam in winter, and lighted by electric arc lights at night. Three spur railroad tracks, running the full length of the grounds, and through the principal buildings, furnish the best of shipping facilities. At present, the plant is running night and day, and the company is carrying over 800 employes on its pay rolls.

Entrance to the grounds is secured through the office building, a two story brick structure 45 x 130 ft. On the lower floor of this are the executive and engineering offices and the bookkeeping department, and in the second story are the drafting rooms, where the drawings and blue prints for all the work that comes to the plant are made.

To the right of the office building is the foundry, 80 x 260 ft. Here three large furnaces are in constant operation, turning out at times 60 tons of work a day. One 25-ton and one 15-ton traveling electric crane, and two 5-ton post cranes, facilitate the handling of heavy material. Some of the important pieces of work now passing through the foundry are several 200-kw. and 400-kw. generator fields and one 1,500 kw. alternator field. This latter ring is cast in two pieces, each half weighing 40 tons.

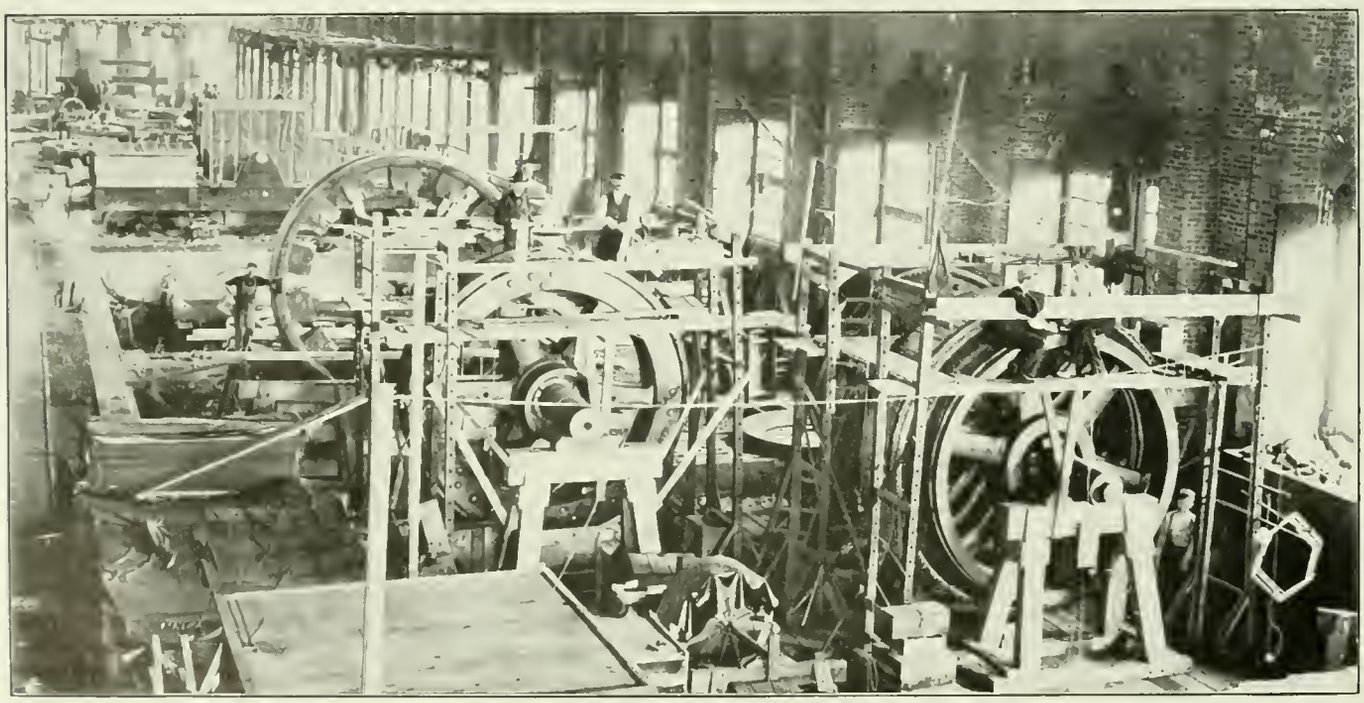
One large division of the foundry is devoted exclusively to the manufacture of automobile motor frames; in fact every department of the entire works now have several men working exclusively on automobile motors, one order alone for 1,400 of these having been received recently from the Electrical Vehicle Co., of New York, for which the Siemens & Halske Co. acts as manufacturing agent. These small motors are built of laminated iron, after entirely new designs, to secure the greatest possible strength with least weight and greatest magnetic flux. That the company's engineer has succeeded in developing something new in this line is shown by recent tests, when automobile motors, rated for 20 amperes were suddenly reversed several times while carrying 100 amperes of current, without the slightest signs of injury. The rise in temperature at full load is guaranteed not to exceed 17° C.

At the back of the foundry and under the same roof, are the core rooms, the carpenter shop, and the brass foundry, where all kinds of brass castings are made. There are six furnaces for this purpose, and these are being worked to their total capacity. A hydraulic press for shaping commutator bars, etc., occupies one corner of the brass foundry.

To the left of the foundry building is the pattern shop, 60 ft. wide and 130 ft. long. This building is provided with large suction pipes for carrying off shavings and dust, connection being made for this purpose with each machine. All the tools are run from shafting, driven by electric motors. A general store room, 70 x 230 ft., for keeping old patterns is located near the pattern shop.

At the right of this store room is the paint shop, 70 ft. wide by 170 ft. long, and immediately behind this, the boiler shop, 100 x 250 ft. This latter building is one acquired from the Grant Locomotive Works, and is not utilized to any extent at present except for doing a little heavy shearing and punching work.

Taking up the greater portion of the northern half of the grounds are the erecting and machine shops, 110 x 370 ft., and the hammer

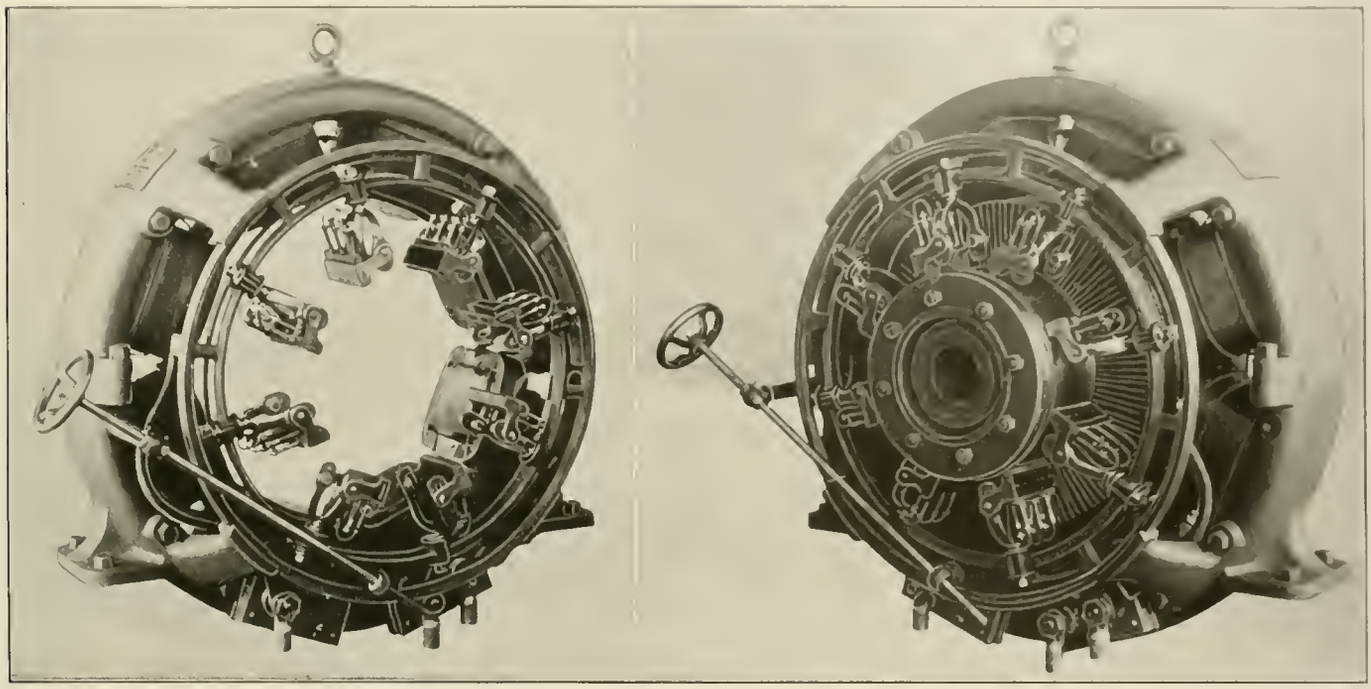


VIEW IN ERECTING SHOP.

and blacksmith shops, 80 x 125 ft., and 80 x 250 ft., respectively; these are in two L shaped buildings, and here are found tools and labor saving devices too numerous to mention, for performing quickly and accurately the different operations of drilling, forging, planing, assembling, etc. On the upper floors of these buildings are the coil winding department, and the switch, switchboard, meter and arc light departments. All oils are stored in a small outhouse.

attending strictly to its own affairs, depending on the satisfaction which its apparatus has everywhere given to make its name known. Our illustrations graphically explain the perfectness and magnitude of its work. The company has important plans in hand which will shortly be announced and which will greatly interest street railway interests.

The Siemens & Halske Electric Co. of America is one of the



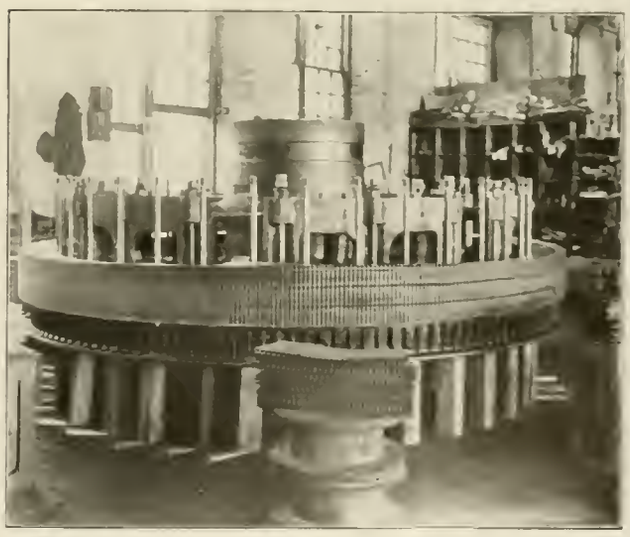
ENGINE TYPE GENERATOR WITH AND WITHOUT ARMATURE.

A power station for furnishing light and power to the buildings, and an artesian well 2,100 ft. deep, complete these well arranged works, which enable the Siemens & Halske Co. to turn out with the least possible delay direct and alternating generators of any capacity, rotary convertors, transformers, etc., as well as its well known line of electrical specialties.

Two important features distinguish Siemens & Halske generators, and are worthy of particular mention. These are the arrangement of the field and the formation of the brush holders. The feature of the field structure is what is known as the shoeless pole construction, designed to prevent sparking under the most adverse conditions, the reversing field being so arranged that the coil to be reversed enters in gradually and is not distorted under any circumstances. The patent brush holder guarantees excellent contact, the current being taken directly from the brush, rubbing contact not being relied upon.

Among the companies in Chicago and vicinity using Siemens & Halske generators may be mentioned the following: Chicago & Western Indiana Railway Co., one 42 kw. and one 95 kw. generator; Chicago Union Traction Co., one 700 kw., one 1,500 kw., one 20 kw., one 16 kw. and four 500 kw. generators; Chicago Consolidated Traction Co., three 750 kw. generators; Union Loop, two 1,500 kw. generators. In addition these companies are using about 200 latest type Siemens & Halske motors, ranging in sizes from 30 h. p. to 50 h. p.

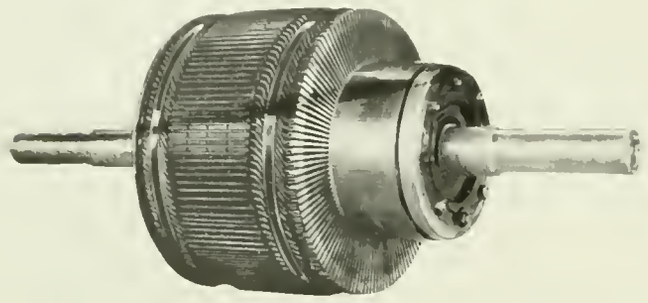
No electric concern in the world bears a higher reputation than the parent Siemens & Halske Co. No new device is ever allowed to go out until the management is ready to endorse it fully, and in arriving at this conclusion two years of experiment and severest test under every possible condition is rigidly required. The result is the products of this company, one of the largest of its kind in the world, carry an unquestioned reputation. The same regard for perfect machinery has been adopted by the Siemens & Halske Electric Co. of America, and easily explains the remarkable success which has attended its operation. The policy of the company has uniformly been not to indulge in publicity as to its sales, which have reached to all parts of the country and include many of the most important plants in the United States. Its history has been one of pioneers in the manufacture of electric machinery, the company having been originally formed in 1892 and being a branch of the Siemens & Halske Co. of Berlin, of which Dr. Von Siemen is the founder. The Grant Locomotive Works plant was taken over in 1895, and the manufacturing headquarters moved to their present location. The officers of the company are: President, Isaac L.



PARTIALLY COMPLETED 50-KW. ARMATURE.

Rice; vice-president and general manager, C. S. Knight; secretary and treasurer, W. T. Block; engineer in chief, Alexander Churchward. Mr. Knight, under whose general supervision all the work is turned out, has had many years' experience in the building of electrical apparatus and is well known in electrical circles. His work in this line commenced in 1881, when he became interested in

the Ft. Wayne Electric Co. of Ft. Wayne, Ind. When this company was placed in a receiver's hands in June, 1894, Mr. Knight was chosen a director in the new company formed, for the purpose of carrying on the business of the Ft. Wayne Electric Corporation. This connection continued until February 1st of this year when he accepted his present position. Messrs. Churchward, Sessions, Duncan and many others of the Fort Wayne Electric Cor-



COMPLETED ARMATURE.

poration, at the same time joined the forces of the Siemens & Halske Electric Co. of America; the Siemens & Halske Co. thereby securing such patents as were owned or controlled by the parties above mentioned in addition to the many furnished by the parent company; it is also bringing out many new designs and types to meet special conditions, etc. The general sales offices of the company are in the Monadnock Building.

A BELT HOSPITAL.

The Leather Preserver Manufacturing Corporation has its main offices and establishment at 27 West Monroe St., this city, and aptly terms it a "belt hospital." In these days, when managers desire to economize in all proper directions, great savings are possible in having old belts overhauled, instead of throwing them away the moment they become unfit for use. By the system em-

J. F. SMITH.

ployed every trace of oil and grease is removed without injury to the leather or glue. A treatment is then given with amber dressing, which renews the life of the belt, makes it soft and pliable and prevents slipping.

The company also manufactures various compounds for preserving belts, which have met with a large sale and proved very satisfactory.

The company makes a standing offer to customers to ship in belts which it examines and names a price for repairing and renewing, and if not satisfactory the company will return the belts and pay the freight. It also buys old belts. The manager is Mr. J. F. Smith, who will be glad to have street railway managers call and inspect the plant.

STREET-CAR STRIKE IN NANTES.

Mr. Joseph I. Brittain, United States consul at Nantes, under date of Aug. 7, 1899, writes the State Department as follows:

Three weeks ago, all the employes of the tramways of Nantes quit work and demanded an increase in wages, an opportunity for promotion, three holidays during each month, and a decrease in the daily hours of service. After a week's idleness, work was resumed, the men having been conceded nearly all they demanded.

The cars are propelled by compressed air. The men who manipulate the machinery from the front platforms of the cars are called conductors, and those who collect the tickets and punch the same are known as receivers. The fare is not uniform for all distances, as is the case in most American cities, but passengers are charged so much per section—2 sous, or about 2 cents, for one section, a distance of nearly a mile; 3 sous for two sections; and so on until 6 sous are charged, which is the maximum price for the entire route, being a distance of about four miles. The cars are not so well patronized as those in American cities, and the service is poorer, persons being obliged to wait 10 or 15 minutes for a car.

Previous to the strike the men were obliged to work 12 or 15 hours per day. The conductors received 4 francs (77 cents) per day, and those of the first grade 4.50 francs (87 cents) per day. Receivers were paid 3 francs (58 cents) for the second grade, and 3.50 francs (68 cents) for the first grade. The tram cars stop running at 9:30 in the evening, and resume business at 6 in the morning, the same men being on duty during the entire time. After several conferences between the company and the employes, the service was resumed, the company agreeing to pay the following prices:

Class of labor.		Wages	
		Francs	
Switchmen:			
First class	per month.	115.00	$22.19
Second class	do	110.00	21.23
Third class	do	105.00	20.26
Track cleaners:			
First class	do	90.00	17.37
Second class	do	80.00	15.44
Third class	do	75.00	14.47
Firemen:			
First class	do	120.00	23.16
Second class	do	115.00	22.19
Third class	do	110.00	21.23
Conductors:			
First class	per day	5.00	.96
Second class	do	4.50	.87
Third class	do	4.00	.77
Receivers:			
First class	do	4.00	.77
Second class	do	3.75	.72
Third class	do	3.00	.58

The men have been granted three holidays during each month, but without pay, and 12 hours are considered a day's work. During the strike no riots occurred, but no attempt was made to start the cars, although the company claimed that new men could have been procured for the service.

A NEW YORK-WASHINGTON TROLLEY LINE.

A rumor to the effect that the Pennsylvania Railroad Co. has a project on hand to connect New York City and Washington has been widely circulated. The company already controls most of the trolley lines in Jersey City and Newark, and is negotiating for the purchase of a line from Newark to Elizabeth, already in operation. This line will be continued to Trenton, 56 miles distant from Jersey City, and will pass through New Brunswick and Princeton.

The formal opening of the new Ypsilanti (Mich.) & Saline Electric Ry., occurred September 5th. A special car, containing 50 Ypsilanti officials and prominent citizens, made the run to Saline, where the authorities of that township were met and conveyed in a second special car back to Ypsilanti. Here the party enjoyed an elaborate banquet.

CONSTRUCTING BY CONTRACT.

So long as there are new railways to be built or old ones to be rebuilt there will doubtless be railway contractors. As in all other lines of trade there are in the railway construction line contractors with responsibility, organization and equipment, and others without these qualifications. It is with the former we deal in this article. As to the policy of letting work to contract: Each side of the question has its partisans, the negative side being usually taken by officers who have either been badly dealt with by some contractor, or have mistaken ideas of economy. As a rule where the railroad company is not large enough to warrant a permanent construction department, new work, if not contracted, is carried on at greater expense than if let to a responsible contractor for many reasons, among them being the following:

First, The incentive to push work is not as potent in the railway employe as in the contractor.

Second, If construction work is carried on by a temporary organization, inexperienced men, indifferent as to results, must of necessity be employed; the man or men in charge having regular duties to perform in the operating department, will be unable to properly look after both construction and operation; hence either or both departments must suffer.

METROPOLITAN, KANSAS CITY.

Third, By contracting, the cost of a piece of work is determined prior to commencement instead of after completion.

Fourth, The purchaser relieves himself from responsibility. In short, by contracting work the purchaser fixes in advance the cost, gets a quicker and better job, shifts the responsibility and at the same time saves money.

The Electrical Installation Co., of Chicago, has gained the confidence of engineers and its customers by the execution of only the highest class of work. The intent of the engineer in the specification is realized, and the spirit of the contract given fullest consideration. Disputes, delays and extra claims are avoided by a broad comprehension of the engineer's purpose. These business methods result in a satisfactory and permanent piece of work. Mr. J. I. Case, the manufacturer of Racine, Wis., is president of the company, and devotes considerable time to the management of its affairs. The name J. I. Case is favorably known the world over.

Mr. Fred H. Fitch, vice-president, is also the general manager of the Sioux City Traction Co. of Sioux City, Ia.; was formerly connected with the Chicago City Railway Co., and is a man expert in railway financing, construction and operation.

Mr. J. A. Brett, general manager, has been constructing railways since the use of electricity as a motive power, having first served with the Sprague Electric Motor Co. in 1886.

Mr. A. M. Howes, secretary and treasurer, was formerly in the stock and grain brokerage business, has been with the company since its incorporation and has had years of experience in financial matters.

The Electrical Installation Co. during the last six years has com-

FEEDERS, SOUTH SIDE ELEVATED, CHICAGO.

pleted work under 112 contracts for electric railway construction and equipment. Some of its most important work is shown in the accompanying illustrations. We give a depot scene on the Wellston & Jackson Belt Ry., a part of the Hocking Valley system, operating between Wellston and Jackson, O. The Hocking Valley Ry. was one of the first steam roads to adopt electricity as a motive power on branch lines. The Electrical Installation Co. not only constructed and equipped this road under contract, but designed the power plant, and did all of the construction work under its own specifications. That the work was thorough is evident from the following letter written a few weeks ago by Chief Engineer Sheldon, who says:

"It affords me pleasure to testify to the stability and satisfactory performance of the electric plant of this company, which was designed and installed by you in Jackson County, O., in 1895-6. All of the equipment furnished and construction work done by you is in first-class condition after a continuous operation since Mar. 1, 1896, during which time there has not been a single stoppage or delay in our traffic, which begins at 5 a. m. and runs till 11 p. m. The record is one of which your people may well feel proud, as we certainly do."

Another view of this company's work shows track construction of

CAR ON WELLSTON & JACKSON BELT LINE, HOCKING VALLEY

the very highest class, for the Metropolitan Street Railway Co. of Kansas City, Mo., which is known to contractors throughout the West as most exacting in its requirements for high quality of construction. The Electrical Installation Co. has completed work for

this company under 10 separate contracts, and new work has been awarded them this year, which will detain one of the large construction forces in Kansas City probably until April, 1900.

Another view shows a part of the feeder work on the South Side Elevated, Chicago. All of the electrical construction work on the elevated structure and the entire electrical equipment of the 180 cars was done by the Electrical Installation Co. in 1897-8. The drilling for track bonding was done while trains were operated on three minutes' headway, and with but very few delays of not more than 10 seconds. In fact all of the work was done under the most extraordinary and unfavorable conditions, and the contractors have often been complimented for the careful manner in which it was prosecuted, as well as for its high quality and permanency.

The company is in the field for the financing and complete construction and equipment of electric railways and lighting plants. Its organization is thorough, efficient and constantly maintained, and the volume of business done by this company has given it an experience valuable to those having work in its line. The general offices are located at 1517 Monadnock Building, and attendants upon the American Street Railway Association convention are extended a cordial invitation to call.

NEW PLANT OF CHRISTENSEN ENGINEERING CO., MILWAUKEE.

That this company has practically and satisfactorily solved the problem of air braking on street cars is strongly emphasized by the fact that twice within the past year the company has found it necessary to double the size and output of its manufacturing plant, and that the demand has so rapidly increased that it is now imperative to again increase its capacity 100 per cent. The management believes that the very satisfactory results obtained by all the roads using the company's devices, has thoroughly demonstrated that the apparatus is now reduced to a condition of efficiency and durability which insures its success. The amount of business already done, together with the large amount on hand and in sight, fully warrants the investment of sufficient capital in special machinery and modern appliances to insure not only prompt deliveries, but to admit of the manufacture of goods at a cost which will enable it to supply the demand at the lowest possible price consistent with first class material and workmanship. A factory site of seven acres has been purchased, conveniently located as to railroad facilities, combined with features of beautiful and healthful surroundings, which would make it desirable, even for handsome residences. On this site the company is erecting a modern plant, consisting of foundry and machine shops, which will give sufficient capacity to insure its ability to fill orders promptly. The plans for the new shops have been drawn with great care, and all the latest conveniences known to the trade will be incorporated. Compressd air will be used in the many capacities for which it has been proved the most suitable power, and machine tools will be run by electric motors arranged in small units for convenience.

The works are so arranged that there is ample space between the buildings, giving plenty of light, and the spaces not occupied will be devoted to well kept lawns. The power house will be located centrally, so that the electric transmission to the motors located in various parts of the works will be effected with the least possible amount of loss.

The boiler room is immediately adjoining a railroad track, and is slightly lower than the latter, so that coal is easily unloaded.

The power house will, besides the boilers, contain direct connected generators in units of 100 h. p., and various dynamos for giving voltages of 80, 110, 220, 250, 450, 550, 650, 750 and 1,000 volts for testing purposes, as well as power.

The foundry will be located near the power house and the coke bins and a store house for pig iron will be immediately alongside the track, within easy reach of the cupolas. The foundry will be fitted with the latest improved machinery, having electric traveling cranes and compressed air cranes for the lighter work. The method of molding will be in accordance with the latest improved practice, compressed air being used for tamping, and wherever practical to use it. This foundry building is connected with the main buildings by means of compressed air cranes, with tracks arranged in such a way that the product can be transferred readily. The machinery in the foundry will be operated by electric motors throughout, in fact no steam will be used anywhere in the plant, except in the power house.

The main machine shop will be arranged with electric traveling cranes to handle the heavier work. The lighter work will be handled by compressed air cranes arranged to cover practically the whole area occupied by machine tools, in which articles weighing over 50 lb. are being finished. The machines will be so arranged that when the parts are finished, they will be near the department where the complete equipments are assembled, immediately adjoining this department is the testing room, in which also are arranged cranes of various capacities for handling the machines and after testing, the equipments are either shipped or deposited in the warehouse, which is arranged with a railroad track immediately in its center. The warehouse is likewise fitted up with cranes for conveniently handling the goods, and is also provided with wood working machinery for making packing boxes, both for domestic and foreign shipment.

WORKS OF THE McGUIRE MANUFACTURING CO.

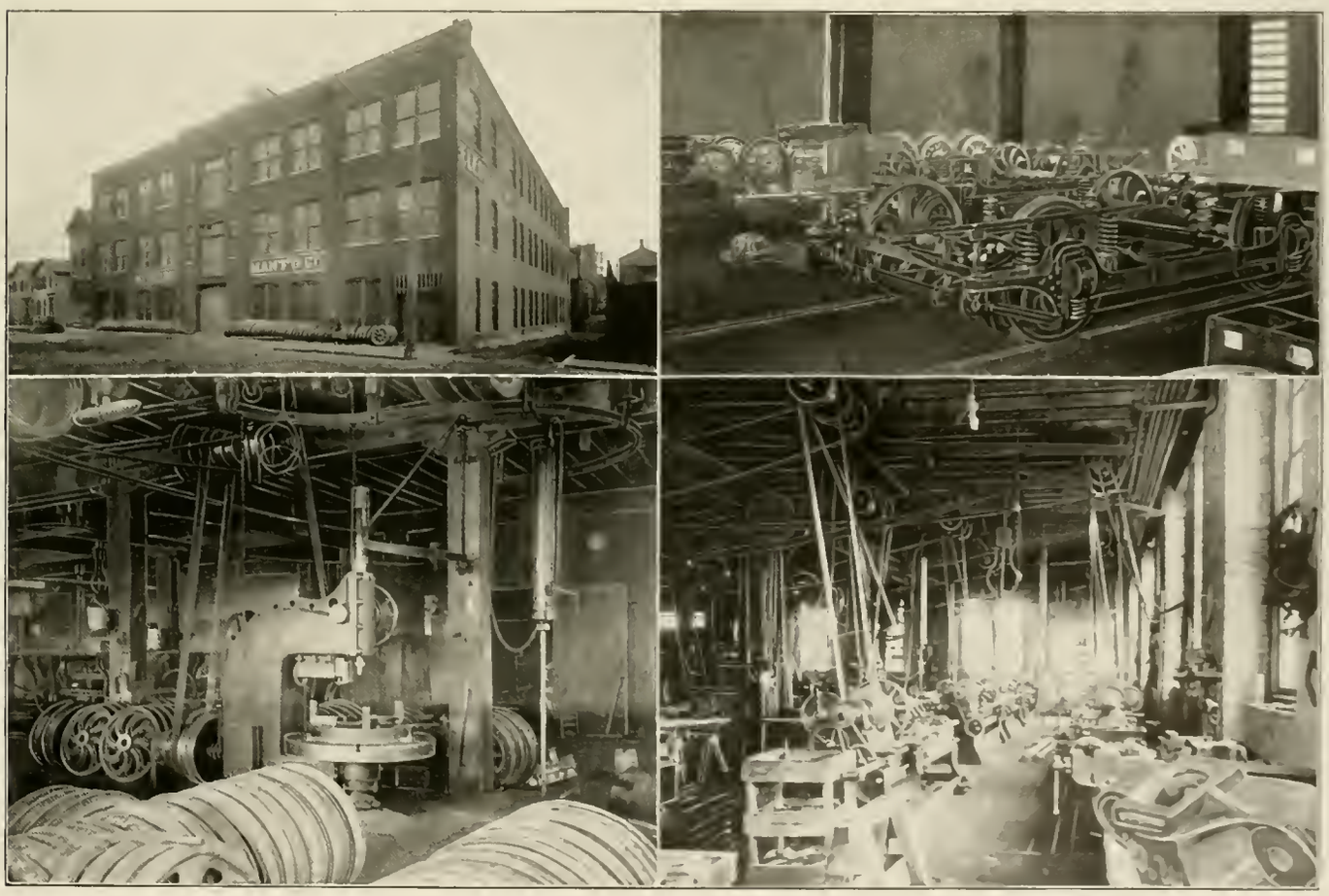
The McGuire Manufacturing Co., of Chicago, was among the first in this country to take up the manufacture of electric trucks for street railways, and it is the owner of a large number of the most valuable patents covering important features in truck construction, and is believed to have produced more original designs of trucks than all the other makers put together. Many of its designs have been copied in this country and throughout Europe, especially in Germany.

W. A. McGUIRE.

W. J. COOKE.

The trucks made by this company are in use in all the large cities of America, and, indeed, there is hardly a road in the country where some sort of the product of this company is not in use. The designs and workmanship are of the highest order, and can be found in operation on lines where safety to the traveling public is the first consideration. In fact, the company boldly advertises that it does not pretend to rival competitors in the question of price—or rather, the original cost of the truck—but claims that its trucks, while costing a trifle more in the first place, in the long run are the cheapest trucks made.

While the company has sold large numbers of trucks abroad,



WORKS OF THE McGUIRE MANUFACTURING CO.

but little attention has been given to that market, being perfectly satisfied with the trade it has had here. It certainly has had a most successful career, and has always maintained the very highest credit. Having an abundance of capital, it has always been able to purchase its raw material at the very best market and has always taken the advantage of discounting its bills.

Besides the truck business, the company has made an enviable reputation as builders of snow sweepers. A very interesting item about snow sweepers will be found in another column, which illustrates the magnitude to which this branch of the business has grown. It also makes a car heater, called the "New Columbia." It is a very superior design, and as well as being a heater it is an ornament to the interior of the car. This branch of the business has also been very successful.

McGUIRE HANGER.

Mr. W. A. McGuire, the originator of the company, who has been its president and general manager from the first, is the principal owner, and besides being entirely responsible for the financial part of the company, has given much of his attention to designs and inventions, which cut a prominent figure in the business of the company. He has accumulated a comfortable fortune and might have retired years ago, but takes a great pride in the company bearing his name and is exceedingly jealous of its reputation. He is sharp in a business way, but upright and honorable in all his dealings. Mr. W. J. Cooke is the vice-president of the company, and has been since it was organized. He has had charge of the sales department from the first. He is the Chesterfield of salesmen in the railroad line and thousands of railway people are always glad to see his smiling face whether they need his services or not. He is a heavy owner in the company and has acquired an independence, which, however, has no effect upon his graceful manners.

The works are located on a valuable piece of ground owned by the company, about one mile from the court house, bounded on the west by Morgan St., on the south by Kinzie St. and on the east by Sangamon St. While the plant is quite large—covering several acres—it is entirely too crowded for such a business as is being done at present, as the accompanying cut will show, every particle of floor space being covered with material or machinery. There is not much question but that the near future will find the company compelled to extend its plant. In fact, an option has already been secured on a large property in the southern part of the city.

We add a list of a few of the patented features of the McGuire trucks which are now being sold in large quantities to railway companies to be applied on all makes of trucks: The elastic brake hanger, safety brake shoe, double acting brake rigging, three-quarter elliptic spring, ratchet brake handle, method of cushioning frame on axle, and adjustable traction feature in bicycle trucks. About 5,000 of the McGuire brake hangers have been sold to railway companies during the past year for use on the trucks of other makers.

The following paragraph heads a recent circular issued by the McGuire company:

"Since it has become a fact that cast steel can be made to equal rolled steel, and that it is susceptible of being worked in a forge in the same manner as the ordinary bar steel, and since the old difficulty with cast steel—of blow holes and shrinkage cracks—has been overcome, we have adopted this metal in the double and single trucks."

The solid steel Columbian truck, a cut of which is shown on another page, has in its construction all the advantageous features which have developed in the experience of the McGuire company, and it has fewer parts than any other truck in use. Its frame being made of cast steel, has all the spring seats, spring cap, housings, etc., cast into one piece, which must surely be a great advantage.

The No. 39 truck is especially designed to carry a long car body as low as possible. Its features are: Solid steel frame cushioned over each box (Cloud-McGuire patents), center bearing, swing bolster on elliptic and spiral springs, short wheel base (4 ft.), motors hung outside, car body carried as low as on a single truck; with one motor it is considered by many the best maximum traction truck on the market, and is the lightest weight for its strength of any truck manufactured.

These two are the latest productions of the McGuire company and its order books show that it is to deliver about 600 of them within the next three months. The following is what Mr. Cummings, superintendent of the Indiana Railway Co., South Bend, Ind., says about the No. 39 truck:

"Let me say right here, that this truck for high speed interurban service is highly satisfactory. It rides like a sleeping car. It is the simplest in its construction, and we do not hesitate to say that it is the best truck we ever saw. It has so many good points that it must be seen and used to be appreciated. Come down and see us and bring your friends and we will show you the very best equipped high speed service in the country."

It will repay a visitor to the convention to see this equipment on the Indiana Railway. The solid steel Columbian may be seen in use on the Chicago City Ry. on the South Side, or the Chicago Consolidated Traction Co. on the North Side.

The Northern Ohio Traction Co., of Akron, has notified the chief of police that police officers in the future will not be permitted to ride free on its cars unless in full uniform.

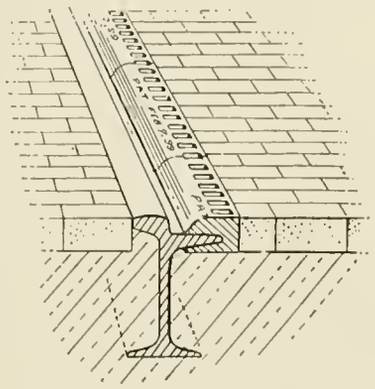
MONUMENTS IN CHICAGO PARKS.

TRANSFORMING TRAM HEAD GIRDER INTO GROOVED RAIL.

A decidedly novel method of producing a grooved rail has been invented by Mr. S. J. Buckland, of Springfield, Mass. He accomplishes this with any section of girder rail by fitting into the tram an iron paving block of special shape. This invention, like many others, was the result of a necessity. The city desired the railway company to use a grooved rail on one of its streets, and the proposed change from the old rail to a grooved was estimated to cost the company $8,000 for rail and the city $10,000 for paving. Mr. Buckland is one of the aldermen, and in his effort to accomplish the desired result at less expense, originated the iron paving block, which bears his name. By his system the estimates have been cut down with a saving of $7,000 to the city, and $6,000 to the company.

Our illustration conveys a good idea of how the block is shaped and used, and where laid in brick paved streets, as is proposed in Springfield, involves little disturbance of the pavement. City Engineer Moulton says of the track laid experimentally:

"I have examined the section of old rail track on Dwight St. in this city, which has been treated by the application of your blocks on the inside flange of rails, and, as far as surface indications show, it appears to answer all practical purposes as forming a safe piece of



BUCKLAND PAVING BLOCK.

track likely to cause no complaint from the public. There has been less chance to test the wear of the blocks from the wheels of the street cars than could be wished, although in track perfectly laid there should be no contact with wheel flanges, but as far as wear from nearly a year's traffic of ordinary vehicles is concerned, there is little evidence of it.

"It would appear that the close fitting of the block on both top and bottom of the inner flange or rail head, together with supplementary support obtained from concrete or paving tightly wedged under the blocks and extending to web of rail would, when the paving between the rails is well laid, render the blocks stationary, and as long as horizontal movement is restrained there can be no vertical movement and consequent looseness. The section of track before mentioned being well laid and the paving between the rails being brick, there is no evidence that any movement has taken place in any block."

Numerous tests were made with blows from a 15-lb. sledge, and inserting an iron bar in the groove and running a loaded sprinkling car over. No damage was occasioned by these and other severe tests. As shown in the cut no bolts are required, and the blocks are placed with ordinary labor.

EXPORT EXPOSITION AT PHILADELPHIA.

With imposing ceremonies and in the presence of a large party of distinguished guests, the National Export Exposition at Philadelphia was opened on Thursday, September 14th. The exercises included a large parade, in which the governor of Pennsylvania, the mayor of Philadelphia, numerous civic officers, Rear-Admiral Sampson and officers of the North Atlantic squadron, and many distinguished citizens identified with the promotion of the exposition, took part; orations were delivered by the governor, Congressman Hepburn of Iowa, Mr. Wilson, managing director of the exposition, the mayor and several others. Music was furnished by a chorus of 600 voices.

At night there was an illumination of the region surrounding the City Hall and the Avenue of Lamps, which consists of a colonnade along Broad St. for some hundreds of yards.

ATTACHMENTS FOR AUTOMATIC COUPLERS.

The W. T. Van Dorn Co., of Chicago, in addition to the developing of the well known Van Dorn coupling head, has paid considerable attention to the perfecting of attachments for connecting these couplers to the car.

In Fig. 1 is shown a No. 5 coupler, connected to the Van Dorn improved ball joint attachment. With this arrangement the head is

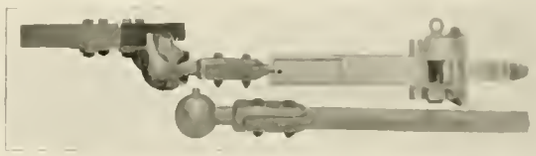


FIG. 1 WITH BALL JOINTS.

readily joined to the car body, either by using a block of wood or flat bar of iron, 1 x 8 in.; the length of the attaching bar can be easily regulated, and the lost motion is reduced to the minimum. An adjustment of $\frac{3}{8}$ of an in. to allow for wear has been provided.

In Fig. 2 is illustrated what the Van Dorn company calls the Barnes T-rail attachment, made especially for very heavy service, and particularly to meet the requirements of elevated roads. It is simply a T-rail, weighing 80-lb. to the yard, and swiveled on the body bolster. The coupling head is bolted on to the T-rail with four turned bolts with rimmed holes. This makes a very solid coupling, durable, easily adjusted and inexpensive to maintain. There are two springs to each attachment.

The Van Dorn couplers, in connection with these attachments, have effectually solved the problem of automatically coupling trail cars on street surface, and elevated railways. They are also of

FIG. 2 WITH T-RAIL ATTACHMENT.

great value, when two cars are to be used together for bucking snow in winter. An important advantage possessed by these devices is their ability to couple to other makes of couplers, as the draw bars make a common pin and link coupler, and the coupling bar can be placed in either of the draw bar heads as desired. All the elevated roads in Chicago and Brooklyn are employing Van Dorn couplers, as well as the leading street railway companies.

ELECTRICITY AT ILLINOIS UNIVERSITY.

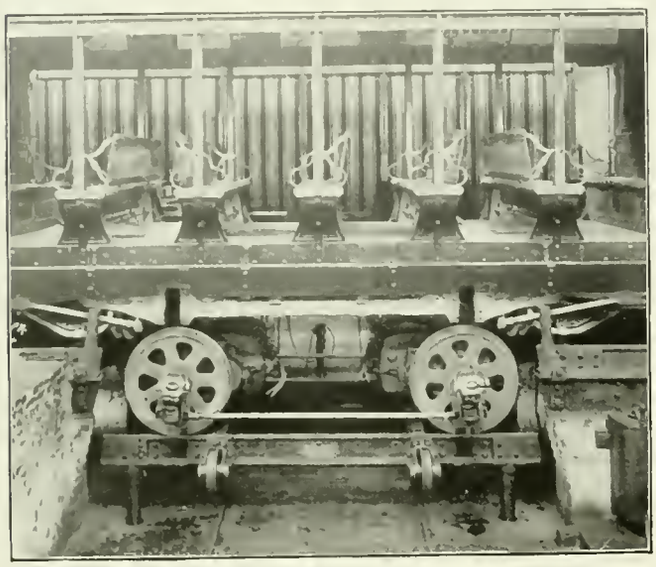
A number of new courses in the Department of Electrical Engineering have been added in the field of electro-metallurgy, alternating current working and polyphase testing, and electric lighting and power plants, at the University of Illinois, Champaign and Urbana, Ill. The equipment of the electrical engineering laboratory is being continuously increased for regular and advanced work in these branches.

The four years undergraduate course has been made elective for the last year and a half; that is, a student may elect his further work in the regular electrical course, in the electro-physical course or in the electro-chemical course. The degree of electrical engineer is given only after completion of five years. The fifth year is devoted entirely to special work.

THE BRYAN CAR DISMANTLER.

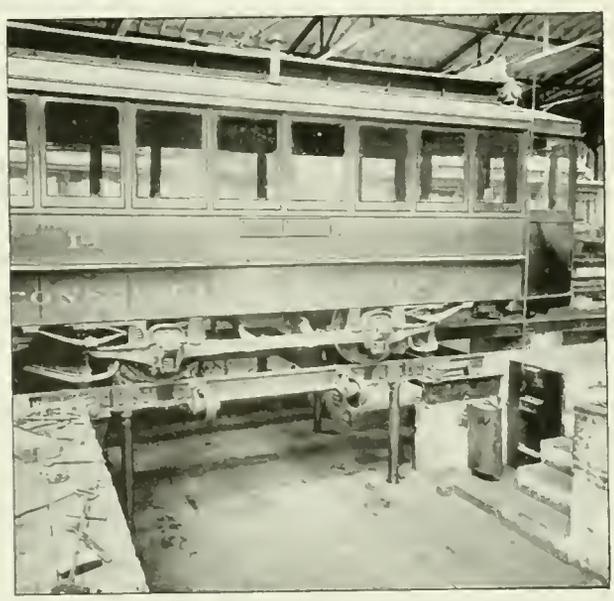
The manager who has once witnessed the operation of the device described in this article will hardly consider his shop equipment complete without it. Our illustrations show this system as installed in the Frankstown shops of the Consolidated Traction Co., Pittsburg.

The dismantling pit in which the device operates is extended sideways for a sufficient distance to allow for hoisting out the



BRYAN CAR DISMANTLER.

wheels and motors. On the floor of this are track rails placed at right angles with the car tracks above. A section of the track over the pits sufficiently longer than the over all dimension of the wheels, is removable, being made in the form of a truck with small wheels on each side as shown. The truck is provided with sliding plates, curved so as to fit the flanges of the wheels, and operated by screw



BRYAN CAR DISMANTLER.

handles, and which form, when screwed up against the wheel flanges a cradle that centres them.

On the I-beams tying the side rails together are provided pivoted supports for the motors. The pivoted supports have screw handles, so that when thrown in position they raise the motor to facilitate the removal of the suspension. The ends of the rails of these tracks or trucks are leveled so as to slide easily into position when being raised, and also to steady the truck when being used as a running track. This section of track or truck is mechanically raised or lowered by four massive screws, so placed as to support the four corners of the truck, and these are operated simultaneously by shafting carried on the frame of the machine under the pit floor, and arranged to operate the screws by means of bevel gears. The corner posts of the frame are threaded to suit the screws and form bearing for the bevel gears operating the screws. The power is supplied by a railway motor, in the latest design, arranged to gear direct into one of the line shafts. This motor is operated by an ordinary street car controller.

At the four corners and just outside the movable section, are pivoted arms with movable steel shoes which may be turned up vertically or folded away beside the rail when not in use supporting the car. The supports for these pivoted arms are carried on substantial cast iron columns so designed as to hold the brickwork of the pit walls in position.

In the operation of the device the car is run into position over the pit, the curved slides are screwed up against the wheel flanges, the motor supports screwed up, taking the weight of the motor off the suspension, the pivoted arms are turned up, bringing the shoes under the ends of the truck frame so as to support the weight of the car. The connections are then severed, the journal box bolts and brake rods are removed, then the wheels, axles, one or both, with the motors, are quickly lowered by means of the screws, till the side wheels of the movable section rest upon the rails in the bottom of the pit, when it is easily run to one side, bringing the wheels and motors into position so as to be readily picked up by a crane and placed in some convenient place on the shop floor, where the motors can be opened, inspected and repaired.

A new set of axles and motors can be rapidly replaced by reversing the process. The crane pickes up the extra set and lowers them into the movable section. The wheel flanges dropping into the curved cradles, and the motors resting on the motor supports, which effectually centres them. The movable section is then run under the car, and the motor being started, the screws lift the section into position and raise the car from the supports. The wheels are secured in place and the necessary brake and motor connection made.

With four men the whole operation of renewing both pairs of wheels and motors and replacing them with new ones ready for service requires from 20 to 25 minutes.

The device can be arranged so that the truck can be under the car lengthwise, and the wheels and motors taken out from the end.

This device was first designed for the Consolidated Traction Co., of Pittsburg, Pa., by Mr. J. Bryan, engineer, Park Building, Pittsburg, and is now manufactured under his supervision: all inquiries for particulars should be addressed to him.

McGILL, POMEROY & CO.

This firm is the successor to that of McGill & Pomeroy, which was dissolved on May 1st last. The present members are James H. McGill and John W. Porter. The place of business is 317 Dearborn St., Chicago, and the concern has some of the best railway agencies in the city. Among the prominent companies represented are the Ohio Brass Co., overhead material; Forest City Electric Co., commutator bars; J. M. Atkinson & Co., rail bonds; the Cutter Electrical & Manufacturing Co., circuit breakers and rheostats, and the Wagenhals Manufacturing Co., slow feed controller handle. All of these supplies are widely and favorably known. Goods are kept in stock at all times, and prompt shipments thereby insured. The house also handles a large variety of electrical mining supplies, and does a large business in this growing field.

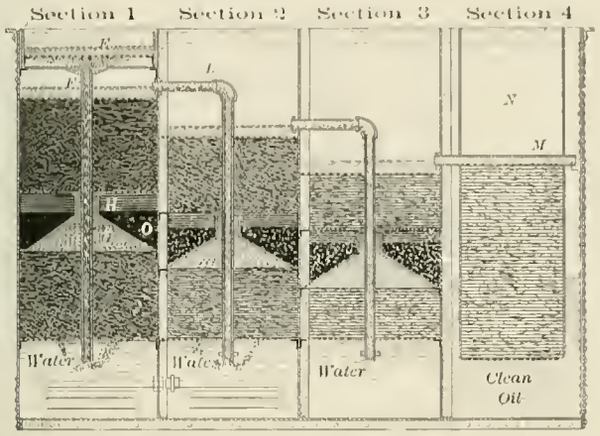
Mr. Jas. H. McGill, the senior member of the firm, has traveled extensively among street railways of the central west during the past five years and enjoys a wide acquaintance. Mr. John W. Porter, the new partner, is well known in electric lighting circles, having been connected for many years with this industry in Chicago. Mr. Edward R. Mason, formerly with the Mason Electric Equipment Co., is traveling salesman for the firm in Chicago and vicinity.

The Terre Haute (Ind.) Street Railway Co. has been ordered to put fenders on its cars within 90 days from September 8th.

TURNER OIL FILTER.

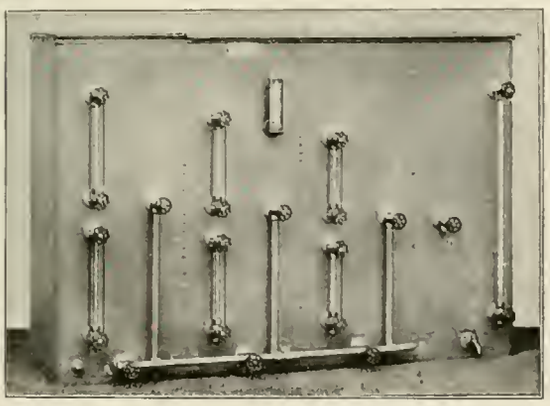
In many plants little attention is paid to the use of oil; in others a large saving is effected by the use of suitable and effective filters. Such a device is the Turner oil filter, made by M. V. Turner, 2777 North Lincoln St., Chicago. This filter is reliable, durable and efficient, and capable of giving absolutely clean oil in the minimum time of filtration.

The working and construction of the Turner filter may be readily understood from the accompanying illustration. The dirty oil is poured into pan E in section 1, and descends through pipe F, discharging into the water, below a perforated plate. The oil now rises through the perforations of the plate and passes up through filtering material and water into the cone G, escaping through perforations at the top of the collar of this cone. The oil now rises, passing through the second perforated plate and



SECTIONAL VIEW OF OIL FILTER NO. 9.

filtering material, while a certain amount of the heavy dirt settles in the dirt chamber, and should be drawn off. The partially filtered oil, having reached the pipe L, passes into section 2, repeating the same operation as in section 1, and so on until section 4 is reached, when it enters pipe M in cylinder N, descending through filtering material into the oil reservoir. The arrangements of the dirt chambers in sections 1, 2 and 3, as above described, is a great advantage over all other filters, as they do away with



EXTERIOR VIEW OF OIL FILTER NO. 9.

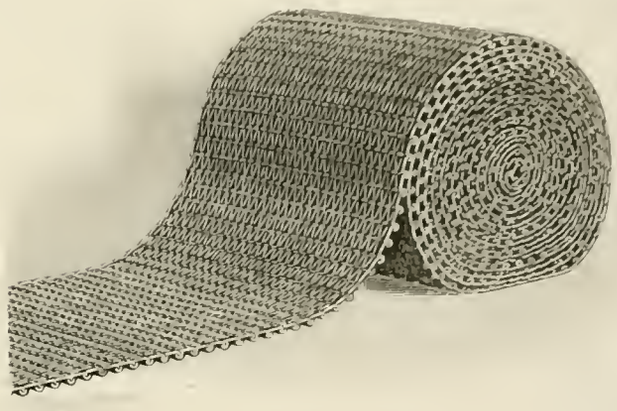
the passing of the oil through impurities left by previous filtrations. It is impossible for the dirt, after being deposited in the dirt chamber, to mix with the oil or water, as the chamber is packed with oakum at O. The filters are made in any desired size and of proper shape to conform to the engine or other rooms where they are to be placed. The directions for working the filters are simple, and involve little care and attention.

Hundreds of these are in use, and in Chicago many of the finest and largest plants in the city are equipped with them. Among such are the Auditorium, Pullman Co., Public Library, Calumet Electric, Crane Co., Cicero & Proviso Electric Ry., Metropolitan Elevated, Union Traction Co., South Chicago City Ry., Alley L. and Union Loop. Also Memphis Street Ry., Metropolitan, Kansas City, Toledo Traction, New Jersey Electric Ry., Omaha Street Ry., and many others.

The Turner waste cleaner by means of pressure under rollers and jets of hot water and steam recovers a large percentage of oil and waste. In the Chicago Edison plant (lighting) the weight of the cleaned waste and oil recovered represented 85 per cent of the dirty waste treated.

HOW TO KEEP CAR FLOORS CLEAN.

In the good old horse car days now rapidly passing into tradition, the car floor and its condition was a matter of little concern, and the traveling public patiently climbed over humps of soggy hay with never a suspicion that it could be improved. But



UNITED STATES WIRE MAT.

today one of the fundamental principles of good management is in the neat, cleanly and sanitary condition of the car. To accomplish these results various means have been employed; wooden seats in frames are nailed to the floor, hemp matting, and later wire matting. The latter seems to be the most practical solution. But here again we find degrees of wire matting, and the desirable one is that which will not curl at the ends; that is self-cleaning, and combines a neat appearance and lasting qualities with a first cost that is considered reasonable.

The United States Wire Mat Co., of Decatur, Ill., makes a wire mat which combines all these desirable features. Unlike all other wire mats it is one-sided, which allows dirt, cigar stumps, etc., to pass through, instead of sticking fast, to be removed by hand. The mat is made in any width desired, and in any length up to one mile. It rolls up like a roll of carpet, and the desired length for a one-piece mat to cover the entire car floor can be cut off and made ready to lay in five minutes. The mat is made of a special weave from the best galvanized steel or brass wire. It is being largely used in banks, offices, halls and public buildings, but nowhere with greater satisfaction than where adopted on street cars.

DEMAND FOR SAND BOXES.

The Ham sand box for motor cars, made by the Ham Sand Box Co., of Troy, N. Y., has been adopted as standard by a large number of the leading roads in this country and abroad, and the demand is constantly increasing. The company's works are overcrowded with orders, particularly duplicate orders from old customers. One of the largest car building concerns in Great Britain is using the Ham No. 4 box exclusively on all the cars it turns out, and has ordered this pattern in large quantities. The Glasgow (Scotland) Tramways has adopted the No. 3 style as standard.

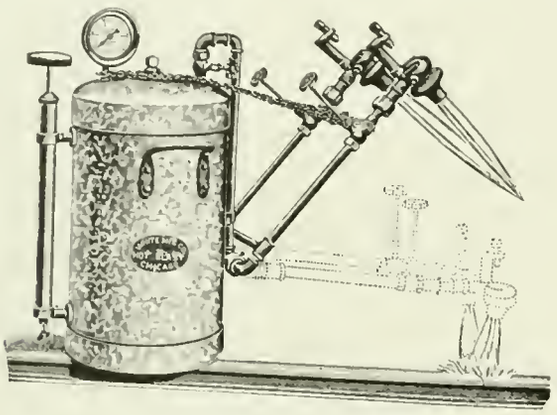
The Ham Sand Box Co. makes five different types of boxes to meet different conditions, and is just bringing out a sixth, which will be shown for the first time at the coming convention of the American Street Railway Association.

A telephone dispatching system will be installed on the lines of the Philadelphia & West Chester Traction Co.

RAIL JOINT HEATER.

With each new development in railway construction involving as it does new work and additional labor, comes shortly appliances for making this work both easy and less expensive. One of the important features in the process of cast welding rail joints is the proper preparation of the rail ends, and unless this is carefully and thoroughly done the succeeding work may be rendered useless by the breaking of the joint.

The rapid adoption by roads in all parts of the country of the welding system will make the rail joint heater, which we illustrate herewith, an appliance of interest to a large number of engineers, managers and contractors. The machine has two powerful



WHITE RAIL JOINT HEATER.

burners mounted on a 10-gallon tank. The burners are provided with a swinging motion both lateral and vertical, which permits of instant adjustment to any desired position. The burners produce a white heat with 10 minutes' application. The tank is powerfully constructed, the joints being brazed, and will stand a pressure of 500 lb., making its operation perfectly safe. It has already been adopted by nearly all the roads doing welding and is giving great satisfaction. It is made by the White Manufacturing Co., of 158 Indiana St., Chicago, and complete details and directions for use will be sent on application. The same concern also manufactures many other appliances used in railway shop and construction work.

THE Q & C CO.

The Q & C Co., of Chicago, maker of steam and street railway specialties, has gradually increased the scope of its business and added new appliances and devices to its list of goods, until it now handles over 40 distinct specialties. These include trolley and electric light poles, tie plates, metal saws, rail drills, jacks, street car steps, oil purifiers, pneumatic tools, steel rails, steel ties, frogs and switches, switch and signal stands, etc. One of the latest devices brought out by the company is its roadbed sprinkler for saturating the roadbed of steam roads and electric interurban lines with oil, for the purpose of eliminating vegetation, weeds and grasses, permanently laying the dust, preventing frost between the rails and in general increasing the comfort and safety of travelers. Oil sprinkling has already become popular with a number of steam roads, and the practice will soon be introduced on several high speed interurban roads.

The president of the company is Mr. Chas. F. Quincy. Mr. Quincy is a native of Boston, and has had many years' experience in the manufacture of railroad specialties. He is vice-president of the National Association of Manufacturers of Illinois. Mr. Frank W. Edmunds, who has charge of the Chicago office, has been connected with the company for eight or nine years, and during the last two or three years has taken an active part in its management. The general offices are at rooms 700-709 Western Union Building.

The Q & C Co. acts as western representative for the Pennsylvania Steel Co., the Maryland Steel Co., the Pearson Jack Co. and numerous other well known manufacturing concerns.

The Athens (Ga.) Street Railway Co. will build a new line to the rock quarry near the city, and haul stone for paving purposes direct to the streets where it is to be laid.

STEAM VALVES FOR HIGH PRESSURES.

In order to meet the requirements of modern extreme high pressure steam plants, the Crane Co., of Chicago, has designed a line of straight-way, globe and angle valves suitable to stand a working pressure of 250 lb., and tested to 800 lb. per sq. in. These valves are very massive, and care has been taken in their construction to distribute the metal, both iron and brass, in order to best meet the heavy stresses to which they are subjected, due to expansion and contraction, and to resist the unusual straining caused by the settling of the pipes. The body of these valves is very heavy, and has large and free openings. The seat in the body is made extra heavy, of hard metal, and in the globe and angle patterns is fitted with the Crane improved bridge to guide the swivel disk.

The swivel disk is made with a guide. Sizes up to six in. are made of solid hard metal. The larger sizes, eight in. and upward, are also made of hard metal, and are stiffened with a cast-iron plate, thereby making the disk very rigid. The combination of the guide on the disk and the bridge on the seat insures the square seating of the disk, and also prevents the rattling of the disk caused by the pulsation of the steam passing through a partly open valve.

All of the Crane valves are fitted with an improved disk nut, which enables them to be packed when open without steam escaping.

Part of the works of this company have been running 24 hours a day for the past six months, and all departments have been working overtime to keep up with orders. The volume of business carried on during the past year is nearly double that of the previous year. A new addition to the factory, 100 x 225 ft., and six stories high will soon be placed in operation and this will increase the capacity of the present works about 100 tons of iron a day.

Crane valves have gone all over the world; among recent customers may be mentioned the Central London Underground Ry.; Government Tramways, N. S. W.; Dublin United Tramways, Cork Electric Ry., South Side Elevated R. R., Chicago; Union Traction Co., Chicago; Chicago & Milwaukee Electric Ry., Chicago City Ry., Consolidated Street Ry., Grand Rapids, Mich.; Kansas City & Leavenworth Electric Ry., Metropolitan Street Ry., Kansas City, Mo.; Cripple Creek (Col.) Power Co., Milwaukee Electric Railway & Light Co.

The officers of the Crane Co. are: President, R. T. Crane; secretary, J. B. Murphy; treasurer, T. F. Gartz; manager engineering department, J. B. Berryman. Branch stores are maintained in New York, Philadelphia, Kansas City, San Francisco, Los Angeles, Portland, Ore., Omaha, Sioux City and St. Paul.

LARGEST SCRAPER ORDER ON RECORD.

The largest order for track scrapers ever given is that received last month by the Van Dorn & Dutton Co., of Cleveland, and was from the Boston Elevated Railway Co. for 1,188 pairs of the Clark patent. When this order is filled there will be upwards of 15,000 of these excellent scrapers in use in all parts of the country. The order was taken by Mr. Dutton, who reports the works as extremely busy all this year, and a large amount of work in hand and still more in sight.

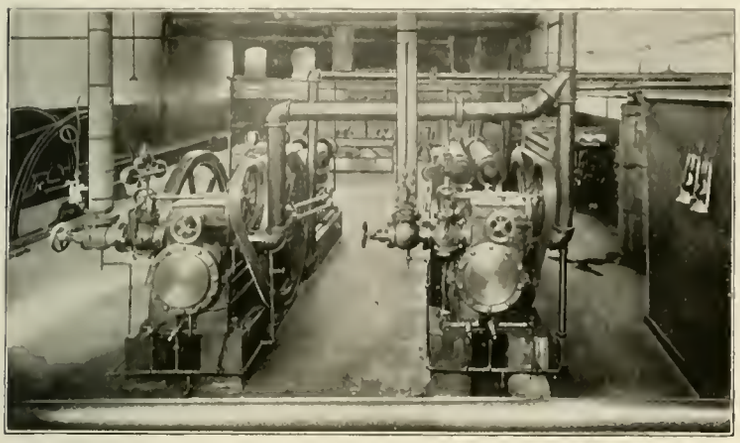
TO PREVENT LOOSE TROLLEY FROM INJURING OVERHEAD WORK.

An ingenious plan for signaling the motorman when the trolley wheel leaves the wire is used in Ithaca, N. Y. On all the cars of the Ithaca Street Railway Co. the rope coming from the trolley pole is fastened to the bell rope with a snap clasp. If the trolley wheel leaves the wire the pole jerks the bell cord, signaling the motorman to stop instantly and thus often preventing injury to the overhead work.

Wire thieves nearly compelled the Philadelphia & West Chester Traction Co. to suspend operation on September 4th by stealing the feed wire for a distance of several miles. The wire was cut down after the power had been shut off for the night on September 3d.

COMPRESSED AIR IN CHICAGO.

Early in the spring of the present year, the Compressed Air Motor Co., of Illinois, installed in the power house of the North Chicago Street Railroad Co., a plant for the operation of compressed air motor cars over the lines of the railroad company. The plant consists of two air compressors, and a bank of 20 Mannesmann tubes, the tubes being used as a reservoir to store the air as it is delivered by the compressors. The air is delivered



PLANT OF CHICAGO UNION TRACTION CO.

to the storage tubes by the compressors (only one of which is used, the other being held in reserve in case of accident), at a pressure of 2,600 lb. per sq. in.

Three motor cars were brought to Chicago, and two of them are now in regular service over the cable road, running from the "Limits" station to Clark and Washington Sts. and return. The first car leaves the barn at 12:40 a. m., and the last reaches the barn about 5:45 a. m., the two cars performing what is known as the "owl" service on North Clark St.

The cars present the same general appearance as electric or cable cars of the same size, and seat as many passengers. The

COMPRESSED AIR MOTOR CAR.

compressed air required to run the car is contained in Mannesmann tubes carried under the body and seats of the car. The mechanism which operates the car is of a modified steam locomotive type, and is all carried beneath the car body, nothing being visible except the controller, brake and reversing levers.

The storage capacity on the cars now being operated is sufficient to run the cars from 15 to 17 miles, but it has been the practice to charge the cars once every round trip. The charging is done in the open street opposite the power house at Elm and North Clark Sts. A copper pipe leading from the reservoir in the power house is connected with the car, and the air is delivered to the storage on the car. The whole operation, including stopping, connecting, charging, disconnecting and starting, does not consume two minutes, as air under this pressure flows very quickly. The motion of the car is very regular and smooth—there are no sudden jerks and no hissing of escaping air, the car being as nearly noiseless as it is possible for a street car to be.

In addition to the use of compressed air for running the car, the same air is used to operate a brake, which brake is pronounced by railroad men, and all who have observed it, to be as nearly perfect as an air brake can be. It is absolutely free from any noisy exhaust so common with other kinds of air brakes, and gives the motorman full control of his car.

There is no leak whatever in the storage of the air, either on the car or in the power house—the first trips of the cars being made with air with which the car was charged 18 hours previously. Air under pressure loses none of its elasticity, and will assume its normal condition whenever opportunity offers, no matter whether it be five minutes or five years after it is compressed, so that no matter how long a car may stand, the power is always there ready for use when required.

When one becomes familiar with all the details of the compressed air system, as demonstrated by this plant and cars, he is surprised at its simplicity and lack of complication. No especial training is necessary to operate the cars, instances having occurred where instruction was given to the motormen on only two trips, and they being given full charge of the car regularly thereafter.

In the installation and operation of a plant and cars of this system, it is not necessary to have a large number of high priced skilled workmen. A steam locomotive engineer of average intelligence can, in the course of a month or six weeks, become so familiar with the construction of these motors, as to be able to take full charge of repairs, maintenance, etc.

Since May 30, 1899, the date the air cars commenced running, they have traveled 5,033 miles and carried 62,428 passengers, counting only paid fares, and keeping no record of transfers, employes, etc. On numerous occasions one and two trailers have been attached to the motor cars, and on one occasion 267 passengers were carried on one single trip.

In this connection we think a word or two in regard to the Mannesmann tubes above mentioned is pertinent. These tubes are made in various sizes, those in the power house being 9 in. in diameter and 22 ft. long. They are seamless, weldless, and have only one opening in the neck. They are tested to a pressure of about 4,800 lb. sq. in. before leaving the factory, and, as they are never charged to more than 2,600 lb. working pressure, the factor of safety is a large one—in fact, tests have been made to ascertain the bursting point of these tubes, and it was found that it required a pressure of between 6,500 and 7,000 lb. per sq. in. to burst them.

MASSACHUSETTS STREET RAILWAY ASSOCIATION.

At a meeting of the Massachusetts Street Railway Association, held at Young's Hotel, Boston, September 13th, the following officers were elected:

President, John R. Graham, of Quincy; first vice-president, E. C. Foster, of Lynn; second vice-president, E. P. Shaw, of Brookline; secretary, Chas. S. Clark, of Boston; treasurer, F. H. Smith, of Quincy. Executive committee, John R. Graham, E. C. Foster, E. P. Shaw, P. F. Sullivan, of Lowell; Robt. Goff, of Fall River; Wm. A. Bancroft, of Cambridge; F. H. Dewey, of Worcester; H. H. Crapo, of New Bedford, and Wm. S. Loomis, of Holyoke.

It was voted that the president of the association attend the coming convention of the American Street Railway Association at Chicago as the official representative of the Massachusetts State Association.

Policemen have been stationed at the Olin Ave. bridge, spanning the Bronx River, in Williamsbridge, New York City, with orders not to allow the Union Railway Co. to put down tracks across it. It is thought by the Deputy Commissioner the bridge is not strong enough to stand the additional burden of car traffic.

FOREIGN FACTS.

The Pennsylvania Steel Co. is rolling rails for a new electric railway in Cuba.

The street railway line at Pueblo, Mexico, has recently been sold to an English syndicate.

A preliminary concession has been granted in Austria for a projected electric railway between Zabrzech and Schonbrunn.

The Corporation of Oldham, Eng., is putting in an extensive tramway system which will cost in the neighborhood of £250,000.

The Potteries Electric Tramway of England, recently described in the "Review" is about ready to open up two sections of lines to traffic.

Work has been commenced on the electric railway from Seaforth to Crosby, Eng., and it is anticipated that the road will be completed early in the spring.

The city authorities of Bath, Eng., have decided to apply for powers to construct a system of electric tramways. The cost is estimated at about £250,000.

The Electrical Corporation, Ltd., of Valparaiso, Chili, will soon let the contract for a large power plant on the Aconcagua River, and an electric road in that city.

The Leamington & Warwick (Eng.) Tramways Co. is desirous of introducing electric traction, and will probably obtain assistance from the British Electric Traction Co.

The Calcutta Tramway Co. has, after some difficulty, succeeded in making terms with the municipality and has now obtained sanction to operate its lines with electricity.

The Bombay Tramways Co. has asked sanction to change its horse lines to electricity. It also proposes to introduce the American system of a uniform fare for any distance.

The drivers and conductors of the Havana street car companies recently went on a strike for larger wages. Their places were filled with new men and the strikers became riotous and stoned the cars.

The council of Gateshead, Eng., has sanctioned important extensions of the tramways, for which powers have been obtained by the Gateshead Tramways Co. The total new mileage will be about 5½ miles.

Proposals are on foot for the utilization of the water power of the Kelso, Eng., flour mills for working tramways, electric lighting, and pumping the town's supply of water. At present about 100 h. p. is available from the turbines.

The first section of the new electric railway lines of Sheffield, Eng., was formally opened by the mayor last month. Sufficient cars are in service to provide a five-minute headway, and the novelty is attracting large numbers of passengers.

Ernesto Pugibet, of Mexico City, who is now in Paris, writes that on his return he will be accompanied by the representative of a strong French syndicate prepared to build electric railways in the Federal districts of Mexico and Tlalnepantla.

The London (Ont.) Street Railway Co. has served notice of an action against E. Jones Park, police magistrate, and John D. Wilson, mayor, to recover $20,000 damages claimed because of alleged illegal licensing of busses to striking employes.

The town council of Neath, Eng., has leased the Neath corporation tramways to the British Gas Traction Co., of England, for seven years. This company will pay a rent of $6,500 per annum, and will equip the tram lines with gas motor cars.

The mule car service of the city of Mexico which for many years has retarded the development of the suburbs of that city, is about to be replaced with electric traction. The new roadbed and track have been completed and the machinery is on the ground ready for erection.

A section of the new Dublin tramways has recently been opened to traffic. Work on a large new power house at Ringsend is approaching completion, and other sections of the road will shortly be opened. At present there are 65 trolley cars in service, and when the lines are all completed 250 cars will be required.

The Middlesex (Eng.) County Council has decided to apply to the Light Railway Commissioners for an order authorizing the construction of light railways through Isleworth, Twickenham, Teddington, Hampton, Hampton Court, and Hampton Wick, over the route originally proposed by the London United Tramways Co.

A proposal has been made by a local syndicate in Dundalk, Ireland, to construct and operate an electric railway system in this town and its seaside neighbor, Blackrock, and to combine with this plant one for the lighting of the town. Work on the railway lines is to commence within a month after the signing of the agreement.

The Compagnie Generale Francaise de Tramways, of Paris, is rebuilding the entire street railway system of Marseilles, and during this year the horse car lines will have been almost entirely converted to electric traction. The electric car trains are limited by law to 118 ft. in length and the speed cannot exceed 12½ miles per hour.

The electric tramways of Carlyle, Eng., will probably be in working order by the close of the year. According to the provisional order the system must be completed by Jan. 1, 1900, and efforts are being made to secure that end. A delay on the part of the contractors in commencing the work was caused by the difficulty in obtaining materials.

An early start will be made in the construction of the proposed tramways of Devonport, Eng. These will comprise 4½ miles of double track, 3 ft. 6 in. gage. Rails weighing 92 to 94 lb. per yard, and of the girder type will be used. The maximum gradient is 1 in 11, and the sharpest curve has a radius of 30 ft. Power is to be taken from the Corporation lighting station.

The Sao Paulo (Brazil) Railway, Light & Power Co. has contracted with the Stillwell-Bierce & Smith-Vaile Co., Dayton, O., for the construction of a water power plant on the Tiete River, 25 miles from Sao Paulo, which will cost $100,000. This will furnish power for 100 miles of electric railway. The electrical portion of the contract will be worth about $700,000.

The town council of Bradford, England, has resolved to obtain Parliamentary powers for the construction of extensive additions to its electric tramway system. The estimated cost of these new lines is about £160,000, being at the rate of about £8,000 per mile of single track. It is not proposed to construct all the lines immediately, and Parliament will be asked to grant five years as the term for completing the scheme.

The street railways of St. Petersburg are operated by horses, although on one of the lines owned by the city electrical equipment is being seriously considered. Double deck cars are used there, two and three being pulled in a train. Franchises are granted for a definite time, with the condition that at the expiration of the time the roadbed and track shall revert to the city. At present the government operates 10 miles and will soon acquire more.

The Griechische Elektricitats Gesselschaft has been formed at Athens, Greece, for the purpose of building an electric lighting and power station and constructing electric tramways. The works in Athens are estimated to cost about £300,000, and current will be supplied for lighting Athens, the Piraeus, the two Phalerums and their environs, and will supply motive power to the Athens-Piraeus railway, the tramways and the numerous factories of the Piraeus.

ELECTRIC RAILWAY IN BORDEAUX.

Consul Albion W. Tourgee writes from Bordeaux, France, that the Tram & Omnibus Co., of that city, having the exclusive right to operate street cars and omnibuses in the city, and whose charter had still several years to run, has recently sold to a new company, which will operate under a new charter. It is understood that the old company is to receive 12,000,000 francs ($2,316,000) for its property and rights for the unexpired term of its charter, stockholders being allowed the option of stock in the new company on favorable terms instead of cash. The former company was English, with headquarters in London; the new one is French. The chairman of the board of directors is M. Mercet, 10 rue de Londres, Paris. It is understood that the present managing director, M. Bretherton, will continue to hold the same position under the new management. As the legal formalities are not yet complete, the terms of the new concession can not be given. It is understood, however, that they require an immediate increase of the service in the city and vicinity, and that the new company will at once proceed to substitute electric power for horse power, which has been used heretofore. Information can be obtained by addressing M. Bretherton, managing director, Tram & Omnibus Co., rue Tivoli, Bordeaux, France.

NEW CLOSED CARS IN CLEVELAND.

The accompanying illustration shows a new type of closed car, built by the J. G. Brill Co., which is being put in service by the Cleveland City Railway Co. As loops are provided at the terminals of all the Cleveland City Ry. lines, these cars are built to run in but one direction, and there are openings for passengers on the right hand side only. The car body is 30 ft. long, 7 ft. 10 in. wide at the belt rails, and there is a 4 ft. 6 in. platform at the rear end. A semi-circular shaped vestibule at the front end adds 4 ft. more to the length of the car, making the total length over dashers, 38 ft. 6 in. The vestibule is sheathed in steel and has a folding door at the right hand side. To facilitate the entrance and exit of passengers, the doors are placed at the side nearest the platform opening, instead of in the center, the longitudinal seats being cut away for a short distance at each end for this purpose.

BRILL CLOSED CAR FOR CLEVELAND CITY RY.

The seats are spring upholstered, covered with plush carpeting; bronze trimmings are used throughout. Eleven windows on each side and three in the ventilating sash at each end guarantee good light and air. The bodies are mounted on No. 27-F trucks, which are equipped with four 12 A No. 30 nose suspension W. P. Westinghouse motors; these enable the cars to make the highest speed permitted in the city or suburbs. Each car is fitted with Brill angle iron bumpers, two sand boxes at the forward end and two Dedenda gongs. Signalling push buttons are placed at each post.

From the exterior it might appear as if these cars had regular steam coach hoods. This hood, however, is not framed as a part of the monitor deck, but is put in separately.

A new electric railway running from the city of Louisville, Ky., to Highland Park was opened early in September.

WELL-KNOWN BOILER COMPANY.

The Stirling Co., whose "Stirling" boiler has been extensively introduced in industrial and electrical fields, has recently organized a department for the manufacture of high grade water tube boilers for marine use, and its works are now turning out all the boilers required for the Russian cruiser "Varrag," the Russian battleship "Retvizan," the United States battleship "Maine" and the United States monitor "Connecticut."

The manufacturing plant of the company, including boiler and machine shops, foundry, etc., is located at Barberton, O., and is completely equipped with modern and improved tools and machinery for doing the required work. The general offices of the company are in the Pullman Building, Chicago. Sales agencies are maintained in nearly every city of prominence in the United States, and in addition the company has its own corps of salesmen in Japan, the Hawaiian Islands, Mexico, Brazil, Cuba and South Africa. The New York branch office is in charge of Mr. B. M. Barr, formerly with the Walker Co., and the Pittsburg office is under the management of Mr. W. S. Elliott, formerly with the General Electric Co.

Among the street railway companies that have ordered Stirling boilers during the past year are the following: Saratoga (N. Y.) Traction Co., Sedalia (Mo.) Electric Railway Co., Kansas City (Mo.) & Leavenworth Street Railway Co., Cleveland (O.) & Eastern Electric Railway Co., Wilkes-Barre (Pa.) & East Pittsburg Street Railway Co., United Railways Co., of St. Louis, Los Angeles Consolidated Street Railway Co., Los Angeles Traction Co., Wheeling (W. Va.) & Elm Grove Railway Co., Vicksburg (Miss.) Railroad & Power Co., Norfolk Southern Railway Co., Walpole, (Mass.), Worcester (Mass.) & Webster Street Railway Co., Wheeling (W. Va.) Railway Co., Mobile (Ala.) Light & Railroad Co., Akron (O.) Street Railway & Illuminating Co., Monongahela Street Ry., Pittsburgh, Cincinnati (O.), Hamilton & Dayton Street Ry., San Antonio (Tex.) Street Ry., Paducah (Ky.) Street Ry.

POOR'S MANUAL FOR 1899.

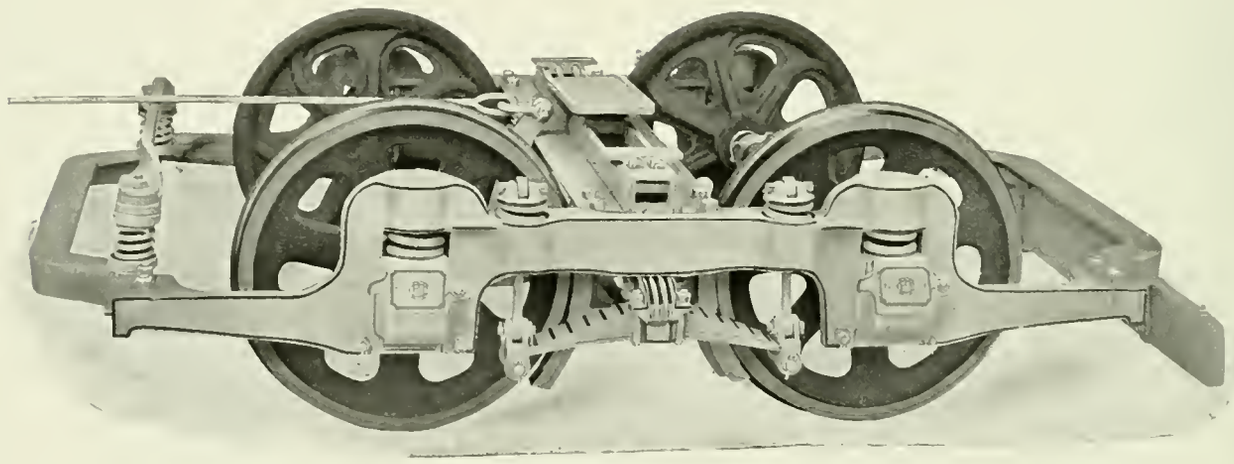
We have just received through A. C. McClurg & Co., Chicago, the 32d annual number of Poor's Manual of Railroads, published by H. V. & H. W. Poor, 44 Broad St., New York. This work has been before the public so long and has won so high a place among statistical books that nothing new can be said in praise of it; Poor's Manual is indispensable to anyone who wishes to keep in touch with the steam railroads of this country, and is a valuable reference book for those seeking information on street railway and other companies, state and municipal indebtedness, etc. We note with pleasure that each year the Department of Street Railways in Poor's is given more space. The present volume comprises 1,500 pages, but by reason of slightly larger pages and smaller type it contains matter that would fill 3,500 pages of some of the earlier editions. The introduction to the Manual for 1899 contains "A Study in Railway Statistics," which is a review of the development, finances, etc., of the railroads of the United States, with particular reference to the last 20 years. Price, $7.50, including cost of delivery in the United States or Canada.

THE PECKHAM NO. 14-B-3 SWIVEL TRUCK FOR KANSAS CITY.

The Peckham Truck Co. at its works in Kingston, N. Y., has now in process of construction 35 pairs of trucks of this type for a street railway company in Kansas City. These trucks as illustrated in the accompanying engraving are composed of cast steel side frames with cross sills and angles which form a transom between which the bolster plays, and these angles are secured to each side frame by two 7/8-in. turned bolts which are driven into holes reamed through the angle irons and castings after the frame has been erected, thus insuring an accurate and positive fit, and a construction that will remain square under all conditions. The side frames and all other parts are designed and proportioned to carry with safety a load of 30,000 lb. per truck.

The bolster, as will be noted, is carried upon two half elliptical springs which in turn are carried by coil equalizer springs. Large coil springs are also placed over each journal box so that there are three separate sets of springs between the rail and car body, insuring easy and steady riding. The journal boxes are unusually large and provide for a liberal amount of packing.

A special feature of this type of truck is the arrangement of the brake beams, which are placed between the wheels so that they are out of the way of the motors, which are carried outside of the axle, and by this arrangement the trucks are built with a wheel base of but 4 ft. The brake rigging outside of the shoes, bolts and hangers, consists of but eight pieces and the operation of the brake is quick and powerful; there is no lost motion to be taken up before the shoes are brought into action. In addition to this order for this type of truck the Peckham Truck Co. has received recent orders, some of which have been delivered and others still in process of construction, for 30 pairs for the Washington Traction & Electric Co., Washington, D. C.; 50 pairs for the North Jersey Street Railway Co., of Jersey City, N. J.; 15 pairs for the North Hudson County Railway Co. and a large number for several other roads. The works are running night and day to keep up with domestic and foreign orders and the trucks continue to maintain their reputation of durability and ease of maintenance.



PECKHAM NO. 14-B-3 TRUCK.

KNOX AUTOMOTONEER CO.

The Knox Automotoneer Co. has been organized to place on the market the "automotoneer" invented by G. W. Knox, electrical engineer of the Chicago City Ry. This device, which was described in the "Review" for September, 1898, page 703, is attached to street railway controllers and by automatically regulating the maximum velocity of the controller handle prevents its improper manipulation in starting. We are advised that the "automotoneer" has been used on many of the cars of the Chicago City Ry. for over a year and given excellent satisfaction.

The device will be exhibited at the convention by the Garten-Daniels Electric Co., space 32.

EXHIBIT OF NEW HAVEN REGISTERS.

The New Haven Car Register Co. will have a most interesting exhibit at the convention, and will show its new round single and double registers in addition to its well-known regular line of "New Haven" single, double and triple registers. It is claimed that these new round registers are the most complete and finest of the type ever made. They are made in a very thorough and workmanlike manner and have all the desirable features of other registers and additional ones of their own. The completeness of the double register which consists of two single registers in one case, is recognized at a glance, and the many valuable features, such as showing the number of the trip, as well as the direction, the number of each class of fare rung up on the trip up to 1,000, in large numerals, which can be read from the end of the longest car, the total number of each class of fares up to 100,000, and indicating the class of fare last rung up in prominent words, will be appreciated by all practical railway men.

Each machine is also provided with red safety shields and with automatic locking and controlling devices, preventing one side of register from being rung up while the other side is being operated. A locking device is also provided so that conductors can lock the register upon temporarily leaving car. This register is also adapted for use on two connecting roads, one side for each road, each conductor securely locking his side of register when leaving the car. It can also be arranged as two separate registers, each side operating and being reset to zero independent of the other side. All these different arrangements make this machine peculiarly adapted to meet the various conditions of registering fares on electric railways.

The round single registers are provided with very prominent numerals, and the safety shield is lettered "Not Registered"; this shield covers the figures instantly as the conductor begins ringing up the fare, and remains in view until after fare is rung up and registered. This machine has been adopted by the Third Avenue R. R., of New York, on its new equipment. Both of these registers, in addition to being very complete, strong and durable, present a very fine appearance with finely finished antique copper cases and ornamental aluminum dials, and will no doubt attract much attention at the convention at Space No. 77, where they will be exhibited.

THE "REVIEW DAILY."

One of the features of the convention will be the daily edition of the "Street Railway Review." The hearty and prompt response of advertisers leaves no room for doubt as to the desirability and necessity of a daily edition. Indeed, the assured success of the publication is such that the publishers have already decided to make it a permanent affair, and will hereafter issue a daily at future conventions, wherever they may be held.

Copies will be at all the leading hotels at daylight each morning for free distribution to convention people. If our readers should fail to find one in their mail boxes, please ask the hotel clerk for a copy. It will give full particulars of what has occurred the previous 24 hours and what is the order of the day.

ECHOES FROM THE TRADE

J. J. RYAN & CO., 68 West Monroe St., Chicago, report their foundry as extremely busy. They make a specialty of brass, bronze and aluminum castings of all kinds.

THE LORAIN STEEL CO. reports increasing demand for its Steel motor. This department is now in charge of Mr. R. T. Lane, with headquarters in Cleveland.

THE CITY OF WINNIPEG has adopted the Western Electric system of arc lighting and has now installed a complete plant for street lighting under municipal control.

GERARD SWOPE, formerly of the engineering department of the Western Electric Co., Chicago, now represents this company in St. Louis. The office is No. 10, Security Building.

THE PITTSBURG OIL CO., 307 South Desplaines St., Chicago, is now filling large orders for its winter motor grease, which has given general satisfaction. It also makes a boiler compound in both liquid and powder form.

THE CONSOLIDATED CAR FENDER CO., of Providence, R. I., following its usual custom of sending to the trade appropriate souvenirs on important days of the year, is mailing to its friends a neat placard commemorative of Dewey Day.

THE McGUIRE MANUFACTURING CO., is a concern not without honor in its own country. It has running at the present time in Chicago on the several roads 1,250 electric trucks, 21 combination snow sweepers and 725 Columbian car heaters.

THE PINTSCH SYSTEM of car lighting has been in use for several years on street railway lines in Chicago with perfect satisfaction. The cable cars of the North and West Side are so illuminated, as are also some of the lines of the Chicago City Ry.

THE DU PONT TRUCKS, made by the Lorain Steel Co., are meeting with steadily increasing favor, and recent contracts are for 35 single trucks for the Metropolitan, of Kansas City; 120 single trucks for Indianapolis, and 12 double trucks for the Detroit & Northwestern, of Detroit.

VISITORS INTERESTED in the process of making feed water heaters will have an opportunity to study the matter by a visit to the works of Wm. Baragwanath & Son, 44 West Division St., Chicago. The Baragwanath heaters are in use in all parts of the country, and in many of the railway power plants here.

ELECTRIC WELDING of rails has attracted recent attention on account of the work which has been done this summer in Buffalo, and described and commented on in the paper read before the New York State Association last month by Supt. R. F. Danforth, of the International Traction Co., of that city.

THE WHITING FOUNDRY EQUIPMENT CO., of Harvey, Ill., describes in a new 110 page catalog its many forms of electric, compressed air, hydro-pneumatic and belt power traveling cranes and hoists. Numerous reproductions from photographs of cranes actually in operation are shown in the pamphlet.

THE PAIGE IRON WORKS, Chicago, is experiencing the busiest time in its entire history. For months past the works have been running night and day and every man employed that could be given room to work in. Shipments have been prompt for these days when it is next to impossible to secure rail and iron.

THE WESTERN BANK NOTE CO., Chicago, is crowded with work on stocks and bonds. The steel engravings and lithographed work are unsurpassed anywhere, and the volume of orders from the East equals that originating in its immediate territory. The company occupies its own 10-story building on Michigan Ave.

THE ELECTRICAL INSTALLATION CO., Chicago, has closed a contract and is about to begin work on six miles of single track and three miles of double track construction for the Birmingham Railway & Electric Co., Birmingham, Ala. This is the third contract this company has had in Birmingham during the past two years.

THE JOSEPH DIXON CRUCIBLE CO., of Jersey City, is sending out two new pamphlets, one on Dixon's flake graphite and one on graphite wood grease for gears of electric railway motors. These catalogs are published in this company's usual artistic style and tell in a brief but forcible manner of the power of graphite to reduce friction.

THE MEAKER MANUFACTURING CO.'S works are at North Chicago, and visitors to the Chicago & Milwaukee electric line will be carried directly past the door. This ranks among the best designed and arranged fine machine work plants in the country, and as usual, is full of orders and very busy. The company's exhibit will be in charge of President Meaker, in space No. 40.

THE TURNER OIL FILTER will be found in use in the following railway plants in this city: West Lake St. plant of the Consolidated Traction (3); Metropolitan Elevated (3); Hobbie St. station Union Traction (3); South Chicago City Ry. (1); Alley L., State and 40th Sts. (2); Calumet Electric (1); Union Loop plant (2); and the Wabash and 52d St. station of the Chicago City Ry. (1).

ALBERT & J. M. ANDERSON, Boston, have shipped tons of their insulators to be used in railway construction work in this city. On the lines of the Yerkes' systems Anderson insulating material has been used almost exclusively, and to a large extent by the Chicago City Ry., the South Side Elevated and the South Chicago City Ry. The type generally used here is their well known Aetna brand.

H. W. JOHNS MANUFACTURING CO. will have a fine exhibit at the convention, which will be in charge of its western agent, the Manville Covering Co. Six representatives from the eastern office will attend, and among other features a working demonstration of its "inclosed fuse" will be given. This device is new and the makers state it is far in advance of anything previously attempted.

C. F. ORR & CO., Chicago, uniform tailors, will occupy space No. 1 at Tattersall's with an interesting display of uniforms and uniform cloths, buttons, etc. The company has had an extremely busy year and added many new roads as customers. The history of this concern has been that when once a road has its uniforms made here, it becomes a steady buyer. Every garment is made from exact and individual measurement.

THE ATLAS RAILWAY SUPPLY CO., Chicago, is meeting with steady and extremely gratifying success with its Atlas rail joint. The joint is in the nature of a truss, and provides a support which is intended to more than compensate in strength for the open section of the rails. It is specially adapted to suspended joints, but can be used with equal ease when it is desired to give the joint a tie support. The company prides itself on "an unbroken record of never a complaint."

THE GREEN FUEL ECONOMIZERS are highly appreciated in Chicago, having been installed in the following railway plants: Metropolitan Elevated, South Side Elevated, Chicago Electric

Traction Co., South Chicago City Ry., and the Chicago & Milwaukee Electric Ry. The system is working very satisfactorily in all cases. By this system the otherwise waste heat in the gases is taken out as they leave the boilers before reaching the chimney, and used to heat feed water, thus effecting a saving in fuel of from 12 to 20 per cent.

ONE OF THE NEATEST and most attractive booklets which will be distributed at convention is that compiled by Mr. E. Nelson, of the Chicago office of the Bethlehem Steel Co. It contains a large number of illustrations, specially made for the purpose, and showing every elevated and surface road power station in the city. Also directions as to what car line to take from Tattersalls to reach each plant. The cover design is in green and gold, and the album makes a collection of views which will be well worth preserving.

THE OHIO BRASS CO., of Mansfield, O., as a result of the increasing adoption of the third rail system, has supplemented its regular line of overhead trolley devices with a new and original design of third rail insulator, a patent for which has just been allowed. This insulator presents several new features, which cannot help recommending themselves to those who are familiar with the difficulties attending the use of third rail insulators in the past. This article appears in the new catalog, No. 4, recently published by this company.

THE REPUTATION of the Crane Co., Chicago, for high class, standard work is well known and applies to all its numerous products. To none more so, however, than to its high pressure steam valves, which are widely used in railway power plants throughout the country. In Chicago the power station of the South Side Elevated is completely equipped with these valves, which are also found in the plant of the Chicago Electric Traction, the Western Ave. station of the Union Traction Co. and in that of the Chicago & Milwaukee Electric Ry. at Highwood.

THE B. F. STURTEVANT CO., of Boston, Mass., describes in a new catalog what it calls its "steel plate planing mill exhausters," or in other words, exhaust fans for carrying off chips, dust and shavings in planing mills, spent bark in tanneries, waste wool and cotton in weaving mills, acid fumes in chemical works, and for use anywhere, where light material is to be transported from one place to another. Diameters, capacities, etc., are given in tables, enabling one to readily determine just what size fan and flue will be required to do a certain work.

THE DEARBORN DRUG AND CHEMICAL WORKS, Chicago, reports the largest business in the history of the company. The labratories are kept working to their full capacity continually, and the works equally so in making up the boiler compounds which are especially made for each case after analysis. The company prepares a special compound for each case, and states that its methods differ from those of other makers just as the prescription of an experienced physician after careful diagnosis differs from some patent medicine a patient may pick up.

HANNA & GRAY, Marquette Building, Chicago, territorial selling agents for Peckham trucks and Magann air brakes have had a remarkably prosperous year. The Peckham truck is well represented in this city. On the Alley L are 32 sets of the 14-A type. The Chicago & Milwaukee Electric has eight of the 14-A "extra strong"; and the Chicago General 20 "extra long" single trucks. The South Chicago City Ry. is using 12 single trucks and the Union Traction 10 single trucks. A Ruggles rotary snow plow built by the Peckham company is ready for the winter season on the Chicago & Milwaukee.

EUGENE MUNSELL & CO. and the Mica Insulator Co. of Chicago will make a combined exhibit at the street railway convention, having accepted a space of 200 sq. ft. near the entrance. This exhibit will consist of "Mica" in its natural state and in its various forms for electrical insulation, also stamped "Mica" segments and washers, both India and amber. Very large specimens of "Mica" will be shown, which will be of interest to all electrical engineers and street railway managers. The exhibit of the Mica Insulator Co. will consist largely of "Micanite" rings, segments, tubes, troughs, cloth, paper, etc. The exhibit will be in the hands of Charles E. Coleman, who has charge of the western business of these concerns. The companies' Chicago offices are located at 117-119 Lake St., where members of the electrical fraternity will be welcome during their stay in Chicago.

THE MORDEN FROG & CROSSING WORKS, Chicago, is among the largest builders in the country of street and steam railroad special work. The variety of this work turned out is great, and special facilities and men of long experience are provided to handle the most intricate and difficult work which arises. The company builds to order every kind of switch, switch stand, guard rails, clamps, frogs, crossings, rail braces, and in short every requisite for track work outside the rail itself. Its plant is large, and provided with every convenience and labor saving device, thus enabling it to fill orders as promptly as it does satisfactorily.

THE "GOLD SYSTEM" OF CAR HEATING is the title of the catalog for 1899-1900 just published by the Gold Car Heating Co., of New York and Chicago. The book comprises 80 pages, 9 x 12 in., and is handsomely bound in cloth. The various "Gold" systems of heating cars by steam, hot water, and electricity are illustrated and the apparatus described. Our readers will be most interested in that portion devoted to electric heaters. There are numerous letters testifying to the excelling satisfaction given by the Gold apparatus in service and an imposing list of users of the system. Copies may be had on application.

THE LOMBARD WATER-WHEEL GOVERNOR CO., of Boston, Mass., is sending out a little pamphlet giving full information regarding the new Lombard type "F" water wheel governor for regulating all makes of impulse water wheels and small turbines. This consists of a hydraulic piston, which exerts its thrust in either direction, through the mechanism of a rack and quadrant, to a rock shaft which is connected to the nozzle mechanism of the intake flume. The piston is actuated by water under flume pressure, and is of such area and stroke as to develop 5 ft. lb. per foot of head; this is sufficient to control all ordinary impulse wheels.

ADAM COOK'S SONS, 313 West St., New York, are making a liberal proposition to superintendents of motive power having trouble with motors by frequent stoppages, worn out babbitting in bearings, burnt out armatures, etc. They will furnish entirely free of expense, a sufficient quantity of their Albany electric motor compound (a barrel if need be) for a thorough test, confident that the result will prove it to be the ideal lubricant for this valuable class of machinery. The compound can be used on any kind of motor on the market today, and is meeting with splendid success on the electric train of the New York, New Haven & Hartford R. R., running at a speed of 50 miles an hour; also on other electric roads.

THE UNION STEAM PUMP CO., of Battle Creek, Mich., has published its new catalog for 1899-1900, describing its latest types of single valve steam pumps. While the field of a single valve pump is necessarily limited, its desirability under many conditions is evident, as for instance, owing to its ability to work at extremely low pressures, it makes an excellent boiler feeder, enabling the engineer to fill his boiler after the engine has been stopped, without extra fire. In designing the Moore valve movement the aim has been to require the piston to positively make one full stroke before it can recede or make another, thus adapting it to the successful handling of hot water condensations from steam radiating coils of all kinds. A full line of air, vacuum and special pumps of various types are illustrated in the catalog.

THE MORRIS ELECTRIC CO., of New York, has recently closed a contract to supply all the trolley, feed and span wire for the equipment of the lines of the Mexican Electric Tramway Co., Ltd., of the City of Mexico; also for all the ornamental brackets, fittings and appliances for the overhead work. In addition it has received an order from J. & O. Braniff Co., City of Mexico, for 650 ornamental electric light poles, one from the Havana Electric Railway Co., Havana, Cuba, for all the underground and overhead feeder cables and trolley wire to be used on that road, and several orders from the U. S. Government for material to go to

Manila and Cuba. During the month of September this company shipped goods to Africa, Italy, England, Brussels, South America, West Indies and Brazil, and on home orders to Texas, Indiana, Michigan, Alabama, New York, Connecticut and Pennsylvania. In this same month its sales of copper wire amounted to three quarter of a million pounds.

F. C. RANDALL, eastern sales agent for the Christensen Engineering Co., has changed his address from Park Avenue Hotel to No. 154 Arlington Ave., Jersey City, N. J.

THE DEWITT SAND BOX CO. has been formed to make and sell sand boxes and will succeed to the business of E. F. DeWitt & Co., Lansingburgh, N. Y. The company has offices at No. 30 Wall St., New York City.

THE GREEN ENGINEERING CO., 518 Western Union Bldg., Chicago, in addition to the grates for 8,000 h. p. of boilers at the Western Ave. station of the Chicago Union Traction Co., described on another page of this issue, has recently secured the order for 16 grates for the new plant to be built for the United Railway Co., of St. Louis. Other plants where the grates are installed are those of the Metropolitan Street Railway Co., Kansas City; United States Glue Co., Milwaukee; Armour Packing Co., Kansas City; Swift & Co., St. Joseph, Mo.; Brown Building, St. Louis; Cincinnati Edison Co., Cincinnati; Milwaukee Electric Railway & Light Co.

The company not only makes these grates, but contracts for complete power installations. The officers are: W. M. Green, president; John R. Gent, vice-president; P. A. Poppenhusen, treasurer; H. A. Poppenhusen, secretary.

THE WESTERN ELECTRICAL SUPPLY CO., of St. Louis, reports that in no department of its business have the effects of the good times been felt so much as in the street railway department. This branch of the business was added about one year ago, and by good management has so rapidly developed that it has become one of the largest in the country. The line of agencies includes the best known and largest makers in the country. Realizing that prompt shipments are the keystone to success, it stocked up liberally months ago, and now the factories are behind with orders, the advantages of such foresight are evident. The growth of this company during the past year has certainly been phenomenal, and proves conclusively what a combination of strict business integrity, prompt shipments, fair treatment of customers, and systematic and well directed hustling will do. The new catalog is strictly up-to-date, contains a very complete and carefully compiled line of supplies, embracing everything pertaining to the electrical business. The agency has just been taken for the "multiplex" reflector, described elsewhere in this issue. This company's exhibit at the Chicago convention will be made jointly with the Ohio Brass Co., space No. 17.

THE GREEN FUEL ECONOMIZER CO. reports recent sales of Green's economizers for the following plants: Third Avenue Railroad Co., Kingsbridge power station, N. Y., 32,000 h. p.; Swift & Co., Chicago; Botany Worsted Mills, Passaic, N. J., (6th order); Berkshire Cotton Manufacturing Co., Adams, Mass., (2d order); Wamsutta Mills, New Bedford, Mass.; Dominion Cotton Mills, Montreal, P. Q., (14th order); Hargraves Mill, Fall River, Mass.; Great Northern Paper Co., Millensocket, Me. (2 orders), and Madison, Me.; American Thread Co., Holyoke, Mass.; Webster Manufacturing Co., Suncook, N. H.; Societe Nestle, Fulton, N. Y.; American Hard Rubber Co., College Point, N. Y. (2d order); Washington Agricultural College and School of Science, Pullman, Wash.; Richelieu Woolen Mills, Chambley, Canton; New York & Rosendale Cement Co., Rosendale, N. Y.; Worcester City Hospital, Worcester, Mass.; Knoxville, Woolen Mills, Knoxville, Tenn.; Anniston Manufacturing Co., Anniston, Ala.; Revolution Mills, Greensboro, N. C.; Parker Mills No. 2, Warren, R. I.; Woonsocket Machine & Press Co., Woonsocket, R. I.; Metropolitan Water Board, Chestnut Hill Pumping Station, and Spot Pond Pumping Station; Schlichter Jute Cordage Co., Philadelphia, Pa.; Sir W. C. McDonald, Montreal, P. Q.; International Paper Co., Otis Falls, N. Y.; Nashua River Paper Co., East Pepperell, Mass. (2d order); Talbot Mills, North Billerica, Mass.

THE CAST WELD STEEL JOINT.

The Milwaukee Railjoint & Welding Co. has recently designed a new type of its cast weld steel rail joints for the work which it is now doing for the Rochester (N. Y.) Railway Co. The Milwaukee Railjoint & Welding Co. is the pioneer in this type of welding. Its success in welding exposed rail has been such as to excite surprise on the part of railroad men, who had not supposed it was possible to accomplish the result obtained. In 1898 the company welded eight miles of exposed rail between the city of Milwaukee and South Milwaukee. This track has been in constant use ever since, and subjected to the heaviest kind of interurban traffic. The breakage during the winter of 1898 did not amount to 1 per cent. Since the joints were repaired in the spring there had not, up to October 5th, been any further breaks, nor is it expected there will be; neither is there any kinking of the rails. In certain portions of the road slip joints were installed, but in other sections equally long the welding was made continuous, regardless of slip joints. The officers of the company state: "We find by experience that after the track is once adjusted after welding, it does not move a great deal, and there is not much necessity for a slip joint." The track referred to is certainly in first class condition, and will bear the closest inspection. As a result of the manner in which this welding stood the test of extreme temperatures the company received a second contract, for welding 15 miles of suburban track between Milwaukee and Wauwatosa on exposed rails.

Another notable contract is on a line of railway running through the main street of Milwaukee, which is believed to be the finest piece of street railway work and cast welding in the country. This is laid with 72-lb. T-rails on a 6-in. concrete foundation, with concrete between the ties; over this is asphalt paving. It is impossible in riding over this track to discern where the joints occur.

The company has recently arranged with the Calumet, of Chicago, for the latter company to do its own welding, using the steel jackets under license; similar agreements have been made with the Rochester Railway Co., and a road at Columbus, O. The contract now being carried out at Milwaukee with the Milwaukee Electric Railway & Light Co., is for 20,000 joints, which with the work done last year will make a total of 28,000 joints of the cast weld steel process on that road. The headquarters of the Milwaukee Railjoint & Welding Co. are in the Pabst Building, Milwaukee, and the officers are: S. C. Buchan, president; T. C. Buchan, vice-president; E. H. McVickers, secretary, and J. H. Kopmeier, treasurer.

INTERESTING LECTURE DURING CONVENTION.

The Political Economy Club, at the Chicago University, has arranged for a series of valuable lectures, and on October 10th H. F. J. Porter, M. E., of the Bethlehem Steel Co., will lecture on "The Development of the Art of Forging." The hour and place will be announced in the "Daily Review" of October 10th; delegates are invited to attend.

A MILE OF "AD."

The committee in charge of the advertising of the Street Carnival, held at Battle Creek, Mich., Sept. 4 to 9, 1899, hit upon a rather novel scheme for bringing the Carnival prominently before the public. People passing through the business district of Battle Creek Sunday morning, August 27th, were confronted by a poster neatly pasted on the pavement between the car tracks of the main thoroughfare, and stretching away in either direction nearly as far as the eye could see. The advertisement called attention to the principal attractions of the fair.

This huge poster was printed on a roll of paper containing 2,264,000 sq. in. in a continuous strip 35 in. wide and over a mile long. A repetition of the form used was made every 24 in.

According to plans, the new plant of the Richmond (Va.) Electrical Railway and Development Co. will be ready Mar. 1, 1900. Current will be supplied from this station for heating, power, lighting and street railways.

HALF FARES.

Reports state that storage battery cars will be introduced on the San Diego (Cal.) Electric Ry.

The sale of the Sutro Electric Ry., of San Francisco, Cal., was advertised to take place October 6th.

It is expected the first car will run over the recently built Detroit & Northwestern Ry. on December 15th.

The Westinghouse Electric & Manufacturing Co., has declared a regular quarterly dividend of 1¾ per cent on the first preferred stock.

The Pennsylvania R. R. will substitute an electric locomotive for steam service on its branch between Jeffersonville, Ind., and New Albany, Ind.

The Mahoning Valley Electric Ry., of Youngstown, O., on September 7th announced an increase of one cent an hour in the wages of all employes.

The electric railway to connect Ashland, Ky., and Centralia will be completed by December 1st. The road will not be opened for traffic before the early spring.

The General Electric Co. has declared a regular quarterly dividend of 1½ per cent on the common stock, payable October 14th, to stockholders of record October 3d.

The City Pasenger Electric Ry., the Logan Valley Electric Ry., and the Altoona Gas Co., of Altoona Pa., have been purchased by a New York syndicate for $1,000,000.

The Fond du Lac (Wis.) Street Ry. will soon be extended to the northwestern part of that city, in anticipation of the new Wisconsin Central car shops to be located there.

The People's Gas & Electric Light Co., of Defiance (O.), owning also a street railway system, offers tickets at the following prices: Six for 25 cents, 30 for $1.00 and 50 for $1.50.

The electric line from Kalamazoo, Mich., to Battle Creek, which is nearing completion, will be run by power from the water driven plant of the Kalamazoo Valley Electric Co., near Allegan.

Notice has been served by the Highway Commissioners upon the Long Island (N. Y.) Electric Railway Co. that it must pave the highways between its tracks and for a certain distance outside the rails or suffer a revocation of its franchise.

Special theater cars will soon be run at night on the East Taunton (Mass.) Street Ry. to Middleton and Middleboro, Mass., from Taunton, enabling residents of those two cities to attend the theaters at Taunton, instead of going to Boston, as they now have to do, on account of lack of transportation facilities.

Contracts for the construction of a new car barn have been let by the Pueblo (Col.) Electric Street Railway Co. The barn will be of brick, 52 x 140 ft., and will have storage capacity for 24 cars. The company is contemplating an increase in the number of its cars in the near future.

Compressed air as a possible motive power on the lines of the Cincinnati Street Ry., is being investigated by representatives of that company. If the trials now in progress on the 28th and 29th St. lines in New York warrant it one of the divisions in Cincinnati will probably be equipped experimentally with compressed air cars.

The Educational Department of the Harlem Branch Young Men's Christian Association at No. 5 West 125th St., New York, has added to its curriculum a course in electricity. The aim is to make this of practical value to all men who are interested in any branch of electrical work. Forty-eight lectures, illustrated with stereopticon views and practical demonstrations, are included in the course.

A new building, to contain a restaurant and cafe, a shooting gallery and a bowling alley, will be built by the Youngstown (O.) Park & Falls Street Railway Co., at its Terminal Park. The company, it is announced, is about to spend $100,000 in double tracking part of its line, buying new cars and motors and making several other improvements.

Mr. T. M. Ellis, gereral manager of the Rockford (Ill.) Railway, Light & Power Co., advise us that the wages of motormen and conductors, formerly 12½ cents per hour, were on September 1st changed to the following rates: First year, 12½ cents; second year, 13 cents; third year, 13½ cents; fourth and fifth years, 14 cents; after five years, 15 cents.

The promoters of the Jefferson (O.), Burton & Andover Electric R. R. promise to build the road if all the franchises and rights of way are given to them, and in addition $2,000 from each township along the route and $3,000 from each township containing an incorporated village, the money to be paid after the road has been constructed and in operation 90 days.

Some maliciously minded person, probably a discharged employe, badly crippled the service of the Chattanooga (Tenn.) Electric Street Ry. on September 13th by grounding the feed wire in one of the suburbs of the city. The work was evidently done by an expert electrician. President Warner, of the company, has offered $50 for the apprehension of the guilty party or parties.

Newspaper reports from Cleveland state that foreclosure proceedings against the Walker Co., on a claim for $175,000 bonds and $30,000, have been instituted by the Standard Trust Co., of New York. A receiver is asked for. This is said to be the final step in the efforts of the Westinghouse Co. to obtain absolute ownership of the Walker Co., which it now controls.

Two electric lines are being built between Xenia, O., and Dayton, and both have been making an effort to get into Dayton over Main St. On September 11th the Xenia Rapid Transit Co. stole a march on its opponents by having a meeting called and an old franchise which had expired several years ago, revived and renewed. The Dayton & Xenia Traction Co. will contest the legality of the proceedings.

The Birmingham (Ala.) Railway & Electric Co. has acquired the fee of all the properties of the Birmingham Traction Co., including the Highland Ave. steam dummy line of the Highland Ave. & Belt R. R., which was recently purchased by the Traction Co. It is further stated that the present officers of the Railway & Electric Co. will operate the consolidated system without change in personnel.

In order to meet the demands of the increased traffic on its lines, and also to enable it to supply power for the loop, the South Side Elevated Railroad Co., of Chicago, is doubling the capacity of its power station at 40th and State Sts. New Allis engines, two 1,500 kw. Westinghouse generators and Babcock & Wilcox boilers are being installed and will increase the output of the station by 4,800 h. p.

The Joliet (Ill.) Street Railroad Co., in accordance with its annual custom, on September 8th turned the entire street railway system of the city over to ladies, who acted as conductors. The receipts for the day went to the Silver Cross Hospital. Numerous entertainments were arranged by the ladies in different parts of the town to increase the receipts, among them being a baseball game and a band concert.

Cable trains are again running on the State St. line of the Chicago City Railway Co., the first train making the round trip on September 24th. When it became necessary to make extensive repairs at the 21st St. power house in July of this year, it will be remembered the Chicago City Railway Co. applied for and received permission to string temporary wires and operate this line by electricity for 90 days.

THE Street Railway Review

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We call the attention of our readers to the fact that the "Street Railway Review" is the only paper to publish a verbatim report of the proceedings of the Street Railway Accountants' Association.

Our contemporary, the Street Railway Journal, in its monthly issue for November, attempts to make some reparation for the injustice it did us in its weekly news bulletins of October 14th and 21st, both of which carried announcements on the first page in display type that the first verbatim report of the convention would appear in its monthly isssue of November 1st. We are disposed to overlook the first announcement, but not the second, bearing date one day after the meeting had adjourned, and after the "Review" had issued five dailies, containing not only a verbatim report of both the American and Accountants' meetings the previous day, but all the other doings of the day previous. These dailies were not inaccurate, as our contemporary insinuates, and we shall be pleased to have our readers compare the Journal's report (12 days after the convention adjourned) with our report day by day.

Speaking of "inaccuracies" the shoe is decidedly on the other foot, for this same "news" bulletin, dated October 21st, takes the convention on a trip of inspection to the Alley L power plant and to the Chicago & Milwaukee road on Tuesday afternoon, October 17th. The trip to the elevated station did not occur until Friday afternoon, and the other, while talked of, did not take place at all. Mr. Kilgour is made to read a paper on Wednesday (three days previous), when in fact he not only was not present at any time during the convention, but did not send in any paper, and the subject was not discussed. This shows the danger of writing advance accounts of events scheduled on a program which is liable to change before the program has been carried out.

Every morning at daylight from Tuesday to Saturday inclusive, the "Daily Review" came out with an absolutely complete report of everything which transpired up to midnight of the previous day. The "Daily Review" also printed on Wednesday the name of every person registered on Tuesday. To copy and classify these names required the work of six persons for nearly six hours; on Thursday the Wednesday registrations were printed, making a list far more complete and much larger than has ever been previously printed. Our issue of Saturday morning gave the banquet toasts which ended at midnight Friday. To do this we employed a force of six expert stenographers and transcribers, whose work was completed in a few minutes after the last speaker had finished his remarks. Our same issue contained photographic illustrations of the exhibits, with descriptions, and made absolutely a complete history of the convention, leaving nothing unreported.

In reporting the Accountants' meetings we printed 12 pages of stenographic report, exclusive of the papers and reports read, as against five pages of long hand notes in the Journal. Our pages, moreover, were in brevier type, which measures 20 per cent more matter than that used in the Journal's long primer account.

The "Review" is not given to boasting of its own work, but after publishing what every one concedes to be the most complete and accurate convention daily ever issued by a trade journal, it does not believe the street railway fraternity will approve of this glaring mis-statement of fact by another paper in its frantic attempt to excuse its own lack of enterprise.

The treatment of employes with a view of increasing their efficiency and creating a spirit of loyalty and good will, is a question that is forcing itself more and more upon the attention of managers, and has received a new impetus by the paper bearing on this subject read before the Street Railway Association of the State of New York, at the Ithaca convention, and printed in the September issue of the "Review." As is usual with questions of this character, there is a diversity of opinion among managers as to the need of efforts in this direction, and also as to the method to be followed in securing better results where it is admitted that some means is desirable for decreasing accidents, increasing patronage and lessening the liabilities of so-called labor troubles. The paper in question treated the subject under five heads. But as there are only three of these heads, about which there could be any difference of opinion, it will suffice for the purpose of this discussion to quote these only. No. 3 reads: "By giving the men a careful education in the duties which they are to perform." No. 4: "By handling employes in such a way that they will feel that they are being treated as men and that they will not lose their loyalty to the company and to their immediate superiors on account of harsh and unjust treatment." No. 5: "By making them feel that intelligent service, loyalty to the company and a good record gives them a chance for promotion to a better position."

As to the first proposition, it is held by some, and the statement was boldly made in one of the papers read at the recent Chicago convention of the American Street Railway Association, "That the best motormen are often men who can neither read nor write and are found among teamsters, drivers on horse railways and the like." Again in the same paper, "The semi-technical man who is 'learning the business' makes the worst motormen of all; his mind is more active, he is interested in the performance of his motors and equipment and neglectful of his primary duties as a motorman. Moreover, he is a dissatisfied individual * * * not inclined to learn the business of motorman thoroughly."

Knowledge is power, but this must be coupled with a knowledge of one's own power and a knowledge of the governing laws of thought and how to apply them. It is difficult to understand why, if knowledge is power to do efficiently whatever one has to do, that the calling of a motorman should be an exception to this rule or principle. It is not usually claimed by the advocates of giving these employes a careful education as to their duty, and an explanation of the machines they are required to handle that it necessarily implies that they should be thinking more of the machine than their immediate duties on the street, or that they should attempt to remedy slight defects or attempt the adjustment or repair of the equipment while en route. In fact, the best trained motormen are not usually expected to do this. These things are left for men specially assigned to the work, properly clothed and equipped with the necessary tools. But the motorman cannot be too well instructed as to the handling of his car and apparatus by a careful and competent teacher. There is such a thing as not carrying these instructions far enough; in which case a little learning is a dangerous thing. But the question is one of thorough instruction, and if it is found that a motorman, whether thoroughly instructed or ignorant, is a "dissatisfied individual" it is prima facia evidence that he is not a proper person to handle the car, for his mind will go "wool gathering" and he will invite accidents and mishaps. Dissatisfaction, coupled with anxiety or fear of any kind will never produce a cool head to act wisely in any crisis. The failure of so-called semi-technical men as motormen is not that they know too much about the equipment, but that they are left to work their mental batteries the wrong way, and have not received proper instruction how to concentrate their thoughts and hold their attention to the thing in hand.

When a manager realizes that there are inherent potentialities in every man and that proper training will bring them out, he will find in his own hands the possibility of greater power and greater success. One's standard of so-called success with ignorant employes often blinds him to the fact that there was a greater and broader success which he failed to reach. The time has come when the laws and rules of success which have been known to a few who have been prepared for them, are now safe in the hands of the many. There is the dawn of a new cycle which will wrench from the grasp of ignorance the victims of its stultifying influence. A manager's success and that of his employes will hereafter be measured by the degree in which he avails himself of the power to think correctly and quickly.

Subjects 4 and 5 will receive attention in a subsequent article.

In the title of Mr. Yerkes' paper on street railway investments two questions were propounded. The first, how can they be made remunerative, was very briefly answered by saying that the matter lay with the management; the management of a street railway can exercise but little control over the receipts of the company and remuneration for the investors must be secured by economy of administration. The second question, how can street railway investments be made secure, was discussed at greater length. The author stated that the security of the investment depended more upon the term of the charter than anything else, and after comparing the cost of the horse car line, that received a 20-year grant from the city, with the electric railway of today, drew the conclusion that if the 20-year grant to the former was equitable then the latter should have a 200-year grant. To the objection that long-term grants would be bad policy, because preventing improvements in the means of transportation, it is answered that improved means of transportation would of themselves make the older franchises worthless. Mr. Yerkes believes that cities and companies should treat each other fairly; that street railways should pay a portion of their earnings to the city in return for the license to do business, and that they should be under the general supervision of commissioners appointed by the governor and holding office for a long term, say 15 years, so as to take them out of politics.

The proposition that the municipality should receive a portion of the earnings of the street railways located within it is one which will not be unanimously accepted by street railway men. It is an acknowledged principle that the consumer should in every case have some of the benefit which results from improved and cheaper methods of production, and in most fields this is obtained through the natural competition of the producers. The legislators of many of our states long supposed that competing street railways would give better service at lower fares, just as rival grocery stores make lower prices for provisions. While this idea is not entirely eradicated—Georgia still believes in it—it is now generally recognized that such things as supplying the public of a city with water, light, or transportation are natural monopolies. That is, the business can be done best and cheapest by a single company. The result has been that a demand has grown up for street railways to pave and light and clean the streets through which they run, for a percentage of the receipts to be paid the city, or for the municipal ownership of the industry.

The business, however, is one in which the local conditions have a most important bearing, and what would be reasonable in one city of say 100,000 inhabitants might be not only unjust, but physically impossible in another city of the same size. The volume of business carried is by no means the same in two cities of equal population, and the cost of fuel and labor is far from uniform.

When a permanent type of mechanical power is reached and it is no longer necessary to discard costly apparatus, not because it has worn out, but because improvements have displaced it, stockholders will be relieved of the large financial risk that, until then, must inevitably hang over their investments in street railway properties. Then, as construction is devised which will be of a much more permanent nature than has marked the history of track work until now, and with a definite limitation to construction and operating expense for a term of years, companies will be in position to share their earnings with the city, as few of them at present are warranted in doing. But even then, we are firmly of the opinion that that money, instead of being paid into the

city treasury, to be frequently squandered by politicians, should be used in improving and enlarging the car service. In this way only will those who have actually paid this money into the companies receive any direct benefit. The reduction in taxes to those wealthy citizens who use the cars seldom or not at all, is of vastly less importance than to increase the length of the ride that the workingman shall receive for a single fare, or the purchase and operation of additional cars, which otherwise would be run at a loss, hence not at all. The street car has emancipated the working people from tenement house life and has changed the social condition of hundreds of thousands. How much better that this work should be extended and enlarged than that a few millionaires should pay a few hundred dollars less tax than at present.

The care of the car equipment of a street railway involves a multitude of details, and as there is a best or a cheapest way of handling each one of these, men having charge of that department always find an interchange of ideas on the subject both interesting and profitable. This was well shown at the convention by the discussion which followed Mr. Vanderveer's paper on this subject. Everyone who spoke told of methods employed on his road whereby a saving of 25 per cent or of 50 per cent had been made in items of repair or maintenance of equipment, and the ideas developed undoubtedly furnished much food for thought. There has heretofore been no department of a street railway which has received more attention with a view to inaugurating economies than the power house. The results have well repaid the thought and labor expended, and it is now beginning to be recognized that the shops and car inspection department will also repay similar attention.

The subject of track construction and maintenance is not a new one before the Association, and in connection with Mr. Butts' paper it is rather interesting to review the recommendations that have at various times been made concerning this very important portion of a street railway. In 1883 it was believed that a track laid "with 40 or 45-lb. tram rails well spiked to stringers with good cast or wrought iron joint-plates at the ends of the rails" would fulfill all requirements. A year later the report adopted by the Association recommended, for heavy traffic, 60-lb. center bearing rails spiked to stringers which were laid on ties spaced 5 ft. between centers, with cast iron knees both outside and inside the stringers at each tie. In 1887 a report was presented which reviewed the history of the two types of construction, stringer and girder; the conclusion was that a rail weighing 55 lb. or 60 lb. per yard, supported by chairs on ties 4 ft. apart and having fish plate joints would be stiff enough to answer all purposes.

In 1892 the subject became more important than ever, and a report on "A Model Electric Railway Roadbed" recommended that the ties be placed about 27 in. apart, that the rail be deep enough to dispense with chairs, and that three-tie, six-hole fish plate joints be used. In 1896 the recommendation of a report on "Track and Track Joints" was for white oak ties 5 x 8 in. x 7 ft. spaced about 30 in. and 9-in. girder rails, held to gage by tie-rods spaced 6 ft. apart, with the joints cast-welded.

When this brief summary of what has been, at various times in the last 16 years, considered the best construction for street railway tracks is compared with that presented by Mr. Butts the changes are very marked. From the 40-lb. or 45-lb. rail of 1883 to the 80-lb. or 100-lb. rail of 1899 is a long step; from timber stringers to concrete beams surrounding the lower flanges and web of the rail is another, but the substitution of a cast-weld joint for the plate under the rail ends is probably the greatest difference, the other changes being in degree rather than in principle.

Mr. Butts agrees with all others who have previously presented reports on this subject to the Association, in advocating the center-bearing rail, but his road is one of the very few that are permitted to use this section. In most cities the municipal authorities prescribe either a tram or a groove rail.

The discussion on this paper brought out statements by a number of members concerning their experience with ties of different materials, rails of different sections, cast-weld joints and other points.

All the problems connected with a street railway do not lie in one department, and after the Association had considered the questions of investments, of equipment, and of track, Mr. McCormack read his paper on train service. He pointed out that a well arranged train service is essential to the commercial success of a street railway, and then entered at length into the ways and means of getting information concerning the conditions of the traffic, and then of meeting these conditions satisfactorily. Mr. McCormack treated his subject at greater length than any of the others who presented papers, and illustrated by concrete examples the application of the methods described and the results accomplished.

After having accomplished a task which he has undertaken a business man first wants to know what the results have been from a financial standpoint; then, having found what he has done or is doing, absolutely, he naturally wishes to know what the relative results are, that is to compare his work with that of others who are engaged in the same business. To get these absolute and comparative results, expressed in dollars and cents, is a part of the work of the accountant.

In the street railway field the wide variety obtaining in the methods of distributing different items of expense was such that one road given the monthly statement of another could tell but little about it, and comparisons were impossible. This led the Street Railway Accountants' Association to take up as its first work the development of a standard system of accounts according to which expenditures would be divided according to a uniform system. With the endorsement of the Railroad Commissioners given last August to the Accountants' "Standard System" this part of the Association's work may be said to be practically accomplished.

But assuming that in a short time all companies will keep their accounts in the same manner, the conditions under which they operate are so different that a comparison of results is difficult because there is no unit upon which accountants can agree as being a suitable basis of comparison.

Mr. Mackay presented the only paper read before the Accountants' Association at its last convention and advocated the "motor car-hour" as the most desirable unit for comparing performances, and particularly urged its superiority over the "car-mile." The lengthy and animated

discussion which followed showed the subject to be a very live one, and that the selection of a unit for comparisons is a work which the Association will do well to take up.

It is evident that the engineering trade of Great Britain and the Continent is now thoroughly aroused to the fact that something must be done and done quickly if American competition is to be met and overcome before it is too late. British and European firms have stood idly by and seemingly without much concern, have watched contract after contract go to American bidders, and have made no effort to determine why home establishments could not successfully meet this competition. But this apathy is rapidly developing into vigorous protestations against this condition of things, as is evidenced by the storm of disapproval raised at the letting of recent London and Glasgow tramway contracts and the building of the Atbara bridge in the Soudan by an American firm.

The foreign technical press is also awakening to a recognition of the conditions and in long, well-worded editorials is sounding its "note of warning." But it is almost amusing to see the different ways in which the various journals have sized up the situation. A few of them still persist in raising the feeble cry of favoritism, "outside influences" and lack of patriotism, and absolutely refuse to see that contracts for structural work, engines, electrical apparatus and tramway supplies are going to America, simply because American contractors can give better quality in shorter time and at cheaper prices. Of these no account need be taken.

But there is another class of papers which have succeeded in taking a broader view and whose opinions are worthy of consideration. Among these is Engineering, of London, and to show the real grounds upon which the coming battle will probably be fought we quote the following from an editorial in a recent issue of that journal:

"No industrial question at the present time has so keen an interest to British manufacturers as that connected with American competition. It has been brought prominently into public notice on more than one occasion during the last six months, but for several years past our manufacturers, merchants, and shippers have been unable to close their eyes to the fact that since the United States have recovered from the effects of the great panic of 1893, they have steadily become more dangerous antagonists, not only in this country (Great Britain), but in foreign markets, and especially in those markets which we have been accustomed to regard as our own. It is still urged by not a few persons that this competition is factitious; that in order to take away our customers, goods are supplied by enterprising Americans at a loss; that the articles forced on the markets of the world in preference to our own, are of inferior quality, and will not stand the test of time and use, and that the spurious phase of manufacture and commerce is but transient. But those who are able to take a broader view know that such statements are fallacious; they know that in many manufactured products the United States can beat us in price, and at least equal us in quality; they know that at present, and still more in the near future, the struggle of competition will grow keener, and that the advantages of this struggle do not lie with us." And again; "The manufacturers of Great Britain must either adopt new methods to cheapen production and increase the rapidity of the output or they must be content to see orders given wholesale to foreign contractors with whom they cannot hope to compete."

But in our opinion there is no great need of worry on the part of American manufacturers. The situation is one requiring simply watchfulness and a continuation of present efforts. Although foreign dealers may begin to recognize their deficiencies, it will take them years to bring their plants and their methods to such a state of perfection as to enable them to stem the tide of orders that is moving toward this country. At any rate this is not the first time that American pluck and genius have been pitted against the whole world, and there has never been but one result.

NEW INTERURBAN ROAD IN PENNSYLVANIA.

The Bethlehem (Pa.) & Nazareth Passenger Railway Co., which commenced operation on October 2d was incorporated at Harrisburg Feb. 6, 1899, with $150,000 capital stock. This is a single track road, with six turnouts running from Bethlehem to Nazareth, a distance of 10 miles, and is one of the best constructed roads in the state. The track is laid with 67-lb. T rails, furnished by the Scranton Steel Co., and is rock ballasted throughout.

The power house is built of brick 50 x 95 ft., with a slate roof. E. Keeler & Co., of Williamsport, as contractors, supplied all the machines for the station, consisting of two Hamilton-Corliss 300-h. p. engines, two 200-kw. Westinghouse generators, and three 500-h. p. boilers. The car barn is not yet completed, but will be 50 x 200 ft., and will contain space for storing 27 cars and 2 snow plows, a repair shop and machine shop. Five motor cars, built by the American Car Co., of St. Louis, will be operated for the present.

The officers of the company are: President, J. J. McKee; secretary, Robert B. Keys; treasurer, C. A. Wolle; superintendent, George H. Wolle.

TRAMWAYS OF BOMBAY, INDIA,

Wm. T. Fee, U. S. consul at Bombay, writing to the department under recent date gives the following report on the street car system of that city:

The company was chartered by the Bombay government in 1874, under the name of the Bombay Tramway Co., Limited. It has an invested capital stock of 30 lakhs of rupees, or about $1,000,000, and debentures of about two-thirds that amount. The stock is principally owned in the United States, and its main office is located in New York City. The road is a double track system, with about 17½ miles in operation.

It has in use 187 open cars, made by the company in Bombay. It employs 1,150 horses, each of which travels on an average 13 miles daily. They are well cared for and never abused, a sort of a hat or padded bonnet being fastened on top of their heads during the day as a protection against the sun. All animals, in fact, receive humane treatment in India.

About 1,100 men are employed by the company. The car drivers and conductors are paid by the trip, and the former receive about 18 rupees ($5.85) and the later 22 rupees ($7.15) per month. The track, barn, and common laborers receive the usual Bombay wages of 6 annas (12 cents) per day.

The rails are of the girder type, 30 ft. long and weighing 83 lb. per yard. They are laid on teak-wood ties and bedded in concrete. The road was opened to traffic in 1874, and its present cost is estimated at about 35,000 rupees per mile of single track. The total gross receipts of the road for the last financial year were $398,498 and the operation expenses during the same year were $257,821.

There is now a movement to convert the road into an electric line. In fact, the company has applied to the Bombay government to sanction the conversion. Electricity has but recently come into use in India, Madras being the only city where it is used on street railways as a motive power.

The Pittsfield (Mass.) Street Railway Co. has been notified to place one cent revenue stamp on all packages carried between Pittsfield and Dalton for its patrons. The company claims such service is in no sense that of an express company and has referred the matter to the department at Washington, D. C.

PRICE OF RAILS STRONG.

One of the questions which is disturbing managers is the immediate future of the rail market. It is understood that recently the rolling mills combined and notified the steam roads that immediate orders would be taken at $33 per ton, to be followed by an advance in price. It is given out that under this offer 1,500,000 tons were placed, amounting in value to nearly $50,000,000. This is about one-sixth of the entire possible output of steel for the next 12 months. The demand for structural iron shows no indications of decrease, which will further tend to strengthen prices. The necessities of the Russian Government in its railroad work will still further curtail the supply. As predicted, the mills have now advanced the price of T-rails two and three dollars per ton, and this of course governs the selling price of girders.

Many have held off in placing orders for next season's requirements, hoping there would be better prices available, but the present indications certainly do not favor any such good fortune for the buyers. Prices may not advance during the next 60 or 90 days, but we fail to note any indications that they will be any less.

We know of several companies which have extensions in contemplation, which have concluded to postpone the work another year, owing to the high price of steel and copper.

In this connection we also note the marked advance in price of motors and cars, but the demand is certainly sufficient to keep the factories running full time or better, hence no reductions can be looked for here. In fact, companies having necessities in these lines for next summer should lose no time in placing orders, for not only are prices certain to suffer no decrease, but as spring approaches it will be more and more difficult to count on prompt delivery. After December 15th every day's delay in placing order is likely to cause disappointment when the summer riding begins.

ANNUAL REPORT MONTREAL STREET RY.

The report of the Montreal Street Railway Co., a copy of which has been sent us by Mr. W. G. Ross, comptroller, for the year ending Sept. 30, 1899, shows the following results:

	1899	1898	1897	1896	1895	1894	1893	1892
Gross Receipts	$1,660,775.63	$1,471,636.65	$1,342,961.78	$1,265,505.29	$1,102,777.87	$896,090.59	$730,751.76	$544,106.61
Increase 1899 over 1898 12.85%	188,836.98							
Operating Expenses	912,849.06	768,584.55	730,423.60	710,544.70	652,911.74	637,068.14	593,041.71	465,647.99
Increase 1899 over 1898..18.56%	143,065.51							
Operating Expenses Per cent. of Car Earnings	55.23	52.14	54.66	56.48	59.20	71.16	78.00	82.68
Net Earnings	747,926.27	707,055.50	605,939.18	555,033.89	449,965.33	259,472.75	137,710.05	97,761.16
Increase 1899 over 1898 5.77%	40,770.63							
Net Income per cent. of Capital	13.16	15.00	12.41	11.56	10.21	8.00	6.17	
Passengers Carried	40,186,463	35,353,036	32,047,317	29,050,471	25,077,258	20,668,01[illegible]	17,127,9[illegible]	11,631,5[illegible]
Increase 1899 over 1898 13.67%	4,833,427							
Transfers	11,060,857	10,508,608	6,705,903	6,341,680	7,053,670	6,929,653	5,994,112	

The company's rolling stock has been increased since the last report by the addition of 64 closed motor cars, 100 open motor cars, 1 pay car and 12 electric sweepers, and there are under construction 36 closed motor cars. Large additions to the repair shops and car barns have been built.

During the year the company has paid to the city of Montreal the following amounts: Taxes on earnings, $70,811.42; on account of snow clearing, $60,456.; real estate and business taxes, $8,832.13, making a total of $140,099.55.

The Detroit (Mich.) Plymouth & Northville Ry., has been opened for traffic.

The Chicago Union Traction Co. has made a number of important changes in transfer arrangements, and the sale of tickets, as the result of several petitions presented by interested citizens.

ALUMINUM FEEDER CABLES ON THE NORTHWESTERN ELEVATED.

Although aluminum has been used for some time as a substitute for copper in the transmission of high voltages over long distances and in telephone and telegraph work, its first application to a direct feeder system is now being made on the Northwestern Elevated in Chicago. The Northwestern will be operated on the third rail system, the third rail conductor being fed from [illegible] in aluminum feeder cables, of which there will be more than 20 miles used. The cables are carried in a wooden trough between the up and down tracks, and are supported on vitrified clay insulators.

One of the chief drawbacks in the use of aluminum has been the difficulty of soldering or brazing joints, owing to the film of oxide always found on the surface of the metal and to its high heat conductivity. This obstacle has seemingly been overcome by the invention of a solder which forms a perfect amalgamation with aluminum, and makes a joint with a trifle higher conductivity than the cable itself. This solder is a secret composition, the parts of which are known only to the inventor, Henry Gronmu[illegible], of 9 Re[illegible] St., Chicago, who is making all the joints in the aluminum cables on the Northwestern structure.

The process of forming a joint is as follows: The ends of the cables are brought up into a movable canvas shanty, that can be erected in a few minutes at any desired point on the structure, and which shields the cable ends from the cold air and wind. It is found that by taking this precaution the joint can be made in about one-third the time. The ends of the cable are covered with fire clay and fluxed with a composition that is also kept a secret, after which they are brought to a white heat, or about 650 or 700° F. by means of gasoline brazers. A copper sleeve 6 in. long tinned on the inside and with an inside bore a trifle larger than the cables, is next slipped over the two ends and through a pour-hole left for the purpose, the melted solder is poured into the sleeve, finding its way between the strands of aluminum and making one solid piece of the copper, the solder and the aluminum. The joint has a conductivity of about 64 per cent and the aluminum cable about 62 per cent of that of fine copper. As copper is practically three and one-third times heavier and at present prices costs about 18 cents a lb., the saving in the use of aluminum at 29 cents a lb. is evident. The relative values of copper and aluminum as conductors for electricity will be found fully explained in the "Street Railway Review" for Mar. 15, 1899, page 157.

RAILWAY PROJECTS IN BERLIN.

The city of Berlin, Germany, is experiencing an unusual degree of activity in the construction and operation of street railways, which is described by D. B. Macgowan, correspondent of the Chicago Tribune, as so extensive that the city might easily be mistaken by a visitor for a street railway experimental station. Ten large systems are either in operation or under construction in that city. These are (1) the overhead "Ringbahn" constructed of brick, stone and iron, making a double loop around the outside and through the center of the city, (2) an elevated railway of steel construction nearing completion which will connect the eastern with the western suburbs, (3) a surface road on the underground trolley system, (4) an extensive system of horse, trolley and storage battery lines, (5) a storage battery line to Charlottenburg, (6) a surface steam railway in the western part of the city and suburbs, (7) a number of independent electric roads, one of which is being extended to Pottsdam, a distance of 20 miles, (8) horse and electric omnibuses and Siemens & Halske combination storage battery omnibus and trolley car, (9) a tunnel road connecting two suburbs separated by the Spree River, and which is to be extended, and (10) a complete system of underground railways which the city is planning to connect the railroad depots which are not situated on the Ringbahn loops. This will be an extensive system penetrating the most populous and busiest sections of the city.

The Newtown (Pa.) Electric Street Railway Co., was the victim of trolley wire thieves on October 16th. Over 1,500 ft. of the line between Newtown and Langhorne was torn down and stolen, completely disabling the road for several hours.

PENNSYLVANIA STATE CONVENTION.

The annual meeting of the Pennsylvania Street Railway Association was held in Lancaster on October 11th and 12th. The three papers read were: "Car Tracks," by W. H. Huelings, jr., of the J. G. Brill Co.; "The Electric Railway Engine of Today," by W. P. Mackenzie, of the Harrisburg Foundry & Machine Works; and "Track Construction Used in Scranton, Pa.," by Frank Silliman, jr., general manager of the Scranton Railway Co.

Officers elected for the ensuing year were as follows: President, W. B. Given, of the Pennsylvania Traction Co., Lancaster; first vice-president, E. C. Felton, of the Harrisburg Traction Co., Harrisburg; second vice-president, E. H. Davis, of the Williamsport Passenger Street Railway Co., Williamsport; treasurer, W. H. Lanius, of the York Street Railway Co.; secretary, S. P. Light, of the Lebanon Valley Traction Co.; executive committee, W. B. Given, Frank Silliman, jr., S. P. Light, W. H. Lanius, John A. Rigg.

The next meeting will be in Pittsburg, the third Wednesday in September, 1900.

CAR TRUCKS.

Read at the Eighth Annual Meeting of the Pennsylvania Street Railway Association, Lancaster, Pa., Oct. 11-12, 1899, by W. H. Heulings, jr., of the J. G. Brill Co.

After the electrical power equipment of a street railway has been placed in satisfactory condition, its engines and boilers, roadbed and track brought up-to-date, the keynote of its successful operation is to be found in the trucks upon which its cars are carried. I am aware that this is a broad and somewhat surprising statement. I think, however, it is capable of demonstration. While I may not be able to make a conclusive proof of it, I think it is possible to make a very strong case in favor of the truck as a controlling element in the durability of the track, the roadbed and the car bodies themselves. At the same time the truck has very much to do with increasing or discouraging pleasure riding at times when the ordinary traffic is at a minimum.

Short and comparatively light car bodies if mounted upon rough riding trucks which pitch and gallop constantly will pound to pieces the best roadbed and twist and bend the heaviest rails more or less out of shape. This result can be accomplished in a surprisingly short time. I could cite instances where such a result has been reached within two or two and a half years. It has happened also upon roads where only moderate speeds were used and where the car bodies were quite small.

W. H. HUELINGS, JR.

The first electric truck introduced upon street railways was of the four-wheel non-pivotal pattern. Its simplicity and convenience seemed to meet every requirement of the street railway men. It was quite in line with the horse car practice which preceded it, and it was accepted as the natural development of the old horse car. Of this four-wheel type of truck more are now in service than of any other. After going through an extremely rapid development which brought out numerous modifications, a standard form was reached which has proved itself fairly soft on the rails, easy on the car body and comfortable for passengers. Its features are, or should be, a solid side frame, preferably forged, making each wheel piece a single bar. The two wheel pieces connected by heavy end irons are carried upon palms forged on the ends of the wheel pieces. The ideal frame for the purpose would, of course, have both ends and side pieces in one piece without a joint. The expense of such a construction, however, has been found to preclude its use, although the cost of the frame in one piece is but little greater than that of the composite type. Either of these frames gives a positive alinement to the wheels and axles and makes the truck what it should be, a self-contained motor vehicle. It possesses ample strength and stiffness to carry the machinery and has enough vertical strength to make it well fitted to carry by means of springs the body of the carriage in which the passengers are contained. The truck of an electric car has a double function. It is both carriage and locomotive. It is self-propelled and in most cases is fitted to haul a trailer when necessary. It has also to perform the function of a carriage, that is, to support the car body easily and while carrying it prevent the passengers from feeling those irregularities of motion which are set up even on the best tracks. The arrangement of what may be called the carrying springs, to which the easy riding of the body is due, is but little understood and the violent pitching and galloping, for which four-wheel cars are notorious, is largely due to ignorance in regard to the work which different forms of springs are fitted to perform. It is perfectly easy, by a slight change in the arrangement of the springs beneath the car body to make it gallop persistently even on a good track. On the ordinary or poor tracks such an arrangement would set the car "teetering" until standing in it would become practically impossible.

The standard four-wheel truck which is known to the world as the Brill 21-E has eight journal box springs. This is double the number usually employed. The advantage gained by increasing the number is found in the great steadying power obtained by having a spring on each side of the journal box instead of a single spring on top and in softening the work of each spring. Not only is the box held steadily without friction or canting in the jaw, but the large number of springs carry the truck frame smoothly, and an advantage is gained inasmuch as two springs accomplish easier motion than a single spring of nearly the same height and the car body can with double journal springs under the frame between it and the journal boxes be rested at a lower height relatively to the rails. It therefore starts by making the locomotive itself easy riding and low in weight. Upon the solid frame of the locomotive are placed the springs which carry the body of the car. These are so disposed that the body receives practically equal support from end to end. To carry the load, the outer ends of the wheel pieces are made with a large and sufficient factor of safety. The outer springs are half elliptics, while those at each side of the jaws are helical springs. This combination has been adopted because it reduces the galloping or pitching motion to a minimum. With such a combination it is almost impossible to set up a continuous galloping motion. The riding is in fact as smooth as is possible with a four-wheel truck.

The records of the Patent Office show that there have been almost numberless endeavors among inventors to devise a truck for four-wheel cars which will possess the feature of equalization. This word, while not quite exact, has come to have a definite meaning among railway men. When applied to a truck it means that the load upon each wheel remains constant even when the wheels are standing or running over very irregular surfaces. The aim of the inventors has been to make a four-wheel car and truck in such a way that the load upon any one wheel would never vary. This has been accomplished but the result has been far from satisfactory. The four-wheel equalized cars have been found to ride extremely hard. In all cases that have come under my observation their pounding while in operation has been so severe as to prohibit their use. With the ordinary construction the fatal defect of the four-wheel car is that when an irregularity occurs in the track, such as a loose or defective joint, nearly the whole weight of the car is instantly concentrated upon two wheels whenever the wheel passes over this low point. Concentration of load takes place instantly upon diagonally opposite wheels. As the car passes forward the load changes its corners. At each change a severe blow is struck upon the rails and there is usually a distinct tendency to a side motion. This ultimately bends the rail so that the joints are thrown outward, each rail becoming slightly convex toward the centre of the track. Where rails are laid to break joints over a private right-of-way, where there are no passing teams, this pounding of the car upon the track is sometimes very forcibly illustrated. Opposite each joint will be found in the center of the rail a depression caused by the blow which the load strikes when the wheel dropping at the joint, shirks its work and throws the load upon the diagonally opposite wheels. In going down the wheel strikes the rail a severe and sharp blow out of proportion to the weight as it is forced down by the spring after the fashion of a hammer.

Any irregularity in the wear of the wheels under four-wheel cars introduces another and very serious cause of destruction to the rails, which aggravates that just mentioned. This irregular wear results in the car "hunting" when in motion. That is, it is constantly

"weaving" from side to side and strikes an outward blow at every joint. In the old fashioned horse car this motion ultimately resulted in the destruction of the track. I know it is the fashion to say that the rails are distorted and destroyed by the heavy trucking that goes over them. This is nonsense. It only requires the most superficial observation to show that with their large wheels, long springs and easy motion that the heaviest trucks as they move on the rails are never as destructive as the defective four-wheel truck. It must be remembered that a wagon having a fifth wheel is perfectly equalized, and in passing over such inequalities as a low joint its load is not concentrated upon a single pair of wheels. The two-horse street car with its four to six miles an hour could easily destroy the rails of its day, and the lightest electric cars when mounted on four wheels and running at the slowest speeds which are found profitable in electric railway work can and do ruin 90-lb. girder rails in a length of time which is altogether too surprisingly short for the profits of the company.

It may be considered heresy to make such a statement, but in spite of that, I doubt whether four-wheel cars are suitable for any service on modern street railways. I cannot conceive how a road which has a small income can afford to have its roadbed and rails destroyed by four-wheel cars. Even in the smaller towns and cities larger units than can be carried on four wheels are found to be profitable. Well substantiated figures from both steam and street railway engineers point to the fact that the cost of propulsion by steam or electricity varies with the number of units rather than with their size and is practically independent of the load carried. The larger the street car the greater number of passengers can be handled with a single crew, and the higher the speed the smaller number of cars required for a given service or for a given headway. For profitable operation speed is indispensable to the street railway. The four-wheel car, whether it be of large size or small, should not be run at a high speed, because the destructive power of the car increases in proportion to the square of the speed. I think I have said enough to make a strong case against the four-wheel car, and certainly sufficient to prove that the wrong kind of truck driven at the wrong speed can pile up an uncomfortable repair account.

In city and suburban service high speeds are indispensable, and a large tractive force is necessary. Here long cars are also required, and the maximum-traction truck appears to give the greatest satisfaction. In 1896 Mr. Darlington in an address before the Street Railway Association of Pennsylvania took the ground that the maximum-traction trucks were not wanted for service of this kind, that their friction was greater than with four-motor cars and that the maximum-traction trucks were "Practically no better than were the light wheels made the same size as those carrying the motor and the weight of the car placed centrally over the truck." Looking back now at Mr. Darlington's remarks it is easy to say that he was mistaken in his statement of facts as well as in his deductions. Careful experiments have proved that the maximum-traction car requires no more power for its operation than the four-wheel car. To fortify this assertion I will cite an instance undoubtedly of interest. In 1894 the New Orleans Traction Co. contracted with the Louisiana Electric Light Co. to furnish power for its cars at a given rate per car per day. The fact of the Traction company introducing maximum-traction truck cars was the foundation for litigation brought by the Light company, claiming more compensation to cover the increased consumption of electricity. The Traction company's engineer, B. Willard, and the Light company's engineer, J. B. Craven, selected Walter H. Knight, then of the General Electric Co., as the third of a committee to conduct a series of tests. Their report was: "We cannot find that the 22-ft. cars on maximum-traction trucks consume any more power than the ordinary 18-ft. car bodies on single four-wheeled trucks, such as used on some of the New Orleans Traction Co's. lines." Experiments by the Consolidated Traction Co., of Jersey City, showed that the repairs to motors and trucks varied directly as the number of motors and was independent of their size, that the eight-wheel car had a repair account practically twice as large as that of the four-wheel cars. Now the maximum-traction truck gives two motors to the car. It carries a long and heavier car body and without increasing the weight of the driving wheels over the weight on the wheels of a four-wheeled car, yet it allows the whole weight of the car body to be increased by one-third. At the same time it has ample traction for the most rapid running. I may allude to the Washington, Alexandria & Mount Vernon line where maximum-traction trucks are habitually run at a speed of 40 miles per hour. The advantage of this truck over those with four wheels of equal size with either one or two motors per truck, is that the car can be brought so low that a single step of the usual height gives access to the platforms. This cannot be done with the four wheels of equal size. Increasing the height of the step or increasing the number of steps increases the danger of accident and decreases the speed of the car and consequently its earning power. The maximum traction truck can be successfully used beneath open cars as well as closed. This simplifies the equipment and reduces its cost. Four wheels of equal size, unless the car body is made of great width cannot be used under open cars. Even then the height of the step becomes objectionable. Referring again to speed, I may say that they are capable of anything allowable on street railways. In fact it may be of interest to know that the road which makes the greatest daily mileage of any in the country uses maximum-traction trucks. From this and the previous reference it is evident that the maximum-traction trucks, properly arranged, are up to any possible speed requirements of the ordinary city and suburban traffic. They can run around curves of the shortest radii. They have a tractive force which makes them favorites with the motormen during the winter snows, as is evidenced by the remarks frequently heard in the car barn on the eve of a snow storm to the effect that "if we can get a maximum traction truck we can get through." In 1897, on the line of the Brooklyn Rapid Transit Co., the cars mounted on maximum-traction trucks more closely adhered to their schedule than any others, and an official of the Buffalo Railway Co., of Buffalo, N. Y., stated to me that the cars on maximum-traction trucks were the only ones out of the whole equipment that maintained their schedule time in heavy snows. They are noted for their ability to "get there" under all circumstances.

The contrast between the riding of a car carried on maximum-traction trucks and one on a four-wheel truck is very great. The steadiness of the body on maximum-tractions is at once remarked by passengers. An example of this is found in Philadelphia where the ease and steadiness with which the long cars are carried is a matter which has apparently not escaped the notice of any passenger who has tried both styles. Where cars of both kinds run over the same route it is not unusual to have passengers wait for a double truck car. For the heaviest service in the world where easy entrance and exit is absolutely essential and where a high acceleration is called for the maximum-traction truck has demonstrated its advantages. It is used on the electric lines of the Metropolitan in New York City and the Brooklyn Heights in Brooklyn. For such service it is indispensable.

The suburban and interurban services which send cars to city centers have the most exacting requirements. They have to run long distances in the country over T-rails with the ordinary construction, frequently at high speeds over private right of way; they also are obliged to enter cities and conform to the ordinary conditions of city service, where grooved rails are bordered by stone blocks. Shallow flanges and narrow treads are a necessity in the cities. In the country the speed is often as great as 50 miles an hour. For this service an entirely different type of truck has been developed. It is known as the "Perfect" passenger truck. Several years ago the Brill company designed a truck for a special and very difficult service, and it must be confessed that beyond meeting the unusual requirements they had little or no idea of the value of the invention which they had made. A truck was built and put in service with fifty or a hundred other trucks. At the time the purchasers were promised that if this one was not satisfactory it should be replaced without expense. The history was rather unusual. The easy riding of the car mounted on these trucks was so much greater than anything else on the road that the people waited for it, and its fame soon spread along the line. Without knowing it, the first radical improvement in 30 years had been made in the type of truck known on steam roads as an equalized swing beam truck. Its salient features are actual and complete equalization of the weight thrown upon each wheel. The ordinary steam passenger truck is very defective in this respect and leverage is greatly against the springs. In the new truck the equalizing bar, spring plank and swing beam are all combined in a single set moving together. The links are removed from the transoms to the wheel pieces. Three sets of springs instead of two are used, one of which is placed in the links themselves. Journal springs are placed on top of the axle boxes. The old fashioned short link is replaced by one which may be more than double the length of the old style. The result is an ease of motion in the car body, almost impossible with the old type of truck. At the same time it is found that owing to the even

distribution of the load on the wheels at all times, and the absence of any shock upon the wheel flanges when passing a curve or meeting a crook in the rails, that it is almost impossible to make the truck jump the track. In the three years during which these trucks have been in use the only case of derailment which has come to my knowledge was that of a runaway on a steep hill. The car left the rails when it encountered a sharp curve at the bottom of the hill. Even this could hardly be called a derailment, for I understand the car left the trucks, pitching over onto its side, before the trucks were thrown from the track. The No. 27 truck is the type from which we have developed the No. 27-G especially for city and suburban use. It has four motors, an inside brake and so short a wheel base that it can be used on cars which have to pass short city curves. It will be understood that the swing of the wheels is so short as to make it possible to use them under cars of ordinary width without unduly raising the car body. The equalizer is replaced by long half elliptic springs which also take the place of the elliptics on the spring plank. The four motors employed give the car the greatest possible tractive force and fit it for running at any desired speed. For certain purposes it is possible to modify this truck in such a way as to make it perform many of the functions of the maximum-traction, using only one motor per truck. In this case the motor is carried outside the axle, thus bringing a considerable increase of weight upon the driving wheel while the center bearing and center radiation is retained. The spring links, the swing motion and the perfect equalization, three sets of springs, together with journal springs of ample size are features which are retained and which together are the reason for its exceptionally easy motion. The "Perfect" truck has shown itself capable of meeting a surprisingly large variety of conditions. At all times it retains its characteristic ease of riding.

While I have no figures to present to you relative to the diminished flange wear of wheels in these trucks, yet it is notable owing to the softening of the side motion by the spring links little pressure is ever brought upon the flanges. The truck may be forced violently from side to side by the irregularities of the track, yet so perfectly is the body hung that it only follows the truck slowly or allows the truck to move without itself moving at all.

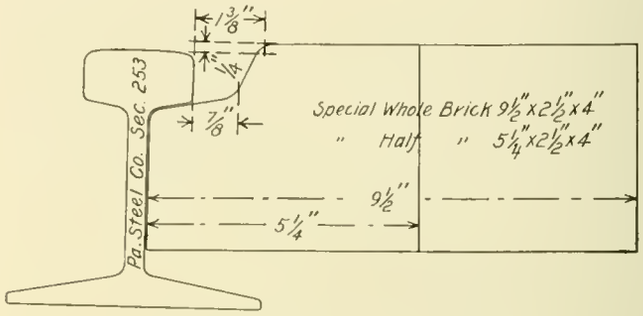
Incidentally in the construction of this type of truck great gain was made in strength. Instead of transmitting the weight of the car body through the transoms to the center of the wheel piece and then from the wheel piece out toward the spring pockets, a considerable distance, in the present case the weight where the spring links throw it upon the wheel piece is but a short distance from the jaws. The wheel pieces are constantly subjected to very little strain and the truck is much stronger in consequence. In fact getting out of square from the stresses set up in running ought to be and is practically unheard of.

TRACK CONSTRUCTION USED IN SCRANTON, PA.

Read before the Pennsylvania Street Railway Association, Oct. 11-12, 1899, by Frank Silliman, Jr., General Manager Scranton Railway Co.

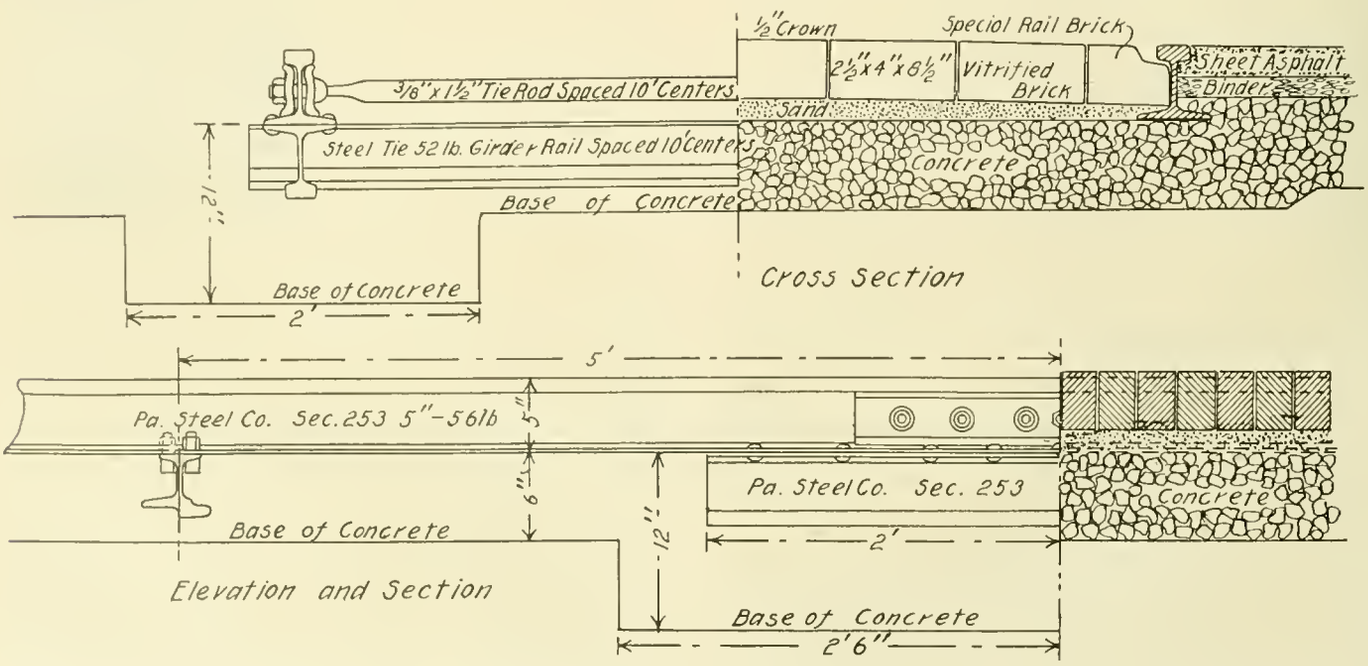
In the design of a construction of track that has been used on the lines of the Scranton Railway Co. to a considerable extent during 1899, the two main points sought, were a rigid joint without the use of an unduly heavy rail between the joints, and the employment only of such materials as are practically imperishable.

The rail used was a 5-in. T section having a base of a width equal to the height of the rail, and weighing 57 lb. per yd., with a web 3/8 in. thick, and having parallel sides. The joint consists of the ordinary six bolt joint that has been heretofore furnished with such rails, except that it has been rolled to a little heavier weight. Entirely in addition to this joint is what we claim to be a novel fea-



SPECIAL BRICK USED AT SCRANTON.

ture of the construction; it is a 4-ft. length of the same section of rail, inverted and placed under the joint, and secured to it by eighteen 3/4-in. rivets, which are driven by a pneumatic bridge riveter in the field. Four of these rivets are of copper, and constitute bonds of the joint. As long as the rivets hold tight, this makes a rail that is 10 in. in depth at the joints, securing a girder as deep as the heaviest sections of rail that are rolled. Between the joints it is, of course, not necessary that the rails should be as heavy, and the great waste in the ordinary 9-in. or 10-in. rail track construction is owing to the fact that there is so much of this great weight of rail used in between the joints, in order that the joints themselves may be of the necessary stiffness and rigidity. Through the middle of each joint is a tie-rod, and every 10 ft. of track contains a tie rod. Ten feet apart and intermediately between the tie rods, are ties which are made, in our own case, of a 52-lb. girder section that we have been taking up from old track. Almost any rail section may be



TRACK CONSTRUCTION AT SCRANTON, PA.

used for ties that has a sufficient width of base to allow the bolt holes to be drilled in it. The ties are bolted to the rails, and not riveted. The tie rods are the same as those that have been in use for many years, being flat bars, so as to interfere as little as possible with the pavement. This metal part of the construction having been

SIDE VIEW OF RIVETED JOINT.

assembled, as heretofore described and surfaced and lined on blocks on a bed prepared by grading and by rolling with a 10-ton roller, is filled underneath with a sub-structure of concrete having a uniform thickness of 6 in., except at the joints and at the ties, where the thickness of the concrete is increased to one foot. The work

BALLAST CAR.

of concreting having been completed, the whole is allowed to stand for at least five days, a week if possible, before any traffic is allowed on the rails. The top of the concrete is the bottom of the rail, of course, and this leaves a height of 5 in. from the top to the concrete to the level of the surface of the street. The pavement between the rails is made of brick which are 4 in. in width, leaving 1 in. for sand on top of the concrete. The bricks next to the rail are of special form, made so that the surface of the pavement is the same as the surface of the head of the rail, with the exception of a groove for the flange along the inside of the rail. On the outside of the rail, plain bricks are used which come up against the head of the rail, and the space between the head and the base, out to a line flush with the head of the rail, is filled with cement mortar. The whole brick pavement is grouted with cement grout, and rolled to a level surface and uniform crown, by a 5 ton roller, running on the rails of the track.

The machinery used by us in this construction is shown in the accompanying photographs and drawings, and a sample of the street is shown also, in a photograph. The work of construction is very much facilitated by the use of machinery, and the uniformity of the work is, no doubt, very much greater than in the case of hand work. Our concrete mixer is mounted on a low car, and driven by a No. 3 Westinghouse street car motor, while the pneumatic riveter is mounted on a car having on it a derrick for handling the riveter, and a motor-driven air compressor for furnishing the air.

This construction has given a great deal of satisfaction to the authorities of the city, and seems to be very popular with those who have to drive on streets where tracks are located. More can

DUMPING BALLAST.

be said of the durability of this construction in the course of a few years time, but it being entirely free from such perishable material as wood, should last a long time. The lightness of the rail is compensated by the fact that it is supported at all points. A wider base for the rail would still further improve the construction.

RIVETING JOINTS.

COMPLETED STREET.

VESTED WRONGS.

A paper upon this subject was read before the League of American Municipalities at Syracuse, N. Y., Sept. 19-23, 1899, by Hon. Robert P. Porter. Mr. Porter said in part:

So far as my own personal inquiries in relation to municipalization of street railways indicate anything, they clearly point out that the glowing accounts we have had of such experiments by returned American travelers from the other side are valueless when submitted to practical American tests. Not only are the statements of success and profits greatly exaggerated, but municipal ownership has not made anything like the headway in the United Kingdom which many would have us believe. Indeed, there is much misapprehension in the United States on this subject. Some accounts would seem to indicate that England has municipalized such undertakings as water, gas, electric lighting and street railways to a much greater extent than the facts warrant. In reality, if an absolutely accurate comparison could be made between the United Kingdom and the United States, it is doubtful which of the two countries would lead in this respect. I refer, of course, to public service, with profit-earning possibilities. For example, should we consider the four important branches of service—the supply of water, gas, electric light, and street railways—together, it would be safe to say that honors in favor of the municipalization of these undertakings would be about equally divided in the two countries.

To those without practical experience in handling such vast undertakings, and who therefore cannot possibly realize the obstacles in the way of turning over such stupendous enterprises as these, requiring, as they do, so much expert knowledge, to officials in no way specially trained, municipalization is no doubt a fascinating idea. Hence we find many writers at home taking it up with avidity, and as a result the literature on the subject during the last decade has increased far more rapidly than the experiments themselves. A few instances of municipal ownership have been made to do duty for so many books, essays, lectures, and articles that the practical man of affairs is beginning to inquire for additional particulars. Exaggerated and enthusiastically written accounts of the municipal millenium of Glasgow and Birmingham no longer arrest his attention, while the sudden change in public sentiment in 1894 in favor of a halt in the startling experiments inaugurated by the London County Council has greatly increased the doubts of those who are not sure that, even if the success in this direction had been as great as intimated in England, similar experiments might not be fraught with great danger this side of the Atlantic.

The results of my own inquiries into the working of municipalized street railroads in England are supported by almost identically the same investigation and analysis of the same facts by Benjamin Taylor, F. R. G. S., who thus sums up his facts in the August (1899) Cassier's Magazine:

"This review, then, of municipal enterprise in the working of tramways in the United Kingdom, leads to the conclusion that in no single instance has it been perfectly successful. Glasgow furnishes the nearest approach to success, but in Glasgow, with a small track for an enormous dependent population, it would take very bad management indeed to produce financial failure. And in Glasgow the system is a very long way short of perfection, while the retention of horse haulage renders the future exceedingly insecure. In no single instance can the municipal working of tramways be demonstrated to be a commercial success; and in no single instance has municipal management fulfilled the socialistic ideal, either in respect of its servants or its passengers."

The fact that these socialistic experiments rarely meet the anticipation of the labor side of the problem is receiving emphasis at this moment in London. In August last, when in London, the newspapers were giving in detail the woes of the County Council tramway employes, who were piteously calling upon their brother omnibus drivers—employed by soulless private corporations, but as well paid as any labor in Great Britain—to come to their rescue. When in London the general secretary of the union gave me a brief list of the grievances of the men thus employed by the London County Council—the body that started out six years ago to relieve all the burdens of London labor and London poor. From this it appears that the men are being asked to sign an agreement to work under the Council's rules and regulations, many of which are said to be decidedly unfair toward the workers. In one case, by Rule 33, the men are required to be always within call. During their hours of rest they are liable to be called upon at any moment to begin work, so that they dare not leave home, and cannot call a single hour of the week their own. Again, by Rule 31, any disparaging remarks made by employes concerning the conduct and management of the tramway system are to be treated as a breach of the rules, and Rule 35 provides that any such breach of rules may be punished by instant dismissal. Further, although a workman is liable to instant dismissal, he may not leave of his own accord without giving a full week's notice. The workmen also object to the exceptionally long hours which they are called upon to work, one instance being an unbroken period of twelve hours and twenty minutes on Sundays. The extra men, moreover, are obliged to loiter about the yards for hours without getting a job, and their work is paid for at the rate of 9s. a week less than that of the regular workers. The men complain that they have been left in the lurch by the Council. The London County Council has always prided itself with being a model employer of labor. Now these men openly claimed to me a few weeks ago that the union could prove that the London County Council was the worst. The tramway enterprise has been conducted contrary to all the principles of trade unionism. Surely the second condition of these men is worse than the first. A London newspaper, in an editorial, takes this view of the subject:

"What seems most likely is that, when the Council came to examine the subject of tramway administration practically, they found that the prospects of extensive improvements in the conditions of labor which the advocates of 'Collectivist' control had held out could not be realized without throwing upon the rates additional burdens, for which even a progressive majority lacked the courage, when it came to the pinch, to become responsible. . . What it means is that the pressure now applied to the men will be transferred to the masters; that under pain of losing votes the Progressives will be urged to concede what their servants insist upon. It would be an interesting struggle, for outsiders to watch, if it did not seem so very probable that the settlement will be arranged at their own expense."

This is a phase of the municipal ownership question which American taxpayers will do well to study. When the wages of men become political questions the men will likely get the increased wage, the political party the votes, and the taxpayer the bill of expenses. If it should appear that, with officials less subject to political influences than the officials of American cities, England has made no greater headway on the whole in the municipalization of such undertakings as water, gas, electric lighting and street railways, then it may be worth while for us to study more carefully that middle and safer ground which may be found in good working condition on the Continent, and which has been able to obtain the best expert service of private enterprises with such municipal control as absolutely protects the public interest; in other words, the highest efficiency of service, adequate compensation for rights and franchises conferred, reasonable public control, without making the municipality an enormous labor employing bureau, with its innumerable complications and stupendous dangers.

It is doubtful, when all the important factors of the problem are taken into consideration, if the advocates of municipal operation can point to a single instance in which such service is performed better and cheaper and on more intelligent principles abroad than in the United States. If American labor would be contented with the foreign scale of wages, we might be able to give our theoretical friends even lower car fares than they now enjoy. This statement is made, however, as the lawyers say, without prejudice to the claim which I believe can be sustained, namely, that in spite of the great difference in wages, such service is performed in the United States today as well and cheaper than similar service in any European city.

Politics, red tape, ignorance, timidity, opposing interests, and the deadly fear that private enterprise should make a dollar profit, have all helped in England, and to a lesser extent on the Continent, to retard the entension of street railways to meet the pressing demands of population. In America, however, private capital has had full swing, and with a courage almost akin to recklessness has not hesitated to discard, regardless of cost, one system of propulsion as fast as a better offered. Whatever the sins of the American street car man may be—and, like all the rest of humanity, he is far from perfection—he is up-to-date. He has planned his railway system on broad lines, including the districts that pay and the districts that must be run with a loss. He has gone ahead and taken his chances with the rest of the community, pinning his faith on the growth of the city and the increase of the suburban districts. He has not

been contented to pick up the pennies within the city walls, but has boldly branched out in all directions, building up suburban districts where none existed, and increasing real estate values along the route. The American street railway man may have driven good bargains for himself, and directly he may not pay much into the coffers of municipalities as toll for the use of the streets, as his co-laborer beyond the Atlantic. Weighed, however, in the balance of good business and common sense, he can point to achievements which far outweigh the results attained in England, where municipal pettifogging has effectually soaked the enterprise out of street railways, and on the Continent, where private enterprise has only been allowed to go ahead after being enveloped in a sack of governmental restrictions. Instead of petty railway budgets, showing so much profit to the municipality, the American city can point to largely increased real estate values, and millions added to the tax rolls, in a large measure the result of distributing the population of our cities beyond the boundaries far into the country districts. Look at the area of American cities compared with the larger cities of Europe. Without cheap and rapid transit, all the recent extensions of the boundaries of our cities would have been impossible.

The American street railway man may therefore point with righteous pride to his track mileage, exceeding by 6,000 miles that of Europe, to the 4,000,000,000 passengers which he annually conveys to and from their homes, and to the fact that he has not waited for the population to come to him, but has gone out, true American fashion, in advance of population, and built up districts at great expense, which he now works with a profit, not alone to himself, but to the city whose revenue from taxes is thereby increased. On the question of charges, the American street railway compares favorably with similar systems abroad. In the first place, we have solved the question of a uniform fare, while nearly every municipality which I have visited in Europe is struggling, apparently hopelessly, with this question. Why? because the municipality has not the courage of private enterprises. A uniform fare, it is contended, gives the longer haul an advantage over the shorter; so, to avoid this, in Glasgow the acme of absurdity has been reached by a one-cent fare for a trifle over a half a mile. It is far better for a man to walk half a mile than to ride anyhow, and quicker, it seems to me, after trying halfpenny fares on the newly inaugurated municipal horse tramways of the Scottish city, which social reformers claim has solved the true art of municipal government and municipally operated transit.

With their eyes bent on the puttering short haul, the street railways of the United Kingdom, and, to a lesser extent, of continental Europe, have failed to realize that it is the cheap long haul that relieves the congested spots of our great cities; that creates cheap homes; that carries the people into the suburban districts; and, lastly, that builds up new taxable areas, which ultimately give back to the city a hundred-fold more than it would ever make trying to do for itself that which can be far better done by private ingenuity, economy and enterprise. So Liverpool and London and Paris are all at this moment in their new street railway enterprises agitating the uniform fare question, as though it was something new and strange and wonderful. To the canny Scotch mind, however, in Glasgow, it seems a dreadful thing that one passenger should get a fifteen mile ride for the same price paid by another passenger for the privilege of going one mile. I say fifteen miles, but on this point I may be corrected because it was only the other day I was told that in New York City you can now ride for 5 cents along 25 miles of road and through territory which 10 years ago would have cost you 25 cents and three hours' time. The efficacy of the American nickel, it is true, has helped us out, though with the elaborate systems of transfers inaugurated in the larger cities, the actual American fare cannot be measured by 5 cents. In New York City the enterprising Metropolitan Railway Co. has, during the last three years, increased the transfer system from thirty-two millions in 1896 to sixty four millions in 1897, to ninety millions in 1898, and to one hundred and thirty millions in 1899, thereby reducing the average fare to about 3 1-3 cents, which, as I have shown, is less than the average fare on the Paris tramways, less by more than a quarter of a cent than the average fare on the omnibus of Paris. In London, where the "Penny Bus" is so much in evidence that one would imagine he could get all over London for 2 cents, the mean rate per mile is nearly 2 cents—that is, 92 of an English penny. The tramways of London charge over one and a half cent per mile, and the fares range, as do those of the omnibus, from 2 cents to 12, according to distance.

DELEGATES TO THE STREET RAILWAY CONVENTION AT THE SOUTH SIDE ELEVATED POWER STATION, OCT. 20, 1899.

VISIT TO THE SOUTH SIDE ELEVATED PLANT.

At the invitation of the Westinghouse Electric & Manufacturing Co., about 100 attendants at the convention visited the power station of the South Side Elevated R. R., the company furnishing a special train. When the tour of inspection was finished the party was grouped about one of the large units and a photograph taken, from which the accompanying engraving was made.

The Chicago council judiciary committee has decided to recommend the adoption of a resolution authorizing the mayor to appoint a commission of seven aldermen to gather information on which to base ordinances for renewal of the street railway franchises. The commission is given the power to gather information and make recommendations regarding the questions of terminals, transfers, switches, motive power, rates of fare, municipal ownership, compensation to be paid the city, tunnels, accommodation of passengers and other terms and conditions on which franchises should be extended.

The Third Avenue R. R., of New York, on October 21st, began operating by the conduit electric system that portion of its road extending from 65th St. to 120th St. The company has recently let a contract to the Electric Storage Battery Co., for storage batteries aggregating 10,000 h. p. These will be located at two sub-stations on the system, for regulating and sustaining the voltage on the line.

MECHANICAL DEPARTMENT

CAR BUILDING IN MINNEAPOLIS.

The Minneapolis Times recently contained the following complimentary notice of Master Mechanic Brown, of the Twin City Rapid Transit Co.:

"The cars of this company are being built at its shops, 31st St. and Nicolett Ave., and were designed by W. M. Brown, the company's master mechanic, and are being built under his direction. Mr. Brown has been with the company for nearly ten years, and for about five years has been master mechanic. All new cars and the rebuilding of all the old cars and motors has been done under his direction. Mr. Brown takes second rank to nobody as designer and car builder and the company acknowledges his ability as a street car man by the confidence it places in his ability to manage this, one of the largest departments of its system. His work speaks for itself and one has only to look through Mr. Lowry's private car to be convinced of the truth of this assertion."

M. C. B. BRAKE SHOE TESTS.

The Master Car Builders' Association, through its Standing Committee on Brake Shoe Tests, has decided to make another series of tests at an early date, which will include only brake shoes of new kinds that have not already been tested by the committee, and which may properly be considered as being on the market, or having some extended use on some railroads.

All makers of brake shoes desiring to enter their designs should communicate at once with the chairman of the committee, stating to what extent their shoes are in use. Address S. P. Bush, superintendent motive power, P. C. C. & St. L. Ry., Columbus, O.

SMALL ROADS ECONOMY.

BY G. J. A. P.

Articles referring principally to small roads may not be of very much interest to many of the readers of the "Review," but there is a large number of small roads, the management of which may be interested in a few experiences along the line of repair economy.

There is so much to be said about economy for any road that it is advisable to start at the "root"—the power house. My experience has been, that to have the best firemen and engineers, is the cheapest in the long run, for the reason that a capable man in this place will keep engines and boilers in far better condition, and consequently the oil and coal bills will be proportionately less than if the machinery is in less experienced hands. To allow boilers and engines to run down is simply increasing the expense, for what is saved at the start will be expended twice over in a short time thereafter.

In the matter of cars and car repairs, a great many managers will buy old and worn out material, expecting it to answer their needs; it does so for a short time and then it begins to need repairs and in the course of a few years (perhaps only months) the company has some worthless cars and equipments on hand, which means a considerable amount of money expended and nothing to show for it. The same is true of the track and roadbed. A tie 6 in. x 6 in. x 6 ft. 6 in. can be bought very cheap; but, as a good building requires a good foundation, so a good roadbed requires a good substantial tie and rail.

In regard to the repair shop my experience has been that few roads look to the small things with sufficient care. Taking charge of a small road some time since, I found on arrival that the total of the company's tools consisted of a few wrenches, one hammer, a saw and a few other small articles. Other tools were "borrowed" from time to time, and the owners supplied with "annuals" which really paid in a few weeks what all the tools were worth.

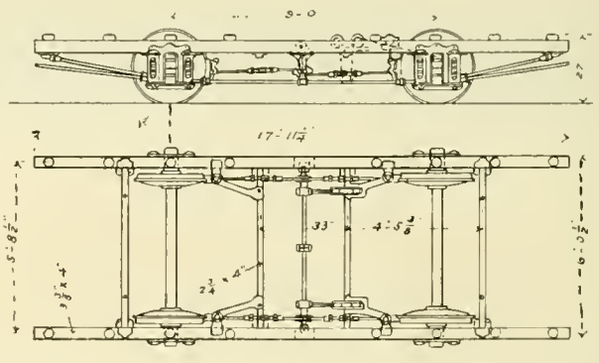
Too many roads count only on the original expense, and do not consider what they are paying at the blacksmith and machine shops for work which could easily be done "at home," if the company would buy the necessary forges, anvils, drills and tools. At an expense of $100 to $150 any road can supply itself with sufficient of these tools to do any ordinary work of this kind.

A wise plan in selecting your trainmen is to secure one of each of the various trades. Where a road has a painter, a carpenter, a blacksmith, and a machinist on its pay roll as trainmen, it is prepared to do its own work very easily and the saving in repair bills will soon become notable. If, however, a road is obliged to send everything out which it has to do in these lines, it will be paying high prices for it, not to mention the delays.

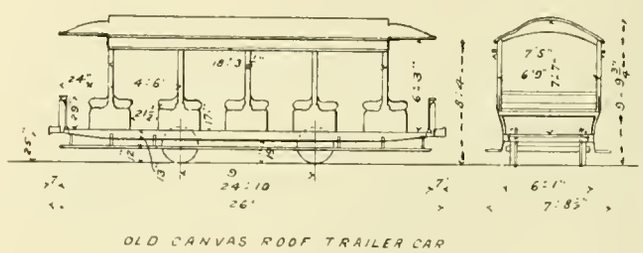
Above all, a too watchful eye cannot be kept on the wastes about a shop or car barn. Have a place for every piece of scrap, and see that it is put there. And keep your oily waste outside the buildings.

POCKET REFERENCE DRAWINGS.

Mr. G. O. Nagle, assistant general manager and superintendent of the Chicago City Railway Co., has originated a plan for bringing into convenient shape for reference, data relating to different features of the system, that may be of interest to officials, holding similar positions with street railway companies. His idea is to



MOORE WOOD TRUCK



OLD CANVAS ROOF TRAILER CAR

reduce to small uniform drawings, 6 in. x 4 in., plans, end and side elevations, etc., of different types of cars, trucks, and other apparatus, in use on the road, and diagrams of car barns, power stations and other buildings. These drawings give dimensions and sizes, and in the case of buildings show the location of tracks, division of floors into offices, etc., thus condensing into a very small space an immense amount of information that a general manager or superintendent is constantly requiring.

COST OF POWER FOR ELECTRIC RAILWAYS.

Output Measured by Wattmeter in Each Case.

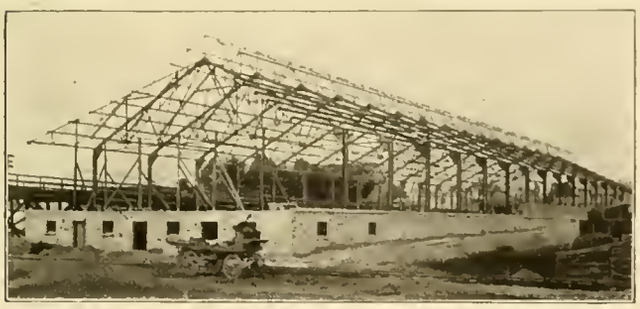
Station.	Month, 1899.	Monthly Output, Kilowatt-Hours.	Cost of Electrical Output per Kilowatt-Hour Cents. Fuel.	Labor	Supplies, Oil, Waste, etc.	Water.	Repairs.	Total.	Gals. Cylinder Oil per 10,000 k. w. h.	Gals. Lubric't-ing Oil per 10,000 k. w. h.	Lbs. Water per Lb. Coal.	Lbs. Fuel per k.w.h.	Price of Fuel per Ton of 2,000 Lbs.	Kind of Fuel
1	June	1,316,138	.276	.181	.047	.031	.052	.587	3.95	1.57	12.62	2.63	$2.10	Bituminous
5. Metropolitan Elevated, Chicago.	"	1,108,298	.380	.196	.051	.044	.012	.684	6.94	5.00	...	4.69	...	"
6	"	554,536	.778	.255	.038	...	.095	1.266	...	...		2.51	.98,54**	Oil
8	"	707,625	.386	.175	.012	.037	.005	.615	...	...		..	.	Bituminous
9	"	758,254	.639	.270	.032	.059	.081	1.081	..	.		...	..	"
10 Central Av., Metropolitan, Kansas City, Mo.	"	435,789	.244	.123	.008	.008	.013‡ .005§	.404*	2 1	2.3		4.46	1.00	"

*Miscellaneous, .002. **Cost of Oil per Barrel.
†Engines. ‡Generators.

Mr. Nagle does not use the original drawings, but has blue prints made; these may be carried in the pocket, until they are worn out, when a new set of prints is made. We reproduce two of the drawing herewith, one showing side and end elevation of an old canvas roof trail car, and the other a plan and side elevation of a "Moore" wood truck.

NEW CAR HOUSE DEDICATED.

The new car house of the Cincinnati, Newport & Covington Railway Co., shown partially completed in the accompanying illustration, was formally dedicated on September 28th, and was in full operation by October 1st. The building is entirely of brick and iron, 90 ft. wide by 375 ft. long, and is located at 11th and Brighton Sts., Newport. There are eight tracks extending the whole length of the building, each one having a pit 80 ft. long. At the front end of the building a second floor has been suspended from the roof trusses and here are located the private offices of the chief inspector and the superintendent of lines, and a library



NEW CAR HOUSE, CINCINNATI, NEWPORT & COVINGTON.

and club room for the employes. On the ground floor at the front end are the division superintendent's offices on one side and a fire-proof oil room and a repair shop at the other. Beneath the stairs is the lavatory, which is fitted with bath tubs, showers, etc.

The evening of the reception, September 28th, the house was ablaze with electric lights and handsomely decorated with flowers and bunting. A very interesting program with music and addresses was provided. President Ernst was called to New York, and was therefore unable to be present, and Superintendent Ledyard did the honors for the company. Col. R. W. Nelson, the Democratic nominee for mayor, made an address. The set program was followed by dancing and supper.

When about one-half of the framing for this building was in position on May 21st last, it was blown down by a storm, as noted in the "Review" for June.

Wages of conductors and motormen employed by the Indiana Railway Co., of South Bend, Ind., were increased 20 per cent on November 1st.

A REMARKABLE RECORD.

The Consolidated Car Fender Co., of Providence, R. I., was one of the pioneers in the introduction of life saving appliances for street cars, placing its fender upon the market long before the necessity for such devices had been recognized by managers. It now has the satisfaction of knowing that Providence fenders are in use on more than 5,000 cars in nearly 70 cities and towns.

This fender is of the cradle type, and in its normal position is carried a few inches above the roadbed, but by a slight pressure of the foot or knee the motorman can drop the cradle to the ground at will. In the latest improved patterns, an automatic wheel guard is also provided as an additional protection in the very few cases where the person struck falls in such a way as to be thrown from

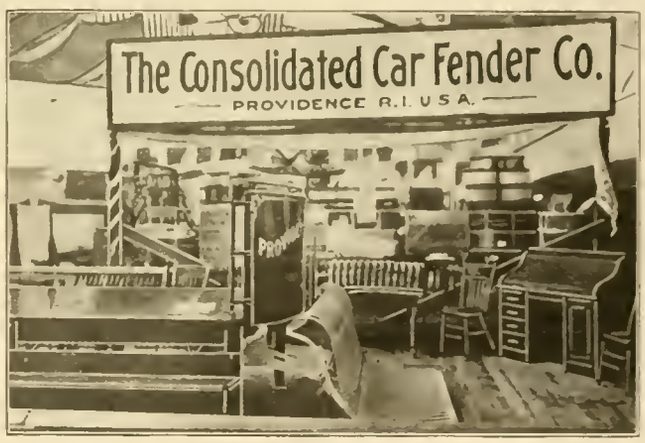


EXHIBIT OF THE PROVIDENCE FENDER.

the fender under the car. This guard is a cradle similar to the main fender cradle and is hung immediately in front of the forward wheels. By a simple connection with a swinging apron it is made to drop whenever the apron swings to the rear, which it must do when it strikes the body of a person.

The Consolidated company's exhibit at the convention attracted considerable attention, as from the samples of Providence fenders shown, their efficiency and reliability were at once apparent. Col. A. C. Woodworth was on hand to greet his many friends and distributed a neat stamp holder as a souvenir.

Electricity will take the place of the cable on the Payne Ave. and Superior St. lines of the Cleveland City Ry. within the next few months.

A New York citizen suggests that the street railway lines ought to be used for removing ashes, garbage and snow, which could be loaded in cars on sidings and the cars drawn by regular motor cars to one general dump.

CONSTRUCTION WAGONS AND CREWS.

The accompanying illustrations show the construction and emergency wagons of the New Orleans City Railway Co. together with their crews, which are well organized and have proved themselves an efficient body of men in this service. The emergency crew which has 144 miles of track in charge, consist of David Rombold, foreman, William J. Kane, J. Criss and Jacob Siebert, linemen, and Oscar Bendix the driver, who has a number of very fine horses under his care. The company places great confidence in this crew which is always in readiness to respond to calls both during the day and night.

The construction crew, which is under the same foreman, consists besides an assistant foreman, of two linemen and six groundmen. These are Alfred Weber, assistant foreman, James Craven and James Harrington, linemen, and V. Jolley, James Howley, M. Joyce, George Bendix, D. Buchman, groundmen; also Jos. Wolf, electrician, and Martin Ryder, driver, who until recently was driver of the emergency wagon of the Nassau Street Railway Co. of Brooklyn, N. Y. In addition to those shown the company has two more tower wagons and two ladder wagons, all of which are stationed at 108 Wells St., New Orleans. The crews take great pride in the appearance and equipment of their wagons and are always pleased to exhibit them to street railway men visiting the city.

ing: Directors, Francis B. Clapp, managing director, South Yarra, Wm. McCulloch, J. M. Pratt, Wm. Cain, and Andrew Rowan, of Melbourne. Auditors, W. S. Flint and I. C. Foden. Secretary, W. G. Sprigg.

EXTENSIONS TO THE BRILL PLANT.

On a recent visit to Philadelphia, it was noted that the J. G. Brill Co., which is now turning out more material than at any time in its history, has begun the erection of a new building, 100 x 200 ft. which will be temporarily used as a machine shop, but is designed for the foundry department. The building is to be equipped with new iron working tools. An extension of 100 ft. is also being made to the blacksmith shop and new machines will be installed. A 150-h. p. Cahall boiler has been installed, making the total boiler equipment of the blacksmith shop 300 h. p., and the total for the plant 950 h. p. The old stable north of the plant has been removed to make room for storing lumber, car wheels, etc., and a new stable is being erected directly along the driveway leading into the plant. Two new electric locomotives, equipped with G. E. motors, will be employed for shifting the material about the works. A new crane car for loading and unloading heavy material has been constructed in the shops; it is provided with friction clutches so that the motor not only drives the car but elevates the load.

CONSTRUCTION AND EMERGENCY WAGONS, NEW ORLEANS CITY RY.

REPORT OF MELBOURNE TRAMWAY CO.

At the recent annual meeting of the Melbourne Tramway & Omnibus Co., Ltd., of Melbourne, N. S. W., the following report for the year ending June 30, 1899, was made:

Traffic receipts	£389,428
Other receipts	10,344
Total receipts	£399,772
Operating expenses	234,145
Earnings from operation	£165,627
Interest, sinking fund, etc.	124,882
Net income	£ 40,745
Interim dividend	14,400
To surplus account	£ 26,345
Balance from previous year	28,474
Total surplus account	£ 54,819

The passengers carried were: By omnibus lines, 603,828, or 6,942 more than last year; by tramway lines, 38,271,382, or 2,026,102 more than last year; being a grand total of 38,875,210, or 2,033,044 more than in 1898. The miles run were: By omnibuses, 280,687, or 2,726 more than last year; by tramcars, 8,084,020, or 100,168 more than last year; or a total of 8,364,707, being 102,894 more than in 1898. There had been no change in the miles of track operated, which still remained at 43½ for cable lines, and 4½ for horse lines.

The following officers and directors were re-elected at the meet-

TRAMWAYS IN VERACRUZ.

There is to be reconstructed in Veracruz a well-equipped modern street railway which will be undertaken by a syndicate of Englishmen who have acquired the property of the Empresa del Ferro Carril Urbano de Veracruz. The organization has not yet been completed but it is understood that the company's capital is to be $250,000.

Vice-Consul Page, of Veracruz, states that there are also five other railways in that city operated by mule power. Three of these are private or individual enterprises run upon a small scale, but are said to be conservatively managed and all of them, including the least profitable, are said to be on a paying basis. They have no bonded debts and no financial reports are given out except to those financially interested. No present improvements are expected to be made except in the case of the road now in English hands.

Patterson, N. J., has been visited by wire thieves. Nearly a mile of trolley wire was stolen near that place a short time ago.

A consolidation of the Johnstown (Pa.) & Somerset Traction Co., and the Johnstown Passenger Railway Co., will shortly be effected.

The Court of Appeals has sustained the action of the New York Board of Railroad Commissioners in granting to the New York & North Shore Railway Co. permission to construct and operate an electric road from Flushing to College Point and Whitestone, on Long Island.

RECENT STREET RAILWAY DECISIONS.

EDITED BY J. L. ROSENBERGER, ATTORNEY AT LAW, CHICAGO.

LIABILITY FOR JERKING OF CAR ATTRIBUTABLE TO CLOSELY FOLLOWING ANOTHER.

Scott v. Bergen County Traction Co. (N. J.), 43 Atl. Rep. 1060. July 8, 1899.

The occurrence of a sudden lurch or jerk of a street railway car, of sufficient violence to throw a passenger off the platform, who was there preparing to alight, and awaiting the stopping of the car for that purpose, the supreme court of New Jersey holds, justifies an inference of a breach of duty upon the part of those operating the car, within the maxim "The matter speaks for itself." That the car was following another closely, which was stopping and starting suddenly, it holds, is a fact for the consideration of the jury in determining the cause of the sudden lurch or jerk, and as bearing upon the questions of negligence arising in the cause.

It is not negligence in itself, the court says, for a passenger to ride upon the platform of an electric street railway car, nor to get up and go there from inside the car before the car has stopped, to await an opportunity to alight.

The railway company operating such a car is bound to exercise a high degree of care to carry its passengers safely in or upon whatever part of the car they are permitted to ride.

Whether a passenger riding upon a platform, or standing there awaiting an opportunity to alight, while the car is moving, should, in the exercise of ordinary care for his own safety, take hold of the hand rail there, the court pronounces a question which, under all the circumstances, must be determined by the jury.

DUTY AS TO ALIGHTING PLACES CHOSEN BY PASSENGERS.

Flack v. Nassau Electric Railroad Co. (N. Y.), 58 N. Y. Supp. 839. June 13, 1899.

As a general proposition, the second appellate division of the supreme court of New York does not understand it to be the law that a street railway company, whose car is brought to a standstill at the instance of a passenger, not at any terminal point or at a stopping place regularly designated as such by the management of the road, is bound, in the discharge of its duties as a common carrier, to furnish to the passenger a safe place at which to alight. The passenger, under such circumstances, chooses the place for himself; and unless there is evidence that its dangerous character was known to the persons operating the car, and that they allowed him to alight without giving him any caution, the court says the railway company is ordinarily not responsible for the unsafe condition of any part of the street, except that which constitutes a part of its roadbed, or which it is legally obligated to keep in repair. But the court holds that if the company provided any part of its roadbed as a place for passengers to alight on, it was bound to exercise reasonable care to keep that particular place safe for the purpose.

Here a car was stopped, on a passenger's signal, near a certain cross street, and when she stepped from the car to the ground the soil of the roadbed gave way under her feet, and she fell to the surface of the street, sustaining a fracture of the hip. The street on which the tracks were had been lowered 18 to 20 inches, making of the roadbed an embankment. There was also evidence that other similar accidents had previously happened to passengers alighting from the cars of this company, under similar circumstances, while the street was in the same condition.

This last proof, the court holds, rendered the company chargeable with notice that its roadbed in that neighborhood was likely to give way under persons leaving its cars, and imposed upon it the duty of exercising greater caution than might otherwise have been necessary to afford passengers an opportunity to alight in safety, even if the company was in no wise responsible for lowering the adjacent surface of the street.

And if the company was unable to maintain its own roadbed in a condition safe for passengers to step upon, by reason of the action of the city authorities in lowering the grade of the street, it was, at all events, the court insists, bound to inform its passengers who were to alight upon that roadbed that they could not do so with safety.

Judgment for plaintiff affirmed.

NO COMMON LAW DUTY TO PROVIDE FENDERS AS SUCH.

Hogan v. Citizens' Railway Co. (Mo.), 51 S. W. Rep. 473. May 23, 1899.

It was argued on appeal in this case that the trial court had committed error in striking out from the petition the averment that the "defendant did negligently fail to use ordinary care in providing said gripcar with a fender to prevent its running over the children it had run down and upon." The court's ruling was that the acts averred did not constitute negligence on the part of the defendant, and hence should be eliminated from the case.

There was no contention that there was any law of the state or any ordinance of the city which made it the duty of the defendant to place fenders on its cars. The obligation to do so, says the supreme court of Missouri, division No. 1, in reviewing the assignment of error, must therefore be found in the common law, if there was any such obligation resting upon the defendant.

It was not contended that the common law expressly imposed any such obligation, but it was argued that "defective appliances, or no appliances at all, or insufficient appliances, is a question of negligence, for the jury."

This leads the supreme court to say that the obligation of the common law is that the defendant shall exercise ordinary care to prevent injury to the public. No particular kind of appliance is required to be used. It is only necessary that the defendant should have used such means to prevent injury to the public as a man of ordinary prudence would have used under the same circumstances. To predicate a charge of negligence upon a failure to use any particular kind of appliance is insufficient, especially in the absence of any averment that the appliances and means employed by the defendant were not reasonable safe.

As between master and servant, continues the supreme court, the master is not required to furnish the best and safest known appliances. It is enough that what he does furnish are reasonably safe for the purposes for which they are intended and used. So, with respect to its common law duty to the public, the court goes on to declare, it is not whether there are known appliances which the defendant did not use, but whether the appliances it does use are such as a person of ordinary prudence would have used, which determines the question of its negligence.

There was therefore, the supreme court holds, no error in the ruling of the trial court sustaining a motion to strike out this allegation in the petition.

RIGHT TO ASSUME THAT RIDER OF BICYCLE WILL TAKE CARE OF HIMSELF.

Gagne v. Minneapolis Street Railway Co. (Minn.), 79 N. W. Rep. 671. June 28, 1899.

To attempt to ride a bicycle between the tracks of an interurban electric street railway, where the street is 120 feet wide and the distance between the inside rails of the two tracks is but 7 feet and every 135 feet there is a trolley pole in the center of the space between the tracks, with a distance between a trolley pole and a passing car of only 16½ inches, the supreme court of Minnesota thinks ought, under any ordinary circumstances, to be held negligence as a matter of law. Indeed, the evidence in this case showing that a man, for no apparent reason, except that it was smoother than the remainder of the street, undertook to ride in such a space between the tracks, sometimes nearer one rail and sometimes nearer the other, down a grade, and then, apparently without the least use of any of his senses to ascertain whether a car was approaching him from behind, turned suddenly to cross the track on his right when a car coming up from behind was within 10 to 20 feet of him on that track, the court holds it was conclusive that the man

was guilty of contributory negligence so gross as to amount to extreme recklessness.

This, the court says, left only the question of whether there was any evidence to go to the jury that the motoneer, after he saw the man in a place of danger, was guilty of wanton or willful negligence in failing to exercise reasonable care to avoid injuring him. And if the fact was, as contended, that the man rode continuously near the rail of the track on which the car was, the court does not think that this would have justified a finding that the motoneer was guilty of any wanton or willful negligence, particularly as the car was in plain sight of the man, if he had looked in that direction, and he had been warned of its approach by the sounding of the gong.

The fact that the man gave no visible indication of having heard the gong, or of being aware of the approach of the car, the court holds, was of very little weight. Any one accustomed to ride on street cars, who is at all observant, it says, must know that there is a very large number of bicyclers who ride between or near street railway tracks, and who seem to think that it is not "good form" to get out of the way of an approaching car, or to give any indication of being aware of its approach until the very last moment.

Under such circumstances, and considering the ease and quickness with which a bicycler can turn aside, and that if a motoneer was required to stop or slow up in every such case until he was sure that the rider would get out of the way, it would be practically impossible to operate the cars so as to properly serve the public, the court holds that the motoneer had a right to assume that the bicycle rider in question could and would take care of himself.

RIGHTS OF AN EMERGENCY EMPLOYE.

Marks v. Rochester Railway Co. (N. Y.), 58 N. Y. Supp. 210. May 24, 1899.

Two bobtail horse cars met on a single track. After some altercation between the conductors, it was decided that one of them should be moved back to a siding to let the other pass. There was no brake on the rear end of the car, and only the one employe on it, who called upon a boy 11 years and 4 months old, who appeared upon the scene, to drive the horse while he himself handled the brake at the oposite end of the car. Some other boys also got upon the car and commenced jolting it by dancing. The conductor made a rush or feint at them, at which they took fright, and, in scrambling off, pushed the boy driver off the platform, whereby he sustained personal injuries.

By a former adjudication it was settled that the platform of the car was not an unsafe place, that the boy was sui juris (under no legal disability), and that the company was not guilty of negligence in placing him, through its conductor, upon the platform of the car, for the purpose of driving the horse. Indeed, with passengers upon the car, the fourth appellate division of the supreme court of New York says that, under the circumstances, it would seem that it would have been grossly negligent for the conductor to have driven the horse himself, and left the brake unattended.

Asuming then that the boy was an emergency employe, the court goes into the question of what are rights of such an employe and the liability of the company to him for injuries while so employed. Concededly, it says, in the employment of the boy the conductor stood in the place of the company, and any contract which he made in that regard would be enforceable against it.

If, under such circumstances, the person so representing the company employs an incompetent person, or a less number of persons than are requisite for the performance of the work, or puts the person so employed in an unsafe place, or furnishes him imperfect or unsafe tools or appliances, and injury results because of such failure, the company, the court holds, is liable.

In the employment of an emergency man, the court goes on to say, the servant of the master making such employment acts for, and stands in the place of, the master; and he is charged with all the duties and responsibilities that the master would have been chargeable with if he had made the employment direct. But, having properly discharged all those duties, when such servant employer returns to the performance of his duties as servant, the court holds, he ceases to occupy the relation of master, and becomes co-employe, as to the person employed by him, and as to every other person in the master's service, and the master is not liable, even to the emergency employe, for his negligence. It cannot be of consequence, the court adds, that the employment of an emergency man is continued but a few moments, or that the service continues for hours or days.

Thus, does the court come to the conclusion that, the conductor having fully discharged his duty to the boy, so far as the employment was concerned, when he commenced managing the car he became a co-employe with the boy, assuming that the later was an emergency employe; and, if the conductor's negligence caused the injury sustained by the boy, it was the negligence of a co-employe, for which the company was not liable.

Furthermore, assuming that the jury, upon the evidence, might have found that the boy was not an emergency employe, but a trespasser upon the car, and sustained that relation to the company when injured, the court holds that the result of the action of the conductor, which was directed towards the other boys upon the car, was so unusual that the company was not liable.

Nor does the court think that the jury would have been justified in finding that the boy was a passenger upon the car. And if it had found that he was taking a gratuitous ride on the invitation of the conductor, being sui juris, or not to be treated as a helpless child, the court holds that the company would not be liable for injuries he sustained through the negligence of such conductor or other employe.

CANNOT ABANDON OPERATION OF ROAD.

State, on relation of City of Bridgeton v. Bridgeton & Millville Traction Co. (N. Y.), 43 Atl. Rep. 715. June 21, 1899.

The supreme court of New Jersey holds that a street railway company incorporated under the laws of that state, and the route of its road, and the location of its tracks, established by an ordinance of the municipality in the streets of which the company is to operate its road, such ordinance being accepted by such company, and its tracks laid in accordance therewith, and the road constructed and in operation, cannot, at its mere will and discretion, cease and abandon the operation thereof, or any portion thereof. It holds that it becomes the duty of the railway company, in the exercise of its rights, privileges, and franchises, for the benefit of the public to maintain and operate its road according to the terms of the ordinance, and in compliance with the statutes which confer upon the company such rights, and franchises.

An implied condition, the court maintains, attaches itself to the grant of the franchise that it be held for public benefit, and the duty upon the railway company is to exercise it for such purpose, and, as a public agent, it cannot escape this duty.

The court further holds that the company, duly incorporated, which has the ownership of, and is in possession and control of, such street railway, its appliances and property, whether under a lease of or by sale from the original or other company incorporated to construct and operate such railway, or by sale under a decree of the court of chancery upon foreclosure under the statute of that state, has conferred upon it all the corporate rights, liberties, privileges, and franchises of such original or other company, and upon it rests the same burden and duty to maintain and operate such street railway under the statutes and the ordinance of the municipality as was imposed upon the original company.

The fact that the located route of the railway is laid across a bridge which is under the control of the board of freeholders which will not permit the tracks to be laid thereon except upon proper and reasonable regulations for the safety of the bridge for the traveling public, the court holds, furnishes no excuse why the road should not be operated upon its route through the streets of the municipality lying upon either side of such bridge.

Mandamus, the court pronounces the proper legal remedy to compel such street railway company to perform the duty of maintaining and operating such railway for the benefit of the public, as the public duty imposed upon the company is always active, potential, and imperative, and must be executed until lawfully surrendered, suspended, or abandoned by the legally expressed consent of the state.

The Kings County Elevated, of Brooklyn, N. Y., and the Brighton Beach road are now operated by trolley and the third-rail system from the New York end of the Brooklyn Bridge to Coney Island.

THE CHICAGO CONVENTION.

The Most Successful of Street Railway Conventions Good Papers and Interesting Discussions Extensive and Well Arranged Exhibits Over 1,300 in Attendance Epitome of Entertainments Kansas City in 1900.

The 18th annual convention of the American Street Railway Association was held at Chicago, October 17th to 20th, and the general opinion of those who were here is that never before has the Association had a meeting more satisfactory in all respects, and particularly as regards the large attendance at the business sessions and the animated discussion which followed the papers read. The credit for the success of the convention is very largely due to Mr. John M. Roach, who, as chairman of the general committee and of the committees on entertainments and banquet, was charged with the general oversight and in particular with the duty of seeing that our guests had an enjoyable visit to Chicago.

The exhibits were displayed on the main floor of Tattersalls, 16th and State Sts., and on the curb at the west side of the building; the meeting rooms for the two Associations were on the second floor at the north end of the building. The "headquarters" of the convention were at the Auditorium, which was the social center of the convention.

The exhibits were well arranged and made a most attractive and instructive display, and Mr. J. R. Chapman, chairman of the committee on exhibits, received many compliments upon his work. He had made the most careful plans, working out all details and making all the necessary arrangements in advance, so that there was no delay in installing the exhibits and everything was in place by Tuesday afternoon. The action of the Executive Committee in setting apart Friday as "Supply Men's Day" was greatly appreciated by exhibitors, and also by the delegates, as was shown by the large number of blue badges seen on the exhibit floor that day.

The other committees, and they all did their work well, were: On halls and hotels; George O. Nagle, chairman. On finance; George A. Yuille, chairman. On reception and ladies; H. M. Sloan, chairman. On transportation; F. L. Fuller, chairman. On publicity and information; H. H. Windsor, chairman. The Bureau of Information is an institution which Boston has the credit of introducing at our conventions, and its success there, and again here, insures that it will be a permanent feature.

In the meeting room of the American Association Mr. C. S. Sergeant presided with dignity and tact. The papers before the Association were four in number, as follows:

"Investments in Street Railways: How Can They Be Made Secure and Remunerative?" By Charles T. Yerkes.

"Maintenance of Car Equipment." By J. H. Vanderveer.

"Construction and Maintenance of Street Railway Track." By Edward Butts.

"Train Service and Its Practical Application." By Ira A. McCormack.

There were over 1,300 street railway men and supply men and 100 ladies in attendance.

The entertainments and social features were particularly enjoyable. An informal reception was held in the Auditorium parlors Tuesday morning by the local committee of ladies, about 40 in number, under the direction of Mrs. J. R. Chapman, and the visiting ladies registered and received their badges at this time. There were about 100 ladies from out of town at the convention.

Tuesday evening the reception, which always marks the first day, was held at the Auditorium, about 500 people being present.

On Wednesday the excursion provided was a trip to the Chicago Drainage Canal, and 504 persons, by actual count, availed themselves of the opportunity to inspect this interesting engineering work. A special train of nine cars left Dearborn Station at 1:45 p. m. over the Santa Fe, and proceeded as far as Lockport, making stops at various points of interest. After inspecting the works at Lockport the party was photographed, after which the return to Chicago was made, arriving at 7 p. m. Mr. Isham Randolph, chief engineer for the Sanitary District, and a corps of assistants, accompanied the party. Badges were distributed by the McGuire company.

For Wednesday afternoon a tally ho ride through Jackson Park and a visit to the packing house of Swift & Co., at the Union Stock Yards, were the alternative trips provided by the entertainment committee. Nearly all preferred to see the Stock Yards, a portion of the party going by the tally ho, about 500 visited Swift & Co's. plant. Wednesday evening the Chicago roads entertained delegates and visitors at the Columbia theater; the street railway party occupied the whole of the parquette, the boxes and a large portion of the balcony. The play was "His Excellency, the Governor."

On Friday morning visiting ladies were taken to the Art Institute and then for a drive along the Lake Shore boulevard, returning in time for luncheon at Marshall Field's, where they were the guests of the firm. In the afternoon the ladies were driven to Tattersalls. Friday afternoon the Westinghouse Electric & Manufacturing Co. arranged for a special excursion to the power house of the South Side Elevated R. R.

JOHN M. ROACH.
President for 1899-1900.

Friday night the annual banquet of the American Street Railway Association was held at the Auditorium. President Sergeant acted as toastmaster; among the speakers were Senator Wm. E. Mason, Mr. James W. Duncan, Mr. John H. Stedman, of Rochester, N. Y., Mr. W. J. Hynes, and President Calderwood, of the Accountants' Association. The newly elected president, Mr. Roach, was then introduced and made a very happy inaugural address, in which he took occasion to pay a graceful and well-deserved compliment to Mr. Sergeant on his administration of the affairs of the Association. After the installation of the other officers a number of short addresses were made and the convention then adjourned sine die.

All Chicago railway men feel that they, by reason of their more intimate acquaintance with Mr. Roach, can most heartily congratulate the Association on its new president. We wish him every success and trust that in 1900 he may preside over another record-breaking convention in Kansas City.

Any report of the Chicago convention would not be complete without a reference to the Daily Edition of the "Street Railway Review." Five issues of the Daily Edition, averaging over 20 pages of reading matter each, were printed, giving a complete verbatim report of the proceedings of the two conventions for the preceding day, descriptions of the exhibits, lists of registra-

tions, and other matter of interest to those in attendance, and hearty appreciation of the Daily was shown by the two Associations and by the supply men. The "Daily Street Railway Review" will be found at all future conventions of the A. S. R. A.

Tuesday, October 17th.

President Sergeant called the meeting to order soon after 11 o'clock. About him on the platform were the members of the executive committee and the past presidents of the association. Every seat in the meeting room was occupied, the attendance being larger than at any previous first meetings of the association. The president announced that the meetings would be called promptly at 10 o'clock. He then introduced Mr. H. S. Taylor, public prosecutor of the city, representing his honor, Mayor Harrison, who delivered the address of welcome as follows:

Mr. President and representatives of the American Street Railway Association: I am here at the request of his honor, the mayor, who is unable to be present at this time, but who has such an appreciation of the highly respectable character of the individual delegates and of the interests that you represent, that he wanted some one from his cabinet to be present to extend to you, not only formally, but officially and very heartily, the freedom of the city. The only direction I had from his honor—the only message, commission or authority—was to be very brief, as he conceived that you would have weighty business topics on large interests to discuss among yourselves, and that any merely conventional speech would not be appropriate. I think even without that direction I should have fully understood what was appropriate upon this occasion.

The street railroad business has grown with the rapid development of our great municipalities and the increased momentum of commercial and social life. We are all growing gradually out of a walk into a trot, and the trot merging into the gallop, and the problems of urban transportation become more and more important and complicated.

You are to discuss these things. I dare say you are to discuss all of those questions which are arising from time to time in the evolution of the future. When the first street railway was put down in this great flat city of Chicago, it was merely a soliloquy on the part of the management. It has long since become a colloquy between the officials and employes and the officials of this great metropolis, and how to adjust and arrange urban transportation in them will become more and more important, and more and more complicated. It may be possible to at least ameliorate those occasions, which almost amount to the dignity of civil war, or the indignity; and how to anticipate the rapid development of the science in the age in which that great door of the electrical science has just been pushed ajar, and compressed air and liquid air and a dozen other motors, possibly; how to satisfy the problem of taxation and dividends as between the railway companies and the people; how to make franchises fair to companies and equitable to the communities that own the street are rising problems which you are to discuss, and upon which I have no useful or pertinent information that is not already in your possession.

The mayor fully appreciates the importance and value and dignity of this convntion. He sends you his respectful salutation, and he wishes you may have a profitable and a pleasant time. Ever since the street railway companies have abandoned the jingling horses, and the epoch of cables has passed away and given place to lightning, we recognize the fact that the street railway man is fast—is becoming fast—and yet, notwithstanding that knowledge, common to us all, I assure you, as the public prosecutor, we have not taken any extraordinary police precautions on account of your presence here.

Once more, Mr. President and delegates, on behalf of the mayor, and speaking for the city of Chicago, we bid you a most hearty welcome. (Applause.)

The president responded briefly, accepting the hospitality offered, and then announced that the roll call would be dispensed with and extended an invitation to all street railways and street railway elevated roads to join the association and then delivered his annual address as follows:

PRESIDENT'S ADDRESS.

Gentlemen of the American Street Railway Association: We are today assembled for the eighteenth annual gathering of our Association, and for the second time we meet in this great and prosperous city. I feel very deeply the honor which makes it my duty and pleasure to welcome you to Chicago in behalf of the street railway men of this city, whose generous exertions have provided us with all the essential elements for a profitable and enjoyable meeting. What remains to be done lies in your own hands, and I may be permitted to urge upon you the desirability of a full attendance upon the business meetings, and a free and ample discussion of the papers which will be presented. In order that the time may be sufficient for this purpose, your Executive Committee has purposely restricted the papers to a smaller number than usual, and earnestly solicits your co-operation in giving them full audience and ample discussion.

As will be seen by the report which is to be submitted, the financial condition of your Association is good and improving from year to year, for which happy condition we should not forget we are indebted to the efficient efforts of your officers in prior years when the bank balance was not so readily visible; nor should the generous support of our exhibitions by our friends, the supply men, escape our notice. The devotion of one day of your convention to the especial purpose of visiting the exhibits, which has been arranged by your Executive Committee, will be availed of, it is hoped, by every delegate, to the mutual profit of all.

Those gentlemen who met here in Chicago in 1883, many of whom are I trust present today, could have had little conception of the changes in their business which were to occur before the end of this century. At that time there were in Chicago, street railways operating about 153 miles of single track. At the present time the mileage of the surface street railways of this city is about 736 miles, of the Chicago interurban street railways about 261 miles, and of the elevated street railroads about 100 miles, either operated or under construction, making an increase since your last meeting here of 944 miles of track. This remarkable extension of street railways, their equipment with mechanical motive power, the unique union loop system, and the successful application of electric power in the elevated railway service, are not only a wonderful testimonial to the courage, energy and capacity of their projectors, but they have made Chicago a street railway Mecca to which we all may come to observe and learn. We are, therefore, to be greatly congratulated upon the advantages afforded us by the selection of this city for our convention.

The year which has passed since we met has presented some unusual features, which are worthy of our attention. The tendency towards consolidation of small or competing roads into larger homogeneous systems has been manifested by many examples. With the introduction of electric motive power the old time horse railway company, operating a few miles of track on two or three city streets, has disappeared, and its larger successor has found necessary such changes in administration, such extensions of its system and service, that the advantages of combination with rivals have become more and more manifest. The street railway which formerly gave a short distance urban service has found itself extended far into the country; the same car which disputes the passage of a busy city street with a truculent teamster, may an hour later be flushing partridges and grouse along the rural highway, stopping to leave the tired artisan at his country home, and bringing a healthful excursion within reach of the humblest family; thus the trolley car is rapidly filling a long felt want, which was neither within the power nor the disposition of the great steam railroads to supply. All this means changed conditions with new responsibilities, and emphasizes the need of consolidation.

To successfully amalgamate such properties, and organize and operate them with due economy and a just regard for the needs of the communities to be served, requires of the operating officials a high degree of experience and skill. The new problems to be met offer better positions to which those who are ambitious may aspire, and the wonderful rapidity with which this situation has been developed, will be a lasting monument to the officials of our American street railways. The advantages of this larger growth are many, and perhaps not the least is a growing respect for the value and importance of the street railway industry, which we may all hope will ere long be recognized by just laws which shall deal fairly and equitably with the relations of the street railways to the municipalities, and give to capital invested in urban and suburban transportation, security and a fair return upon the investment.

Another of the notable events of the year has been the failure

of a striking attempt at municipal ownership, with which we are all familiar.

It is greatly to be regretted that the year has been signalized by several very serious strikes and attempted boycotts. With the consolidation of systems, the question of labor assumes a greater importance. The paralysis of all the transportation of a large city is a grave public calamity, to be prevented by all reasonable means in the power of the officers and men of the transportation companies, and by the municipal authorities. The larger the system of any corporation is the more necessary it is that its management shall firmly and wisely conduct its affairs, and the more impossible that the responsibilities imposed upon the management should be delegated to others. Does it not, therefore, devolve upon us who are charged with such responsibilities to take the greatest care that our representatives before the public, the employes, shall always receive such liberal and just treatment at the hands of all our officials that they may feel their interests and ours to be identical, and may loyally work with us for the good service of the public and our corporations?

Care in the selection and instruction of employes may, therefore, well engage our constant attention. We are all merchants in that we have transportation to sell and must present it in an attractive manner if we wish to retain our customers.

The good will of the community which it serves seems to be an essential element of success with any public transportation company, and the best means to obtain that good will should receive our careful consideration. In this direction lies, I believe, a field of work for our Association, and for each and every one of its members, which may be far more fruitful for good than our technical papers or our exhibits of apparatus. We are all aware of the wide difference of opinion which exists in the community as to the proper relation of street railways to the public, the service they should render and the burdens they should bear, and last, but not least, the returns they should expect upon capital. In the press and in educational and social reform institutions much prejudiced opinion and misinformation is promulgated calculated to injure public service corporations, and in so injuring them to deprive them of much of their ability to adequately serve the public. Is it not our duty, each and all, in our own communities and wherever else opportunity offers, to take steps to remedy this state of affairs? Let us seize every opportunity to refute these current fallacies, meet the self-styled economist on his own ground and show him that his "quasi-public octopus" is the greatest public benefactor and social reformer the world has ever seen!

Fair-minded men will generally listen to both sides of any question, and the ignorance of even those who should be well informed as to our industry, is so great that mission work to disseminate truth is imperatively demanded. I believe that work of this character has already been undertaken by one of our friends of the Chicago technical press, and that in so doing he has set a worthy example which we may beneficially follow.

One of the saddest events of the year was the sudden death in April last of our lamented friend, Mr. M. K. Bowen, president of the Chicago City Railway Co. Beloved by all who knew him, ever ready to spare his valuable time for the aid and information of others who sought to learn from his experience, he was an honor, not only to the corporation he served so well, but to the profession which will miss him so sadly. Ever faithfully interested in your Association, his untimely death brings a feeling of deep loss to us all.

I venture to remind you of the work which our friends of the Accountants' Association have undertaken and are accomplishing. The importance of accurate and uniform accounts to the success of any railroad can hardly be over-estimated. A thorough knowledge of accounts and of finance is an essential qualification for the administration of large properties. The work so far accomplished by their Association, and their further deliberations merit your earnest support, which will not only be beneficial to them, but to each and all of the members of our Association.

I wish here to express my appreciation of the cordial support and valuable work of your efficient secretary and executive committee. That our Association may always be so fortunate is my earnest wish. In conclusion may I once more express my sincere appreciation of the honor which you conferred upon me by electing me to preside over this meeting, and bespeak your patience with my shortcomings.

Then followed the reports of the executive committee and secretary and treasurer, which were adopted. In substance they were as follows:

Report of the Executive Committee.

The executive committee reported that it had received the report of the secretary and treasurer showing the statement of the finances of the association, the members in arrears and the Boston convention exhibit space remaining unpaid for. The secretary was instructed to write all eligible companies, inviting them to join the association. On motion of Mr. Woodruff it was voted that any American elevated railroad is eligible for membership. On motion of Mr. Lang it was voted that the publication by the association of legal decisions affecting street railways be dispensed with, as the street railway periodicals devote considerable space to this subject each month. The president read a letter from Mr. John T. Burnett, chairman of the special committee on the carrying of the United States Mail on Street Railways, in which he stated that the conditions during the year had not been opportune for effective work, and he believed that the committee should be continued for another year and be given further time for action; or, if preferred, a new committee should be appointed; on motion it was decided to recommend to the association that the committee be continued for another year. It was decided to enforce the usual rules concerning banquet tickets. On motion the following rules for the convention were adopted:

1. No member will be recognized by the president unless he shall announce distinctly his name and address.
2. Speeches will be limited to 10 minutes unless the time shall be extended by the convention.
3. Members who desire to offer resolutions or other matters to be considered by the convention, are requested to submit them in writing, over their signatures, to the secretary.

Report of the Secretary and Treasurer.

The statement of the finances of the association showed cash on hand Aug. 25, 1898, as $3,656.28 and the receipts to Oct. 11, 1899, as $7,650.87, of which $450 was for membership fees, $3,930.67 for dues, $3,137.70 for space at the Boston convention and $132.50 for space at the Chicago convention. The total expenses to Oct. 11, 1899, were $5,648.28, leaving a balance of $5,658.87.

Aug. 25, 1898, there were 173 members; to Oct. 11, 1899, 7 new members had joined and 8 had withdrawn, making the membership at that date 172.

The president then said some other committee reports would be presented later. Mr. Charles T. Yerkes of Chicago was then introduced and presented the following paper:

INVESTMENTS IN STREET RAILWAYS: HOW CAN THEY BE MADE SECURE AND REMUNERATIVE?

By Charles T. Yerkes, President Chicago Consolidated Traction Co. and Union Elevated Railroad Co.

The subject you have given me for consideration is one in which I take great interest, and for a very good reason; about all the investments I have are in street railway securities. You can therefore see that my faith is great, for it is from our actions that we are judged.

My experience with street railway securities dates back to a period almost 40 years ago, at which time street railways were in their infancy, in fact, you may say, in their swaddling clothes. It was in the early 60's, when the scientific operating of street railways was unknown, and, in fact, not dreamed of. In those days the men were worked from 16 to 17 hours out of the 24, and they, as well as the officers of the companies, did not seem to be aware of the fact that this condition could be bettered. The roads themselves were of a cheap character, and while intended to be permanent, they were far from it. But they were equal to the demands of the public and requirements of street railway transportation. In those days even a car register was unknown. The street railways in each city were owned by a few influential persons, generally men of large means, and the stocks and securities of the companies were but little distributed. Few people knew of their value or cared to have much to do with them. To hypothecate street railway stock as collateral with banks was unknown, and it was not until 10 years after, in the early 70's, that the banks would look at them. The dividends in the meantime were generally fair, particularly with companies doing a

Charles T. Yerkes was born June 25, 1837, in the city of Philadelphia, of Quaker parents, and his early education was received in Quaker schools. After establishing and putting upon a successful basis, a banking and brokerage house in Philadelphia, he came to Chicago in 1881, for the purpose of starting a Chicago branch of this business. While here Mr. Yerkes early realized the possibilities for investment that were offered by the transportation systems of the city, and in 1886 he succeeded in gaining control of the North Side lines and reorganized the company as the North Chicago Street Railroad Co. Two years later he purchased the West Side systems. The substitution of cable and electricity for the horse on

CHARLES T. YERKES.

all these lines, and the extension of branches out across the prairies, began at once after Mr. Yerkes secured control and has continued to a greater or less degree ever since. Mr. Yerkes next turned his attention to the elevated roads and organized the Union Elevated Railroad Co. to build the down town loop connecting all the elevated systems; he is also the controlling spirit in the Lake Street and Northwestern Elevated roads. He has within the past few months sold his interests in the North and West side surface lines, and is at present giving a large amount of his time to the Chicago Consolidated Traction Co., which he formed for the purpose of uniting under one management eight companies operating systems in the outlying districts.

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large business in the thickly populated part of the cities in which they were located. To my mind, the chief reason of their unpopularity was that the building of street railways in those days was always opposed by the people in the vicinity of the location, and particularly on the streets where the rails were to be laid. I remember very well the first track laid in the city of Philadelphia, where I then lived. It was the Fifth and Sixth St. line. The people tore up the track at night which the company had laid during the day, and it was not until after there had been several riots, and the authorities had awakened to the fact that the law must be sustained, that the company was able to finish its road. The Chestnut and Walnut St. line in the same city was bitterly opposed by the citizens, and everything was done in the legislature and in the courts to prevent the charter from being granted and the tracks from being laid. And this has been the experience in most all large cities. Consequently, the people who were promoting the laying of street railway tracks were looked on as sort of "free booters" and their securities with much distrust. To some slight extent this feeling still exists, notwithstanding that there is scarcely a road which was laid years ago that could be taken up today without great objection being made on the part of the people.

It was not until the early 80's that street railway securities were seriously considered as popular investments, and since that time their popularity has continued to increase as time developed the great resources which lie within them. The quality of the street railway plants of those days consisted in the kind of track, the condition of the cars and the class of horses which were used. These differed most materially. On some roads it looked as though the cars were never repaired or painted and the broken down horses were very much in the majority. Added to that was the uneven rail, spiked to a string piece, which almost made the rider seasick during a passage over it. Then again, there were other companies where the track was well laid and kept in good order, the cars in a good state of repair and well painted, and the horses of the highest class for their work. These two conditions were almost invariably the result of the adversity or prosperity of the different companies, and while the latter class, that is, those that were prosperous, came to be sought as an investment sooner than the other, the anxiety of the public to so invest was never great. But about 1880, when consolidation of different roads came to be more in fashion and the economics resulting therefrom and also the studious consideration which was given as to how to operate roads, it was more a matter of reality. The attention of capitalists and the people generally was drawn to the stocks and securities of street railway companies, and this condition has been on the increase ever since that time. The fact that great improvements have been made after the horse was relegated to a past era has had much to do with this, and naturally so. The mechanical propulsion of street cars has attracted the attention of the whole civilized world, and the question naturally arose in the minds of those who witnessed these changes, and who had money to invest, "Isn't this a good place to invest our money, and isn't there profit in it?"

The change in the mode of propelling the cars and in fact the whole outfit of street railways, has created what might be safely termed a "revolution." To look into the history of all the street railways of 20 years ago and see the changes which have taken place, is certainly wonderful. I can see before me a plant that was run with one-horse cars, a driver and no conductor, a pay-box in the front of the car, where the passenger was required to advance and deposit his fare. I see that line changed to two horses and obtaining the dignity of a conductor to collect fares from passengers. That was a great improvement, and then we had straw in the bottom of the cars in winter—not overly clean, because we could not afford to put fresh straw in every day, but still this was a luxury—an oil lamp at each end of the car which supplied the double purpose of lighting the car and showing the signal on the outside. We went at the rapid rate of six miles an hour when we could make it and keep on the track. The motion of the car was most agreeable to a person who desired to ride on the billowy waves. We see this changed, so that the track was smooth, the straw in summer time was taken out, floor always clean, and a stove giving comfortable warmth placed therein in winter time. This was advanced luxury. We were pleased with all this, except when the snow would come, or the days were hot in summer, when the horses were not able to pull us to our destination.

We see another change—the great power of electricity was brought into use, the horses were gone, and instead of making our six miles an hour we could go twice that rate. The oil lamps were removed and electric lamps put in their places. As like begets like, the conditions of the cars were improved, cleanliness—always, an adjunct to electricity—was substituted for uncleanliness. The districts of the city were expanded, lines were made in the suburbs, creating new towns, improving the property of the people, increasing the amount of the assessment on real estate, until we seemed as though we were living in another world. Aladdin's lamp did not produce any more wonderful changes, and this could not have been done had it not been that the attention of investors, both great and small, had been attracted to the street railways. And what of the great benefits to the people? Instead of the slow, uncomfortable manner of travel, rapid and easy means are given. Points that could not be reached with the old system are brought within easy access. Everything is better and cheaper. While in days gone by it cost 5 cents to travel three miles, with the new improvement, four times that distance can be traveled for the same money. Then it cost a person to ride about 2 cents a mile, now it costs ½ cent per mile. Why, then, I ask, should not a continuance of this condition be encouraged?

And now I come to the second and most important part of my subject, "How can they be made Secure and Remunerative?" To my mind security is most to be considered. The remuneration must be brought about by hard work and close attention to the corporation. We cannot do much to increase our receipts, they come from

natural causes, but we can control our expenditures, and that really, together with knowing where and what to do, in the science of street railway management.

But in regard to making them secure, we must depend very much upon the justice of the people and the fact that we, as managers, are willing to do what is fair with the public. There seems to be an idea in the minds of many legislators that a street railway is a very simple affair and of very little account. This, feeling has been engendered by their knowledge of long ago, and that knowledge has not advanced with the change in street railways. In fact these changes have come and been accepted as such a matter of course that little attention is given to their worth.

The most important matter in regard to the security of street railway securities is the length of charter under which they are operating. This question is of as much importance to the people as it is to the street railways themselves. The longer time that is given to a charter to run, the greater improvements and the more expensive plant can be operated by the companies. That is to say, it can be made more permanent than if the charter was of short duration, and naturally it would be. If a company had a charter with but a few years to run, the improvements will be of a cheap character, commensurate with the length of that charter, and the better the improvements, the better it is for the people. Not only for those who own property, but for those who ride and have no property. We see this exemplified daily. Let us ask the question, how many bridges of iron or stone would the steam roads have if their charters ran for only a few years? There would certainly be none, and the speed of trains would be greatly reduced. Years ago 30 miles an hour was considered rapid traveling, with 20 as an average. Now the rate has been run up to more than 80, with 45 as an average on fast trains. This latter condition would never have existed if the steam roads had not had charters long to run. Why should not the charters of street railways be equal to those of steam railways? In fact, considering them all in all, they should be longer. The cost of a steam railroad today is not nearly equal to the cost per mile of a street railway, even counting all the appurtenances that go with each. One hundred years has been the time granted in this state for a charter to a street railway, and the municipality grants an ordinance for 20 years. That this was wise or unwise at the time that period was designated, I will not argue, but considering that it was a proper time for what we had in street railways then—rails weighing 40 lb. to the yard, laid on a wooden string piece, this string piece laid on sleepers 5 ft. apart, cars of a cheap class, a lot of horses, good ones, if you please, and a five-acre lot in the suburbs where the car barns were erected—this practically constituted their outfit. At the end of 20 years, if there was to be no removal of the ordinance and the charter was allowed to lapse, what would be the loss? The track, considering that it had been kept in good order would sell for, say 20 per cent of its cost, the cars for about 30 per cent of their cost, the horses for about 25 per cent of their cost, and the real estate which had been bought by the company 20 years ago, and where in all probability, a settlement had since gathered, would sell by the front foot, realizing without doubt 20 times as much as it had cost. There, you see, there would not be much loss if this road had to be given up. But what are the conditions today? The street car tracks are laid with heavier material than that used by the steam roads, the power houses cost hundreds of thousands of dollars, where the old structure cost but a few thousand, the electric plant on the cars and in the power houses and the wires and poles cost immense sums. So that it can truly be said that the electric plant cost more than 10 times as much as the horse car plant. If, therefore, it was right to give a horse car plant a charter for 20 years, the electric plant should receive a charter for 200 years, and city ordinances to correspond.

It has been argued that if grants were made extending over a long period of time other means of transportation might come into existence and these charters would interfere with the adoption of these improved methods.

Let us suppose 50 years ago perpetual privileges had been given to operate exclusive omnibus lines in this city, or privileges of the same character had been given to operate ferries across the Chicago River, what would they be worth today? Long ago the charters would have been forfeited, simply for the reason the improved methods had rendered them worthless.

But while I feel that the legislature should treat the street railways fairly, I also feel that the street railway companies should treat the municipalities and states in the same spirit. I believe that a fair amount of the earnings of the companies should be given to the municipalities in which they are located. There is no doubt but that the street railways are of great benefit to these municipalities and to the people generally and to the property owners, but at the same time, it is my opinion that a spirit of liberality should be engendered by the street railways towards the municipalities, for the reason that it is through the municipality that they are permitted to transact their business. It is a mutual benefit, with the burden on the corporation. There is no doubt but that the extending of the lines in a large city is a great burden on the railway company. There is little money to be made out of them for years, and while the company is waiting, the property owners and people are being benefitted. The very mention of the fact that a line is to be extended in a certain district causes advances in the value of real estate, and these advances are emphasized when the extensions are really made. There is nothing that has added so much to the health of the inhabitants of a city as the extension of street railway lines. In this city the tenement house district, which would have been a perfect pest hole, is scarcely to be found. The prairies have been covered with street car tracks, which forces the opening of streets. Cheap lots and cheap homes for the working people and the poorer classes, as well as the well-to-do, is everywhere in evidence. While there may be efforts to influence the people against street railways, they cannot but see these conditions, which are so plainly visible to them, and seeing them, fail to properly appreciate them. I believe in educating the people, of whom the legislatures are the representatives. Every state wherein there are large cities, which necessarily have important street railways, should have a commission appointed to ascertain the condition and requirements of this industry. The commission should be appointed by the governor of the state and should be composed of intelligent business men, of first class standing who are not interested in street railways. Under no condition should a person holding office, or who is ambitious to do so be named. A man of this character is never to be trusted in any affair where courageous opinions are expected. The reports of such a committee should have great weight with the legislators.

I believe that all corporations which receive their life from the commonwealth should be subservient to that commonwealth. That there is nothing in their formation or general business which should not be reported to the proper authorities and be subject to investigation. I believe that the law should provide that an intelligent commission be appointed by the governor of the state in the same manner as is now done in this state, in regard to the commissioners of the park system. The duties of this commission would be to see that the laws concerning street railways are carried out and that the companies have the protection to which they are by law entitled. The commissioners should have terms of 15 years, so as to insure their becoming experts and receive such salaries as would enable them to live well and take care of their families in a good manner. They should understand when appointed, something of the street railway business, and as years pass by their knowledge would increase, as also their worth. They should have the power to dictate to the railway companies where new roads should be laid, if at all, and also the kind of new improvements to be used, when a railroad contemplated making any change in motive power. They should have the power to regulate the devices to be used for saving life and preventing accidents. With an intelligent, honest commission of that kind, street railway managers would be made more comfortable, the people would be benefitted and the securities of the corporation would be more solid. The advice of the commissioners would be sought and the advice of such men, with the experience and knowledge they would naturally have, would be most valuable to any railway manager. Their reports would be explanatory, and much of the ignorance regarding street railways which is fostered by our enemies, particularly in this part of the country, would be done away with.

To make securities more secure, we must have these different matters fully understood. We must do our business in a straightforward manner, with due consideration to the public, who are our patrons, continuing to increase facilities as opportunities offer and adopting the most improved kinds of transportation, which experience is proper. And last, but by no means least, holding with the kindest regard our employes, who are faithful to us to the end, that there may be perfect harmony between them and the management, and seeing to it that our corporations are able to earn honestly a fair remuneration for their money, time, experience and labor that have been spent upon them.

Mr. McLean moved a vote of thanks, after the adoption of which the president said: Mr. Yerkes, I wish to thank you personally also for the very able paper that you have given us and for the points on how to get at the real meat of the whole financial question, which from your experience outlined in this paper I am sure will be a most valuable lesson to us all. The paper is now open to discussion, and I think I will call upon Mr. C. D. Wyman, of New Orleans, to open the discussion.

Mr. Wyman: Mr. President and gentlemen of the Association, I think that by the vote we have just passed, in which I most heartily joined, we have expressed our sentiments touching this paper most sincerely. When I was notified that such a topic had been assigned by the committee having that matter in charge for presentation at this time, I felt that it was a topic of the greatest importance, and one which we might congratulate ourselves upon having presented here, and especially that we were to be congratulated when it was announced that Mr. Yerkes would read a paper upon that subject. He is a gentleman who has been so thorough a student of street railway affairs, from both the financial and operating sides, it seems almost a work of supererogation on my part to attempt to add anything to what he has said upon this subject. But I venture to say a word or two upon some lines which may possibly touch us as managers in our relations to our stockholders, to our investors, that we have all duly considered, and yet which it might be proper to suggest in connection with the lines of thought that Mr. Yerkes has presented. Of the importance of sustaining and preserving the confidence and faith of the investors in the enterprises in which we are engaged there can be no question. When it is remembered that one-third of the invested wealth of civilized nations is today in railroads, and not an inconsiderable portion of that investment is in the street railways, that we should secure and hold the confidence of our investors and that we should make their investment profitable, is very manifest. The great desire which now is manifest on the part of capitalists to put their money into street railroad enterprises is one which should be met by a corresponding effort on our part to make everything plain, clear and distinct to them in regard to such enterprises.

Now in the selection of a board of directors from our stockholders it is always customary, of course, to select men not only of financial responsibility in the community, but we always regard it as necessary and proper to select men of high probity, men of reputation and of position and for officials of the company. There is made emphatic in the eyes of the public this feeling of responsibility to the public, and also the equal responsibility to their investors and the capitalists. The impression is wise, beneficial and tends moreover to the extension and expansion of our business, for I take it in this respect, at least, we are all expansionists.

I remember reading in a paper recently of a distinguished orator here in Chicago on the occasion of the great gathering which was talking about trusts, I believe that he said, "In his opinion there was no danger from aggregated capital if there was a sufficient amount of publicity given it." However much we may agree as to the causes and reasons that suggested that convention, I submit to you as my belief that we should be frank, free and open with our investors; that we should tell by means of circulars or statements, or printed publications of our operations and results, the truth, and the exact truth as near as we can ascertain it, to all that are interested in our respective companies, whether they be interested to a large or to a small degree. While it is true that a complete disclosure at all times of the policy of the company might hurt it, I still hold that the results of our work should be set forth constantly, fully and freely; I believe this can be done, and I believe that the more of it that is done in a proper manner—a complete and thorough manner—the more we shall secure and retain the confidence of our investors and likewise what is a very important thing with us, to the increasing of their holdings in our enterprises. We often have what are known as panics, a sort of neuralgia that pervades the financial market, and the reason given to us by those who are skilled in these matters, is that it springs from want of confidence; that actual values are not disturbed but that speculative values are, but it results from a want of confidence, and fear and distrust and uncertainty as to what is going on. Credits are withdrawn. We may, to some extent, ward off any such feeling, any disquietude on the part of our investors by letting them know the facts as far as we are able to do so, and giving them frankly and freely our best judgment as to present facts and future anticipations in reference to the enterprises with which we are connected.

I also believe that we should adopt, so far as possible, a plain, simple and thoroughly understandable method of bookkeeping, and I am therefore most heartily in accord with the Accountants' Association, which is now in session, and is endeavoring to do just precisely that which I am attempting feebly to speak concerning. The average stockholder often becomes very much muddled when he attempts to study out the question of what we shall charge to operating expenses and what shall be charged to permanent expenditures, and so far as it is possible, such a system of bookkeeping and record of expenses should be made clear and comprehensible to his mind. I would also suggest in this connection the question of depreciation. I am exceedingly glad to see that some of the railroads and notably, so far as I know, the Milwaukee road, has taken up the question very carefully, and very particularly that of the depreciation of the different mechanical parts entering into the physical equipment of the road, and it is setting aside, as I understand it, annually, a certain amount of money from its receipts to make good that depreciation. It is not infrequent that railroads electrify or cableize, and the first year or two their receipts naturally increase, properly so, and their expenses may remain at a very low ebb by virtue of the fact that everything that they have is new, and the era of repairs has not set in. It is, it seems to me, unsafe to base our calculations upon the result of a particular year, or some years—to predicate upon those results what the earning power of the company is to be, and to publish to stockholders that they might be always expected. While it is always to be hoped, of course, that the increase of receipts will take care of repairs and depreciation, nevertheless if we can make certain and absolute that point by studying out what this depreciation is, we are at least on the safe side if we begin to provide for it, publish it and set an amount aside to make certain of it, tell our investors what we are doing from the very first roll of the wheels upon our line. I think this is very, very important. The average net receipts of a few years as they pass should be made up, and out of these net receipts should be taken an amount of money necessary to replace the rolling stock, the power houses, etc., after their life shall be exhausted, and if a certain amount is set aside it may be very positively found what electricity or that motive power which the major portion of the railroads are using, has been in our hands, and it is, therefore, not a very difficult matter to ascertain as to the life of these various mechanical devices, and the material which we use in our different operations may be. Sometimes we may be put under pressure possibly to hasten matters, but I think a conscientious, prompt, truthful and honest management, while it may be criticised as too conservative, had better to err upon this side than upon the other. (Applause.)

Mr. J. I. Beggs, of Milwaukee: Mr. President, I feel very deeply interested in this subject that is so ably presented here by a gentleman that has spent almost a lifetime in the ownership and in the direction of the affairs of street railways, and I feel so deeply interested in it because I am in a similar condition to that stated by Mr. Yerkes. I am charged with the responsibility of managing what is becoming one of the larger street railway systems of the country, but I am more than that, Mr. President, and have, therefore, given to this matter the most close and careful thought. I can say with Mr. Yerkes, all I have in the world is in street railway property. I am, therefore, particularly interested in the security of these investments.

I think there is a side to this question that has not been touched upon in Mr. Yerkes' paper, even so thoroughly as he has discussed it, or in Mr. Wyman's analysis of it, and I desire to throw out that thought here. It is one which the Milwaukee company, as my friend, Mr. Wyman, has suggested, has taken hold of. I want to know when I have been laid to rest, and those to whom I may leave the results of a life of hard work, want to know what protection for the payment of these securities there is when these short term franchises have ceased to exist. Taking the property of which I am now speaking, a little over 20 years to run and yet we are discussing it as they are in some other sections of the country, trying in advance to make calculations as to the franchises to know how much we are justified in putting into that property; how long we have in which to get a return from it. I do not know that it is being done so methodically by other properties—it may be. We have calculated, and I be-

lieve you will recognize that it is a proper charge against earnings, that you have a right to set aside this amount before the public can demand that you shall give greater accommodation for the carrying of a passenger 12 or 15 miles, to which Mr. Yerkes has alluded, or that the fare shall be reduced. We are setting aside a certain amount for this purpose, and we want to know what is to be paid to those who may succeed us in our investment in these properties and if, after the 20 years expire, they will simply have turned over to them out of which to recoup the investment there a pile of junk on the streets that the city wants to return in order that it may make a better dicker with some one else. I feel that we have a good investment in the property if properly run. We usually do not, when the road is new, and the equipment requires very little repairs, and the roadbed is new, look forward to the time when we shall be taking out 45-lb. rails and replacing them with 80 or 90-lb. rails, nor to the time when we shall be taking off the single truck cars, the equipment of each one of which is $2,900, and replacing them with cars costing almost four times as much. I desire to throw out in connection with this paper of Mr. Yerkes, the thought that we want to make some provision for the time that these bonds of ours will mature. In the case of the Milwaukee property, our bonds do not mature until two years after the expiration of the franchise.

Now, as to the other point suggested—as to the security—because I have always believed in holding this security myself—I do not want to have anything to do with a thing that I cannot put my own means in—I want to know what provision has been made to pay them. Is there any sinking fund being set aside by your companies to take care of these various investments when they shall mature? Gentlemen, you must make proper provision for your property, by looking forward a very few years, when they will have to be thoroughly reconstructed from the ground up. I estimate that we replace 10 miles of track every year, and that is not conservative at all, because we have got about 150 miles of road in the city limits, and I estimate that it will last 15 years, which no road has done thus far; therefore, we must put down 10 miles per annum to make it good. We estimate our rolling stock in the same way. It is a wonderful thing to tell, not only to the specialist, but to any business man or to any court, and it was very influential in the argument where the city tried to make us give 4-cent fares, that with proper maintainance of our system we could not do. Although if we had taken the figures as they appeared on their face, our earnings would have seemed to be sufficient to warrant a reduction in fare, but they were fictitious, they did not represent our normal repair condition as it was, and I desire to know in connection with this what provision is to be made for the redemption of those securities, when your city gets to the point when the socialistic element exists, which seems to argue that you have no right to use the streets when you are performing the functions for which the street is made, and carry the public over it without any burden upon the city whatever. I desire, gentlemen, to impress upon you the necessity, in order to make these securities safe, of having the public take them as they do our water works and gas stocks, in nearly all of which their charters are perpetual. The longer time our franchises have to run the more you can afford to spend upon the betterment of your system, the greater the facilities you can give. We are merely merchants, as Mr. Yerkes stated, in selling transportation, and we must make it the practice of, I sometimes use the phrase, "Provoking the public to ride." It seems necessary to me in order to give security to these investments, to make some provision for the bonds when our franchises have expired and when you cannot earn the interest on them, to say nothing of the principal.

Mr. H. H. Vreeland: I had hoped that our president could have waited until a little later to have called upon me, because it is placing me in rather an embarrassing position, calling upon a boy to talk in the presence of a lot of men. I am but a child in street railroad work, and it seems that anything that I might say in the way of analysis of the very valuable paper of my friend, Mr. Yerkes, would be criticising the pioneer and the patriarch in street railroad work. I have learned since my connection with the industry that of the few men who started their life's work in connection with street railway interests, who have invested their money as they made it in the interest which they had created, who have followed up as a life work until it reached a success far beyond what was considered possible for men to attain in any line or calling years ago, that Mr. Yerkes is really the pioneer in that direction.

There is a thought in connection with Mr. Yerkes' paper that occurred to me when he suggested the question of management, the consideration not only of the average revenues, but the average of expenditures; that is one of the very strong points that appeals to the confidence of investors and the general public in properties. The great steam railroads of this country with which the greater part of my life has been spent—you have only to mention the Pennsylvania, the New York Central, the New York, New Haven & Hartford and roads of that class to bring it to mind—have created a confidence in and permanency of management. Secure the proper man to manage the property. It is really more important in the street railway interests than it is in steam railroading, from the fact that in the steam road the directors do direct. There is not very much done in street railways in that direction. The manager is elected and put to work and allowed to run the property. He does not get much help and he has to be a man who can meet the local municipal conditions, the state conditions and the general conditions as affecting the properties as far as the legislative and municipal affairs are concerned. He has to be a man who can take care of the financial part and of the operating side, and he has to do it with very little assistance.

The next thought that occurred to me was what my friend, Mr. Wyman, suggests, and it is a very important one—the question of publicity. Coming out of the school where we are taught—were taught for years—not to submit a report to your directors or president without analyzing it thoroughly, not simply showing that their train tonage increased so much, mileage increases so much, revenue decreased so much, but went to work and analyzed it, and the same with reference to passengers—coming from that school then I was surprised to find how very little of that there was connected with the street railroad system. In many cases in an early day there were good reasons for it. From the fact that two or three men ran the railroad and for years acted in the same manner that they run a country store, and divided the money in the drawer among themselves. But the effect of consolidation and merging of the railroad interest in this country, both of steam and of street railroads, where 946 properties have been consolidated within the last ten years, irrespective of what may be termed trusts or monopolies, have changed this. The consolidations have reached a point where our securities by reason of recapitalization and reissuing of bonds necessary, have come into the hands of the investing public, and the managers are the caretakers of the property, not of the few, but of the many. But it is necessary to let people know what they are buying and what values they are getting to determine whether it shall be made into a fund or be a different proposition. The number of the stockholders in the large corporations, I am glad to say, is increasing very rapidly in the different properties with which I am connected. The increase in the average number of stockholders has been very large. In the Metropolitan Street Railway Co. the increase has been over 150 per cent in the last 10 or 15 years, both in the increase of capitalization and the bringing in of new investors. At the present dividend we had 130 more stockholders than we had at the last dividend three months ago, and not one of them held over 100 shares of stock in the increase, and they are residents of New York City. That is one of the greatest elements of strength in the handling of this property where we have to meet with the municipal and state question—a common interest with citizens in our properties—are located in the properties themselves. It assists and helps out with the question, gains friends for the property and assists very materially in the management.

With the question of 20-year franchises and 25-year franchises, I am very glad to say, that many, many years ago my predecessors, with very wise views for the future helped the state legislature to grant permanent franchises, and after we had secured all the permanent franchises that we thought were necessary for the handling of the business for the territory where we operated, we arranged it so that others are limited to 25 years, so that it is not a question for me, as manager of the property, to seriously consider, but it is a very serious question for the other fellows.

There is one further point that Mr. Yerkes suggested, and that is the labor question. It is the life of the street railroad. All other matters connected with the property are insignificant. The financial side, the transportation side, except as represented by labor, are insignificant as compared with the great problem of handling labor. In the large consolidations there are, say, 15 or 20 different lines in which the employes have been handled under the theory and ideas of as many different managers, and you see how difficult

it is to bring that body together, to try to get them responsible to one man and responsive to one method of management. It is a thing that requires a great deal of energy and ability, but it is a thing if once accomplished, that gives the public to understand that the manager is managing the labor problem and not the agitator. And if you can get that confidence you must adopt the same policy of the agitator and take the platform that he does when he talks in his interests and decide that it is just as valuable to the manager to go on that platform and talk to them in his interests; that is one of the greatest elements of strength in the street railway question in my mind, and I feel that it is one of the works in connection with the large work of consolidating the property, and I feel today that the success that has come to our property is largely attributable to this. The success of the investment is in the confidence of the stockholders and the general public that there is no crisis going to confront the property this year or next, that may not only wipe out the dividend, but mean the wiping out of the entire earning capacity for that period and the disturbance of all the smooth working conditions that is necessary to have at all times.

Mr. President, I consider it an honor to have the opportunity to reply in a small way to the very valuable paper of our mutual friend, Mr. Yerkes. (Applause.)

The President: We have all heard with very great pleasure the remarks of Mr. Vreeland on this subject, but we want to hear from everybody. Mr. McLean, I think we ought to be entitled to some remarks from you.

Mr. Thos. H. McLean: I have felt, Mr. President and gentlemen, that I am amply repaid for attending this convention by listening to the discussion already had upon the very valuable paper of Mr. Yerkes, and, without taking up the time of the convention, I think it proper to say that the paper itself and the discussion had upon it stirs up a line of thought that we can carry home with us, and that will inure to the highest benefit of all the members interested.

The President: We should be glad to hear from Mr. Foster, of Lynn.

Mr. E. C. Foster: Mr. President, and gentlemen of the Association: I feel entirely unable to express to you my opinion upon this subject, although I have listened with a great deal of interest to the very able paper read to us by Mr. Yerkes, and to the very able discussion by the other gentlemen who have preceded me, and I agree with them that it is a subject of very great importance, and it appears to me to be a subject of far more importance to those operating street railways in the western country than it may be to us in Massachusetts, for in Massachusetts you understand that we have a board of Railway Commissioners who have the supervision of the accounts of the street railways. Our tenure of franchise is entirely different, as I understand, from what it is in this part of the country. There the franchise is granted to the corporation without limitation. To be sure it is subject to revocation by the local boards, approved by the Railroad Commissioners, but, gentlemen, it would seem to be absurd on the part of the board of Railroad Commissioners to revoke a location on which they had approved the issuing of security. Their approval is set upon the securities as a seal. Also the amount of securities which are issued or may be issued upon any street railway is limited. They have the power of limitation. I understand that not to be the case in the western country, and it would seem that you were justified in seeking some better and greater protection than you now enjoy. I do not say, gentlemen, that the laws of Massachusetts are superior, as regards street railways, to those of any other states, but I do feel that the investors are protected. It is frequently remarked by those holding the securities of the street railways of the home companies in Massachusetts that it is a dividend paying stock, and it is free from taxes, making it a very desirable investment. A person holding a street railroad stock in any of the home companies, I believe, has a security which would justify any one in investing in it. There we are subject, of course, to the whims and caprices of the local authorities to a certain extent, but that is limited by reason of our right of appeal to the board of Railroad Commissioners. Gentlemen, I do not think it necessary for me to weary you with further remarks, as I feel that there are others here far more competent to discuss this subject tonight. I thank you. (Applause.)

Mr. Yerkes: May I be permitted to ask the gentleman a question on one point that he made. I understand you that the franchises of street railways are liable to revocation at the instance of the local authorities, confirmed by the Commissioners.

Mr. Foster: Yes.

Mr. Yerkes: That is what I understand. Now isn't this a fact, and this I merely ask for information—isn't it a fact that the courts have decided that these revocations cannot be put into effect unless it can be shown that the roads are not needed? That is the point that I want to make. As things stand now, according to your argument, it would seem that if the municipal authorities and the commissioners would get their heads together they could compel all the tracks in any town in Massachusetts cities to be taken up.

Mr. Foster: In reply to that, Mr. President, it would have to be shown that it was for the public interests and convenience that they should be removed, otherwise it would not.

Mr. Yerkes: Then it is a pretty difficult thing to get a track up when the people want to use it.

Mr. Foster: I don't know of that ever having been done, except in one instance. I think there was at least one road where they undertook to revoke the location. And the location was revoked, but another was substituted for it, so that it was not a complete revocation.

The President: We do not want to hear from one section alone. I may recognize the faces of some gentlemen more readily than others, because they are from New England. I want to hear from all sections of the country. The South is right here. We would be glad to hear from Mr. Jones, of Memphis, or any other gentleman from the South. Mr. Jones, won't you favor us?

Mr. F. G. Jones: Mr. President, and gentlemen of the convention: We certainly have gathered very considerable information for the business in the line of making investments attractive to people looking for that line of security. I do not believe it would be possible for me to say anything that would be of interest on the subject. We have gathered some points here—ideas that are new to us, on the line of these short franchises. You heard from New York; from our friend of the Metropolitan, who gives a pretty good idea how some of the larger companies have gone in and succeeded in getting a perpetual franchise, and then gone and procured legislation as to the 25-year law. Those ideas are certainly new and will help us when we ask for extension, and it is gratifying to me to hear these things.

The President: I see in the hall another New England gentleman, Col. Heft, of Bridgeport, Conn. He has had a very large experience in street railway business and is very level headed.

Col. N. H. Heft: Mr. President and members of the American Street Railway Association: While my time has been given to building these roads, I have not been required to direct any of my energies to raising the money for them. Our board of directors has done that. I have simply directed my energies in the direction of seeing how I could best spend the money to make the investment the most desirable, and while I believe that it is necessary to look after your municipalities, your Legislature and your representatives in general, yet I believe that the greatest benefits that will come to the street railway investment will be through the mechanical and electrical engineers in improving the present equipment of the railroad. I believe that our attention never has been sufficiently called to this matter, and that in a great many cases we have suffered from this lack of attention to the question of car equipment and to the weights that we are hauling today. We haul one passenger for whom we receive 5 cents, and for whom we are compelled to stop our cars twice, to take him on and to let him off. In going over the question of weights that we are drawing today, I was simply horrified to find that for every passenger we were hauling 720 lb. of dead weight, where the steam railroads are hauling 137 lb. with their standard system of railroad equipment. Now, I think that it behooves the street railroad managers to turn their attention to the question of equipment to see if we cannot get rid of some of this weight, and we expect to produce within the next two months a car, including the entire equipment, that will not exceed 227 lb. per passenger.

Now, I have been very much gratified in listening to the paper of Mr. Yerkes. I have also been very much interested in what our friend Wyman has said. He is always good, and I have also listened with a great deal of pleasure to our friend Vreeland of New York. I do not think I can add anything more, and can only say that I am very glad to have been here, and very glad to have listened to you all.

The President: If there is no further discussion on this paper, the business which has been laid out for the day is over, and the convention may adjourn until tomorrow morning at 10 o'clock sharp.

It is the intention to have these meetings open promptly at the hour appointed. Our friends have laid out so much for us outside of the meeting to do, it is absolutely necessary that we should depart, and I think that every member should be here promptly tomorrow morning.

The Secretary: It is the desire of the local committee that every delegate here, from both railroads and supply houses, will be at the Auditorium this evening at the reception. We want to get acquainted with our friends from a distance. The reception will be held in the Auditorium parlors at 8:30 p. m.

The convention then adjourned.

Wednesday, October 18th.

The second session of the convention was called to order by President Sergeant at 10 a. m.

The secretary read an invitation from the Siemens & Halske Electric Co. to visit its works, and announced that the excursion to the Drainage Canal would leave the Dearborn station at 1:30 p. m. sharp, and that no tickets would be required. It was also suggested that the delegates bring the ladies to see the exhibits in the hall tonight.

The following paper was then read by Mr. Vanderveer:

CARE OF CAR EQUIPMENT.

By J. H. Vanderveer, Superintendent of Shops, Brooklyn Heights Railroad Co.

In giving the writer's views as to the proper care of car equipments he expects them to be thoroughly criticised, but at the same time it should be borne in mind that different conditions obtain in different cities.

When the writer was first put in charge of a street railway equipment, the road had a certain number of cars and it took all of them to operate the road, except from 8 p. m. to 6 a. m., during which time all inspections were made and all possible overhauling done. If a car broke down during the day every one possible was put to work on it, including the motorman and conductor. As the motormen in those days all carried a kit of tools with them, and inspected the motors at the end of each round trip they were very helpful when it came to overhauling. However, those days have passed away with the double reduction motor.

In the maintenance of motor equipments today, where almost continuous service is demanded and high mileage made, only those equipments fitted with both oil and grease boxes will safely run over 40 days without a thorough overhauling. To do this overhauling a large road will be obliged to do it at a number of different points. To overhaul a motor car thoroughly it is advisable to have at each overhauling shop, extra trucks with motors mounted and all in first-class order ready to run under a car body whose trucks and motors need overhauling. To properly lift the body from the trucks four duplex chain hoists, or air hoists, conveniently located together with two cross timbers and four stirrup irons form as good a combination as can be found, and will do the work with the least possible injury to the car body. When the body is lifted the truck to be overhauled is run out and the good truck substituted, the car lowered, connected up and turned over to the operating department. The whole operation taking about one hour, and for that length of time only is the use of the car body lost. For convenience in overhauling, a suitable crane, properly located, equipped with a carriage and another duplex or air hoist, will be found of great convenience. Such a crane can be readily made in any blacksmith shop and for the arm a piece of old rail can be used. When the motor is opened the armature should be lifted out and placed on a suitable rack, where the commutator can be cleaned and the armature tested for insulation. The fields should also be tested for drop, and where there is a drop those fields and armatures should be used in motors by themselves, keeping new and rewound fields and armatures in motors by themselves. This prolongs the life of the equipment and reduces the number of crippled cars taken off the road. The motor shell should be thoroughly cleaned out, either by compressed air or by washing with kerosene. The grease in the grease boxes should be taken out and put in a gear case and the grease boxes thoroughly washed out with kerosene. Brush holders should be taken out and thoroughly inspected and cleaned. At the same time is the best opportunity for truck inspection. The writer has found that all overhauling done with the car standing over the pits, the bottom half of motor dropped, does not allow the thorough overhauling necessary to keep the motor equipment in the shape it should be kept, besides tying up a complete equipment while such overhauling is being done.

In the matter of general inspection a car started out, say today, in perfect order, will safely run five days before it is necessary to inspect again. In this connection, to inspect from 20 to 25 cars per day, one man can be responsible for the proper inspection of all trolleys, including the taking out and replacing any defective poles, wheels or springs, and the straightening of all bent poles. Another man should be responsible for the proper inspection of all circuits, together with hood switches, fuse boxes and lightning arresters. Another should give his whole attention to controllers. While the brakeman and his assistant should be able to keep all brakes in good shape and replace all worn out shoes. This arrangement of inspection and overhauling should keep the truck and motor equipment in good shape, if the night men take equally as good care. The writer recommends doing as little work as possible at night. At a car house operating, say, 100 cars, three men should be able to grease motors, inspect brushes and make any small trolley repairs. Car cleaning should come directly under the operating department. The night car cleaning should be limited to sweeping out, cleaning windows and dusting cars, while all washing should be done in the day time while the car swings or is on the stand, if the car house is on one end of the line. In connection with car cleaning, if the cars are of the closed type with seat risers and drop sash, the space under the seat should be cleaned once a week, as the traveling public have a tendency to drop newspapers, apple cores, etc., down behind the seat back, not to mention the bits of lunch the motormen and conductors drop there if their runs compel them to eat on the car. The best way to avoid this and to also save the annoyance of rattling sash, is to make the sash stationary and cover over the space between the top of the seat back and sash rail. This, of course, does away with blinds and compels the use of curtains. The cost of maintenance is reduced by using curtains and, at the same time, if you happen to be an official riding in a car of this type you need not be in fear of a passenger pulling a blind with three or four broken slats, and the whole thing covered with dust so thick that you can write your name in it with your finger.

A car house from which 100 cars are operated should have a good carpenter stationed there, to make small running repairs and to take care of bell cords and register ringing devices. Any car

J. H. Vanderveer was born in Somerville, N. J., Mar. 28, 1864. He passed through the public school in that city and entered the grammar school with the idea of preparing for Stevens Institute. While in this school he passed the examination for admittance to the Naval Academy at Annapolis, but was rejected as being under age. In the meantime, through an unfortunate investment in real estate, he was obliged to give up the idea of going to Stevens, and entered the employ of the Central Railroad of New Jersey, in the terminal station at Jersey City, as office boy. On June 1, 1884, he was appointed chief clerk and also put in charge of the harbor transfer work. He remained with the Central R. R. until Dec. 24, 1888, when he accepted the position of superintendent of the People's Street Ry., of Scranton, Pa., which was then being changed over by the Sprague Co. from horse to electricity. The following year he was made manager, and remained with the company until the spring of 1892, when he resigned. During the time he was in Scranton the other two trolley roads in the city were taken into the People's company. During the summer of 1892 he was engaged in inspecting street railway properties for several Scranton gentlemen. On September 1st he entered the employ of the freight department of the Erie R. R., where he remained until 1893, when he became connected with the engineering department of the old Brooklyn City R. R. He has been in this department ever since, through the different consolidations, and at present holds the position of superintendent of shops.

that has been in a collision and damaged so badly that it cannot be repaired in one day should be sent to the general repair shop. All cars should be taken to the general repair shop once a year and the body put in thorough repair, and the car varnished or burnt off and painted anew, as the case may demand. While the car is in the carpenter's hands the wiring should be gone over carefully and put in shape. If the car goes to the shop with its regular truck and motors, the truck should be run out and gone over thoroughly. In case it is a built up truck, all rivets and bolts should at this time be carefully inspected and renewed where necessary. In case of a solid side frame truck it should be carefully squared to see that it has not sprung. The brake rigging at this time should be taken apart, and if it is a truck with brake beams working in slides, the beams should have what are termed "Dutchmen" jumped into the ends to bring the wearing parts back to their original thickness, as the beams will probably be found to have worn wedge shaped. If the brake beams are hung in links, these should be renewed where signs of wear show. At this repair shop should be concentrated all classes of repair work, not only repairs to bodies and trucks, but all electrical repairs. The writer believes it pays for all railway companies to make their own repairs to electrical apparatus, including the making of armature coils and renewing of commutators.

In connection with the latter the writer has found that hard drawn copper makes the best commutator. This is bought in lengths and the bars sawed off with an ordinary metal saw. It will be found that the same bar will often do for several types of commutators. In making commutators yourself it is well to study out the diameter and increase that over these turned out by the factories as much as you can safely get between the brush holders. Drop forged bars can also be had for any width of commutators you wish.

On repairs to controllers, hood switches, etc., most roads will find it cheaper to buy the ordinary repair parts and then assemble them, themselves.

In conclusion, the writer would say that he has found it is advisable to make car body repairs, painting, rewinding armatures, making commutators, armature coils, field spools, etc., by piece work. If good inspection is provided and the prices honestly watched, both the company and the employe are gainers by this method. The writer has in mind a case in point. A shop was operated by day work and the regular carpenters' wages were $2.25 per day of 10 hours. Cars that were being remodeled were costing $120. This was changed to piece work and each car given to four men for $110 per car. It was found that the men could do it easily for this and make about $6 over their regular wages. They soon became so expert at this line of work that the price was cut to $80 per car gradually, and the cars are being turned out at this price now, and the men are averaging $2.50 per day. Close inspection, however, is a necessity.

The President: The thanks of the Association are due to Mr. Vanderveer for his able paper. I trust that it will be very fully discussed by all the practical men that are here—and I don't think there are many impractical ones. I want to call on some one to open this discussion, and I will ask Mr. Connette, of Nashville, to speak. I know he is able to discuss this thoroughly.

Mr. E. G. Connette: Mr. President, and gentlemen of the Association. My primary education in the railway business being with steam railway systems, has probably diverted my mind in a different direction from the opinion of some street railway people in regard to the inspection and maintenance of street car equipments. You know that when a locomotive makes its trip of 100, perhaps 150 or 200 miles, it then enters the round house and is inspected and cleaned and all necessary repairs made before it makes its next trip. So with the line with which I am connected I adopted this method; when a car comes in from its trip of 100 to 150 miles, it is first cleaned, then inspected. All the parts of the motor, including the wire connections of the brush contacts and all the parts of the truck are properly inspected, loose parts tightened up, and all minor repairs made, and the car is prepared then for its journey on the following day. My experience with that method for perhaps 10 years prompts me in saying it has been entirely satisfactory. It is argued by some that daylight inspection is better because the men have a better opportunity and perhaps feel more like working in daylight than they do in night. That is true to a certain extent, but with a limited car equipment, and perhaps with the car barns located in such a manner that it would be inconvenient to have the car run in during the day from time to time to have the inspection, cleaning and repairs made, it therefore becomes necessary with some companies to do the work at night, and this to a large extent is so with the system in Nashville. But, as I have stated, the system of cleaning, inspecting and making minor repairs at night has been very satisfactory. If a car goes out in the morning and something occurs to disable the car and it is brought into the shed, and the defect is caused by the lack of inspection at night, why then, of course, proper action is taken, and that is an incentive to the night inspectors to do their work properly, because if they do not do it, results will tell. Then the general overhauling of the car is done by the regular repair force in daylight, and we make it a rule to give the motors a genuine overhauling perhaps once in six months. About two years ago we had a very large exposition in Nashville, the Centennial Exposition, in commemoration of the 100th anniversary of the state. During that period we hauled a very large number of people, trail cars behind every motor car, with a headway of from one to one and a half minutes regularly during the six months of the Exposition, and there were but six motors disabled. I think that record will justify me in stating that the adoption or the application of steam railway methods to street railway service has been entirely satisfactory to our company. (Applause.)

The President: Gentlemen, I hope this discussion will go on. It seems to me that the subject is one that comes right home to all of us. There are a great many different practices in the country, I think, as to the number of men employed, and as to the frequency of inspection, and as to the records which are kept of failures on the street or the failures of armatures, wheels, and other parts of the motor; and it seems to me that we should have a pretty free discussion here. I am unable, perhaps, to call on gentlemen by name, but I should be most happy to have them get up and announce their names and tell us what they know about it.

Mr. W. P. Harrington, Camden, N. J.: We have a road on which we operate at this time about 43 cars, and do the bulk of our inspection and general repairs at night time. We do the general repairs and painting on the piece work system, and it is very satisfactory. One of the difficulties we found in adopting the piece work system was in fixing the price for the work, not having any precedent, and we struck upon a method of covering possible mistakes in price by limiting the amount of bonus that we would give. If we set a contract price for a piece of work at say $5, and the work was actually done for $2, that would make a profit of $3, which would be entirely disproportionate; so we settled on the limitation of 20 per cent of the actual cost. If it cost $20 to do it and the price was $5, the bonus paid was 40 cents, whereas, if the cost exceeded $5 the loss would not exceed 20 per cent of the actual cost price. That seemed to satisfy all the shopmen and enabled us to settle quickly and use our best judgment in price, and it has been very satisfactory. We have followed that same practice in track construction, and in every respect it has been very satisfactory.

The matter of car cleaning and washing with us is a very serious matter, on account of the great amount of dirt and dust. We do our washing at night, and are doing that also by piece work, and washing 16 to 18-ft. bodies, single trucks, at 15 cents a car, and double truck cars at 22 cents. It formerly cost us from 40 cents to 60 cents for our cars. Those figures are exceedingly low, I think, and the work is very satisfactorily done. I personally would like to know what the expense is in reference to the number of cars that are housed for repairs, taking the percentage of cars in actual operation. On one road we average about 10 per cent of the actual cars in operation in the house of repairs. I think this point ought to be brought out pretty thoroughly, because it is a guide to know how many equipments to buy and provide for in a road, and it is a point that I never heard discussed.

The President: Perhaps Mr. Vanderveer can answer that question.

Mr. Vanderveer: In regard to the allowance of 10 per cent, we found that on some lines it would average 10 per cent, but on others it would go as low as 4 per cent, depending a great deal on the service and on the equipment we may have at that particular depot. Ten per cent of the total number of cars is the extreme limit.

Mr. Harrington: What bearing would having a single or a double motor equipment have on the percentage? We are running single

motor equipments and I know our depreciation is relatively high on our armatures. I assume a great deal of the large percentage is due to that fact. What is your experience in that matter, or your judgment?

Mr. Vanderveer: Well, with the single motor equipments, I have had nothing to do the last year or two. But my recollection is that we ran higher than 10 per cent on single motors. Of course the number of miles run per day and the style of motors have a great deal to do with that.

Mr. Elwin C. Foster, Lynn, Mass.: I would like to ask Mr. Vanderveer if he considers that there is any economy in operating a single motor. As I understand, the gentlemen have been speaking of disabled cars which are lying in the car house during part of the day, and this, I understand, is due to defects in the apparatus, and he says that 10 per cent of his cars were in the house all of the time. I might say, for the benefit of the Association, that we have not found it profitable to operate single motor cars, practically on account of the increased expenses created in the maintenance of them, as compared with the double motor cars. This past season we have been operating one 10-bench open car with one pair of G. E. 57 motors of 52 h. p. capacity each. That, as of course you all recognize, is much greater than the power required to operate a single 10-bench single truck car. But the result, so far as repairs are concerned, has been very satisfactory, there being no repairs necessary on that car the entire summer. The car has made about 120 miles a day and we have not worn out even a set of brushes. Now, I believe it has been the custom in the past to operate a motor of too small capacity, and by reason of that small capacity the expense of maintenance has been increased very materially. I would ask the previous speaker if he has any figures as to the cost for labor of painting up and varnishing the cars.

Mr. Harrington: In reference to the first matter, the depreciation in using single motor equipment, we have been using single motor equipment practically up to date, with the exception of a few double truck cars we recently purchased. About a year ago we took one of our 18-ft. trucks with double equipment, 330, and where we average a car in the house say once in 10 days with a single motor equipment, that car has only been in the house three times in the year, and that for only petty repairs. On the strength of that, our directors have concluded to double the equipment of 12 of our cars as a starter. Our armature depreciation has been, in my judgment, tremendous, and altogether out of reason. For a 50-mile road we have one armature man busy all the time, doing nothing else, and I think we can put him on other work when we get a different equipment. The exact difference in cost is difficult to say, but we are sure that we will very materially cut that down. In reference to the cost in mounting, we have the figures all listed out for the general run of the work. For a car to be taken in the house and the paint burned off and painted and varnished throughout, the inside varnished, the contract price is $20. For ordinary touching up and varnishing the outside with the paint that is already on, and one coat of varnish on the outside, the contract price is $6. The cost of the material runs approximately the same as the other. But I have the figures for all that on file.

Mr. Foster: I would like to ask the gentleman the rate of wages paid, where the work is done in the house.

Mr. Harrington: We pay painters $2.50 a day and carpenters $2 a day for that class of work.

Mr. W. P. Read, Salt Lake City: How many coats of paint do you include in your specifications? The number of coats of varnish that you are under contract to receive?

Mr. Harrington: The usual formula of putting on the first coat, that is the rough stuff, rubbing down, putting on the second coat, rubbing that down, and putting on three coats of varnish. There are really five distinct steps in the operation.

Mr. Connette: There is one element of saving in running single motors where they can be run, and that is in power. In Nashville, Tenn., there is very little level ground. It is up and down hill everywhere. But I tried the experiment of a single motor and found that by test it used about 35 per cent less power than with double equipments, but we could not use the single motor for the lack of traction. Most of our roads have no loops at the ends, and consequently the ends of the cars are reversed, and when the motor was in front there were a great many places where it was quite difficult to get up with a single motor, on account of traction. When the motor was on the rear axle, that difficulty was not so great, but there is a saving in power by the use of a single motor. It strikes me that where single motors are used it would, to a large extent, limit the capacity of the car or the size of the car in proportion to the power of the motor used. Now, in Louisville, Ky., where they operate possibly 200 or 300 cars, it has been my observation that nearly all of them are run with one motor, one S. R. G. motor, but the cars are small, most of them having been old horse cars converted into electric cars, and the city is comparatively level, and, as I understand it, they are operated very satisfactorily.

Mr. R. Douglass, Cleveland, O: It seems to me that this question of single and double truck cars depends a good deal upon the condition of your track. I represent the Big Consolidated road of Cleveland, where we recently had a little disturbance, and we have some old Johnson rails on chairs, and all that sort of thing. Our people have recently purchased 150 double truck cars, modern cars. One motive was to keep up with the times, handle our people promptly, and another reason was because we had some bad track. By putting these double truck cars on we could run our cars very smoothly over that track that was almost unbearable with our single truck cars. It seems to me it is a question of track to a great extent. I think a 10-bench open car or an 18 to 24-ft. open car on long wheel base, single truck can be operated much better than the other kind.

When I went to the Big Consolidated road, May 1st, I found that painting contracts were in force there, and they were very unsatisfactory. The company was paying 25 per cent more for painting cars, that is, painting, touching up, burning off old paint and varnishing the different equipments, than it actually costs now by day work, and we were not getting as good work. We get much more satisfactory work by day work, and I think we save 25 per cent. That would apply to painting and varnishing. We have a contract for making armature coils and doing that sort of work, which is entirely satisfactory. I have not canceled that contract; it is still in force. That is the only contract work we do. I have not seen fit to change that.

Now, about the trolley wheels. When I went to the Brooklyn Heights road about five years ago Mr. Vanderveer was still there, but I don't think I ever made his acquaintance. They were making their trolley wheels out of tempered brass and copper. I have often wondered since why we do not put in a brass foundry and make our own trolley wheels. We are buying our castings in the rough, and have a very well equipped shop and are turning them out. I wonder why we do not make those castings ourselves. We have to scrap our old copper and brass at about 15 cents a pound, and then pay a large price for new wheels. Yet I believe the Brooklyn Heights Co. has discontinued that, have they not, Mr. Vanderveer?

Mr. Vanderveer: In regard to the brass foundry, while it is very handy to a large road, our experience was that we made things out of brass that we should have made out of iron, and we shut it down for the time being, but started up a short time ago to help out on some parts for motor equipment. That was a part that could have been made out of cast iron if we could have reached the cast iron people as well as we could the brass.

Mr. Douglass: Is it not economical to make your own wheels?

Mr. Vanderveer: Yes, if the matter is followed up properly, I think it is the proper thing to do.

Mr. Douglass: And you can save 25 to 30 per cent?

Mr. Vanderveer: Easily. There is always a tendency though to drift out into other matters.

Mr. Douglass: I am surprised more of us do not make our wheels.

Mr. Beggs: Whether or not a road could profitably make trolley wheels, like many other parts in use, would depend upon what they are compelled to pay for them. I have a contract for trolley wheels at the present time, made according to our formula, such as have been used on our lines, and seem to be the most advantageous as to the proper degree of hardness to give the best results without wearing the wire; these preferably permit wear on the wheel, which is easily repaired, at 23 cents a pound, and we contract for converting the worn out trolley wheels into others of equal weight. Now, I don't believe that any road can afford to put in a brass foundry and make trolley wheels if

they can buy them for approximately that amount, because the old wheel you could get 16 cents a pound for.

Mr. Douglass: That is the rough casting?

Mr. Beggs: No, the finished wheel. We use a 5-in. diameter wheel on our line, because a large wheel travels at less speed than a small one. Our wheel weighs approximately something over three pounds, nearly three and a half pounds, finished. Take that, with the brushes, and I do not believe that there is any road that is making its own wheels that can maintain a brass foundry. In that connection I would like to suggest, the argument is so often made by municipalities that they can operate an electric lighting plant and other public utilities at less than we gentlemen who are in that business; that very many times our special foundry in connection with our roads is not charged with all that it should be charged. That is too often the case with the brass foundry and other appliances run in connection with the road. There is nothing charged to it for superintendence. You fail to charge up to it the amount that it represents, and when it covers that amount I do not believe any road that makes a proper contract for trolley wheels can begin to make them as advantageously as some shop which has other things to make of the same character. It depends very largely on how the contracts for the roads are made. For instance, I am now paying 30 per cent more for trolley wheels than a contract made about eighteen months ago called for, and in order to get what was a satisfactory figure to me, knowing the difference between the relative value of brass, copper, zinc and tin entering into the composition of a trolley wheel for our own use, I made a contract for 5,000 wheels, to be delivered to us at the convenience of the shop turning them out, made according to our formula and according to our pattern. They can turn them out between times at their shop, and I know that I could not run a brass foundry and begin to turn those wheels out for what they cost us today under a 5,000 wheel contract. I would like to throw out a suggestion here, Mr. President. It is not in line with this, but in regard to motors, and particularly in reference to what my friend Douglass says, who claims they just made a contract for a large number of double truck cars. I would like to give him the benefit of our experience at Milwaukee in reference to the increase of motors. I do not believe any road can advantageously run one motor. I never have believed so in ten years. I do not believe so now, for the reason that the 35 per cent power that is saved I think is three-fold paid out in the greater cost of repairs to the single motor, and to other parts. The cheapest thing, virtually, that we put in the electric railroad today is the power that moves the cars. It costs less than almost anything else in the service. Three and a half years ago we adopted a standard car on our lines; a double truck car. We have been steadily advancing and improving that equipment, until this year we put on 25 cars. We put on about 35 new cars annually in order to keep up our equipment. They are double truck cars, our standard. For three years we contented ourselves with two motors on these cars. We put on 25 cars this year and have a contract now for 30, to be delivered in April next, on which we shall put four motors, a motor on each axle. We have done this for the sake of economy and in order to provide facilities for giving good service. Our traction is very much better. We can speed up a car very much more quickly, and in a city where you have to stop every 300 or 400 ft. it is an important matter to gain a second or two in getting in motion. For that reason we have finally adopted, at considerable expense, the four motor car. We put on ten cars 15 or 18 months ago, with four motors, and we find it costs less for the maintenance of cars with four motors than it does those of two. The actual cost of repairing that equipment is very much reduced, and the number of cars we have in the shop do not average 2 per cent. Taking up what my friend from Camden says, we seldom have to pull one of them into the shop. We can get the cars up to speed between streets in a very few seconds, and if the car gets behind time it has the reserve power which enables it to make speed, which is a very important element in the economical running of street railways. We run pretty long lines in our city, few are less than seven or eight miles from terminal to terminal; in that run we make, say, 200 stops, and a second or two in each stop means a considerable amount in the run, and aids us in maintaining our schedules. We know that the cars with our four motor equipment, speaking off hand, require 30 per cent more power than the others to pull them over the same line, but we are making higher speed, consequently saving money in other ways, giving more satisfactory service and saving our equipment. As I said, the cheapest thing we have is power.

Mr. Douglass: What type of motor have you?

Mr. Beggs: We have the G. E. 1,000. We put one G. E. 1,000 motor on each axle. We have a number of grades, but none are very severe, and we have no trouble. When it comes to a slippery rail in winter we never have to worry about whether our four motor equipment car is going to get over the line. Our number of flat wheels is very greatly reduced. So that in every way the cost of maintenance of the four motors is 25 per cent less than on the two. One of the reasons we adopted these cars was to give better service to the public and to be able to make our time more regularly and haul larger crowds. We use pretty large cars, almost as heavy as steam railroad cars. We have them built to seat 44 passengers; 22 double seats. We frequently have over 100 passengers in those cars and on the very wide platforms. The car is 41 ft. over all. This is the car we have taken as a standard, after many years of careful experimenting. I don't remember the number of men in our armature shop, but it is half of what it was 10 years ago.

Mr. Connette: I don't mean to advocate a single motor equipment, but I do say this, that for small cars, where the streets are comparatively level and where the power of the motor is in proportion to the size of the car, that it can be operated for less expense than a double motor equipment. I know by actual meter testing that with an 18-ft. closed car body, single truck, double motor, that it requires about 150 kw. hours per day for 125 to 140 miles. The cost of power, of course, varies, but a fair average is one cent per kw. hour, therefore if you use 150 kw. hours per day and save 33 1-3 per cent, the saving of power would be 50 cents per car per day, and where, we will say, 30 cars are run it means $15 per day, and it strikes me, with the experience I have had in maintenance, that it will not cost as much to maintain one motor, even with a little extra service, as it does to maintain two motors. We have, with two motors of the ordinary kind that is used, four fields and two armatures, with all the incidental connections, and it is common sense to say if you are running only one motor with even extra service it would not cost as much in power to maintain it as it would two motors. But when the element of service enters into the question in larger cities, where you have got to have large cars and high speed and heavy travel, then perhaps our judgment would change to the double motors, because you can give more effective and more satisfactory service with two motors on a car than you can with one motor. But so far as the element of service is concerned, I believe that it is more economical to operate one motor than it is two motors where it can be done, and I believe that this practice is limited to small places, and where the streets are comparatively level.

Mr. Foster: I would like to ask Mr. Beggs what is the average rate of speed made by the four motor cars, also if he uses power brakes, and if so what kind?

Mr. Beggs: No, we don't use power brakes on our city equipments. We try to maintain a speed of about 8½ miles an hour over the whole city system. We furthermore maintain on our lines probably the longest headway of any city in the United States for a thickly populated city, and one of the means of doing it is the larger cars, the great regularity we maintain in our time table, which is adhered to as closely as that of a steam road. Even on lines where we stop every 300 or 400 ft. we make on an average 8½ miles, and sometimes 9 miles per hour. There is none of our equipments that runs less than 160 to 170 miles daily. On our interurban lines we make as high as 380 miles a day. We have a considerable number of interurban lines spreading out like the spokes of a wheel. We use only the ordinary ratchet brake on our city cars. We have one line on which we make 19 trips a day, with hourly cars, and we do that with two cars. These two cars keep up the service, making 19 trips of 20 miles each. On those cars we have air brakes and arc headlights, both of which elements are indispensable to a high rate of speed.

Mr. Foster: What is the maximum rate you are able to attain on the interurban line?

Mr. Beggs: Fifty miles an hour on certain portions of the line. The cars become part of the city service when they get within the city limits. We make a speed outside the city limits

of from 30 miles an hour up to as high as 40 and 50 miles an hour. On all of our city lines we have high speed gears.

Mr. Foster: Is that on the public highway, or on a private right of way?

Mr. Beggs: On the particular line I refer to half of it is on a private right of way. We have one interurban line which is all on the public highway. On that line we do not make quite as high speed.

Mr. Albion E. Lang, Toledo, O.: Mr. President, I want to touch upon two subjects that seem to be most prominently before the convention this morning, and the first is with reference to the maintenance of a brass foundry. We are operating a street railway and electric light plant combined, and we maintain a brass foundry, and I take it that that is an endorsement of the wisdom of maintaining a brass factory. We pay our brass foundryman daily wages of $1.75 per day, and he is a good man. He spends his entire time in the brass foundry and he takes every scrap of brass that we have and works it into every place on the cars and about the power house that brass is used, and we are satisfied beyond any doubt, the most economical way to operate a railroad is to maintain your own brass foundry. We cast our own trolley wheels, and, as I say, every fitting of the car that brass enters into is manufactured from our furnace. Now, with respect to the double car equipment. It depends, I think, very largely upon local conditions with respect to grades. We operate two motors on each car, our standard being the No. 3 Westinghouse motor. We have a few G. E. 800, but a suggestion that I desire to make that may be of value to some of you is the fact that we have just entered upon a method of splicing two 16-ft. body cars together. It has been a serious question with us what to do with four-wheel cars that have been in operation from eight to ten years, and following the same line of procedure that they adopted at Columbus about three years ago, we have just taken two 16-ft. body cars and spliced them together, and put them on double trucks, and we have placed those cars upon one of our longest lines, where we have been maintaining a nine-minute interval for some two or three years, but found a necessity for shortening the interval. To overcome that necessity we have concluded to put these double truck cars upon that line, and we have had them out now about sixty or ninety days, and they look just like new cars. An expert, of course, could tell the difference, but the riding public say "What a magnificent car this is!" They are pleased beyond measure, and we think by that means that we are going to still maintain our nine-minute headway without complaint, because they take more passengers and their speed is just as good as the 16-ft. car. It was argued that we would not be able to maintain our speed, using a 25-h. p. motor, but in our city where we have few grades we find we can maintain our speed just the same with our double truck cars as we did with our 16-ft. cars, and you can see that it can earn a good deal more money, and I think that where the situation of the road is similar to ours that you will find it of great advantage to take some of these cars that are nearly ready for retirement, and by putting in new sills and bracing them up properly you can utilize them for a long time.

Mr. Beggs: Have you any estimate as to what it has cost to reconstruct these cars?

Mr. Lang: In the neighborhood of $300, including the labor and material entering into it.

Mr. Beggs: That, of course, makes a longitudinal seat car when you are through with it?

Mr. Lang: Yes.

Mr. Dimmock: I would like to say for Mr. Lang's benefit that we took 16-ft. car bodies after they had been in service between 6 and 7 years, spliced them together, made a 42-ft. car over all, including vestibules, and have run them 5 years, and, outside of the painting, we have had practically no repairs to speak of since the day they were built. I think the splicing of those cars cost us in the neighborhood of $300 or $400. I have forgotten the exact price, as it was some time ago, but we find with the double truck cars that the service is better. It was also claimed that we could not keep up our schedule, with the same headway, after splicing these cars, and especially after putting gates on them. We equipped these cars with gates, which are operated with a lever by the motoneer, and we find that although the power consumed is greater than it was before the gates were put on, on account of the greatest number of dead stops that are required to be made, nevertheless this type of car is giving good service, and is running on the same time card as the 16-ft. cars, the speed being as high, many times, as 30 miles an hour, and the repairs are not any more than they are on the cars running up town, which are only 16-ft. cars.

Mr. Beggs: I would like to ask if the cost of splicing the two 16-ft. car bodies makes provision for the trucks?

Mr. Lang: No, it does not.

Mr. Beggs: What do the trucks cost, or do you put regular double trucks under them?

Mr. Dimmock: Double trucks.

Mr. Beggs: That is an important question, because we have canvassed that matter thoroughly for three years, and we finally determined that it was not economy to splice our old car bodies, for the reason that by the time you have added the cost of these trucks to the cost of the car, it would still be an old car and will have cost half as much as the best car that can be built. Of course, as Mr. Lang has said, local conditions have a great deal to do with it. We, in our city upon the lake, this summer have had very little warm weather that would require people to go out to take rides in the open cars. We intend to dispense entirely with open cars and get our equipment down to a standard that we can run all the year. In order to do that we have cross seats on all cars and must have greater width of body than you have, ours being 9 ft. 6 in. This gives us two cross seats with a very good center aisle. We do not want any longitudinal seats on our cars. Our patrons prefer our standard car, and with the sash down it virtually becomes an open car. We have a car, then, on which we do not have to change the equipment. There are no trucks to take out or anything of that kind. I want to bring out that the $300 does not begin to cover all the expense that is involved in reconstructing the old car bodies, and I think you will all admit that when you have taken an old car body that was built for the lighter traffic for which it was intended some years ago, it will only be a little time before the car will begin creaking again.

Mr. Dimmock: We have run our cars five years without repairs, but in order to make the car as good as we thought it ought to be, we had a steel frame put around the bottom of it, and very heavy truss rods, which have caused the car to stand up to all conditions of traffic, bad track, etc., but I will admit one point, that if we were buying new cars we would prefer them wider and prefer the cross seats; and as to your open car we also spliced our 16-ft. open cars and the difference in the two cars is that the closed car seats 44 people, while the open car seats 75. Another feature that we could not lose sight of was the track center. Our track centers will not permit of a wide car, therefore that aided us in making a decision much quicker. If the track center had been wider we might have considered a new car. Still we feel we are money in pocket by the splicing of them as we have.

Mr. Foster: What is the depth of the flange on your wheels?

Mr. Beggs: I think it is an inch and an eighth.

Mr. Foster: Do you run that over a T rail or a grooved rail?

Mr. Beggs: Our standard road bed construction is a T rail, with granite headers and stretchers. We form the groove out of granite, and I think if you come to Milwaukee you will see almost the same effect as a grooved rail. We put down a rail that will permit the city to pave in any way it wants.

Mr. Dimmock: Before we get away from the question of trolley wheels, I would like to ask if any of the gentlemen present have kept the mileage on their trolley wheels.

Mr. Beggs: We get from 8,000 to 9,000 miles out of our trolley wheels. I know there are roads that get as high as 16,000 or 17,000 miles. We use a composition consisting of 86 per cent of copper with 8 or 9 per cent of tin and 4 or 5 per cent of zinc, and we get a composition which allows the wheel to wear rather than the trolley wire. It costs us much more to wear out a trolley wire than it does to wear out trolley wheels. I know there are certain roads that make a boast of how many miles they get out of a trolley wheel. When I went to Milwaukee three years ago I found them using a steel wheel. The result was rapid wear on the trolley wire.

The President: Is there any further discussion on this subject? If not, I think we should take up the subject on which we were promised the paper from Mr. Kilgour, of Cincinnati, which is "The Modern Street Railway Shop." I would ask whether Mr. Kilgour is in the hall. The committee has not heard from Mr.

Kilgour, and I think there will be no paper on this subject, but it is a subject that I am sure every one here is ready to talk upon, and I am in hopes that it may be started by Mr. Knox, if he is in the hall.

Mr. Holmes, Cincinnati: I want to say for Mr. Kilgour, I am sorry he did not prepare this paper for us, but he expects to be married tomorrow or next day, and is quite busy making his arrangements. He is a bright young street railway man, and I think we ought to forgive him this time. It is a disappointment to me, because I think Cincinnati has about the best street railway shop I ever saw.

Mr. Knox: I was only notified a couple of days ago that I was expected to participate in this discussion, and I have not given it any special thought. It was a paper I hoped would be presented to the convention, because I consi er it one of the most important problems we have, where there are perhaps greater leaks than in the other departments, but I am not prepared to speak upon it at this time.

Mr. Penington: Mr. President, and gentlemen, I have just been informed that it is not necessary for anybody to get lunch at the hotel today. Mr. Roach says he has a baggage car on this train that is full. (Laughter.) I didn't ask him of what, but he said he had plenty of sandwiches "and so forth," so that you need not go to a hotel to get lunch unless you wish to. The train will leave at 1:30 from the Dearborn station.

The President: If you will please give your attention for a few minutes, gentlemen, we will adjourn the meeting. The chair has today to make the announcement of a committee of five, which committee shall determine upon a location for the next meeting and shall report nominations for officers. The location and the nomination will be presented to us as recommendations by this committee, and the Association will act upon it. I would nominate for this committee: Mr. H. C. Moore of Trenton, Mr. E. C. Foster of Lynn, Mr. E. G. Connette of Nashville, Mr. Robert McCullough of Chicago, and Mr. A. E. Lang of Toledo. Invitations to the Association to hold its next convention in any city should be presented to this committee and any arguments or inducements that are held out by any city should be laid before them, which does not, of course, in any way preclude the presentation of any arguments at the time of the committee's report. Mr. Moore announces that he can be seen at his room at 8 o'clock this evening—room 316, Auditorium Hotel.

The convention then adjourned.

Thursday, October 19th.

The convention was called to order by the president at 10:30 a. m.

The secretary read a letter of regret from Mr. H. M. Watson, of Buffalo, who was unable to attend the convention. He also read an invitation from the Westinghouse Electric & Manufacturing Co. to visit the power House of the South Side Elevated Railroad. The South Side Elevated will furnish a special train, which will leave from 47 Congress St. at 2:30 p. m. Friday; the train will leave the 18th St. Elevated station at 2:35.

The first paper was:

CONSTRUCTION AND MAINTENANCE OF STREET RAILWAY TRACKS.

By Edward Butts, Chief Engineer, Metropolitan Street Railway Co., Kansas City, Mo.

The construction and the maintenance of street railway tracks are inseparable, when we have to consider the capital required for the enterprise; that is a cheaply built track will be expensive to keep up, and to reduce the maintenance charge, more must be spent in the construction. One of the preliminary points is to decide upon the kind of a street railway that is to be built. Is it to be built simply to float on the market, or is it intended to last and give good service for as long as possible? In other words, is the road built to sell or to keep? The writer in preparing this paper had in mind a road of the latter kind.

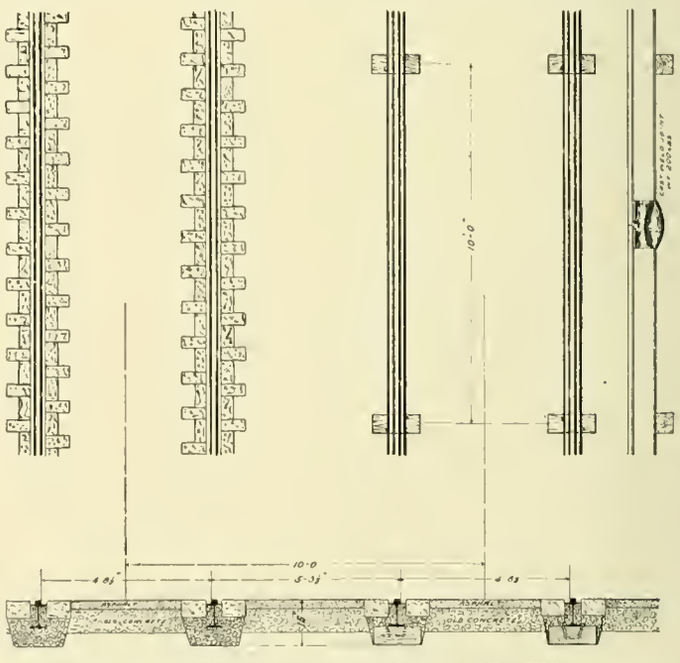
Local influences which may affect the cost of maintenance or may in the future compel changes should be carefully considered, and these local influences lead to the primary division of street railway construction into urban and interurban.

EDWARD BUTTS.

Edward Butts is a civil engineer and surveyor of wide experience. He commenced work as transitman on railroad lines between Albany and Steventown in 1869, and from that time until 1892, he served for varying periods as draftsman for the New York Central R. R., transitman in charge location L. E. & N. W. R. R., leveler Kansas City & Northeastern R. R., assistant engineer for the Atchison, Topeka & Santa Fe Ry., the Kansas City, Ft. Scott & Memphis R. R., and the Utah & Pacific R. R. He also acted as assistant engineer on the construction of the Grand Avenue Street Ry. cable system of Kansas City, Mo., and for the Kansas City Belt Ry. He was appointed assistant city engineer of Kansas City, Mo., and in 1892 was made city engineer. He resigned two years later to become chief engineer of the Metropolitan Street Railway Co., of Kansas City, which position he still holds.

It is desirable, in all cases, that the whole of the track shall wear out at the same time, and as the urban portion of the line is subjected to the more severe service it becomes the governing factor as regards durability. We shall take up such a construction as experience has shown, all things considered, to be most satisfactory for urban lines.

In making the rail foundations a trench is dug; this should be 20 in. wide at the top, 16 in. wide at the bottom and deep enough to allow 6 in. below the rail when it is at the established grade.



PLAN, ELEVATION AND SECTION OF TRACKS.

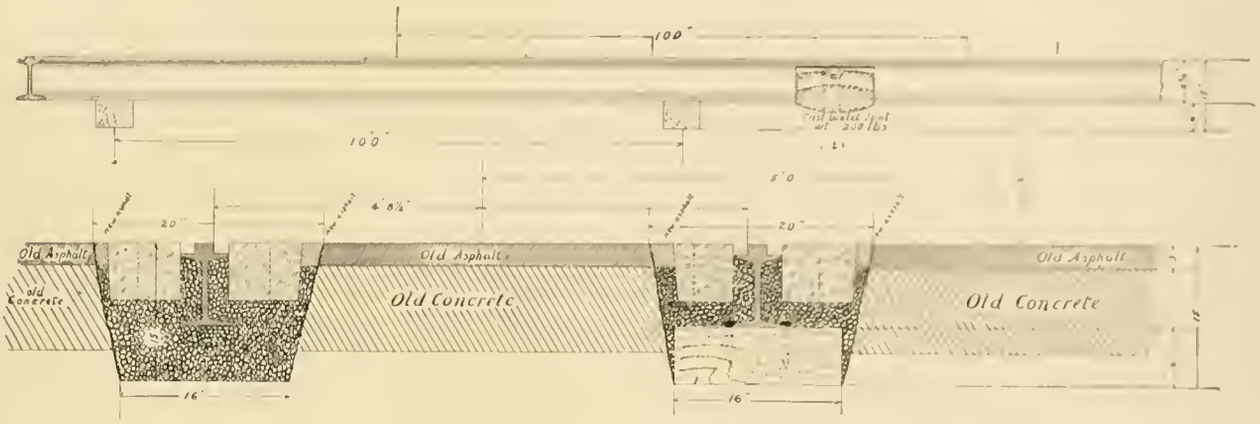
In this trench at intervals of 10 ft. are placed wooden blocks 8 x 10 x 16 in., and the rails are spiked securely to these blocks, which serve to hold the rails while they are being laid and tamped to surface, the joints being held in position by temporary splices. After nicely gaging, alining and surfacing the track the trenches are filled with concrete, covering the rails up as far as the bottom of the proposed paving. This concrete which is placed in the trenches around the rails is composed of crushed stone, measuring not more than ½ in. in its greatest dimension, mixed with portland and domestic cement and sand.

These are mixed by measure, two parts sand, one-half part port-

land cement, one-half part domestic cement and five parts crushed stone. Great care should be taken to get the mortar flushed close against the rails and to bring it full up under rail trams. The concrete in the trenches should be allowed about six days to set; however, this depends upon the condition of the atmosphere, as it sets much more rapidly in warm than in cold or chilly weather.

The concrete for the paving foundation may be composed of one part domestic cement, two parts sand and four parts broken stone by measure, the broken stone to be not larger than 2½ in. in the greatest dimension. All concrete to be thoroughly tamped till the mortar flushes to the surface.

The rails should be not less than 6 in. in depth with a base equal in width to the exposed upper surface. Where streets are paved with asphalt and a stone toothing course is placed adjacent to the rails, the rails must be at least 9 in. in depth in order that the base may be securely imbedded in the concrete below. Rails should be center bearing and rolled in 60-ft. lengths and handled so that they will be perfectly straight when placed in final position.



ELEVATION AND SECTION OF TRACK.

Tie-rods 1 in. in diameter, shall be placed 6 ft. c. to c. along the line, with hexagonal nuts which, when in place, shall clamp the rails securely on both sides. The tie-rod threads should extend far enough from the rod ends to allow the rod to be put in place without bending it. The reason for this rigid tie-rod is that the street traffic and pressure on the outside of the rails should be provided against as well as the car thrusts on the inside. The top of the tie-rod should be placed at the center between the top and bottom of the rail to better accommodate the paving, especially if brick or stone is adopted for the wearing surface.

After the concrete has set cast-weld joints shall be made at all joints, including the special work, which may be needed.

The cast weld joint on 80-lb. rails should weigh 150 lb. and on 100-lb. rails, 200 lb. of cast metal; the cast metal should be composed of two-thirds pig iron and one-third common scrap iron. The metal should be heated to a bright yellow and each joint formed with one pouring. The depressing clamps should remain in place for at least one hour after the pouring, and the surface of the rails finally dressed smooth, so that they present the surface of a continuous rail. In preparing the joint a better result as to smoothness is obtained by inserting a thin shim between the rails than by placing the rails too close to admit a shim. These cast-welded joints should be so formed as to interfere as little as possible with the wearing surface of the pavement.

As a general proposition the wearing surface of the paving should be composed of the same material as the rest of the street; if different paving is used there will be an undue amount of vehicle travel on the street railway tracks and consequently accidents will occur more frequently and the track will wear more rapidly.

For instance, if the street is paved with asphalt and the track with brick or stone, heavy loads on slight grades will be driven on the stone or brick for the reason the latter material furnishes a better footing and keeps the grease well in play in the wheel boxes. On the contrary, if the street railway tracks are paved with asphalt and the street roadway with brick or stone the drivers of light vehicles will immediately seek to occupy the street railway tracks as well as some of the other class.

At all times attention should be paid to drainage, and at street crossings where the established grade is level, the surface of the tracks on one side should be elevated several inches to prevent the retention of water pools.

At all changes of grade the rails should be bent to form vertical curves and no joints allowed in such vertical curve, as it is almost impracticable to form a uniform curve unless shop work is resorted to.

There is no economy in trying to construct a railway too hastily, as it results generally in inferior work and there will be an expense in the future.

The special work, turnouts, crossings and cross overs should be of cast steel construction, except steam railway crossings, which it is best to make of the regular built up work located on the foundation. The tongues of turnout switches should be placed on the high or superelevated rail of the curves, otherwise the guard rail of the mate should extend the full length of the casting on which the tongue is placed. All curves of a radius under 300 ft. should be provided with a guard rail, and curves of less than 50 ft. radius should be double guarded.

A very important item as a matter of economy in the construction of street railways is the contract and specifications. This document should cover, without doubt, all that is intended to complete the whole line, and in street railway construction there is so much to consider that often items are left out or neglected, which finally become very serious and costly matters.

With a track constructed as described the cost of maintenance will depend largely upon the rolling stock used; that is, whether single or double trucks are used, the wheel base, the diameter of the wheels, the arrangement of the car springs, etc. The longer the wheel base of the car the less durable the curves in the track will be. Single trucks will destroy frogs, joints and switches more rapidly than double trucks, and the diameter of the wheels and the springs between the truck and the car body have an important effect on the life of the track.

The President: The chair will ask Mr. E. C. Foster, of Lynn, to open the discussion upon this paper.

Mr. Foster: I have listened with a great deal of interest to this paper upon the construction and maintenance of street railway tracks, and it seems to me that he has well covered the specifications for building a first class girder rail track. I did not notice that he touched upon construction of a T-rail track. Now, the tracks of our road have to be constructed differently in different localities. All the city roads that I am familiar with require a construction much superior to that used on roads located in the suburban towns.

The subject of cross ties is one which we meet in the East, and I find it is met in nearly every section, as I believe over 90 per cent of the roads are using cross ties. Now the dimensions of a tie and the placing of it are points I am interested in, and I have often pondered on what are the proper dimensions of a tie. Some roads use ties 6 ft. 6 in. in length, which are 5 x 6½ in., and place them from 24 to 30 in. on centers. To my mind, on T rails, where you are going to operate at a high rate of speed, as many of the electrical roads now anticipate doing—many of them are doing it in fact at the present time—we should use a tie

of about the same dimensions as do the steam railroads. We are at the present time constructing five miles of a double track with T-rails. The ties are 6 x 7 in. to 6 x 10 in. and 8 ft. long. The rail that we are laying on this tie is a 70-lb A. S. C. E. section T-rail, and we are using one of the improved joints. We believe it necessary to construct a good track for high speed; our speed will probably be 25 miles an hour, possibly more. We believe we should adopt as near as possible the steam railroad construction. On some of the smaller and less important lines it is not necessary to have so heavy a rail, although I am thoroughly of the opinion that the money invested in a heavy rail and a very heavy cross tie is wisely invested. On the subject of girder rails we have to lay them in our part of the country on cross ties; the ties are 5 x 6 or 6½ in. x 7 ft. long. Some roads I know have a tie 7 ft. long, others 6½, and I have thought many times and could not quite understand why a tie 6½ ft. in length should be sufficient where the street is concreted, and you get but a small bearing on the outside of your rail. It seems to me the addition of 3 in., if you use a 7-ft. tie, is very important, and adds very materially to the strength of the track, keeping it in service and alinement. We all agree, I believe, that the first construction should be of the best, providing finances permit of it. The question of maintenance that is quite as important, perhaps, as the construction, and with many it is a problem as to how best to repair an old track. We all remember how in the old horse car days we used to operate over a rail weighing only 20lb. to the yard, spiked on to a stringer, and underneath that stringer was a little tie about 4 x 5 in. Then the weight increased a few pounds at a time to 60 lb. per yard. All of these, 25, 30, 35, 40, 45 lb. were made in the tram section and about as many in the T section. Then they commenced with the girders, 40, 45, 50, 70 lb.; now most roads, where it is necessary to lay a girder rail, are laying a 9-in. 90-lb. rail, and it is these lighter rails that I have referred to that make the problem. We have some 45-lb. girders laid in 1890, on to a steel chair and a small tie, which was 4 x 5 in. x 6½ ft., 3 ft. on centers, and that was thought to be the proper construction at that time. It was a road that was acquired by our road by purchase, six miles of it, and they made a pretty thorough examination prior to the building of the road, and thought they had secured the ideal construction for an electric road. Time has developed that they were in error. Now the problem with us is how to best repair that track. The lips of many of the steel chairs have become worn so that they do not hold the rail securely. We do not believe it wisdom to purchase new steel chairs, so we have been sustituting the old-fashioned stringer, knowing that we can obtain from 6 to 7 years out of the stringer and thereby get 6 or 7 years more out of the rail. I believe this to be economy under some conditions, as where you have light traffic. Of course, where you have a traffic requiring a 15 minute service, and from that down to 20 or 30 cars a minute—if as many as that can be run, which I doubt very much—you want to have the latest and most modern construction. The caring for T-rails is another subject. Take a 35-lb. T-rail; while it may answer your purpose—and there are steam railroads today operating over 35-lb. rails—I believe we cannot do it successfully on cross ties. It is very difficult to hold the joints even with any of the improved joint plates—and there are some very excellent ones.

As to cast-welding; I suppose this might be applied to some of the old tracks; I suppose it has been, but I have opposed applying it to any 26-lb. rails I have ever seen. There were many rails that were old in 1891 and 1892 that were soft and wore out quickly. That seemed to be due to defects in the formula for mixing the metals at that time. That, of course, has been very materially improved, so that today they roll a very high carbon rail. I believe on many of these small roads that this light rail construction can be repaired and perhaps used successfully and profitable until the finances of the road will permit of a more modern and a better construction. To my mind the local conditions and the ability of the company to make an outlay govern very largely that which will be best for the property which you are attempting to operate.

Mr. Thomas Hawken, Rockland, Me: In New England the question of railroad ties is a very important one. We have several woods, and I would like to ask Mr. Foster what kind of tie he has found to last the longest and give the best results?

Mr. Foster: Our experience has been that the chestnut tie gives us the best results. We have used many of the soft woods, such as cedar, hackmatak, and we have used oak, and the best results have been obtained from the chestnut tie.

Mr. E. H. Keating, Toronto, Ont: The method described by Mr. Butts seems to me to raise a very important question as to the advisability of rigid construction on lines where there is heavy traffic. I have had occasion to construct some lines on concrete foundations where the traffic has not been excessively heavy, and the result so far has been very favorable indeed, but it would be very interesting to learn from some one who has adopted this rigid construction, whether any observation has been taken to determine whether there is any yield in the rail at all. I have had observations taken on the other lines and found that the give in the rail is very considerable. Where there is heavy travel and rigid construction has been adopted, it is a question whether it does not affect the rolling stock. I should like to hear from Mr. Butts as to whether he has ever made observations to see if there has been any yield in the rail at all. Also, what is the style of joint he adopted. I take it from his description that it is what is generally known as the Falk joint. I would also ask if any provision was made for contraction and expansion of the rails. I know some companies do not make any such provision at all, but I understand that in some places a great many broken joints have been the result. On the other hand, during the cast-welding of these long lines of track what provision is made for contraction and expansion while construction is going on. The action of the sun in hot weather, naturally if the rail is exposed, would be rather disastrous.

Mr. Butts: We have operated a road for the past four years, as described in the paper I read, and there is no perceptible deflection or yielding of the rail. We have been constructing every year from that time up to the present. If any yielding did occur it would probably be on account of the quality of the material that is used, or from getting the soft material close to the rails.

In regard to the cast-welded joints, or the expansion of the rails, I would say that our method has been to put the concrete around the rails before the welded joint is put on. That holds the rail perfectly in place, and there is no displacement on street lines, though in one instance we have had to do some little extra work; but this was because we commenced welding before the concrete had set thoroughly. We put in the concrete and leave a place where a welded joint is to be placed; after it has set we cast weld it, and in that way we have not had any bad results.

Mr. Jones: I would like to hear from Mr. Butts or some gentlemen who have had experience in this rigid foundation for track as to how they can arrange to put in their construction and operate their regular service.

Mr. Holmes: We use these portable cross-overs and cut off so many feet of track. We take one track and do it in that way.

The President: Do you take your cars off that track for the seven days necessary to do this work?

Mr. Holmes: It depends a great deal upon the weather; if the weather is warm and the cement sets quickly, four or five days is enough. It has been customary in most cities to divert the traffic and put the cars on some parallel street.

Mr. Watson, Cleveland: There are one or two points in the use of cast-welded joints that we have brought out in Cleveland that I would like to call to your attention. We have had some experience with electric welding. In our experience with joints of that character we have been unable to keep perfect gage and surface. The 12-bolt fish plates have proved much more satisfactory than the cast-welded joints. We have not put in the foundations as Mr. Butts describes, but there were plenty of ties, and the work was carefully done. Now we are using cement concrete. I do not think we shall use the case-weld joint, but will depend entirely on fish plates with 12 bolts. It does not seem to me it is possible to ignore the contraction and expansion of that amount of material, no matter if seven-eighths of it is covered underground and held in place in a measure by concrete or brick pavement.

The suburban work, it seems to me, cannot be made too well. If you follow the lines laid down by the steam railroads you surely will not lose money. If you cannot afford that construction do not build the road. (Applause.)

Mr. McGregor, Houston, Tex.: Mr. Butts does not say any-

thing about cast-welded construction in streets without paving.

Then the question of bonding is not mentioned in this paper. Another question is that of the form of rail head. I have taken a fancy to what is known as the Trilby section. I have not used any, but I have always used a T-rail; but we have to use something else now to satisfy the municipal demand, and I would like to know if anyone has used the Trilby rail, and if it is satisfactory.

Then another trial we have had is that of trying to keep the pace set by the big roads. Yesterday we started out with a coach and four on cars—that is, four motors. We use one motor. I can readily understand that with a company which has business waiting for it the matter of expense of fuel does not cut much figure, but for a road that has not much business to add a fixed expense is hardly an advantage, and I think if we can get ourselves into two classes, that is, those that have all the business they can handle, and more, too, and those that have not enough, we may get a standard for each. (Applause). Speaking on the rail question, the big roads have set a standard of 9-in. rail. Now I have a 6-in. rail and I want a girder rail that will match up with it, but the supply people cannot furnish it to me. They will give me a 4-in. base, but I do not think anyone who runs an electric car wants to put a 4-in. base down now. They say everything is 9-in. We have not any ballast down our way, and we try to get up near the top. One inch of concrete we put in cost us $1,200 a mile; we have skimmed along because our pocketbook is thin, and we would like to get a standard down to the thin credit we have. We only earn $25 a day, and that is different from $150 and $200 a day. We would like to get into that class. We feel it is embarrassing for these little roads to talk with the pace makers, but at the same time, I have come up here for information, and I would like to get it.

For ties, we use spruce ties, being close to the spruce swamps.

I am putting in cast-welded joints, but I have not the experience that will enable me to express an opinion on the results yet. From those who have had the experience I would like to get information.

Mr. Heidleberg, Chicago: I have heard the cast-weld joint discussed so much that I must say that I was the second one who took hold of it. I started out about 1895. It was first tried in St. Louis; our road was the second. The alinement of the track and the surface have been mentioned here. I only ask the members of this Association to go and look at some of the track that we have made in the later years. I will call your attention to Indiana Ave., which was put down last week; on 18th St., from Wabash Ave. to Indiana Ave., and on Indiana Ave., from 18th St. to 29th St.; 10 miles on Halsted St., from Archer Ave. to 79th St., which was put down this summer; and I don't think you will find one joint that is out of alinement or out of level.

I have made experiments and I think that creosoted cedar or hemlock the only tie to use in sand, and in clay soil, white oak. We use a 7-ft. tie, 5 x 8 in., and chisel pointed spike side brace plate, which are used on a great many roads.

We have tried all kinds of rails. First we had the old flat rail. From that we came to the first girder rail that was made, and 42-lb. Johnson; then we got a 63-lb. Johnson. From this Johnson we went to the 70-lb. 6-in.; next to the 75-lb. 7-in.; and then to the 85-lb. 7 3-16-in.

We laid a great deal of 9-in. 90-lb. rails which did not give satisfaction. The reason is that we have various kinds of pavement, such as macadam, cedar block, asphalt, granite and brick, and the rail was too large; it rocks too much. Another fault we found with this section was that it was too thin for the height. The severe cold weather that we had and the extreme changes here, where we get a warm rain in the morning and a cold snow storm in the afternoon, made our rails pull and break, because the metal was not compact, the body was not close enough together. It was rolled out too thin. In the way of pavement, very often we would like to construct a road one way, but the municipal authorities will not have it so.

Our cable lines are all laid in concrete, and we find that in from 11 to 15 years concrete crumbles. Our yokes and rails go down in it and it becomes a trench. Every time a car goes over it it goes down.

Mr. Butts, in his paper, stated that for joints he poured the metal at a bright yellow. My instructions to my men are to pour no metal into a mold unless it is at a white heat; if the metal is not at a white heat they make a pig of it. The essential thing after sand blasting the joint and getting all the scale of the rail perfectly clean is to have the metal very hot in order to flux and amalgamate the rail. If you do not do that you are not sure of the bond. When you do that and have a man watching to see the metal is at the perfect heat, then your bond is sure. We have made a great many tests, and on making test after test and becoming more thoroughly acquainted with this work and getting it perfect, we found the bonds were not necessary and only a waste of money.

Now as to maintenance; no one seems to have spoken about the organization of the maintenance department. In the first place it is very essential in maintaining railroad tracks to have a thorough organization of all the men under you, so you can get them together quickly. I can get all the forces in our track department at one point inside of an hour. Track work has been my study for years. Give the men good tools. Have them thoroughly organized. Our forces are organized in this manner: We have a track master and a section foreman. Our road is cut up into six sections, 40 miles of road to each section. To these sections men are allotted according to the work to be done. If there are a great many railroad crossings in one section we take some straight lines off that section and put them on another. A railroad crossing is special work, therefore a man always has that section and knows he has to take care of it. Our system of calling men is to have one caller on a section. The telephone operator at the main office sends to the station or barn, and calls the one nearest to the barn, and that caller calls all the rest of the men, telling them where to go. These things are very essential, especially in the North, where you are liable to get a snow storm in 30 minutes, and have to have men cleaning out the slots, etc.

There is one thing I would like to have some one explain to me that I have been trying for the last eight years to cure for myself, and that is, a wavy rail. We have some, what we call wavy rail. There is a depression in the rail about every 3 in.; it looks like a wavy sea. I have taken those rails out and sent pieces of them to the best experts in America, but I never got any reply from them. (Laughter.) Now I want to see if there is any one here expert enough to tell me what is the cause of a wavy rail.

Mr. Butts: In answering some questions, I would say we have not advocated in this paper anything less than a 6-in. rail. We have not experienced any breakage in cast-welded joints, and we have welded not less than 3,000; they do not break. What depth of rail did you have on your cable construction?

Mr. Heidleberg: We have now 7 3-16 in. Previously we had a 6-in. rail without a foot, round bottom.

Mr. Butts: Generally the cable construction rail is based upon yokes placed 5 ft. apart 4½ x 5½ in., and they are not, as a general thing bedded in concrete. They are supported entirely by the yokes. That is my experience in the matter of rails, and therefore the concrete construction of cable railways does not apply to concrete trench construction, as we understand it. There is a variation between those yokes that will wear out most anything. It is not held rigid; it is not rigid construction. In regard to the bonding of the rails, we do not bond the rails where they are welded. The welded joint is of the full electrical capacity of the rail. When we do not cast-weld we bond with a No. 0 wire.

Mr. Heidelberg: Do you cast-weld outside the streets paved?

Mr. Butts: No. We have not had any experience in that line, although, as I said before, it depends entirely on the amount of material that you have embedded in the earth as compared to the amount of material exposed to the sun. I don't see why, if it could be kept embedded in the earth that it would not be just as successful as if it were embodied in other material.

The President: Gentlemen, I am sorry to cut short any discussion on this very interesting subject, but our time is getting short, and I think, therefore, that we shall have to proceed to the next paper.

Mr. Heidelberg: All the members here are interested in track work, and I would like them to make us a visit before they leave the city. They can find everything open and a hearty welcome We have a yard at 55th St. and Cottage Grove Ave., one at 30th St. and Wallace, and one at 49th St. and Oakley Ave., and we would be pleased to have any member come and see us. Tomorrow we will be welding joints at 55th St. and Western Ave in the day time, and we will be pleased to have them come.

The secretary then read resolutions passed by the supply men expressing their thanks and appreciation of the action of the executive committee of the American Street Railway Association in setting aside one day for the supply men, and also for the courtesy shown the supply men. The resolutions were signed by every exhibitor in the building.

The President: The committee appointed to nominate officers and select a place for the next convention will now report.

Mr. H. C. Moore: Mr. President, and gentlemen: The committee received invitations from three places, Cleveland, Kansas City and Charleston. We found ourselves in a very difficult position. We loved you all equally well, but had to make a decision. We also received an invitation from the city of Milwaukee for the year 1901, and from the city of Toledo for the year 1902.

The secretary then read the following report of the committee on nominations:

The nominating committee respectfully recommends Kansas City as the next place of meeting, and the following gentlemen for officers of the Association for the ensuing year:

President John M. Roach, general manager Chicago Union Traction Co., Chicago, Ill.

First vice-president—John A. Rigg, president United Traction Co., Reading, Pa.

Second vice-president—H. H. Vreeland, president Metropolitan Street Railway Co., New York City.

Third vice-president—F. G. Jones, vice-president Memphis Street Railway Co., Memphis, Tenn.

Secretary and treasurer—T. C. Penington, treasurer Chicago City Railway Co., Chicago, Ill.

Executive committee—The president, the vice-presidents and C. S. Sergeant, second-vice president Boston Elevated Railway Co.; C. K. Durbin, general superintendent Denver Consolidated Tramway Co.; Nicholas S. Hill, jr., general manager Charleston Consolidated Gas & Electric Co.; Charles W. Wason, vice-president Akron, Bedford & Cleveland Railroad Co.; John R. Graham, president Quincy & Boston Street Railway Co.

Mr. Harrington: I move the report be accepted and the secretary be instructed to cast the vote of the meeting for the gentlemen nominated and the place of meeting for the next year. The motion was seconded and carried unanimously and the chair appointed Messrs. Dimmock and Connette as tellers to prepare and cast a ballot for the officers nominated by the committee. Mr. Dimmock announced that this pleasant duty had been performed and the president declared officers, as nominated, elected.

Mr. Holmes: I desire for Kansas City, and the Metropolitan Street Railway Co., that I represent, to thank you all most sincerely, and especially the committee for this compliment. I will say that while you are with us in our city we will do everything we can think of to make your visit a pleasant and profitable one. (Applause.)

Mr. McCormack then presented the following paper:

TRAIN SERVICE AND ITS PRACTICAL APPLICATION.

By Ira A. McCormack, General Superintendent Brooklyn Heights Railroad Co.

It is an unquestioned fact that a well arranged train service is as essential to the commercial success of a street railway enterprise as is expert management of the power house and equipments, the use of economical machinery or any other vital detail, and it is perhaps one of the hardest problems that street railway managers have been called upon to solve. In presenting this paper the writer would not wish to be understood by the members as presenting a sovereign solution, but rather as submitting methods which he has found to be useful in cases that have come under his observation. The conceded fact that all discussions must have a nucleus, and that the experiences of no two persons are alike, whereby the natural law obtains, that one is certain to learn something from another, must be the apology for what follows.

In mapping out the train service of street railway systems in a large city the problem will be found very intricate. Some lines have continuous traffic at almost uniform proportions at all hours of the day; some have rush hours at morning or night, or both; some have hours of over-crowding at more frequent intervals, and with some the traffic is exceedingly irregular. There is the passenger who rides but a few blocks. There is the through passenger, and transfer passenger. The problem is further complicated by the location of parks, places of amusement, shopping or residential districts, branch lines, and the summer and winter seasons, and it is perfectly evident that no general methods can be laid down.

The problem naturally divides itself into two parts; first, the ascertaining of the conditions of traffic which are to be met, and second, the means for meeting these conditions in the best possible manner. No matter what the character of the service may be, suburban, excursion, or local, there is one ideal condition to be aimed at, and that is to have each car full of passengers. If there be less than a full car the equipment is not run to best advantage and fewer car-miles would render the same service, while if the car is crowded the traffic of those who dislike a crowded car may be lost and the management is likely to be criticised unfavorably by the public and the press. It is important, therefore, to determine with as much accuracy as possible the traffic conditions, that is to say, how many of the public want to ride, where they want to ride, where they wish to take the car and where they wish to leave it.

IRA A. McCORMACK.

For convenience in making specific illustrations and also to enable the discussion of different conditions as far as possible, the following different characters of service may be cited:

A. A line of heavy traffic in shopping districts in close competition with elevated railroads.

B. Doing a heavy traffic in residential districts without competition.

C. A cross town line serving as a transfer system to connect other lines and add to their attractiveness.

D. A cross town line connecting with centers of transportation, such as railway stations, ferries and the like.

E. An excursion line, half of which is residential, on which the excursion traffic varies with the season.

F. A suburban line of considerable length and operated at moderately high speeds.

G. A line not over remunerative and operated for such reasons as public or press opinion or hope of its future value.

The conditions that will obtain on these various lines are obviously widely different. At first it will be necessary to evolve a method of determining what these various conditions are.

At the start the manager is as helpless as an outsider. He can merely generalize and deduce a time-table which to his best knowledge of the system will fit the conditions, but having thus formed an existing time-table the knowledge of how it operates and how it can be corrected is rapidly and easily acquired by the best of all methods, that of practical experience. In collecting the necessary data a method which the writer has found of value is to provide each car conductor with a blank which contains spaces on which the number of passengers carried on the car between the termini can be conveniently listed and totalized. This slip is conveniently arranged so that on it are registered the following data:

1. Name of operating line.
2. Run number as per time-table.
3. The date.
4. The time due to leave terminal.
5. The actual time of leaving terminal.
6. Passengers carried on down trip.
7. Passengers carried on up trip.
8. Totals.

This slip, signed by the conductor, is turned into the proper office. This of course gives general information as to the traffic. It shows whether it is heavy or light, whether it is falling off or increasing, whether it is increasing on the down or the up trip, and also gives a check on the register. This information is usually collected in one way or another by almost every street railway manager.

The records are duly tabulated on a printed blank and daily compared, and if it be found that the traffic is increasing, it may be wise

to put more cars on the route, and if the traffic is diminishing, a longer headway might be good policy. The next thing to determine is how these changes had best be made and if possible to ascertain the specific reason for the increase or loss in traffic. To do this the inspectors are provided with blanks and are sent out on the line. Various points are chosen and at these points the passenger record is very carefully taken. This slip provides for the record of the following data:

1. The place of record.
2. The name of the line.
3. The date.
4. The observed headway.
5. The number of passengers on the cars at points of record.
6. The fares rung up on the register at record points.
7. The totals.
8. The general average of these quantities.

On the back of the slip the inspectors find the following instructions and queries to be answered:

MAP SHOWING LOCATION OF DIFFERENT LINES.

Note. Inspectors will be careful to show correct count. Make report plain and clear, but use as few sheets as possible. If record of but one line is being taken, show the name at top of page.

If record of several lines is being taken, indicate name of each line in blank space at head of column.

If conductors are found short, give conductor's badge number and state particulars.

Give any and all information on this report that will prove of value in permitting change of headway and condition of cars, etc., to improve the service.

Is the headway well maintained?

Is there enough or too much service at any hour?

Are cars running to proper terminals to accommodate the public?

General condition of cars.

Conductor found short?

Car No. Conductor's No. Particulars.

It is sometimes instructive to plot the results in the form of curves. Suitable section paper is selected and the number of passengers per hour are plotted as abscissae and the hour of the day as ordinates. This gives opportunity to examine a large number of figures at a glance and is sometimes useful in drawing general conclusions.

These reports give much valuable information. They show the average number of passengers on the cars at the point of record, thereby determining whether the cars are overcrowded or not. It give the total number of passengers carried up to the point of record and an approximate idea of where they left the car. If the traffic on the line is irregular it shows in a measure where it is heavy and where it is light, according to how near together the points of observation are selected and it further shows the exact time at which these traffic conditions obtain.

In order to obtain trustworthy results it will be necessary to take these records for some time, possibly for a week, for a single record might be completely misleading because of the condition of the weather or a yearly Sunday school picnic or similar flush of traffic not likely to be repeated. It remains to be said, however, that as a rule weekly records check very closely. Having obtained a fair average of the number of passengers to be carried between two points, the proper headway between these points can be computed and the next question that obtains is how to get this headway. It may be advisable to actually put on more cars, or again it may be that the increased traffic occurs between such points on the line when it would be advisable, if possible, to loop down upon this section a few more cars from some adjacent line, and more especially would this be desirable if at the corresponding section on the adjacent line the headway was found to be too short.

So far the method seems to be a simple mechanical process in which the steps for remedy are as obvious as in a station test. It is unfortunate for the sake of simplicity that this is not the case. In making a station test the diagrams and curves obtained invariably show the condition of the machinery or apparatus tested. The curve traffic above described would show the condition of traffic were it not for the fact that the public and many local conditions, which would seriously affect the traffic, must be considered. As an instance of this, when the information is being gathered to plot out the curve traffic, a fair, festival or entertainment of some nature may be in progress, which would cause traffic to go in the direction of the entertainment. Therefore, the curve traffic, without considering the local and all traffic conditions, might lead to an erroneous conclusion. The maker of a new time-table must know the lines root and branch. There are certain rules which long experience has shown are almost inviolate. There are certain traffic conditions which are temporary and others which are permanent. There are competition conditions and in many ways there is much else besides these records to consider.

For instance, those who travel on street cars, I have classified as follows:

1. The workers who travel from 5 to 7.

2. The clerkers who travel from 7 to 8.

3. The bankers, brokers and proprietors, who have sometimes been facetiously termed the "shirkers", who travel from 9 to 10:30.

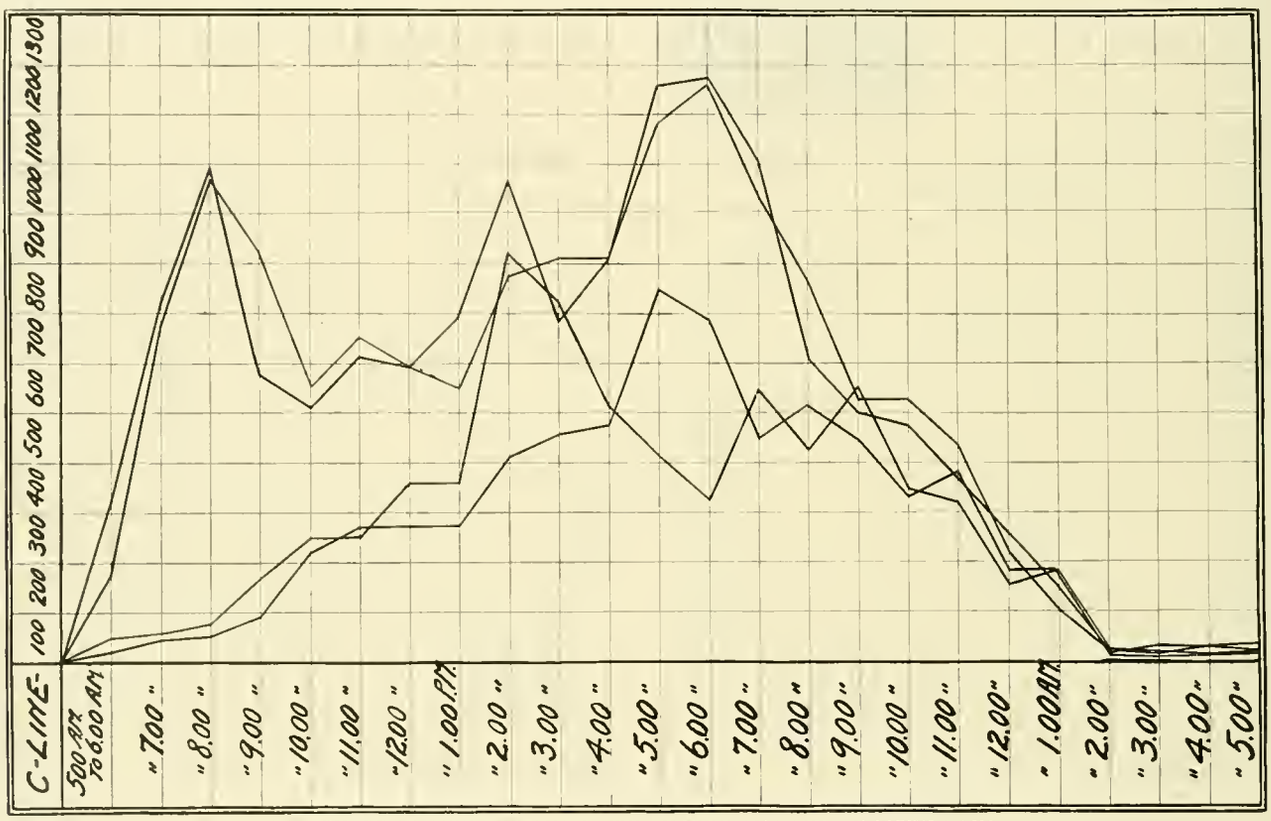
4. The shoppers who travel from 10 to 12.

The greater part of these people remain in the city, coming back in one grand rush, which begins between 4 and 5 and reaches its culmination point a little after 6, and sometimes lasts until after 7. Then the theaters and places of amusement begin to influence the traffic which swells in the direction of the metropolis till a little after 8, and outward again from 10 to 12. The regular nighthawks who take care of the traffic of the city between 12 and the early hours of the morning, it is usually wise never to disturb.

It is sometimes possible to meet the traffic conditions on a line without increasing the car mileage by simply changing the character of the cars which are running upon the line. Long cars with double trucks are advisable on through traffic, and it should be aimed to run them at such times as they will collect through passengers. Short cars should be run for the convenience of short

be the case. It is very important for the company to have a force of competent, well satisfied and not overworked men. I contend that a man earning $40 a month and who is satisfied with his surroundings and conditions, is a better employe for any company or corporation than a man who is earning $500 a month, and who is discontented and dissatisfied with the surroundings; and on the other hand it is important for the men that the company shall be prosperous, for otherwise there will be fewer regulars and more trippers.

It frequently happens that the time-table of a road can be corrected to meet the conditions of traffic by delaying the cars at certain points and increasing their speed at others, thus, for instance, it has often been found beneficial to instruct the motormen to stop their cars at junction points and wait for the car on the cross road in order to exchange transfer passengers, or perhaps to wait a stated time, say two minutes, and then to proceed. It is plainly to the advantage of the road to exhaust all such devices as this before actually running more cars to meet the increased conditions



PASSENGER TRAFFIC UP AND DOWN ON SUNDAYS AND ON WEEK DAYS.

riders and if it be found on any line that a certain hour of the day a large percentage of short riders take the cars between certain points, a little ingenuity in adjusting the long and short car service may frequently accomplish a great deal.

On Sundays and holidays the traffic conditions change radically. On some lines the traffic falls off a great deal and on others it becomes exceedingly heavy. On lines running to places of outdoor amusement, such as parks, beaches, race tracks and the like, it is well to watch the weather, for it is obvious that if the day is pleasant the traffic will be much heavier than otherwise.

The best men are picked out to run on the strange lines, and on lines of heaviest traffic in order to have the benefit of their experience in handling the public, knowing that they will be more safely handled and more convenient service given them than if a poor class of motormen and conductors are operating on the lines of heaviest traffic. A street railway manager would, were it in his power, locate amusements and entertainments upon the best built and best equipped lines; for it is on these lines that the best service to the public is given.

Of the last statement it may be well said that the duty of a superintendent may be divided into two equally important portions; first, the arrangement of the system for the good of the company and public, and second, for the good of the men. These duties are not at all incompatible, although by some this has been thought to

of traffic. If more cars are actually to be run the question should then be considered as to what kind of cars, that is to say, long cars or short cars, and if the road be a main artery receiving the traffic of several branches or cross lines, whether these cars should be main line or branch cars, and if branch cars, which branch.

From a practical knowledge of the conditions and from the data that have been outlined, a new time-table can be made up, but it is not to be expected that it will prove of lasting value. The traffic must be carefully watched, the conductors' reports carefully compared and whenever an increase or decrease of traffic is shown, the advisability of sending out inspectors with passenger record slips should be at once considered.

Traffic may be increased temporarily, particularly in manufacturing districts, when some large manufacturer will put out of work, temporarily, by the closing down of an industry—the workers of which industry were mostly patrons of the road, and the superintendent will be at once advised of these changed conditions by the conductors' slips.

Those conditions show the necessity of an intimate knowledge of the entire system. The management, however, should not deceive itself in case mere adjustment is not successful. If the cars are still crowded in spite of all manipulation of length of car and variation of headway more cars should be put on.

However instructive it may be to make general remarks on these

matters, specific cases and their solution are always interesting, and to provide this the writer has selected from his records a number of cases illustrative of different conditions which may be of interest to the members.

A practical condition that obtained recently was the case of a line H which formerly had its route down another line J to a ferry terminus. The inspector's report showed, first, that it was needed to increase the service on a certain intersecting line B and second, that a great many passengers from line H transferred to line B, in fact more than continued down line J. When these facts were known the solution was obvious. The traffic of line H was cut off altogether from line J and sent down line B, thereby giving the desired service, avoiding the transfers, and only very slightly increasing the mileage and not at all increasing the number of trips of equipments.

Another interesting case may be cited on a line I, a short line running from the terminus of a main artery upward into the country. The traffic was found to be so great that it was necessary to diminish the headway. This was done by running some of the main artery cars over line I. This had the effect of slightly increasing the car mileage, but did not require any new equipments and gave through service from the terminus of the main artery to the further terminus of line I, which was beneficial.

Another interesting case is that of a cross town line O. This line carries through passengers to its terminus and also acts as feeder to the various lines which it crosses, therefore in one portion of its length the traffic is exceedingly dense and the headway must be correspondingly short. This object is simply attained by running short lines which travel back and forth through the sections of heavy traffic, and the through service is run on a headway suited to fit the conditions of the more extended portion of the line and also helps to diminish the headway in the more heavily patronized sections. Line D—the other character of cross town line—is also very interesting. The line starts at a railroad terminal and distributes incoming passengers to their destinations. It passes through a large factory district and transfers a great many passengers to other lines crossing it at different intervals, also traverses shipping districts and gives access to the docks. It is essentially a day line and it has been found that in such a case the traffic has been met to best advantage by a practically uniform service. This is a unique exception in railway work. As a final illustration we may take a line E on which the traffic varies. The first section of this line is residential. The last is excursion. In the summer season the headway on the residential district has to be quite short to accommodate both classes of traffic. In the winter season the conditions are met by cutting the line in ⁊o and running a suitable headway through the residential district and a shuttle service of a few cars over the excursion section.

The street railway manager will easily see that these methods are typical but by no means exhaustive. There are many methods of manipulation and the opportunity for ingenuity on the part of the maker of the time-table is exceptional.

Besides ascertaining the traffic conditions on the various lines it will be found necessary to pay strict attention to the actual management of the system in order to obtain the train services that may be desirable. In the first place the power houses must be located at such points as to conduce to equal distributions of voltage. Low voltage on any line means slow time no matter how good the motorman or the equipment, and everything that may produce this trouble should be carefully avoided. Every precaution must be taken in the operation of the power house to prevent shutting down. Power house attendants often become careless and are slow in replacing a circuit breaker when it is blown out, not realizing that they may be wasting the time of as many as 1,000 persons. The writer has known cases where the circuit breakers of two different lines were thrown at one time. The man who watched only noticed one of them and replacing that, failed to close the other, resulting in a most serious delay to the line which it supplied. It has been suggested that a switchboard should be equipped with an automatic device, which, in the event of a circuit breaker being thrown, would close a circuit and cause the ringing of a large gong, which would show to the switchboard tender, or employes of the power station, whose duties it is to see that the circuit breakers are kept in, that there is some breaker or some line which is not furnished with power. In this and in scores of other ways the station attendants are responsible for the accuracy of the train service in fitting it to an approved schedule.

There are also other cases which are incident to the power house which are in no way attributable to the men in direct charge. One of these which may be mentioned is the practice of false economy in purchasing a poor quality of coal which in spite of all that can be done, allows the steam pressure to drop and does not supply the engines with sufficient energy. Similarly the use of poor oil may allow important bearings to become heated, which results in crippling the line or overloading other machinery, thereby causing a reduction in voltage, or it may be that the headway for the time will have to be lengthened, thereby departing entirely from the approved schedule. In short, everything must be done at the power house to provide at all times sufficient current at a sustained voltage at the cars. Without this, any schedule, however accurate and elaborate, will fail in carrying out its object. The details of producing such service are so voluminous and have been so ably discussed by other writers that anything further than the statement of the condition would be superfluous here.

The track and overhead construction should be secure and serviceable. It is obvious that a good track is essential to good comfortable riding which will please patrons. Special work should be maintained in first class shape and renewed promptly. It may be mentioned that it is not a wise practice to allow work of this nature to become worn to its last stages before steps are taken for its renewal. An order for special work of necessity cannot be filled promptly and it may easily be that if there is delay in placing the order, the old frogs and crossings will become very much worn, cars will be derailed, axles bent or broken, motors dropped and aside from the actual expense of repairs and maintainance, the train service, which is the prime factor, will be interrupted. The writer's experience has been that considerable trouble has been encountered in maintaining a train service by reason of the spread of the rails and consequent accidents and delays. Where the traffic is at all heavy, this accident is very liable to occur unless the rails are bound with tie rods.

Like the track, the overhead construction should be of the very best. A broken trolley wire is even worse than a disabled track, for it may tie up not only one car but a whole section, and anything which will minimize the liability of wires coming down is advisable. In order to preserve the train service, the work of repairing the overhead construction should be performed at such times as will least interfere with the service. This is usually at night.

In order that overhead maintainance can be performed to the best advantage, emergency stations should be located, each of which is assigned to certain territories. The station covering the heaviest travel should be able to reach its outer boundary in 8 minutes, while in suburban districts the further limits should be reached in from 15 to 20 minutes. The construction wagons should consist of an extension platform from which the overhead work can be reached without standing the wagon in the track way.

Track and overhead repair men should be impressed as strongly as possible with the fact, that in making their repairs, it should be done in such manner and at such times as will least interfere with the operation of the cars. The judgment of some track and overhead repair men cannot always be relied upon to carry out this injunction. Train service is often interrupted by track and linemen in making repairs to the track and overhead system, by attempting to make too permanent repairs at a time when the service is heaviest and should be least interrupted; when a temporary repair would have done just as well until such a time as the service was light and permanent repairs could be made without interruption to the service.

The writer knows of one particular case where the ear of a double pull-off on a curve had become so bent and out of its proper position, that when the trolley wheel was riding under it, the trolley would come off and one of the arms of the pull-off and the bent ear would serve as the prongs of a boot jack; the trolley harp and wheel catching in the arms of the pull-off and doing one of two things: pulling down the overhead work, or pulling the trolley pole from out of its base.

It is a common fault to pay too little attention to the application of guy wires on curves and serious delays due to failure of overhead construction on curves are very frequent. Sometimes the work is satisfactory for short cars, but on long cars the motion of the trolley being somewhat different is likely to throw the wheel off the wire. Frogs should be placed in the overhead work where the lines diverge at a point that will insure the trolley wheels following the desired route.

Another and exceedingly important feature of good train service is the selection of motormen and their instruction in running the cars. Many elaborate papers have been written on how to run a car to use minimum current and to produce minimum wear and tear on the equipment. These instructions, while ingenious and accurate from a technical point of view, and possibly of wise application in small country roads, are not at all suited to the heavy traffic conditions which obtain in large cities. In such cases the most important duty of the motorman is to make schedule time, keep a sharp lookout for passengers and avoid accidents. It is interesting to note in this connection that the best motormen are often men who can neither read nor write and are found among teamsters, drivers on horse railways and the like. These men are accustomed to do implicitly as they are told. They are accustomed to watch the street carefully and keep good track of vehicles and persons, by which means they avoid accidents and secure passengers.

The semi-technical man who is "learning the business" makes the worst motorman of all. His mind is more active, he in interested in the performance of his motors and equipment and neglectful of his primary duties as motorman. He is always on the lookout to take note of matters, which though they may be valuable to him in his personal advancement, are entirely foreign to his duties. More than that he is a dissatisfied individual, looking for better employment in the near future and for that reason he is not inclined to learn his business of motorman thoroughly, regarding it as scarcely worth his while.

Of course it is necessary that the motorman have certain instructions with regard to managing the controller. He should know that it is not advisable to give the motors too many notches at once, that he should, wherever possible, allow the motor to gain speed on one notch before passing to the next, that he should run the car on certain notches as far as possible, that he should not allow the controller handle to dwell on spaces between notches, but it is not at all necessary for him to know why the motors are more economical at full series or full parallel or just what misconnections are likely to obtain if the controller is run between notches. It is sufficient that certain things must be done and that certain other things must not be done.

It is, nevertheless, a fact that a good motorman will run a car with less energy than a poor one and still maintain schedule time. A good deal of this may be ascribed to the careful use of the brake. It is necessary in making a fast schedule with many stops to shut off the power and use the brake almost before the car has gained headway. This frequent use of the brake is a temptation to many motormen to keep the slack of the chain taken up so that a slight pressure on the brake handle will put the brakes on hard. This keeps the shoes in contact with the brakes at all times, giving excessive friction and loss of power. A good motorman will coast his car as much as possible when the schedule will permit it. It is certainly advisable to keep accurate record of the way the motorman manages his equipment, but inferences must not be drawn too hastily from such records. If a motorman in charge of an equipment wears out his brake shoes rapidly and comes in with the regulating resistances sizzling hot, the schedule on which he has been running must be considered. If he has been on fast schedule with many stops and has followed it closely, the condition of his car signifies very much less than would be the case if he had an easier run and had failed to make schedule time. In forming an estimate of the qualities of motormen, train inspectors, conductors and particularly of officials having men in charge, the writer has found first impressions to be exceedingly valuable. The well known saying that the sober second thought is seldom wrong, is not always correct. Judgment should, of course, be suspended until the second thought has been well considered, but the first thought may be right after all. It certainly has the advantage that it usually represents the only impression that the majority of people will consider and hence may be the popular impression, which in street railway work at least must be catered to.

After all has been said and done with reference to the manipulation of train service it is interesting to know what results may be expected from good work in this department and to exemplify these matters, the writer again cites from his records cases which he ventures to think will justify the statement that the matter of train service is of great importance.

It is not always easy to record the income of a line, for instance, a passenger may take line A and ride on it for 100 yards and pay in his fare simply and solely because he can obtain a transfer on line D. Line A gets the credit on the books and line D, which actually performed the transportation, carries the debit side of the account. There is nothing on the transfer to show whether the passenger rode a longer distance on line A than on line D, or vice versa. To be strictly accurate the fare and the expense should be charged to each line in proportion to the distance the passenger was carried on each, and while attempts may be made to equalize the accounts, in this respect absolute accuracy cannot be hoped for. The results are therefore submitted subject to this criticism and are the best that can be obtained under the circumstances. The following examples are taken from monthly comparison sheets, which sheets are made up from the reports of the conductors, the inspectors and the books of the company, and comprise the following data:

1. Receipts.
2. Total passengers.
3. Mileage.
4. Receipts per car-mile.
5. Number of trips.
6. Receipts per trip.
7. Average length of trip.
8. Average number of cars per day.
9. Average mileage per car per day.
10. Time-table cost.
11. Columns for the record of increase or decrease of these quantities over the same month in the previous year.

If the comparison sheet shows increased receipts, diminished mileage, diminished number of trips and diminished time-table cost, the result must be ascribed in a large degree to the management of the train service. I may cite as examples the following:

From a monthly sheet on a certain line the increase in gross receipts was $3,586, the decrease in mileage was 18,920 miles, due to the substitution of short lines for longer ones. The decrease in time-table cost was $1,612, representing an actual increase in revenue to the road of $5,198. This amount as a monthly incentive for ingenious manipulation of the train service is certainly attractive. On another line almost as large the increase in gross receipts was $13,765. It was, however, accompanied by an increase in time-table cost of $1,902, representing a net gain of $11,867, certainly a wise investment for the added expense. The large gain in gross receipts was due to changing of the terminus to a better center of distribution. This maneuver not only filled up the empty cars that were running formerly but necessitated the running of additional equipments. Another case may be cited in which the gross receipts showed a loss of $7,087 and the time-table cost a decrease of $2,814, representing in total a loss of $4,275 as compared with the same month of the previous year. This, while not so pleasant for directors' contemplation, is very important to know. The reason for this was found in the fact that a number of large factories on the line had been shut down. It might have been due to local conditions or that the train service could be improved.

In like manner a yearly comparison sheet can also be drawn and careful management can often, in a well established road, increase gross receipts or largely diminish the time-table cost. From such a sheet involving a yearly total from 37 different lines may be cited an increase of more than 10 per cent in gross receipts and a little over 1 per cent in time-table cost. The receipts per car-mile showed an increase of 5.8 per cent. The receipts per trip were increased 16.5 per cent. The average mileage per car increased 15½ per cent, whereby about 144,000 trips and the incident expenses were saved.

Such figures as these on a system in which the building of new lines has been relatively small can hardly be ascribed to growth and extension and could scarcely be obtained except by running the cars longer distances and by suiting the public taste whereby larger loads of passengers were carried, or briefly and in other words, by improved train management.

The President: We are to be congratulated on having heard so interesting a paper on a subject which I think has never been presented to us before. We are indebted to Mr. Holmes, of Kansas City, for the suggestion of this subject, and I think it is only fair to ask him to say a few words on it.

Mr. Holmes: We have adopted a plan of setting aside a portion of one day in the week, which is Monday morning, from 9 o'clock to 12, when we receive applications, and at that time generally call in some of the division superintendents, who look the men over as they pass through the office. I think it is wise to have the men who are employed under you with you at those times, and

after selecting what men we need they are required to make out an application, stating where they are working and giving such references as they are able to give. We have found that to be the best way of handling the matter and have been able to get very good men. As Mr. Vreeland very happily said, the treatment of the men or the handling of the men is a vital thing in the management of the street railroad. I think it is possible to have your men like you and respect you at the same time. I have arranged this winter to give my men, the motormen especially, a course of lectures. I have arranged with Prof. Black, one of the best lecturers in the West, to come to Kansas City and deliver a lecture on electricity to our men once every two weeks through the winter months. Our company will pursue the matter just as far as the men wish to go in their study of the subject. My position about the train service is, that we are merchants to the extent that we are selling rides, and that in the selection of our men the company is judged almost entirely by its employes. The passengers seldom come in contact with the managers of the corporation, and I think it is more important than anything else to use great care in the selection of men. We have followed the policy of promoting men from the ranks. We think that is best. We select, wherever we can, married men. In our city a great many young men, many of them married men, come in to learn the professions, to become dentists and doctors and different things, and often take up street car work for three or four years until they complete their education.

The President: There is one railroad in the United States that has the most difficult problem of train service to deal with that there is in the country, and that company is fully represented here, and I think we ought to have a few words from Mr. Vreeland, of New York, on this important subject. (Applause.) Will you give us a little information, Mr. Vreeland, as to how you run so many cars on Broadway.

Mr. H. H. Vreeland: Any information that I can give the Association with reference to this important subject presented by Mr. McCormack would hardly be valuable in connection with its work. The work that we have in New York City the greater part of the 24 hours, is to see how many cars we can run on the track we have, consistent with crossings at various points. Crossings and terminals govern our headway more than anything else.

As no doubt some of you noticed in my previous remarks, the steam railroads of the United States last year handled 560,000,000 of passengers, approximately within the borders of the United States. We moved last year 265,000,000 of cash passengers and 90,000,000 of transfers, or a movement of nearly the total of the whole of the steam railroad traffic of the United States.

I might say, following the line suggested by Mr. McCormack, that our system is handled with reference to time-tables, and the methods of making time-tables are on the same general plans as Mr. McCormack has suggested, and on lines which we very frequently talked over together. The essential point in arranging traffic, irrespective of its volume, is a study of the conditions. The division superintendent, with the amount of business that devolves upon him and the general foreman, in my opinion, are not men that can make a time-table. I made time-tables for five years for one of the largest steam railroads, and I would not attempt to make a time-table for one of our lines in New York. A man has to give his time and attention to the local conditions surrounding the problems. An expert goes to lay out a prospective railroad, and his idea of what the volume of business of that property is to be is by a complete and thorough study of the character of that section of the country and its people. The same study must be made with reference to the daily requirements of the street car lines in car mileage and the distribution. To show how essential this is, a superintendent who had operated a very large line for 20 years, was asked: "What are the heavy hours of traffic on your line, and how are you distributing your car service?" He said: "During the commission hours we run a large service, and then we reduce it, and we put it on again in the commission hours in the afternoon." I said: "Do you know the middle of the day is the heaviest hour of traffic on your line?" He said: "It is not so." I said: "It is, and I will prove it to you by figures." I had a man studying this, and I actually showed this man, who was regulating the thing, taking cars off during the day, that there were more people moved on his division per mile of track between the hours of 12 and 2 than at any other hour of the day. We don't allow a division superintendent or general foreman or a chief inspector to make time-tables for our system. The study is thorough, and the time-table is laid out by a man who is employed for that purpose. Again, east and west of Central Park there are three lines on each side of the town. The regulation of the traffic conditions or car conditions by the company are almost equal at the early hours of the day. A complete study of the people and their peculiarities, and the class of the people who live on the different sides of the town, determined that in the eastern part the large car service that went into 23d St. should be started at 6 and the large car service that went into the west end of the town should be started at 8:30; they had been running very nearly the same service on both sides of town, and the saving, of course, was large.

On the question of average speed, etc., affecting the condition, we have to study the factors very closely to keep things moving. We found it was impossible even on a short distance, to keep up the average of our lines for the heavy hours of the day, to maintain any regulation in the speed from the current direct from the generator, and we have put in two 4,000-h. p. storage battery plants to keep the voltage up so we could do our business. For a long time there was a question of what affected the time-table, and measurements were taken. Sending out men especially for this purpose, determined the fact that it was not the fault of the motorman, although he had been blamed by everybody. He had a car full of passengers and his voltage was down probably to 400 or 450, and men were being blamed for not keeping up to the schedule; by equalization through the storage battery plants we keep a uniform voltage of approximately 550, and meet the condition in that way.

The question of efficiency of employes and questions of that character are too numerous for a man to discuss in this connection. I have suggested that traffic diagrams are the most important thing for a man to have in connection with the operation of a railway. We have traffic diagrams taken at least once in two weeks on every division of our system for the 24 hours, passengers against hours, similar to the one described by Mr. McCormack, and a copy of that is furnished to the general foreman and inspector on the line, as well as the man who makes time-tables. They show the number of passengers carried per hour, in each direction, on every line of the system. We do not go by the 24-hour system, but it shows that from 9 to 10 o'clock 4,000 people went south and 3,000 people went north over the system. Now it is impossible to get any system so accurate that it will show where those people got on or off, without supplementing it by the system which Mr. McCormack indicated, special inspectors at certain points. I heartily agree with Mr. McCormack, and it would be utterly impossible for us to do the business that we do in New York City, run the number of cars, handle the number of people that we do every day without making this one of the very important studies of our transportation department. (Applause.)

Mr. McCormack: I would like to ask Mr. Vreeland whether on making the curve he shows the up and down trips on paper as I have, the upper line showing the down trip and the under line showing the up trip. You can see the traffic is almost uniform from 5 to 8. On Sunday we show the traffic up and down by different lines.

Mr. Vreeland: It is our plan to subdivide our blue sheets, using the upper half for the twenty-four hours south and the lower half for the twenty-four hours north bound. We worked on the system that Mr. McCormack has laid out there, and I do not consider it as valuable for the regular operation as it may be for this purpose here, from the fact that if you put these charts of traffic in the hands of men who are not technical men, but operating men, you must have it so that it is a graphic illustration of what you want to say, and by interlacing your lines you throw the men out. We show a clean sheet of north bound or south bound. The two peaks are coming toward each other, practically the same, only they are distinct in their location on the chart.

Mr. Heidelberg: I am interested in train service. The greatest trouble today in our train service in Chicago, something which we cannot cope with, is the trading of transfers at transfer points, and as I understand it, in New York City they have had this before the state courts and I would like to hear from Mr. Vreeland what they did with it.

Mr. Vreeland: I don't just understand what the gentleman

wants. Is it information with reference to the special cases where arrests were made?

Mr. Heidelberg: No, in general. Here you find boys standing at transfer points asking for "Transfers you don't need." The boy takes the transfer and sells it so two passengers ride for one nickle, and as I understand it, they tried to stop the practice in New York; what they did I don't know, but would like to know.

Mr. Vreeland: I fully appreciate, Mr. President, the difficulty under which you do a transfer business in Chicago, because in walking up town the other day here, I stepped into a drug store and bought a cigar, and when I was going out the fellow says, "Are you going up on the railroad? Here is a transfer." The transfer went with the cigar. But it is a long matter of detail, too long to bring before the Association at the present time; this subject was very thoroughly discussed, not only by our attorney, but by the men who directly handled it and who are the heads of our transfer business, together with the gentleman who handles the transfer system of the Brooklyn Heights road, and it was fully outlined in the report of the proceedings of the Ithaca meeting of the New York State Association, published last month in the street railway papers. While I would be very glad to give the information now, I appreciate it would be altogether too long to take up now.

The President: We will be glad to have further discussion on this train-service question.

Mr. Dimmock: I would like to ask Mr. Vreeland what laws in the state of New York, if any, govern the crowding of platforms particularly the rear platforms.

Mr. Vreeland: There are no regulations except the regulations of the board of Railroad Commissioners, that passengers shall not be allowed on the front platform of either the open or closed car with the motorman. That is the regulation. We do not follow it and a law was proposed to compel us to close the front gates and keep passengers off the cars. I made an argument against it, stating the law did not regulate the company; it regulated the public.

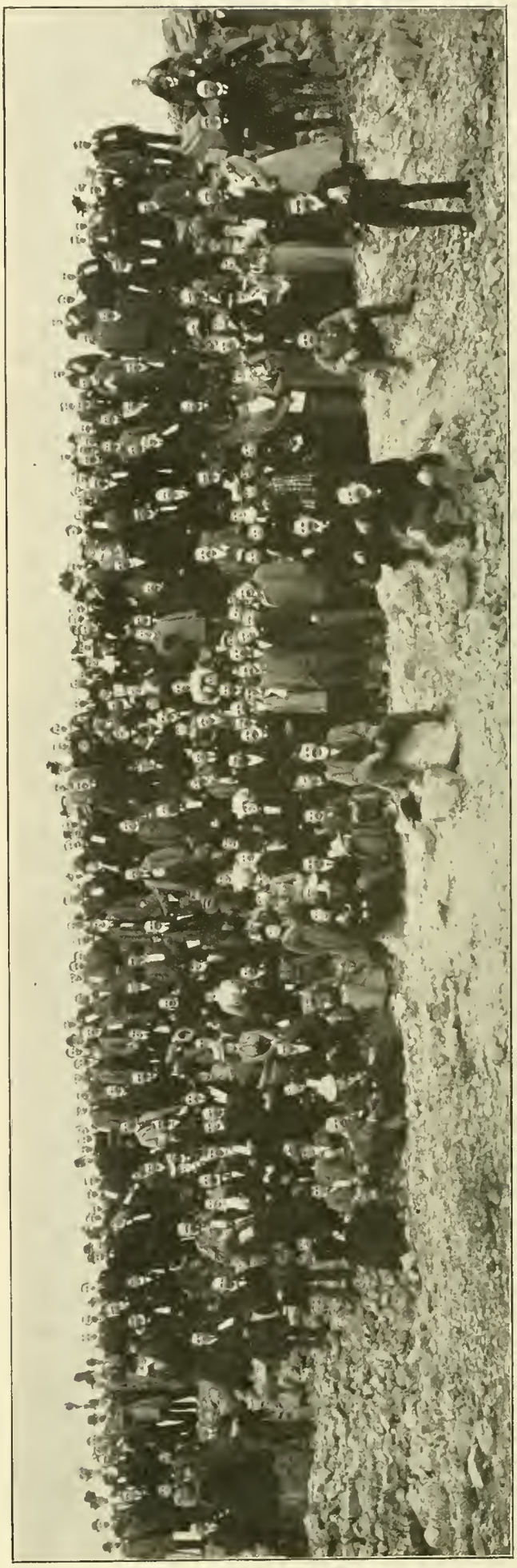
Mr. Dimmock: Have you not a law that covers the rear platform of the car when you run single cars, in regard to passengers crowding that platform so as to make it inconvenient for other passengers to get on the car?

Mr. Vreeland: There is no regulation, either municipal or state, on that question. We have, as probably you all know, the double doors in New York City, which open practically the full width of the rear platform and we insist that our conductors shall not allow a passenger to stand on the side of the door of which passengers are getting on, but that is not carried out very carefully. The Railroad Commissioners with their inspectors came down last winter and looked the situation over thoroughly with reference to our Fourth and Madison Ave. line, and they said after their inspection, "We have nothing to recommend. We do not see what you can do unless we say that the people shall not ride. You are running just as many cars as you can run. You are running them at these rush hours with frequency and dispatch, and doing everything you can to handle the traffic, and now we have to place ourselves in a position to say not what you shall do, but to say what the public shall do." And they, like good men, did not care in their own interests, to tell the public what to do. (Laughter.)

The President: Gentlemen, this is our last meeting for business, and yet it is not. The committee this year decided that it would be an interesting feature of the banquet to have the new officers installed and take charge after the speeches at the banquet. Therefore, when we now adjourn we shall not adjourn till next year, but to be called to order again after the literary exercises at the banquet.

Mr. Vreeland: I would like to say one word, Mr. President, before you adjourn. I regret very much that my engagements will compel me to return to New York this afternoon, and I wish to say that this is the first opportunity I have had since I have been connected with the street railway interests, to take any part in the convention proceedings. It has been exceedingly enjoyable and I have made a great many friends here, I think, from the expressions I have heard. I certainly have been very much benefitted by these proceedings, and I feel that even if it is a long way from New York to Kansas City, if I am in this country next fall, I shall certainly call on our new president, or our next president, Mr. Holmes, as the result of my visit here. (Applause.)

The convention then adjourned until the banquet.



A. S. R. A. AND GUESTS AT THE DRAINAGE CANAL.

THE ACCOUNTANTS' CONVENTION.

Enthusiasm and Hard Work Again Characterize the Meetings of the Accountants' Association Large Number of Delegates Present Department of Blanks and Forms Standardization Committe's Report Paper on Car Mileage.

In accordance with its by-laws, the third annual convention of the Street Railway Accountants' Association of America was held at the same time and place as the meeting of the American Street Railway Association. The sessions were held in a large room on the second floor of Tattersalls, and in a room adjoining was exhibited the complete collection of blanks and forms which now makes an important feature of the Accountants' conventions. All of the meetings were largely attended, the numbers and enthusiasm of the members testifying to the healthy and vigorous condition of the Association, while it is a noteworthy fact that the attendance at the last session was larger than at the first, a very unusual thing for conventions of this nature. This sustained interest is due largely to the happy way in which President Calderwood succeeded in getting expressions on the vital questions before the meetings, from representatives of all classes of roads, both large and small, and from delegates whose experience made their opinions of inestimable value. A large measure of the credit for the unbounded success of the convention should also, of course, go to the Association's secretary and treasurer, Mr. W. B. Brockway, whose capacity for work seems to be unlimited. As one delegate expressed it, Mr. Brockway was everywhere.

The roll of honor would not be complete without the name of Mr. C. N. Duffy, of Chicago, the new president. Mr. Duffy gave, practically, all his time for the entire week to the convention, and if there was anything to be done to add to the comfort of the delegates or the value of the meetings, he was on hand to do it. But it is impossible to mention all to whom credit is due, for that would necessitate the printing of nearly the entire list of delegates in attendance. The Chicago convention was a complete success because every member present put his shoulder to the wheel and did his part.

C. N. DUFFY,
President 1899-1900.

The exhibit of blanks and forms and Mr. Brockway's accompanying report on this department were alone worth more than the amount of the annual dues and the expenses of a trip to Chicago. This collection is the outcome of a demand by the member companies for an opportunity to exchange ideas on this important subject and as already announced is a permanent department of the association. It forms a most valuable store house for suggestions, which will be open at all times to members.

Reports were presented at the meeting, by C. N. Duffy, chairman of the committee on "A Standard Classification of Accounts"; by W. B. Brockway, on the "Department of Blanks and Forms," and a paper was read by H. C. Mackay, comptroller Milwaukee Electric Railway & Light Co., on "Car Mileage." No sessions of the Association were held in the afternoons and the delegates were thereby enabled to enjoy the many pleasant excursions provided by the Entertainment Committee of the American Street Railway Association for the visitors to the Convention.

The absence of two of the Association's best friends and hardest workers, Mr. H. J. Davies, of Cleveland, and Mr. W. F. Ham, of Brooklyn, was keenly felt by all. Both of these gentlemen were unavoidably detained and sent sincere regrets.

Tuesday, October 17th.

The convention was called to order by President Calderwood at Tattersalls, Chicago, Oct. 17, 1899, at 11:30 a. m., and the president then introduced Mr. L. E. McGann, commissioner of public works, who represented the city. Mr. McGann said:

Mr. President, and gentlemen of the Street Railway Accountants Association of America: Carter H. Harrison, mayor of Chicago, has requested me to attend your meeting and present his compliments and to extend to you a welcome in his name to the city of Chicago. He is deeply interested in this branch of street railway service, and begs to assure you, notwithstanding the impression that may have gone abroad in certain sections that there is a prejudice against the street railway men or persons engaged in that business in Chicago, that such is not the case, and that during your brief stay here, while we are not prepared to decorate you with buttons that will give you a free pass to all the good things in the city of Chicago, we can assure you that nothing but real true, gold bricks are sold in Chicago at the present time, and should you attempt to invest in one you will be sure of getting the genuine article. Seriously, and for myself, I will say that I am deeply interested in the line of work that your Association is developing, each individual having his own line of training, acquiring his views as to how accounts should be kept, how affairs should be directed, and having had myself somewhat to do with the street railway business and with the larger affairs of the municipality, I can appreciate probably more fully than many persons who have not had dealings in both matters, the importance of a classification of accounts, whether it be railway work, or whether it be the conduct of a great municipality or the conduct of states. The classification of work, putting under such uniform indexes as will simplify the work itself and convey a knowledge as to the particular class under which work is being performed, will make work much easier, and more comprehensive to the persons who are responsible for its conduct. Those of us who are not now interested in street railway business are certainly interested in the principles underlying the work that this Association is now doing; so that in addition to conveying to you the welcome extended by the mayor, I, for myself, wish to assure you of my interest in your work and to hope that you will have a most successful convention and that your work itself will be most successful.

As to your entertainment during the period of your stay in Chicago, it goes without saying that with this Association in the hands or under the guidance of committees formed in this city by Mr. McCulloch, Mr. Roach, Mr. Greene, Mr. Yuille and the other gentlemen who are in the street railway business in this city, there are none of the good things in the city that can escape the observation of you gentlemen while you are in the city. I hope every gentleman present, and every gentleman visiting the city from the American Street Railway Association, will avail himself of the opportunity while in the city of visiting the City Hall and inquiring into the methods of doing business and also into the methods of granting railway franchises. The question appears to be as great a one as that of accounts, and much prejudice exists concerning it that can be cleared up by a few careful inquiries while in the city. On the equities of the proposition as between the municipality and the companies, there can scarcely be a division of opinion throughout the world as to what they should be. Without attempting to discuss the question, I simply suggest that while here—and so that we may not suffer from the prejudice that generally attends a discussion far away from home, that the question will receive some consideration at your hands, because, after all, the accountant must in the end present to his manager and to the president of the company, the question as to whether the payments of the corporation to the municipality for the privilege of operating are sufficient or not.

In conclusion, gentlemen, I hope that you will be most successful in your deliberations, and that the work of your Association will be more far reaching than the street railway business, that it will extend to the conduct of public as well as private corporations. (Great applause.)

The President: Mr. McGann, on behalf of the city of Chicago, and gentlemen: I wish first to acknowledge to this Association

and the members present my great appreciation of the honor which they conferred upon me by making it possible for me today to acknowledge with pleasant anticipation the welcome and the good time that we shall have in Chicago enjoying the rare hospitality of this city. I speak as one, probably, who might be considered as living in the suburbs of the city of Chicago, in the state of Minnesota. In speaking of Chicago I am always reminded of that little girl, who on the eve of her family moving to Chicago said in her prayer: "Good-bye, O God, I am going to move to Chicago."

Here on Michigan's shores from age to age,
May Chicago lift her spires,
And gem with stars her history's page,
By the light of her hearthstones' fires.

PRESIDENT'S ADDRESS.

Gentlemen of the Association: "Know thyself," that simple injunction carved over the entrance to a temple of ancient Greece—so old that no one knows who wrote it—is a motto which has impressed me as ideally appropriate for this organization, the newest branch of a business which is at once the effect and the cause in what might be called the latest phase of modern civilization—Rapid Transit.

The executive head of one of the larger street railway systems of America said recently that the industry had not developed beyond 20 per cent of what might reasonably be expected as the ultimate future of street railway business in America; in other words, that there still remains four times as much to do as has been accomplished in the perfection of the art of carrying the public. If this be true, no small part of the future development must be due to the work of the men who, by analysis of accounts, establish the data for future advancement. Managers are continually balked by new problems. And while the operating department is usually able to answer satisfactorily the question: Can this or that be done? it is for the accountant to go further and ascertain what can and what cannot be done profitably; for, in the end, the wisdom of every policy must pass the ordeal of ultimate cost.

Andrew Carnegie, the captain-general of the iron and steel industry, paid this tribute to the calling here represented: "There is not a science or class of men on whom the business of the world is more dependent than the science of accounts and accounting." It is an axiom of modern business on which its success depends. I will go further and say upon which its very life depends, that of having within it a well devised system of accounting which will show at all times (with the least labor and the greatest accuracy) its true condition. In the idiom of the street, show me the management of any company, mercantile, manufacturing or transportation, that does not recognize this principle and act upon it and time will show you its "finish."

More, perhaps, than any other, does the street railway business depend upon and involve diverse and extraneous conditions, rendering it doubly necessary that a successful management, in order to secure the greatest revenue with a minimum of expense, should be prepared for prompt action and unerring judgment by careful analysis and minute comparison of the various items of revenue and expense through its accounting department. Pursuant to a general desire on the part of those who had struggled single-handed and alone through the maze of unsystematic street car bookkeeping in a desperate effort to supply these much needed data, a few accountants met in Cleveland, Mar. 24, 1897, for the purpose of promoting an organization which would bring together, for exchange of ideas, those engaged in the accounting departments of street railways.

Many of you will remember that paper, fruitful of discussion, read by Mr. C. N. Duffy, upon the Standardization of Street Railway Accounts, which, by common consent, became the chief subject of discussion at that meeting, as it has been ever since the foundation of the chief work of this Association.

For the purpose of preserving the continuity of the developments I will remind you briefly of the appointment of a committee upon this subject consisting of Mr. Duffy, chairman, Mr. W. F. Ham, of Brooklyn, and myself, which reported at the convention held at Niagara Falls in October, 1897. The report of the committee was approved, but the question arose as to the probable action of the Railroad Commissioners of the various states, since these commissioners in many states, prescribe what system of classification shall be used by the street railway companies reporting to them. As a result of the debate it was decided to continue the committee permanently, its membership being increased by the addition of Mr. H. L. Wilson, of Boston, and Mr. H. J. Davies, of Cleveland. The permanent committee endeavored during the following year to have meet with it the Railroad Commissioners of the states which exercise any control over the accounts of street railways, but arrangements could not be made previous to the convention which met in Boston. A full and complete report covering the matter of uniform accounting was presented at the Boston convention by the committee and adopted, notwithstanding their inability on account of lack of time to secure the approval of the Railroad Commissioners.

You will have presented to you, at this meeting, a full report from the committee covering its conference with representatives of the state Railroad Commissioners, and also of the American Railway Accountants' Association. At this conference Mr. Duffy and Mr. Ham acted for our committee.

I take pride in calling your attention to the recognition there accorded the action of our Association in the adoption by the conference of the entire system of classification (with a very few minor changes) as prepared and promulgated by our organization.

This tribute to our committee is admirably expressed in the language of Mr. William O. Seymour, chairman of the committee which reported to the Railroad Commissioners at their meeting at Denver, August 10th, last. Mr. Seymour, in his report, said:

"It was found that the form prepared by the street railway accountants was so much more advanced in its preparation, so complete and full in its details, and so well adapted for its purpose, owing to the familiarity of those who prepared it with street railway accounting, that we deemed it wise to abandon the work which we had commenced, and advise the endorsement and adoption of the form prepared by them."

The recommendation of their committee was adopted by the Convention of Railroad Commissioners, and we have every reason to believe that the same action will be taken by the American Railway Accountants' Association, since its representatives at the conference concurred in the action then and there taken. We have thus established, through our committee, a recognized standard classification of the various items which enter into the three chief elements of street railway accounting, namely: the revenue, the cost of operation, and the cost of construction.

This important feature is now substantially fixed, subject of course, to slight modifications from time to time as new and varying conditions make it necessary to slightly modify the present established classification, and to that end I would recommend the continuance of this permanent committee on the Standard System of Classification.

While our Association has accomplished much by the practical establishment of a permanent classification of accounts, we are far from having concluded the work necessary for a complete system of accounting, such as would be available for purposes of comparison. What we now need and must have before we shall have fulfilled our mission, is the establishment of a unit of comparison. We may have properly classified the cost of maintenance of way, transportation and general expense, and severally and collectively determined the amounts of each for a certain period as compared with another similar period; the comparison of the totals of one period with another may be in the aggregate more or less. This means nothing in itself, unless we can reduce these several sums to a unit of comparison. Now, whether this unit shall be the ratio which each item of expense shall bear to the total revenue, or whether it shall be so much per car-mile, per motor-mile, per motor-hour or ton-mile, is the next great and important question for the Association to consider and to settle. To Mr. H. C. Mackay has been assigned a paper bearing upon this subject, which will be read at this convention, and we trust he will suggest a solution of this most perplexing proposition. I would recommend the appointment of a committee on the Establishment of a Unit of Comparison. When this is done I shall feel that we are nearing our goal. With the classification and the unit established, the next important feature is a statement blank that will enable the accountants to present, in a uniform, simple and concise manner, the various results and comparisons.

We have established a Department of Blanks and Forms, and to our energetic and persevering secretary, Mr. W. B. Brockway, the Association is indebted for a remarkable exhibit of the blanks

and forms of various street railway companies. These he has arranged and will present with his report, the first important feature, as well as one of the most interesting on the program for Thursday's session.

I cannot conclude this task without yielding to a duty which I feel to be incumbent upon me at this time. I desire to remind the members of this Association that the enthusiastic accountant, charmed with the possibilities for analysis and classification which lie within apparently meaningless statistics, is frequently tempted to indulge in hobbies, which, while pretty enough from the accountant's standpoint, and frequently necessary in part, are worse than useless so far as giving practical information to the management. The ideal accountant wastes no energy upon unnecessary labor. His aim should be to prepare and present to the management only such salient facts as will enable the man in command to make instant comparison upon the three fundamental elements of street railway operation, namely: the revenue, the labor cost and the material cost; all else is subsidiary.

The revenue statement should show, by hours or otherwise, the number of passengers carried, so that the management may be enabled to secure the largest revenue with the least expenditure.

The labor statement should show, in a systematic and comparative manner, the number of men employed and the amount of wages paid in each department, that the management may compare with corresponding periods, and be able to control labor expenditure and keep within a fixed ratio.

The material statement, by showing the kinds, quantity and cost of materials bought and the consumption of the same, enables the management at all times to regulate the stock of material on hand.

I shall be pleased if what I have just said, fragmentary and brief as it must needs be in an address of this character, will create a discussion; if not at this meeting, at some subsequent meeting of our Association. I believe we get more out of the "experience-meeting" feature of our gatherings than from the set papers, valuable as they are.

In ending my term as president, I wish to express my especial appreciation of the good work of Mr. C. N. Duffy, that perfect type of an aggressive, progressive and intelligent all-around master of accounting and business man, who laid at Cleveland the corner stone of this structure, and to his worthy associate, Mr. W. F. Ham. To these two gentlemen this Association is indebted for the larger part of the great work which it has accomplished since its birth, and I hope that this Association has only begun in a field of usefulness which broadens as we advance. Purely practical and limited in scope though it be, it has afforded us a vehicle for good fellowship which I have enjoyed quite as much as the professional stimulus and suggestion. I look forward to future meetings with pleasure, and I thank you all for uniform courtesy extended to me since I have had the honor to preside over your deliberations.

Mr. Wilson then presented the annual report of the executive committee, which was adopted. It was as follows:

During the year the executive committee has held three meetings and has had five mail votes, admitting 34 companies. As was noted in the call for this meeting, the executive committee now recommends that the section of the by-laws referring to the annual dues be so changed that they provide for an annual assessment of $20 in place of the present dues of $10. We also recommend that this Association consider the advisability of holding its annual meeting at a time other than the time chosen by the American Street Railway Association. The books of the treasurer have been audited and found correct.

The report of the secretary and treasurer was then read as follows:

SECRETARY'S REPORT.

The past year has been an exceptionally busy one in the secretary's office, not alone in the regular work falling to such an office, but in the preparation of the Department of Blanks and Forms, which is explained in the report of that department, to be made Thursday.

Thirty-four companies have been admitted to membership since the last meeting, as follows:

Tiffin, Fostoria & Eastern Railway Co., Tiffin, O.
Omaha Street Railway Co., Omaha, Neb.
Stamford Street Railway Co., Stamford, Conn.
Cleveland City Railway Co., Cleveland, O.
Citizens Rapid Transit Co., Nashville, Tenn.
Ottawa Electric Ry., Ottawa, Ont.
City Electric Ry., Port Huron, Mich.
Fair Haven & Westville Railroad Co. New Haven, Conn.
Milwaukee, Racine & Kenosha Electric Railway Co., Racine, Wis.
North Hudson County R. R., Hoboken, N. J.
Metropolitan Street Railway Co., New York, N. Y.
Norfolk Street Railway Co., Norfolk, Va.
Tri City Railway Co., Davenport, Ia.
Metropolitan Street Railway Co., Kansas City, Mo.
Syracuse Rapid Transit Co., Syracuse, N. Y.
Quebec, Montmorenci & Charlevoix Ry., Quebec, Canada.
Union Traction Co., Philadelphia, Pa.
Vicksburg Railroad, Power & Manufacturing Co., Vicksburg, Miss.
North Chicago Street Railroad Co., Chicago, Ill.
Savannah, Thunderbolt & Isle of Hope Ry., Savannah, Ga.
San Diego Electric Railway Co., San Diego, Cal.
Duluth Street Railway Co., Duluth, Minn.
Glasgow Corporation Tramways, Glasgow, Scotland.
Calumet Electric Street Ry., Chicago, Ill.
Brightwood R. R., Washington, D. C.
Mobile Light & Railway Co., Mobile, Ala.
Butte Consolidated Street Ry., Butte, Mont.
Schenectady Railway Co., Schenectady, N. Y.
Central London Ry., London, England.
Third Avenue Railroad Co., New York, N. Y.
The American Railway Co., Philadelphia, Pa.
Alton Railway, Gas & Electric Co., Alton, Ill.
Kansas City & Leavenworth Railway Co., Leavenworth, Kan.
Albany Ry., Albany, N. Y.

And but two have resigned:

The Birmingham Railway & Electric Co., Birmingham, Ala.
The Manchester Street Railway Co., Manchester, N. H.

A statement of the growth of the Association is as follows:

Companies forming the Association at Cleveland, March, 1897	25
New members reported at Niagara Falls, October, 1897	12
New members reported at Boston, September, 1898	32
New members reported at Chicago, October, 1899	34
Total	103
Withdrawn	3
Total members to be reported October, 1899	109

But a new problem of consolidation is confronting us, a problem which is having a tremendous effect upon the whole street railway world, and I would commend to your earnest consideration the suggestions made in the report of your executive committee.

The statement of finances is:

Balance from Sept. 9, 1899	$ 51 84	
Received from application for membership	340 00	
Received from 1899 dues	730 00	
Received from 1898 dues	60 00	
Received from bills payable	225 00	
Received from interest and miscellaneous	4 18	
		$1,411 02
Expended for salary of the secretary	$200 00	
Expenses of the secretary's office	83 24	
Printing circulars and stationery	90 65	
Postage for reports, circulars, etc	79 03	
Executive committee meetings	46 05	
Stenographer for Boston meetings	105 00	
Printing report of the Boston meeting	224 67	
Printing 1898 report of the Standardization Committee	74 49	
Expenses of the Standardization Committee, 1898	68 50	
Secretary's traveling expenses	156 00	
Department of Blanks and Forms	157 21	
Bills payable	100 00	
Cash in Home Savings Bank, Toledo, O.	19 28	
		$1,411 02

Bills payable		$125 00
Cash in bank	$19 28	
Unpaid dues	30 00	49 28
Deficit		$ 75 72

Thus I cannot report the Association as having been a dividend payer, but I am sure the results of the work of the committee on a Standard System of Accounts and the Department of Blanks and Forms, which now has something tangible to offer, will well repay any reasonable stringency which we may encounter. The circulars sent out from the secretary's office to explain the benefits of membership have all resulted in the increase of applications. We seem to have almost accomplished most of the expensive work made necessary by the creation of the Departments of Standardization and Blanks and eventually we will sail on the smoother waters of "well-to-do."

It is again my bounden duty to express my doubly grateful thanks to all who have in so many ways assisted in the performances of the work of the Association. It has all been so cheerful that the thanks are the more heartfelt and in all sincerity I say, thank you. Respectfully,

W. B. Brockway,
Secretary and Treasurer.

Toledo, O., Oct. 14, 1899.

On motion of Mr. Hibbs the report was adopted as read.

The President: There are two very important features in the report of the executive committee, which we had probably better take up and discuss now. One is the question of revenue, which is a very important matter with this Association, in view of the fact that so many of the companies are consolidating and our list is limited; and the second is the question of holding our meetings simultaneously with those of the American Street Railway Association. There are a number of the larger street railway companies that are not members of this Association, and I think it is due in part, probably, to the fact that they have not been canvassed either personally or by letter sufficiently, and I would suggest that the secretary read a list of those companies that we would like to see members of this Association, and let each man make himself a member of a committee to see those people. I know one, the Buffalo Street Railway Co. We have never been able to get them to join, although Mr. La Pierre was seemingly very much interested in our Association when we met at Niagara Falls. Now, I understand they have a change in management and Mr. W. Caryl Ely is head of the consolidation. I understand he is here and I would be glad if some one would interview him.

I should like to hear from Mr. Duffy on the question of raising the dues.

Mr. C. N. Duffy: I do not know that I can throw very much light on the subject, but from the reading of the report and noting the condition of this Association financially, I think it is very evident that we need a larger revenue, and I do not see how we can reduce expenses. This Association is conducted on a very economical basis and the minimum limit of expenditure has been very nearly reached, taking into consideration the work that there is to be done. Now, the large items of expenditure are the publication of these books, the annual report and the classification books; for instance the books that we had published here in Chicago, which were distributed to you, embodying the report of the committee on a standard system of accounts, will cost in the neighborhood of $125. We have 500 of them, and hope that we will not have any more expenses of that character.

The president spoke about consolidation. As an illustration of that I would like to refer to St. Louis. We had seven members from St. Louis, which meant $70 a year. If we retained the united company down there it means $10 a year. There is a difference of $60 a year in one city, and every large city in the United States is rapidly reaching that same condition. Now, the dues of the American Street Railway Association are $25, and it seems to me that any company that is a member of the Street Railway Accountants' Association can well afford to pay $20 a year if it can afford to pay $10. I do not believe that the question of $10 or $20 would enter into the proposition at all. If a company wanted to be a member of this Association, I believe it would not stand on the difference between $10 and $20. Now, we have 100 or 102 members. We do not know next year whether we shall have 50 or whether we shall have 75, and according to that statement, as read by Mr. Brockway, we must look forward to at least $1,000 as revenue. With 100 members at $10 each we would only get $1,000. If we should lose any one of those members we would not have enough for our expenses next year. Another thing that is somewhat embarrassing to this Association is that under our by-laws the dues are due and payable on and after January 1st, whereas all these expenses are incurred prior to January 1st, and somebody has to carry this Association until January 1st.

It is my judgment that any company which is a member of this Association can well afford to pay $20 a year, and that it will certainly get value received for its money. I do not believe we will decrease our membership by an increase of dues, and I certainly think the executive committee has done wisely in recommending $20 a year dues instead of $10, and I hope that it will pass.

Mr. F. E. Smith: The matter was pretty full discussed in the executive committee meeting, and we decided there it was a great deal better to make the raise now than it was to get behind, and I think we had better do it. I think we can just as well get $20 as we can $15. The chances are that with all these consolidations we are going to lose some of the membership, and I do not believe that we can run on less than $20 dues. I hope that the resolution will pass.

Mr. Wilson: I hope sincerely that this motion will prevail. I think Mr. Duffy has expressed all that need be said on the subject, with perhaps the exception that he hesitated to say that the committee on standardization of accounts has been put to considerable expense, more particularly Mr. Ehrhard himself, which the members very generously paid out of their own pockets—expenses of travel and hotel bills and so forth.

Mr. Ehrhard: I cannot say much in addition to what has been said. Under the condition of things, I think it is perfectly proper to take some action on that line. If the majority thinks $20, that will be all right; if they think $15 would be enough, make it $15. Evidently we have got to raise something. I cannot enlarge on what they have said.

Mr. Durbin: If it is a question of raising the dues to $20 or even more, I think it should be done to carry on the work of the Association. I am sure our company won't withdraw if they raise to $25.

Mr. H. C. Mackay: I think the question has been pretty well discussed already. It is necessary to increase the dues to carry on the work of the Association, and a matter of $15 would be very little increase.

The Secretary: There was a question in the executive committee last night as to whether the increase of dues would affect small roads to such an extent that they could not afford it. Is there any real small company here?

Mr. Simpson, Augusta, Ga.: I represent one of the smallest companies in the United States, as far as street railways are concerned, but we are ready to pay the present dues and double it if necessary. But it looks to me, in regard to getting around and getting the larger companies interested, that we should also look to the smaller companies. It is the number as well as the size and the capital represented, I think, that make up the Association.

The question was then called for and put, and it was voted unanimously to increase the dues of the Association to $20, beginning Jan. 1, 1900.

The President: The next question, a very important one, is that of holding our meeting at the same time and place as the American Street Railway Association. I should like to hear from Mr. White, of Toledo, on that point.

Mr. Elmer M. White: It has been my opinion from the day we started that that was the only true way. Here is proof that it is the only true way. There are so many arguments for it that it is useless to try and say anything about it. I do not know where we can find one argument against it.

The President: I think there will be no question we could hold our convention at the same time as the American Railway Accountants' Association, which would be a good thing. A good many of us are working toward the steam railway business in connection with the interurban traffic. I should like to hear from Mr. Hibbs.

Mr. E. D. Hibbs: Mr. President, if I recollect right, at the original meeting of this Association, this matter was very thoroughly

discussed, and the only advantage claimed for having meetings at the same time was that we got the support of the other Association financially. On the other hand, there is a tendency for the entertainments, which are a feature of the other Association's meeting to direct our attention from the business on hand.

Mr. Burington: I have not given the subject very much thought since our meeting at Cleveland. I was then in favor of meeting separately, but since then I have changed my mind in several ways. By meeting by ourselves we would not get the reduced rates over the railroads, and that always is an item to our companies in the matter of expenses. I doubt if with the consolidations that are going on and likely to go on in the near future whether we shall be able to retain a membership of 100, which is required in order to get reduced rates. We might do better work probably by ourselves, and it is possible we might get a better attendance, from the fact that the smaller roads cannot excuse too many officers at one time. There is that much in favor of our meeting separately. It would be easier for us to get away, perhaps, but when it comes down to the privileges that we enjoy in meeting together at the same time and place as the Street Railway Association, it almost overbalances all the other considerations. Do we not get a little additional standing by meeting in connection with the Street Railway convention? It gives us a dignity that we might not have otherwise? That is one thing, I think, that should be considered very fully. I am a little at a loss to make up my mind. There are so many arguments in both directions that it is really a difficult question to settle. Possibly if it comes to a vote I may be obliged to vote for meeting at the same time and place as the other Association.

The President: I should like to hear from Mr. Lawton. Mr. Lawton is from Colorado Springs and comes a good way to be with us.

Mr. A. L. Lawton: I think that these Associations should hold their meetings at different times. Since listening to the discussion of this subject, it has occurred to me that either two days before or immediately following the Street Railway convention would be a good time to hold it, and at the same place that the American Street Railway Association meets. I traveled a long way last year to go to the convention, and I found as much interest in the American Street Railway Accountants' Association as any feature in connection with the meeting. I would like very much to have got some pointers this morning in the way of conducting street railways and managing their affairs, so as to enable a road which, perhaps, is not paying as well as some of the larger roads to buy some new equipment. I would like very much to have listened to the address of the president of the American Street Railway Association this morning. For that reason it occurs to me it would be better if the meetings were held at different dates. They are so closely associated together it seems to me it would be too bad, particularly for small roads and those who come from a great distance, to separate them entirely. I am very much interested in both associations.

Mr. C. L. Wight, Toledo: Would it be possible to join with the American Railway Accountants' Association?

The President: I don't think there would be any objection to it. They are all very much interested in it.

Mr. Wight: Could not we get the reduced rates if we went with them?

The President: They go free.

Mr. Wight: That is all right. I move that we go with them. When do they have their meeting?

The President: In May.

Mr. Wight: We would be ready by May.

The President: Well, gentlemen, this is a very important question, and I am going to defer the vote on it till tomorrow morning. In the meantime I would like everybody to give it careful consideration. Now, tomorrow morning's program is a very interesting one. The first is the report of the permanent committee on the standard classification of accounts, by Mr. C. N. Duffy, auditor of the Chicago City Railway Co.; the second is a paper by Mr. H. C. Mackay, comptroller of the Milwaukee Electric Railway & Light Co. on "Car Mileage," the question of determining what shall be the unit of comparison. Mr. Mackay has given this matter a great deal of thought and consideration. He has been in correspondence with a great many street railway companies throughout the country, something over 100, and I think he is prepared to give us some light on this subject. I know he is well prepared for arguments from different sources, and I would like to see a very full attendance tomorrow when this paper comes up, because I consider this the next very important feature in connection with our accounting, the question of determining a unit and what that unit shall be. That concludes everything for the morning, except the appointment of committees. There is the committee on nominations and the committee on resolutions. As the committee on nominations I will appoint Messrs. F. E. Smith (chairman), E. D. Hibbard, C. L. Wight, Palmer M. White; as the committee on resolutions, Messrs. Burington, Simpson and C. K. Durbin. I understand that Mr. Yerkes is now reading his paper before the American Street Railway Association, and I presume a good many gentlemen present would like to see Mr. Yerkes and hear a portion of his address, and we will adjourn now until tomorrow morning at 10 o'clock. I would like to have every one here at 10 o'clock promptly, as we have a very important day.

The convention then adjourned until 10 a. m. the following day.

Wednesday, October 18th.

The meeting was called to order by the president at 10 a. m. After the minutes of last year's meeting had been formally approved the following paper was read:

CAR MILEAGE.

By H. C. Mackay, Comptroller and Auditor, Milwaukee Electric Railway & Light Co., Milwaukee, Wis.

One of the greatest problems affecting the street railway interests is that of securing an equitable and standard unit, and the subject assigned will be treated in its general relation to accounting as such.

Car mileage has been adopted by practically every road in the country as the basis of comparison, but a study of the methods used in computing the mileage made by the different systems will convince any one that under the present conditions it is misleading and unreliable. It makes but little difference what is used as a basis, as long as its purpose is simply to show if the earnings or expenses are proportionately above or below that of a similar period; but to make a comparison with another system, on which the speed, length of day operated, size of cars, etc., are different, or where the physical conditions are dissimilar it is absolutely necessary that the units be identical.

It is not practical to make general comparisons of any given expense item as to the amount in dollars and cents for the reason that there are so many factors to be considered which have a direct bearing on the cost; hence, it is necessary to reduce the items to the same basis for all systems. When this has been accomplished, the result of the operations of the various systems will establish an average for each division or item of expense, which will be an accurate guide to the manager, an indicator showing all expense items in which reductions should be made. Here is where the greatest value in a standard unit lies; the cause of an abnormal expense is at once detected and the energies otherwise wasted in an endeavor to locate the trouble can be applied in the correction of it.

The principal objection to "car mileage" is the variation in speed. Between city and suburban lines there is a difference in speed of from eight to thirty or even more miles per hour. The increase in speed does not materially affect the cost of operation. The liability of accidents due to increased speed being more than offset by the difference in density of population of district traversed, while the principal items of expense, such as "wages of conductors, motormen, car house employes, etc.," are the same in either case; hence the suburban or interurban line would show from two to four times the number of miles run, at only a slightly increased cost as compared with a city system. The question may be asked why the interurban line should not be entitled to the credit of operating at a less cost (as the object of a standard unit is not to make expenses uniform, but to show the actual conditions). I shall answer this by saying that while the cost "per car-mile" would be less, on the basis of "passengers carried" it would be more, by reason of the longer haul, thus indicating that its expenses are not proportionately less except upon a basis favorable to itself.

Another disturbing element is the "trailer." Where trailers are

Harry C. Mackay was born in La Salle, La Salle County, Illinois, Oct. 6, 1869. In 1886 he accepted a position with the Minneapolis, Lyndale & Minnetonka Railway Co., and at the age of 18 was made paymaster, remaining in that capacity until the road was leased by the Minneapolis Street Railway Co., his services being retained by this company as bookkeeper. In 1891 the Twin City Rapid Transit Co. acquired and operated the street railway systems of Minneapolis and St. Paul and with this company he filled the positions of paymaster, head bookkeeper, chief clerk and assitant auditor, resigning in 1897 to accept his present position, that of comptroller and auditor of the Milwaukee Electric Railway & Light Co.

H. C. MACKAY.

regularly used and to any considerable extent, they are considered as separate cars, mileage being computed for both motor and trailer in nearly every case. Theoretically, a system whose equipment is exactly adapted to its needs, would assign to runs, cars of just sufficient capacity; the trailers being abandoned and in the place of say a 22-ft. motor car and an 18-ft. trailer, a 40-ft. motor car would be run, thus eliminating the expense of one conductor, as well as the extra maintenance charges.

New cars are rarely purchased for use as trailers on electric systems, those in use as such being either relics of horse car days or an indication of an extraordinary growth of the city, and consequently of the system; the trailer is an indication that the capacity of the car is not equal to its requirements while it is still in good condition and too valuable to be consigned to the scrap pile or even to be sold at forced sale, so its motors are placed under a longer car body, and it is transformed into a trailer, to be brought out and used as an attachment or extension whenever the motor car's capacity is liable to be overtaxed.

Surely no one will contend that it is cheaper to operate a motor and trailer whose combined length is 40 ft., than to operate a motor car of the same length. If so, the same rule must apply to a 24-ft. car, and we would be substituting a 12-ft. motor car and 12-ft. trailer in its stead. Yet the method of computing both motor and trailer mileage attempts to show just this result. To better illustrate, we will take two roads, one using 40-ft. motor cars, the other a motor and trailer, whose combined length is 40 ft. They are operated at same speed, headway, etc., yet the first shows a cost of say 12 cents per car-mile, the other, by reason of the double mileage, a little more than one-half of 12 cents, though with the additional expense of an extra conductor. My contention is, that a road using trailers is naturally handicapped and should not be expected to produce as good results as one whose equipment is nearer adapted to its needs, and that the trailer is but an extension of the motor car and the extra expense of running it should show as the result of unfavorable conditions.

To secure data, the writer sent to most of the railways of the United States and Canada, a circular letter, requesting answers to a number of questions, with the results as follows:

1. Is your mileage computed from conductor's trip reports? If not, how? Answers were received from 103 roads, and were as follows:

Conductors' or motormen's reports	73
Foremen, dispatcher or switchmen's reports	15
Time tables	4
Unanswered	11

From this we see that over 70 per cent of the total number and a still greater per cent of the answered reports arrive at mileage from the trainmen's reports. Some new companies have adopted a system whereby the conductor reports his route run by numbered points, each switch, crossover, etc., being given a number, permitting the accounting department to accurately trace the car. It, however, requires a careful examination of each trip sheet, which on a large system means the expenditure of considerable time. I would suggest that the trainmen be required to report only the exceptions to their regular trips; that is, either lost trips or extras made; thus, instead of going over all the trips made during the day, only the deviations from the regular schedule would be examined and computed, and this result added to or subtracted from the regular schedule. The method adopted would depend upon an answer to the following question:

2. Do you keep record of mileage made by each car?

Affirmative	51
Negative	46
Unanswered	6
Of the 51 roads that keep such records	
26 are in cities of less than	50,000
10 are in cities of 50,000 to	100,000
15 are in larger cities.	

Neither of these two questions have any bearing on "car mileage" as a unit, except so far as accuracy is concerned. A great many data are usually prepared by the accounting department, to which reference is seldom made. Mileage by cars is valuable and necessary to determine the life of wheels, gears, pinions, etc., but these tests are rather rarely made and special records can be kept in such cases at a less expenditure of time and money.

3. What method have you of verifying the figures on mileage? The answers were:

None but care in computing	45
Time tables	28
Dispatchers' reports	8
Pay rolls	4
Foremen's reports	4
Motormen's reports	3
Trip receipt returns	1
Unanswered	10

It would seem that the simplest method of verifying the results would be by a report from the foremen showing deviations from regular schedule and have this result checked by the trainmen's reports.

4. Do you include dead mileage, i. e., from the car station to the point where the car strikes the regular route?

Negative	50
Affirmative	36
Have none	11
Unanswered	6

The reason assigned why dead mileage should not be included is that the car is not earning revenue, and that it would be unjust to decrease its earnings per car-mile. Nevertheless, the mileage had to be run before it could earn revenue, the expenses were the same as when on regular service, and I consider it legitimate mileage. Thus the system whose stations are advantageously situated would receive whatever benefit there was due to that fact.

5. Do you include full trailer mileage? If not, what proportion, and give reasons why full mileage is not used?

Trailers not used	46
Affirmative (of which number only half use trailers regularly)	37
Negative	11
Unanswered	8
One-half	1

The roads using trailers regularly, as shown, are only about 20 per cent of the total. As stated before, the trailers should not be computed for general use.

6. Is any allowance made for partial trips lost?

Affirmative	57
Negative	37
Unanswered	9

This question is covered under No. 4. Allowance should be made for partial trips lost, or in other words, the mileage used should be the actual mileage made by motor cars.

7. What is your average motor mileage per day? Trailer?

8. What clerical help is required for mileage work and the approximate cost per month?

9. How long does it take to ascertain the total mileage for the day?

The object of the preceding questions was to determine the rela-

tive cost and adaptability of the method used; but owing to the different construction placed upon question No. 7 (answers covering average motor miles per day per motor and total miles per day), no conclusion can be drawn except that the speed varies so that the average motor miles per day per motor ranges from 65 to 300 miles.

10. Do you use "cars operated per day" as a basis for comparison of earnings? If so, what constitutes your car-day?

The answers were

Affirmative		44
Car-day of 20	hours	1
Car-day of 19	hours	1
Car-day of 18	hours	31
Car-day of 17½	hours	1
Car-day of 17	hours	3
Car-day of 16	hours	1
Car-day of 15	hours	4
Car-day of 115	miles	1
Car-day of 80	miles	1
Negative		48
Unanswered		11

Car-days, especially in the larger cities, are gradually lengthening and eventually will, no doubt, reach the maximum of 24 hours.

The adoption of the "passenger-mile" (being the passenger trip distances divided by the number of passengers carried) is precluded owing to the impracticability of obtaining the length of the separate passenger trips.

This applies to the "ton-mile" as well, if the element of "passenger weight" is taken into consideration. If the "ton-mileage" is based upon the dead load hauled, I do not consider it complete. In fact, the showing made on the basis of "ton-mile" would have a tendency to mislead the management. For example: One system operating "20 ton motor cars" with a corresponding large ton-mileage would show a small cost per ton-mile. Another system, operating "10 ton motor cars," would show nearly double the cost per ton-mile, when as a matter of fact the lighter car may be the more economical.

But with the mileage computed carefully, all dead miles included, and the elimination of the trailer, we have a unit which will be uniform and applicable to all electric systems as soon as the question of speed is adjusted; hence, we have but to divide the car-miles by the average rate of speed and this result, verified by the motormen's time, will be a standard unit. This is equivalent to a "motor car-hour."

To illustrate the method of ascertaining and verifying the "motor car-hours," at the same time showing the effect that speed has upon the car-mile as a unit, I submit the following exhibit:

Traffic Sheet.	City Line.	Interurban Line.
Cars operated	3	3
Speed per hour, miles	8	24
Length of trip, miles	24	24
Trips per day, regular	18	54
Extra trips	2	6
Trips lost	½	1½
Trips run	19½	58½
Miles per day	468	1404
Motor car-hours	58½	58½
PAY ROLLS—MOTORMEN'S TIME.		
Regular trips	18	54
Extra trips	1½	4½
Total trips	19½	58½
Motor car-hours	19½ x 3=58½	58½ x 1=58½

Assuming cost of operating these cars at $60 per day, the costs are:

Per car-mile	$ .1282	$ .0427
Per car-hour	1.0256	1.0256

From the foregoing we see that the time table of the city system shows 18 regular trips per day. From the conductors' and foremen's reports we find two additional trips were made and half a trip lost, a net addition of 1½ trips, or a total of 19½ trips, amounting to 468 miles. This amount divided by the speed equals 58½ motor car-hours. This figure is verified by the pay roll.

Time allowed, 18	trips at 3 hours (regular)	54 hours.
1½	trips at 3 hours (extra)	4½ hours.
Total		58½ hours.

For the purpose of comparison, the interurban line is based upon same conditions excepting speed, which is increased from 8 to 24 miles, thus increasing the mileage without changing the car-hours.

Thus it will be seen that on exactly the same cost, the city system would show 12.82 cents "per car mile," as compared with 4.27 cents, while on a basis of "motor car hours" the cost is the same.

It has been contended that the unit for earnings should be the "motor car-hour," and that operating expenses should be based upon the percentage of earnings. The car-hour certainly applies to earnings just as well as it does to expenses; but I do not think that a percentage of earnings is the correct basis for the expenses. For a standard unit it is too fluctuating. If a road's equipment were always taxed to the limit, its earnings and expenses might be held at a fairly uniform basis, but these conditions would never exist for any length of time and could not become general. Any large convention or carnival would swell the earnings abnormally, and while the expenses would increase at the same time, they should not be increased in the same ratio; hence, a comparison of the month's result under such circumstances with another system under normal conditions, would be unfair. Again, the geographical location would disturb fair comparisons, as the time of the year when expenses would be proportionately low in a northern city would undoubtedly find just the reverse in New Orleans or other similarly situated places.

It has also been suggested that the sub-divisions of "General Expenses" are not consistently covered by the "motor car-hours," and that such items as "Advertising and Attractions" and "Insurance" are not affected by the number of car-hours run. As far as such accounts as these are concerned, the same may be said of any unit. Good management will always keep the car-hours as near the point where profit and loss separate, as it is possible, whether on a large or small system, and while such accounts may not be affected by the car-hours, nevertheless, the car-hours, being the index as to the management, the amount of such expenditures are proportionately and correctly shown.

Before concluding, I wish to briefly refer to an article on the "Cost of Electric Power for Street Railways at the Switchboard," by Mr. R. W. Conant, read at the last convention of the American Street Railway Association. Quoting therefrom: "The car-mile basis is not a fixed standard. A car up hill takes a great deal of power, while a car down hill should take none, and may be made a source of power." This is undoubtedly correct, as all grades and loads affect speed, and without this adjusted mileage is not a fixed standard, but with the speed taken into consideration it would be practically the same as on a road without grades.

The President: This is a very important question to our Association, and we should like to have it fully and freely discussed this morning. We would like to have any one ask Mr. Mackay questions that suggest themselves. Mr. Vreeland, I would like to hear from you.

Mr. Vreeland: Any question connected with accounting is of very great importance to me; I went early into steam railroad work, when properties were small, mileage small, and corporations small, and as a young man, starting with due consideration of the future, went very thoroughly through all the departments of railroading. It was made possible by the conditions that existed which I have cited. The properties were very small and departmental questions were not of the magnitude they are today. I, fortunately, went into the work at a period before this evolution commenced, and went through all branches of railroad service. There was no one separate department but what I did a great deal of work in, including all branches of operating, mechanical, and accounting. I left the steam railroad service about the time that consolidations had been very largely effected, and came into the street railroad service at the time when consolidation had just been commenced. I have always looked upon the accountant or auditor or accounting officer of a railroad as the most important lieutenant and aid of the managing officer or the president of a road.

I have always insisted, in any property that I have had charge of, be it as general manager or president, that the auditor or comptroller or whatever he may be called, was my man. I looked upon

the man at the head of the accounting department as the confidential adviser of the head of the institution. You must have confidence in him. You must feel that his supervision of affairs is to your interest, and I have always said that while I liked friendship and a community of interest through heads of departments, I would rather have a superintendent and comptroller at loggerheads than too friendly, because it was an evidence he was doing his work thoroughly. There is nothing that hurts the practical hard-headed head of a department as much as interference by an accountant with his system of doing business. He looks upon it as an interference. When I went into the steam railroad business this question you have up here today was a very important one then. The old method was a computation with small properties on a percentage basis. It was not a proper guide to all because the physical conditions were different, and the characteristics of the property, hours of traffic, etc., could not be shown merely on a basis of 70 per cent, or 60 per cent, or 50 per cent, and in those days when men were not so well educated about the conditions of our country, I have heard the capabilities and capacities of different people criticised. For instance, a manager of a road in some hilly, mountainous country, the operating expenses were 80 per cent, was criticised, because in some other part of the country the percentage was only 50 per cent. The evolution was to a separation of accounts, and to the question of engine maintenance and mileage, and car maintenance and mileage, and the separation of traffic, both freight and passenger, until the basis of the train mile was reached. On the steam railroad today, the cost of maintenance and construction, buildings, transportation, general expenses and everything is computed for the train-mile unit.

When I entered the street railway service I took hold of a property that had just been the result of the consolidation of many properties, and I saw there was no systematic method of accounting. I called to my aid at that time, a man who had been for years the auditor and comptroller of steam railroads, and who was at that time acting as expert accountant in the consolidation of properties. I turned over the books to him, and told him to make a thorough study of it and start the books on what he considered good accounting practice. He worked a long time at it, and brought out a set of books. In the distribution and classification of operating expenses, we are, in New York, subject to the requirements of the law under which the Railroad Commission of New York was created. The commissioners have the supervisory powers over all that we do, and also have the say as to how we shall conduct and classify our accounts, the same as the Inter-State Commerce Commission of the United States has over the steam railroads. After we had run under that system of accounting for some time, the board of Railroad Commissioners decided, as a result of the character of the reports they were receiving from our system, to call a meeting of all the accountants in the state of New York, to arrive at some standard classification of accounts. The meeting was held in my office for a series of days, nearly a week, and the matter was thoroughly discussed, pro and con, and the system under which we were working, with a very few slight modifications, was adopted as the standard of New York. We used no trailers, and we adopted as the unit the car-mile irrespective of whether a car is to run somewhere to start a trip, and we classify our accounts so that on the 15th of each month, each month closing itself, I have a statement showing all the conditions, cost of material, etc. As you know we are, in New York City, pretty far behind the age, and it may seem strange to our western friends and cause them to smile, as it did me when I was on a trip, but we have at the present time 5,000 horses working in our system, so that we have horse, electric and cable car items. This financial exhibit is a complete abstract of the results of our auditor's work every month. This is open to the inspection of any stockholder or director, or any one who is interested in the property, There is a concise classification which covers the individual lines of the system, carried along by the month, so that I get on the 15th of the month a statement showing everything on a car-mile basis, and it is only necessary for a manager to make a comparison to determine for himself whether they are accurate or not throughout. The equipment expenses and transportation expenses and general expenses of the system are brought down to the actual cash basis per car-mile. I have had occasion in the past six years to make, in an expert capacity, many examinations of properties in this country, but I would not for an instant give any opinion on this question against the opinion of you gentlemen who are daily in the work. To me it is an incident of a large business at the present time, and my mind would not certainly be as fresh upon it as if I were working at it constantly, but the question up is a very important question. I have for a series of years been working on the line of Mr. Yerkes' paper yesterday in getting our company into a position so that we can say to the world or any man interested in our property, "There it is, you can take it or leave it, we are not afraid to give it to you or any one else; we have done the best we can with it, there is the condition."

I have taken some of the most expert accountants that we have in New York and have had them take up this accounting and go through it, and incidentally on account of my earlier association with these men on steam railroad work, my mind has naturally turned to the men that I have known in that work as expert men, but frequently in the last year or so I have taken the street railway accountant with me, and in every instance I have asked what in his opinion would be the most available unit for us to work on to get an idea by comparison of the properties in the United States or the world, and the answer has been the car-mile.

Of course there are exceptions to everything, and everybody can find good reasons why anything we do or say should be different. I remember when the system of keeping the car mileage on steam railroads was introduced. I remember that it was stated at a meeting where the question was up, that it was an absolutely impossible thing to do, and the reason why it could not be adopted was, "I can trust myself, but when the car goes anywhere else I have got to trust somebody else," but the result has turned out in such a way that every man was satisfied—I know I was always satisfied—whether the car was on my line or in St. Louis, or in California—that it was getting proper treatment, and that we were getting proper returns. I only state that as an illustration. We have to choose some course and go ahead with it, but the concensus of opinion upon this proposition as I have got it is for the car-mile as a unit. But the exceptions, such as Mr. Mackay has illustrated here, and why they cannot be handled in that way, I am not in a position to discuss at present, because I take this question up with you at the request of your president—I took it as an entirely novel position when I came into the room. It is immaterial whether you put five cars together and put a motor and cable car on ahead of them and call that a railroad, or whether you take the same number of people and put them in coaches and put an engine in front of them and call that a railroad, you arrive at the same point; you have practically the same classification of expenses, because the street railway of today stands right on the line with, and as far as its being progressive is concerned, a little ahead of the average of steam railroads, and the unit that has to be the determining factor in the end must be based upon a very careful study of all the conditions that surround it. For our part, our accounting officers are well satisfied with the car-mile as a unit in considering the expenses of the system. So far as the question of the methods of these various things are concerned, to which our friend has alluded in the paper, the question of keeping the mileage and things of that character I would say that I think that anything that can be done on Broadway in New York can be done anywhere. By reason of the congestion of our system, we do not know where a car may go when it starts out; it is likely to go two miles and be switched back, or to go four miles and be switched back, or it is just as likely to go to the terminal in another direction from the car barn, so that any statistics furnished by a starter or any car barn man are absolutely valueless, because he does not know where the car has been. The only method we have of determining this is by the report of the conductor, and we have an arrangement covering the system by which certain points are numbered, and the conductor makes his report that he left point No. 1, for instance, and if point No. 5 is his terminal, that he went from 1 to 5 and from 5 to 1; if he got switched back by orders of the inspector by a blockade at point 3 his report will show that, and the time of the men based upon the trip is governed by that as well as by the mileage. The statistics of mileage of wheels and motors and things of that character may not be accurate, but it is worked out from that system, and is as accurate as we can get it. The man whose mind has not been trained to the fact that one-tenth or one-eighth or one-quarter of 1 per cent is a valuable factor in the operation of railroad systems cannot appreciate your work, and when you go to work, and probably sit up

nights to work something out that you consider is of value to the system, it is thrown aside as of little importance from the fact that the importance of it cannot be appreciated. When you take into consideration the mileage, and the effect of the slightest fraction of a cent on the aggregate it is of great importance to determine the wheel mileage and motor mileage and everything connected with the operation of the line, and this brings up the point that the accounting department is a most valuable adjunct in determining what the system is doing.

We have the auditor and comptroller take up these matters with the division superintendents and general foremen, monthly, quarterly and yearly, and say: "Such and such has been the case. Now, boys, look out. Here is the sign; it has pointed the way." We do not think it is wise to send a man an aggregation of figures which he is incapable of analyzing, but we bring him right in to the auditor or comptroller and point out to him that he varies either more or less from others in this particular direction or that. The car-mile unit as used by us has been adopted in some of the other large systems such as New York, Philadelphia, and some others, but I am very free in saying that I would not give a snap for a departmental man under me connected with a railroad, that would not get up and express his opinion and fight for what he thinks is right, and if any of you gentlemen have anything to offer that will enlighten me, I shall be just as pleased to hear it as any man in the room.

The President: You do not run any trailers?

Mr. Vreeland: No, sir.

The President: But you attempt to have the same length of car on your system?

Mr. Vreeland: Yes, sir, but at the present time we have 18-ft. horse cars, and we have a 22-ft. and the 28-ft. car, so that there is a variation, but at the same time it does not affect the general value of the proposition when you get it sub-divided into your lines.

Mr. Mackay: I would like to ask Mr. Vreeland if the question of speed enters into the calculation?

Mr. Vreeland: We have never taken any consideration of that. Take our Lexington Ave. line for instance; from 130th St. to 105th St. it is run electrically; where there is very little congestion, from 105th St. to 25th St. it is run on a cable that runs on a speed of 12 miles an hour; from 25th St. to 5th St. and Broadway, 10 miles an hour; from 23d St. to Houston St., 8 miles an hour, and from Houston to South Ferry by a cable which runs 6 miles an hour, and that is just on one line; it is not a comparison of two lines. Take the Broadway and the Columbus Ave.; that is run at 14 miles, 10 miles and 6 miles.

Mr. Mackay: You do not run an interurban or high speed line, say at 25 miles per hour?

Mr. Vreeland: No, sir.

Mr. Wyman, New Orleans: I have been led, during the last two weeks especially, to consider the immense utility of the accounting department along the line of preparing the information to give to our investors in order that their confidence in their investments may be secured. A system of bookkeeping or accounting should be plain to the average investor. Men are studying these questions now as never before.

I have felt, as Mr. Vreeland has so well expressed it, that the auditor is the man next to the manager, and the one upon whom the manager himself must rely most implicity and most positively. The two should be most closely allied in the work, and that alliance I have always sought on whatever roads I have acted as an officer. I may say that this car mileage basis is the one which we have adopted—which was adopted in Milwaukee when I was there—and is adopted in New Orleans, and yet I very heartily sympathize with some of the points made by Mr. Mackay in his paper, that there are questions regarding it that are sometimes difficult and over which we may possibly stumble. If the motor car-hour should replace as a standard the car-mile, I am not sure but what it might be wise. In our power houses we have adopted the kilowatt hour. Now, while the motor car-hour may not be directly allied to the kilowatt hour, I can see it might be a very useful standard.

But I do hope that the effect of this Association will be so pronounced that whatever shall be decided upon will meet with the approval of all street railways. As Mr. Vreeland has stated, our business has now got to be a public business; it has reached out and become a business that is attracting the attention of everybody all over the country, and some of our neighbors. Investors are looking at it constantly. People are seeking to put their money into street railroad enterprises. They are regarded as gilt-edge investments, and properly so, and aside from it being a great factor in civilization, aside from their being, perhaps, the most important factor in municipal life today, they are a factor in the world's markets today like none other that I know of, not even steam roads, and therefore there should be standards adopted of universal application, so that the investor or one interested in these matters may read as he runs, and know precisely where we are, what we are doing, what our comparative value is as placed along side some other company; and on the other side we should be very perfect, very clear, in stating exactly what our position is financially and I think that the managers, operatives and officers and presidents of roads will join with the Accountants' Association in effecting that sort of an end. (Applause.)

The President: Mr. Duffy is a member of one of our very important committees, and as such he can explain to these gentlemen briefly what we have been doing in connection with the meetings of the steam railroad people and railroad commissioners.

Mr. C. N. Duffy: I have been very much interested in the remarks of Mr. Vreeland and Mr. Wyman this morning, in the discussion of the very able paper by Mr. Mackay, but I would have liked to have heard a little more discussion on the matter of the unit of comparison; as to whether it should be motor car-hour or car-mile. Mr. Vreeland's comparison as to the manager up in the Rocky Mountains being put on the same basis with a city line is a point very well taken. It illustrates the practicability of the motor car-hour, but I am digressing from what our president referred to. I was very much pleased to hear Mr. Vreeland say that he and his accounting officers had spent a great deal of time in the earnest study and adoption of a standard classification of accounts, which now stands as the standard of the state of New York. As chairman of the committee of this Association, and having charge of that matter, I am acquainted with the classification that Mr. Vreeland refers to, and if our president will remember, at Niagara Falls, Mr. DeFreest, secretary of the board of Railroad Commissioners of New York, was with us, and the standard classification adopted by this association is very similar to the classification adopted and used by the New York Railroad Commissioners. And I would like to say for the information of all of you, and more especially for Mr. Vreeland, as he is from New York and directly interested, that in July our committee met with a committee of Railroad Commissioners, of whom were Ashley W. Cole, president of the New York board, and Mr. Seymour, of Connecticut, and two gentlemen representing the Association of American Railway Accounting Officers. The reason for this conference was that the convention of Railroad Commissioners—that is the title, but it is really the National Association of all the railroad commissioners of the United States—wanted a standard classification of accounts for electric railways. They wanted it to operate with reference to street railways and electric railways, just as the Inter-State Commerce classification operate with the steam railroads. There were two members of our committee present, Mr. William F. Ham and myself, and there was a long discussion of this question. We went over the thing very carefully, and as a result of that conference the classification of accounts that was presented to this convention at Boston, 1898, with very few and slight modifications, was recommended for adoption. It was presented at the convention in Denver on August 10th, and unanimously adopted. And that the Street Railway Accountants' Standard Classification of Accounts has now been adopted as the standard of the Railroad Commissioners of the United States, and in every state in the United States that exercises any supervision of accounts in, and it will be the standard classification, and in 1900—Mr. Wilson here is shaking his head, we do not count Massachusetts—in 1900 they propose to put this thing in actual operation and have their reports made on blanks, modeled after this classification. The steam railroad accountants do not meet until next May, and a committee from that Association will recommend to that convention the adoption and use of the same classification. Now the effect of that will be that we will have a standard classification that will be universally adopted, and we have all four elements. We have the street railways, then we have the Railroad Commissioners, we have the steam railroad accountants, and we have the street railway accountants, then in addition the American Street Railway Association. We have a standard classification of accounts

and we ought to have a standard unit of comparison, and we ought to have a standard form of statement—an arrangement in the regular annual form of report which this Association has adopted, and I would be very glad to hear a full discussion on this subject of whether or not the car-mile unit should be the standard unit of comparison. I do not know whether you consider the different sizes of cars, whether single or double truck, whether they are 10-ton or 20-ton, and whether they run trailers—Mr. Vreeland does not run trailers—well, we run a few in Chicago. We have a train of four cars, sometimes of five, and sometimes that train on its journey is partly electric and partly cable, and like Mr. Vreeland we still have a few horses, not 5,000, but something over 200.

Now, there is one feature of this question that I do not believe has been touched upon. Even if you are figuring on a car-mile basis, how are you going to treat the trail car—in all its different phases—are you going to call the trailer the same thing as the motor; it does not take as much power to pull two trailers as it does one motor. In the summer, if you are operating a trailer, it will earn more money than your motor. These are questions that enter into the question of comparison which do not enter, I think, into the motor car-hour. This subject has a great many attractions., that is for me, and I would like to have some of these gentlemen talk upon it. (Applause.)

The President: Col. Heft of the New York, New Haven & Hartford road is with us and we should be glad to hear from him.

Mr. Heft: I was very sorry that I was not able to be present and listen to the paper, and I am in the position of a man who woke up and found himself in a place and said he had no country. But I have listened to the gentlemen in discussing the question of whether the item of cost should be made up upon the car-mile basis, or upon the motor car-hour basis. It seems to me that the question is one that is governed wholly by the conditions which exist upon the road you are operating. If you attempt to make up the cost on the motor car-hour on our system it would be very misleading, for the reason that during certain portions of the day we are hauling two trailers, other portions of the day we are hauling four trailers, and some portions of the day we are hauling only one and some other portions only using the motor car. Now any costs made up on such a basis would be wholly misleading. Our company has adopted the car-mile basis in making up the cost, and in doing so we figure the cost of power consumed when using the motor car alone, the additional power of each trailer, and make up the cost of the motor car-miles and of the trail car-miles and stating whether one, two, three, four or five trailers are used. We also follow the same rule in arriving at the cost of maintenance and in our figures on car-miles we add everything—every item except the depreciation upon equipment and upon the tracks, and the interest on the capital invested, but at the present time we are not wholly satisfied with the way our accounts are made up and are drifting around to see if some bright fellow will not substitute some other system which will be more desirable than ours. But I think in all these questions, that in arriving at the cost of any system, the manager should be governed wholly by the conditions which exist on his line and that no stereotyped rule can be laid down by which you can make up your minds on all these various systems where the conditions are so wholly different, and no one will welcome a system—a universal system that can be used by all railroad companies, more than I would, but it seems to me that it is a knotty problem and one that deserves our best consideration, and we should not decide upon any system until we feel satisfied that it will answer all the requirements of the different members of our Association.

I have attended the meeting of the Railroad Commissioners on two occasions when the accountants from the steam railroads met with the Railroad Commissioners and devised a system upon which our reports should be made to the Railroad Commissioners, and I found that there was a great diversity of opinion among all of the different commissioners, and it seemed to me that there was a work in a worthy cause for some of you bright accountants to devise such a system as we could satisfactorily adopt for all our statements.

I am very glad to have had the pleasure of speaking this morning and of meeting with you, and I wish you a full measure of success. I think your Association is a live one. There is a need of it, and you have certainly accomplished a great work, and yet I think the future is very bright and that the result of your deliberations in the end will be of great benefit to all the systems which are members of your Association. (Applause.)

The President: I understand that lunch will be served upon the train, so that while it is now 11.30 we need not hurry away from here. I would like to hear from Mr. Wilson.

Mr. Wilson: I have always supposed that I was a native up to this morning, when I have been informed that I am a foreigner coming from Massachusetts. In this respect we are in very much the same position as Mr. Vreeland. We do not run any trail cars whatever, and we run something over 300 routes every day, every one of which has a different length and a different speed. There is no basis whatever that I know of upon which this thing could be figured but car-miles. We could never take a trip and say that a car will take a certain length of time to come back, not quite in the way as suggested by Mr. Vreeland, but while we do not shift cars from point to point as he does, yet a car may go out on its route to come back on its schedule time, or it may not. The question of the basis of car-miles, I think, can only be taken up by a company of the size of the one which I have the honor to represent in comparison with a road in some large city of a similar nature. While this traffic sheet that is shown here is very interesting, when it comes down to the question of three cars being compared with 1,800 cars, which we probably run on certain days, the comparison is of but little use, and in connection with the question that Mr. Vreeland brought up, of the foreman of the men who are directly connected with the maintenance of the equipment, the system which we follow is the same in every individual car house. Each one has its maintenance crew, which keeps the motors, trucks and cars of that particular car house in condition. Each month we make up a statement giving the details of some 6 or 8 accounts, showing what the labor and material in each of these car houses has cost, and then we have a comparison.

Now when we first started this I used to have an inventory of the stock taken once in three months or once in six months, but I very soon found out that we didn't always have the stock which we should have had. Each man was so anxious to make a good showing for his car house that he would include a lot of the material that had been consumed. In order to avoid that I have for two years had the men make a return each month of the stock that they have in hand, and in that way I think that we have an accurate statement of it. On the basis of car-miles we get a very good comparison, while on the basis of car-hours I don't know of any way in which we could possibly make a comparison.

Mr. Mackay: I wish to say that the comparison here of three cars only would apply just as well to 3,000 cars. It was simply shown in small figures so that it could be readily grasped. Mr. Wilson certainly knows how many hours his motorman makes. Now that gives him right there the number of motor car-hours made. There is only one motorman to a car and he certainly knows the time made by those motormen. Now as to the speed; while it may be shown that a line will start out and run eight miles an hour and then decrease to six miles an hour, and then increase to eight again, the average speed is based upon its time cards.

Mr. Wilson: In that connection I desire to say that Mr. Mackay is entirely wrong when he says that we know the hours of our motormen. Our motormen are paid $2.25 per day for 10 hours out of 12 consecutive hours; some run 10, some 9 and some 9½, for in the congested district of Boston a car starts out, but it may not get back anywhere near on time. That man might have a schedule of possibly 9¼ hours or possibly 10½ hours, but for every 10 minutes over the 10 hours in 12 consecutive hours the man receives extra pay, so you see that by multiplying some 1,800 of these items and keeping it up by hours, would make a large item of expense.

Mr. Mackay: If the man only worked half a day would he be given a full day's work.

Mr. Wilson: He would be given half a day. He might work four hours and a half and he might work five hours and the rest of the time might be done on trips. Certain trips would have a certain price. It can be done, but it is a matter of expense, and the bigger the road the more it precludes its being done.

Mr. Hibbs: I would like to ask Mr. Mackay if that is a statement of facts actually or theoretically.

Mr. Mackay: It is theoretically.

Mr. Wilson: A comparison of a city line and an interurban line is just what I have brought out. That is hardly a fair comparison. A city line should be compared with a city line.

Mr. Mackay: We want to get a standard that will apply to both if it is possible.

Mr. Ross: I think the question of car mile and motor hour is a local one. I think the proportion of expenses to earnings is the proper method of comparison.

The President: Then you would have to get at some comparison for the earnings.

Mr. Ross: No, you cannot compare a very large road with a very small road. We also have such varying conditions. Down in New Orleans we have no snow at all, while in Montreal we spent $80,000 on snow in a year.

Mr. Wilson: It might be interesting for the gentlemen to know that in Boston we have had a snow storm that has cost us $116,000 to remove the snow alone.

Mr. Duffy: I do not see how the conditions would be any different figuring on the car-mile or car-hour. Mr. Vreeland spoke about the man who ran the steam railroad in the Rocky Mountains, whose percentage of operating expenses was 80 per cent, while the man in New York with the flat road had an average of 60 per cent. Now, in regard to this chart that has been referred to, as I understand it, it is not the purpose of Mr. Mackay to compare an interurban road with a city road, neither is it the purpose of Mr. Mackay to show that it is applicable to a three-car road, but it is his purpose to show that there is a road that runs three cars 468 miles at 12.82 cents per car mile, another road runs three cars 1,400 miles at a cost of 4.27 cents and the car-hours the same. He does not say that the interurban road could or ought to be compared with the city road, nor that this is only applicable to a three-car road. I believe what can be done in Boston can be done on a three-car road, and what is done on a three-car road can be done in Boston.

Mr. Wilson: I stated that anything could be done, but that it was the expense that precluded its being done. We make a comparison with ourselves. We have nine different divisions—eight of them are operating divisions—and we have all cars with the exception of one division come into the central portion of the city. That division is so far removed from the headquarters that we consider that a separate division and have a superintendent for it who has his headquarters in the center of the city. Cars after they pass a certain point come into his division and those are amenable to him and his assistants. They make a comparison both on the basis of car-miles and percentage, one division with another, but as to what we were discussing, we have to take the physical condition of these roads into consideration when we compare one with another.

The President: Have you formulated a classification of accounts which makes it possible to compare one road with another, or the expense of one with another?

Mr. H. C. Mackay displayed a chart exhibiting the data shown in the following table:

Month.	January.			May.			July.		
	Total.	Per cent Earnings.	Per Car Hour.	Total.	Per cent Earnings.	Per Car Hour.	Total.	Per cent Earnings.	Per Car Hour.
Motor Car-Hours...	60,000			60,000			60,000		
Earnings.	$100,000		$1.67	$120,000		$2.00	$150,000		$2.50
Operating Expenses.	60,000	60	1.00	60,000	50	1.00	60,000	40	1.00
Maintenance	15,000	15	.25	15,000	12.5	.25	15,000	10	.25
Conducting Transp'rtat'n	30,000	30	.50	30,000	25	.50	30,000	20	.50
General Expenses.	15,000	15	.25	15,000	12.5	.25	15,000	10	.25

In explanation of this chart he said: The purpose of this chart is to shew the incorrectness of a unit based upon a percentage of earnings. Here are three comparisons based upon the same service and covering the same cost, but for different months when the earnings naturally vary. For instance, January's earnings are $100,000, and the operating expenses $60,000, divided between Maintenance, Transportation and General Expenses in the ratio of 15, 30 and 15 per cent of Earnings or a total of 60 per cent. On the car-hour basis we have an earning of $1.60 per hour and an expense of $1.00, divided between Maintenance, Transportation and General Expense as shown, viz: 25 cents, 50 cents and 25 cents per hour. Now when we attempt a comparison with May, with its earnings of $120,000 and the same expense as January (and I think you will agree with me that the earnings can increase without an increase in expenses) we have the same cost per car hour, but a percentage of earnings gives but 50 per cent as compared with 60 per cent for January; an apparent decrease of 10 per cent. This shows the unreliability of the basis of percentage and likewise the correctness of the car-hour. The applies also, only in a greater degree with July's earnings of $150,000.

Now, assume that the two comparisons (January and May) represent two roads of practically the same size (as I believe Mr Wilson suggested that comparisons could only be made fairly with roads of the same size). To say that the management of the road showing 50 per cent is more conservative I do not think will hold good and the car hours bear me out by showing that the cost was the same in either case.

Mr. Ross: Comparisons can only be made from the same periods.

Mr Mackay: This would not apply in a comparison of a Southern with a Northern city.

Mr. Ross: There are different conditions covering all roads, but by taking cities of about the same size and under similar conditions, and comparing the two you may be able to determine as between the car-mile and car-hour. Mr. Duffy referred to Mr. Vreeland's statement in regard to a man running in the Rocky Mountains. I don't see how, putting it on the car-hour basis would bring the proper result.

Mr. Mackay: I think it would, Mr. Ross, for the reason that you are keeping your car-hours in accordance with the requirements of your service. In the winter when you require less you are keeping down your car-hour proportionately.

Mr. Ross: Yes, but I don't see what difference it makes figuring on the car hour in the Rocky Mountains or on a level plain, as compared with figuring on the car-mile basis.

Mr. Mackay: I don't think it does in that feature.

Mr. Hibbs: Mr. Mackay, as a matter of fact, is there any satisfactory basis for comparing roads under different conditions. We do not operate any trailers, and I cannot see how we could be compared with another road that does.

Mr. Mackay: As I mentioned in my paper, I think that a road that is operating trailers operates at a disadvantage.

Mr. Hibbs: Is there any opportunity for comparison of two roads operating under similar conditions?

Mr. Mackay: Only to adopt a uniform basis. All motor car-hours are the same as yours. Hence I advocate that as a basis.

Mr. Ross: I think it is only a question of time when trailers will be taken away—a very few years. I think in cities there will be no trailers in a very few years.

Mr. J. K. Newman, of the New Orleans & Carrolton Railway Co: I am not an accountant, I am a president, but I do not believe I could be a president without having a great deal to do with the accounting department, and there is no one branch of our road in New Orleans to which I give more attention.

Now, about the basis. You can establish any basis you want, whether it is a car-hour or a car-mile, but you cannot compare different roads operating under different conditions. It is simply impossible. But you can arrive at a unit, or two units, or three units, as we do, and you can get those subdivisions just as easily as you can the one. I believe in the car-mile basis for the reason that it is a small unit—the smaller the unit the greater the subdivision, therefore the car-mile is the basis that we adopted. But we go a little further. We have on our system the car-hour unit also. Now we go a little further and we get into percentages. We put each subdivision of the road in the statement, and we also put in our statement of percentages each of the general divisions in the operating expenses and each in detail. That will give you all the information that you could possibly ask. You cannot get a unit that will permit you to make comparisons of roads operating under different conditions, except that you can find out why the differences exist. I think it will be absolutely impossible to get any basis which will be fair for all roads alike, independent of whether they are operating in snow which cost $116,000 in one season, or otherwise.

Mr. Mackay: If this is as the gentleman says, we might as well admit that we have accomplished nothing. I am of the opinion myself that it is not an impossibility, but I believe that it is simply a matter of detail, to be worked out at different points.

Mr. Newman: I do not argue against getting comparisons, but

I mean to say that it is impossible to put in a statement a number of figures which are supposed to be comparative figures, and set them by the side of those for another road and say it is operating cheaper than you or otherwise, unless you understand all the details of the roads that you are comparing, because the conditions are so different. But I believe we have arrived at a basis so far as we can get at it, and that is the car-mile, unless you want to add on the statement the car-hours and also the percentages. I do not argue against the comparison, but against an effective comparison without knowing the conditions under which the road is operated.

Mr. Mackay: I would like to ask the gentleman how he would make a comparison on the mileage basis with the road which operates a city and an interurban line. I have shown here on this chart that a road operating a city line, on exactly the same cost, would show 12.82 cents per car-mile, and the interurban line would show 4.27 cents. If you cannot compare two separate city systems how can you compare the road which has both the city and suburban features with another system having only one.

Mr. Newman: I do not argue against getting a comparison, but take that diagram of yours and cut off the top of it. What will it show, or what would it mean? It would be ridiculous. Without this you cannot tell anything about it, and that is why I say you cannot arbitrarily take sets of figures and put them on a statement and compare them. You must take your statement and mark on it, "This is a city line, running so many miles an hour, with so many trailers, the cars are heavy."

Mr. Wilson: I do not think with Mr. Mackay that the work of the Association would be practically thrown away if some basis is not arrived at. I think that on sober second thought he will change his opinion. If we have a standard statement giving the certain distribution of our operating expenses, one may get the detail of that operating expense and compare it with others, and having the same basis can at once see in what particular operating expense account the difference is, and then by comparison of the physical conditions of the road will then arrive at the correct basis of comparison.

Mr. P. S. Mackay, Minneapolis: I may be a little dull of comprehension, but it seems to me that some of the gentlemen who were speaking here, while favoring mileage as a unit, have been furnishing arguments against it. I refer, for instance, to the case stated of "congested traffic," where cars would be sent out without any definite knowledge as to where or how far they would go or when they would come back. In such a case as this, I submit it would be easier to determine the number of motor hours involved than the number of miles run, and would not motor-hours be a better basis for comparison? The fact that mileage has been adopted all through the country is not proof of its being the best unit. We are looking for a better unit, and it is our privilege and duty to work earnestly for that which is the nearest to perfection. That mileage as a unit for comparison between different systems is not reliable I believe, particularly so when we consider the varied methods of computing mileage throughout the country, nor does it give the best information by way of comparison between different periods of time on the same system.

The Twin City Rapid Transit Co., of Minneapolis, made a computation a short time ago affecting the operation of a portion of its system for certain periods of time, with a view of determining the relative merits of the mileage and motor-hour units, and while this test was not by any means exhaustive or conclusive, it tended to show that for the time involved, the motor-hour unit was preferable.

I am inclined to think, however, that after a standard unit of this nature has been adopted by this Association, it should apply only to earnings.

I agree fully with Mr. Ross, that the ratio of operating expenses should be that of "Expense to Earnings." Our statement to the management and all others who have the right to scan the results of our labor, should show every item of expenditure from Maintenance of Track and Roadway clear down to Dividends to be a certain proportion of the earnings, thus furnishing a clear, concise, truthful and easily comprehended statement of facts, the salient points of which could easily be grasped by the examiner. I am well aware, that to the accountant who laboriously figures out the ratios of expenditures upon the basis of any unit whatever, the results of his labor seem plain. There are doubtless many here who could fill columns with algebraical hieroglyphics which would unmask all the unknown quantities in the whole proposition, and there are doubtless managements who could decipher it if they had the time and would take it for that purpose, but the management have a right to demand of us such statements as will give the fullest information in figures the easiest of comprehension.

Supposing, for instance, we have a statement showing a surplus of 25 cents on the dollar of earnings, this would be instantly understood without going any further, but, on the other hand, supposing the surplus was given as 62½ cents per motor-hour, this would not convey any information whatever until the examiner knew or his mind recalled the fact that the earnings were noted at $2.50 per motor-hour, then by a mental calculation he could reduce the figures to the 25 cents which we ought to have furnished him in the first place.

Mr. Dimmock, Council Bluffs: Mr. President, I would like to know if anything has been said as to a comparison of mileage between a long haul and a short haul, and whether with a long double truck car the mileage would be counted the same as with a single truck car if they both went only one mile.

Mr. Mackay: No. The point is that a small car would cost less than a large car, but you could get only half the efficiency, and the showing would be more particularly in the earnings. The expenses would not show in the large car as it should show.

Mr. Dimmock: If the short car runs one hour or any car runs one hour, would you regard it as each car running the same? I know of some roads where they count the short cars double what they do the long ones.

Mr. Mackay: I would base it on the actual time the car was out, without regard to the length of the car.

Mr. Ford: Mr. President, I have listened with a great deal of interest to the discussion, and without discouraging Mr. Mackay in his efforts to find a better unit, I feel that it will be almost impossible to find a rule that one could lay down against any street railway in the country as a basis of comparison. We use the car-mile, but my statement to the president and manager or directors also shows the percentage. That is good so far as it goes. Take for an illustration a statement that shows our earnings to be $100,000 with operating expenses of $60,000 for one month and almost the next month, we have shown $15,000 or $20,000 increase in earnings and the expenses are not increased $1,000. Now that has been our experience, because our schedules are governed by city franchises. We are required to run our cars on a certain headway and our expense is about the same month after month. Now, this statement also shows the earning per car per day of 18 hours and the expense per car per day of 18 hours. We also show the earnings per car-mile and the expense per car-mile. All these are figured out on percentages. We run no trailers except on our west and suburban resort line. There we run electric trains. Now I can see that on most any basis it would be hard for us to compare with another road that is not operating under exactly the same conditions, and my suggestion to this Association would be that we show, and not necessarily to our directors or stockholders, because they are seldom interested in these matters, but to our manager or to our president, who takes an active part in the management of the line, what all this includes. Let us show him the motor car-hour the car-mile, the car per day of 18 hours, the earning percentage, the expense percentage—let us give him all of this information and then if I or anybody else wants to compare with Milwaukee, I lay these things all down together. I show that perhaps his condition was different from ours; perhaps he operates trailers and that his condition is different from our own, but on a comparison of all these matters I would strike a unit by a general comparison. Now that will be my judgment in the matter, because I believe you can discuss this matter from now until the next convention and cannot be any nearer arriving at a unit that will enable you to compare your road absolutely and accurately with what we are doing down in New Orleans, or Boston, or any other place.

Mr. Wilson: I would like to ask Mr. Ford how he arrives at 18 hours a day.

Mr. Ford: Well, we just consider that the road is in operation 18 hours. We have on our road about 210 cars in daily operation. We count 18 hours for a day; it is simply arbitrary.

Mr. Mackay: Mr. Ford bears me out exactly in my diagram of percentages, and the idea of this paper is to bring about a com-

parison of each individual item of expense, the average of cost, or a minimum cost of each item of expense. Now, when we have arrived at the average cost for heating or lighting the cars, or any particular item of expense, then by comparison of these items of another road that average will show whether we are above or below the normal. A condition which will, I think, benefit any road and save lots of time and expense.

The President: We have on tomorrow's program the first thing in the morning, Mr. Brockway's report on department blanks and forms, but the first thing in the morning we will take up for further consideration Mr. Mackay's report and in the mean time you gentlemen can give it some thought and consideration for the benefit of the committee that will be appointed at this meeting probably. Now, there is a short report to be made by this committee on standard classification of accounts. Mr. Duffy has partly covered it by his report, but I understand there will be a supplemental report made here.

Adjourned to Thursday, October 19th, at 10 a. m.

Thursday, October 19th.

The president called the meeting to order at 10 a. m. and announced that the Association would take up this morning the report of Mr. Duffy, chairman of the committee on "A Standard Classification of Accounts."

Mr. Duffy: I have a letter from a gentleman who was, and whom I have always considered is still a member of this committee. I refer to Mr. H. J. Davies, of Cleveland. Mr. Davies, as you all know, was the assistant secretary and treasurer of the Cleveland Electric Railway Co., and you will recall that in Cleveland he was present at the first meeting, and afterwards, through illness, was obliged to remain at home.

He was very much interested in the Accountants' Association, and those of us who are on the committee, more especially Mr. Ham and myself fully understand and appreciate the value of Mr. Davies' services in the work of this committee, more especially the work done at Manhattan Beach in August, 1898, and in Cleveland immediately following that meeting. Mr. Davies writes me as follows:

"I have felt this year that I had no right to participate in the work and discussions of the committee on Standardization of Accounts, because I have had no connection, except as a small stockholder in a street railway company, and therefore no membership either personally or as a representative of any street railway company in the Association.

"This has been my greatest regret at leaving street railroad business. (Mr. Davies is the secretary of the National Carbon Co., of Cleveland.) I have just read again, however, very carefully your report of July 21st to the president of the Association and other papers which you have sent me from time to time, and I am sure no one will question my right to say that I approve in all respects the recommendation made by you and Mr. Ham, including the change in the classification of taxes.

"As an outsider, I can congratulate and compliment your committee, and the Association, on the progress made toward the universal adoption of the system of accounting recommended by the Association.

"If you can induce the Association to suspend its rules or over-ride its constitution so that I may have a copy of the report of the proceedings of the Chicago convention, I shall be very grateful."

I will suggest, if it is agreeable, that we should not only send Mr. Davies a report of the proceedings of this convention the same as if he were a member of this Association actively, as before, but I would recommend that Mr. Davies be made an honorary member of this Association with Mr. Windsor and Mr. Higgins, and I make that as a motion.

The motion was carried.

Mr. C. N. Duffy then presented a printed report of the conference between the representatives of his committee and committees of the Convention of Railroad Commissioners and the Association of American Railway Accounting Officials, and the report made to the former Association by Mr. Seymour's committee. The substance of this printed report was published in the "Review" for August, 1899, page 538 et seq. He then read a letter from Mr. Henry F. Billings, who is the clerk of the Railroad Commissioners of Connecticut. He says: "In reference to the classification, beg to advise you that it is the intention of this Board to recommend the same, and it will go into effect with reference to the fiscal year ending June 30, 1900. I have been at Mr. Seymour today and he promised to prepare a letter of instruction, or perhaps I should say, a letter ordering its adoption to be sent out with copies of the classification to each road in the state. I might say that if he does not get at it pretty quick I shall, for it is time that the various companies have notice of such a classification in anticipation of the report for 1900."

The report was adopted on motion.

Mr. Duffy: We have had 500 numbered copies of this copy printed, from 1 up to 500, which will be officially distributed by the secretary, and the number charged up to each company to which it is issued. In addition Mr. Duffy presented the following supplementary report taking up:

1. Construction and Equipment Account. "Investment Real Estate." The instructions classifying this account read, "Charge to this account all expenditures for land and buildings not used in operation of road." The committee wishes it understood that this refers to land and buildings purchased in connection with securing right of way, and real estate used in the operation of the road, but not a part of either, although incident to the construction and equipment of the road. This does not refer to the purchase of land and buildings bought for the purpose of investing surplus funds of the company, which should be charged to a special account; for example, "Surplus Investments." It having been suggested to your committee that the instructions concerning this account were not sufficiently clear or explicit, and that "Investment Real Estate" was not a construction and equipment account, we submit the above for your information.

2. Monthly reports, debiting and crediting the month's proportion of each item under "Income from Other Sources," "Deductions from Income," and "Deductions from Net Income," currently, each month, and charging to accounts Nos. 36 and 37, respectively, the month's proportion of the total annual charge of these accounts, estimating such debits, credits or charges, if the exact amount per month is not known.

The instructions regarding these questions appear to be complete and sufficiently clear and explicit. As far as your committee knows, they are fully understood, but they are not always properly carried out. The debits, credits or charges referred to, should be estimated and apportioned monthly, as closely as possible, from the best information obtainable, and the amounts taken up each month by journal entry, so that they would appear on the books. In many instances, these amounts are pro-rated on the monthly report, without having been put on the books at all.

3. Classification of material and supplies. A Classification of Material and Supplies is submitted, because your committee considers it of the greatest importance in connection with the use of the standard system of accounting adopted by this association. Material and supplies have been classified under 13 departments, A to M inclusive. The items properly classified under each department should be alphabetically arranged as they are under each account. In addition, the items should be indexed, showing the department or departments to which each item properly belongs. This detail would have been carried out by your committee, if sufficient time were at our disposal to do the work.

The "Classification of Materials and Supplies" submitted was as follows:

Department.

A. Material and Supplies for Maintenance of Track and Roadway.

All material and supplies as classified under Account No. 1, that properly belong only to Track and Roadway.

B. Material and Supplies for Maintenance of Electric Line.

All material and supplies as classified under Account No. 2, that properly belong only to Electric Line.

C. Material and Supplies for Maintenance of Buildings and Fixtures.

All material and supplies as classified under Account No. 3, that properly belong only to Buildings and Fixtures.

D. Material and Supplies for Maintenance of Steam Plant.

All material and supplies as classified under Account No. 4, that properly belong only to Steam Plant.

E. Material and Supplies for Maintenance of Electric Plant.

All material and supplies as classified under Account No. 5, that properly belong only to Electric Plant.

F. Material and Supplies for Maintenance of Cars.

All material and supplies as classified under Account No. 6, that properly belong only to Cars.

G. Material and Supplies for Maintenance of Electric Equipment of Cars.

All material and supplies as classified under Account No. 7, that properly belong only to Electric Equipment of Cars.

H. Material and Supplies for Maintenance of Miscellaneous Equipment.

All material and supplies as classified under Account No. 8, that properly belong to Miscellaneous Equipment.

I. Material and Supplies for Shop.

All material and supplies as classified under Account No. 9, that properly belong only to Shop.

J. Fuel (Coal, Coke, Charcoal, Kindling).

All coal, coke, charcoal and kindling, including coke for welded joints, charcoal for electric line; charcoal, coal and coke for shop; fuel for power; charcoal, coal, coke and kindling for heating cars; coal or coke for heating buildings, and fuel for drying sand.

K. Lubricants and Waste (Oil, Grease, Waste, Rags).

All oil, grease and other lubricants, and all waste or rags used with lubricants, or shop, power plant, cars, track, wagons, etc.

L. Printing and Stationery.

All printing and stationery of every description, including tickets, transfers, legal papers, signs, posters and other advertising matter.

M. Miscellaneous Material and Supplies.

All material and supplies as classified under Account Nos. 14, 21, 22, 23, 24, 28, 29 and 30, that properly belong only to those accounts, and all material and supplies not classified specifically under Departments A, B, C, D, E, F, G, H, I, J, K or L.

The following is a list of the items that it is proper to classify under Department "M."

Arc lights and fixtures.
Babbitt (metals).
Badges (employes).
Batteries (for car bells).
Bedding (stable).
Bell Cord.
Belting.
Blankets (stable).
Bolts.
Brass (metals).
Brick.
Brooms.
Brushes (car washing).
Brushes (flue).
Brushes (generators).
Brushes (horse).
Brushes (motors).
Brushes (scrubbing).
Buckets.
Carbons (arc light).
Cement.
Chamois skins.
Conductor's books.
Conductor's punches.
Copper (metals).
Cotters.
Curry combs.
Emery cloth.
Feather dusters.
Feed (stable).
Fire buckets.
Fire extinguishers.
Fuses (cars).
Garnet paper.
Globes (arc light).
Horse shoeing supplies.
Hose.
Iron.
Lamps (incandescent).
Light (lanterns, oil, wick, torches, candles, incandescent lamps).
Lumber.
Matches.
Medicine (stable).
Metals (babbitt, brass, copper, etc.).
Mops.
Nails.
Nuts (for bolts).
Oil cans.
Packing (for engines)
Painting material (linseed oil, turpentine, varnish, white lead, painter's brushes and supplies).
Paving material.
Pokers (car stoves).
Polish.
Portable registers.
Rags.
Rivets.
Sand.
Salt.
Sandpaper.
Screws.
Shakers (car stoves).
Shovels (car stoves).
Soap.
Spikes.
Sponges.
Sprinkling cans.
Steel.
Stone.
Stove blacking (car stoves).
Tape (insulating).
Tools (hand).
Towels.
Trolley rope.
Uniforms.
Washers (iron).
Washers (car washers).
Waste cans.
Water gage glasses.
Wire.

The President: What is your pleasure with reference to the vacancy on the committee? Shall we fill it here, or shall we leave it to the committee to select some one to fill the position left vacant by Mr. Davies?

On motion, it was decided to fill the vacancy.

The President: The next matter for our consideration is the report on the "Department of Blanks and Forms,'

REPORT ON THE DEPARTMENT OF BLANKS AND FORMS.

By W. B. Brockway, Secretary, Toledo, Bowling Green & Fremont Ry., Toledo, O.

When the call was issued for the meeting which organized this Association, it also included the suggestion that the companies represented at that meeting should bring samples of their blanks and forms in order that helpful and suggestive comparisons could be made. The idea was so well received that a long table was necessary to display the collection. In the exhibition the blanks of each road were placed in a pile by themselves, but the contents could only be ascertained by a detailed search of the pile. The popularity of the exhibit was attested by the constant attention it received and by the packages of exchanged blanks most of the members carried home with them.

At the first annual meeting, held in Niagara Falls, October, 1897, the plan was again tried, but for various reasons it was not so successful as the previous experience at Cleveland. However, a committee was appointed to arrange the blanks presented, and its work was as well done as the blanks and room would permit.

In view of the accepted importance of the idea, it was decided for the convention at Boston in 1898, that a special effort should be made to have the exhibit be of the size and bear the results it deserved Therefore a committee of arrangements was appointed from among the gentlemen in and near Boston, who issued a special circular and those attending that convention are familiar with the thoroughness and popularity of the work.

It was really the object lesson given by the orderly display of the blanks of the Montreal Street Railway Co. at Niagara Falls in 1897 and the classified collection exhibited by the committee at Boston in 1898, which called forth the resolutions establishing the Department of Blanks and Forms and making it a permanent part and feature of the advantages of membership in the Association.

The blanks as they are exhibited this year are mounted in 13 large books 20 x 30 in. and one 30 x 30 in. These books are bound in canvas and are made from special 120-lb. manilla paper, which will insure the wearing qualities needed for exhibition year after year. For the convenience and safety in transporting these many heavy books, there has been provided an oak box, with a shelf for each book, securely locked. And that there may be no reason for heavy handling end over end, it is mounted on heavy castors that it may be readily moved.

In the whole physical make-up of the department care has been taken to have the material as good and permanent as possible. And the assistance authorized at Boston and engaged by the secretary has been of high order, rather than cheap, as he felt confident that the result would be well worth the care and expense. The exhibition, it is hoped, will bear out the soundness of that reasoning.

As a foundation for the blanks preserved there were taken those exhibited at Boston, which, it will be remembered, amounted to several thousand; to this already fine collection there have been added the private collection of the secretary and the complete sets of very many other companies, so that at the present time there are complete or partially complete sets of upwards of 80 companies, many of which are the representative companies of the continent.

The secretary takes this opportunity to thank most sincerely the companies contributing for their cordiality and promptness in granting original and the many special requests made for additional copies of blanks that duplicate and triplicate filing might be made where the construction of the blank demanded it. This co-operation has materially lessened the burden of preparation.

Many methods of classifying were considered, but there were but three which seemed feasible for so large a collection of diversified blanks as this one, viz:

1. By companies whereby the blanks of each company would be placed together in rotation.

2. According to the standard classification in which those blanks relating to each account of that classification are filed under the different headings.

3. Logically, by which is meant the arrangement into classes all blanks of all companies intended for a similar use.

The last plan was adopted for the reasons that if the arrangement by companies had been followed it would still have been necessary to have followed some general classification of each company's blanks. But in the practical use of such a filing, a company satisfied with its entire form list, except this or that blank would be unable to obtain a comparison without searching through every book in the collection, and even then to compare any two blanks on file, possession would have to be had of two or more books, which, according to the law of average would be perpetually in use by someone else which objection would make the annual exhibition a difficult one to make of use.

And in considering the arrangement according to the Standard Classification of Accounts it was found that there were many blanks which applied to more than half the accounts, which, to make the filing complete for each account, would frequently require as many as forty copies of a blank that the face and back could be shown. This is illustrated in the blanks relating to labor, it being obvious that there are few of the 38 accounts in which labor does not form a prominent part. This difficulty seemed so insurmountable that this plan could not be followed.

In view of the difficulties and objections found in the other plans which, to make the filing system easily understood, had to be omitted in the plan adopted, it seemed to be better to make certain classes to contain blanks of all companies. This permits the closest comparisons in each class and will at the same time include in one book all blanks of all companies which in any way relate to that class. It is true this plan has broken up the continuity of the blanks in use by the individual company, but we have substituted a continuity in which all the companies join, for there is a certain channel through which the business of a company must go, and the various changes in the direction of that channel have been followed as closely as was possible. For instance, in the books containing Income it will be noticed that Book A starts with the first record of income, viz: Conductors' Reports. These are followed at once by the Report Envelopes, the Receipts of the Receivers, the Reports and Records of the Counting and Verifying Clerks, etc. Thus there has been a natural sequence kept in mind, but it is one in which all the railroads join for the benefits of a prompt and efficient comparison. It is sincerely hoped that the reasoning by which this plan of filing has been adopted is sound, for the amount of study and time involved is considerable.

The three fundamental divisions into which the collection has been divided are:

1. Income.
2. Expenses.
3. Records and reports.

These are divided further into classes, which can be best shown by the following description of the contents of each book:

Book No. 1—Income A. Consists solely of those blanks relating to the handling, reporting, verifying and depositing the actual cash income, and the daily, weekly and monthly reports of earnings only.

Book No. 2—Income B. Contains tickets and transfers, their records of the number received, used and on hand, and physical records of registers.

Book No. 3—Labor A. Includes the application, investigation, hiring, disciplining and discharging of employes.

Book No. 4—Labor B. Covers all the various steps of paying the employes, from the time reports to the comparison of pay rolls.

Book No. 5—Materials. Is for those blanks for material only from the request for, through the purchasing, receipt, and issue to inventory.

Book No. 6—Maintenance. Consists of the reporting of work done outside of and in the shops. The records of wheels and axles and other blanks not strictly labor or material, but rather the result of their combination.

Book No. 7—Power House. Contains everything relating to the power house, labor, maintenance, operation and efficiency. All blanks in this book are filed, each company by itself.

Book No. 8—Transportation A. Covers the actual operation of the cars from time tables, through the various steps of dispatching and running.

Book No. 9—Transportation B. Is the miscellaneous needs and results of the operation of cars, as instructions to trainmen, secret inspection, lost and found articles, cleaning snow and ice, care mileage, stables, benefit association, etc.

Book No. 10—Injuries and Damages. Takes the accident from the original report of, to the settlement and records and summaries.

Book No. 11—Vouchers, etc. For the vouchers, bills, journal entries and various office stationery.

Book No. 12—Contains monthly and annual reports and comparative statements of earnings and expenses.

Book No. 13—Records. Includes voucher, accounts receivable, check, cash and other general records.

Book No. 14—Electric Lighting. Consists of all blanks relating to electric lighting as a business of itself.

To make the books useful for ready reference there has been provided a system of cross indexing for each book by the use of which a company intent upon only the conductor's reports of the X. Y. & Z. Ry., can readily turn to it without searching for it until found. The index for each book is inside the cover and explains itself, and as a means of assistance to the casual looker-on each page has been labeled at the top to show what form that page contains, so that, in the rush of convention hours, "he who runs may read." Small figures in green will also be found in some corner of each blank to show the date of the original filing. This is done that an intelligent idea may be formed of the changes from year to year.

In many instances it has been important to make a duplicate and sometimes a triplicate filing. This is caused by the combining in one blank the information covered by two or more of the divisions into which the collection is separated. It was thought better to file as many times as necessary, so that the specialist intent upon but one form will still find the collection as complete as possible within the limits of the blanks filed.

In all cases where a blank contains a form upon both sides, each side has been shown and an explanatory stamp has been impressed upon it showing that is the "Front of" or the "Back of" the form to which a hand points. This will save confusion. It is expected that errors of omission and commission will be found both in the classes selected and in filing, and it will be of great assistance if a memorandum be made of each error and handed to the secretary that attention may be given to the correction.

As to the practical working of the department there is to report that the books comprising the official file and annual exhibit are intended to remain in the office of the secretary for continual additions and they will only be moved to make their annual appearances at the succeeding conventions. For the use of members there has been provided a reserve set, unmounted, which are at all times subject to the request of those entitled thereto. A letter of request is an application, and the secretary makes a selection from this reserve set and forwards it to the applicant. Accompanying them is sent a blank giving such information needed to make clear the length of time they may be kept, and the cost (which is always nominal) to the applicant.

This reserve set is treated on a library basis and selections should be returned upon the date allowed (usually 30 days) as it sometimes happens there are other roads awaiting their turn to get the set which is in use somewhere else. It will be of interest to say that this occurs oftener with those blanks relating to materials and supplies than to any other.

In a circular, No. 9, issued from the secretary's office, attention was called to the many requests for sample blanks which every company received. It may be well to repeat the suggestion made, that all such requests be referred to the secretary, who will gladly fill the request, if the company making it is a member of the association, or will courteously decline if not. By this action considerable trouble and expense would be saved the individual company and new members be gained to the association.

While I do not feel qualified to make any extended criticism of the size, shape or other characteristics of the blanks on file, there are found in working over and studying so large a mass of blanks and forms certain little kinks or tricks of practice which have become almost a habit and, while they are harmless and unnoticeable while by themselves in use on the roads where they originate, yet when included in a collection the size of this the comparison

is more or less marked and I cannot refrain from making a brief reference to some of them.

The most prominent of these is the omission of the name of the road. It is not a bad guess, I am sure, to say that of the thousands of blanks filed 30 per cent are without any mark of personality. Very many and devious were the schemes tried to locate blanks of which another copy was necessary for duplicate filing. For instance, one very important blank was recognized only by the water mark in the paper being compared with other blanks till one was found of the same kind, and from this blank we were enabled to find the issuing company. In another case an explanatory note was written on the face of a blank, of which we again needed additional copies, and in this instance no less than 12 different blanks were found with an explanation in the same handwriting, but not one had an identifying mark. The company was only found by comparing the handwriting with the correspondence on file in the secretary's office. It was absolutely necessary to the value of the collection that these two cited should be duplicated, hence the efforts made to locate them.

If there can be any second choice in the shortcomings now being referred to, it is perhaps best covered by the term "ambiguous." A number of these are of undoubted importance to the companies making use of them, yet in the hands of one unfamiliar with the ins and outs of the particular roads by which they are used they become almost meaningless and many were the inquiries sent out by the secretary where a few words printed at the head of the blank would have made the use clear.

In the next thought the other extreme is brought out and I can think of no better term with which to describe it than "Persistent Information," meaning thereby the repetition of information in two or three blanks. The persistency of some forms reminds one forcibly of the annual report required of the steam railroads by the Interstate Commerce Commission, wherein questions are asked in so many ways as to be almost bewildering at times. This class of blanks were difficult to file, requiring many times a duplicate or triplicate filing to properly care for the various information, most of which is contained in other blanks already on file.

While not the most important, perhaps, the most prominent feature of the whole department is the tremendous lack of uniformity in the shapes and sizes of blanks intended for the same service by different roads. One of the largest city companies in the United States has a report measuring 2½ x 4 in., while another road of about the same size requires a sheet 3 x 12 in. for but little more information. In another case one company uses two pages (meaning cross-pages) for a book of record, where another has precisely the same columns and headings and needs but one page, and that is smaller; the difference is in the space allowed for the columns. The larger one has a date column of 3 in. in width, and the number of the report from which the record is made has room enough to run up into the millions, with still room to spare. These are extreme cases, but the principle is unchanged.

Careless press work and ridiculous selection of type make, in some instances, a jarring effect; on the other hand there is often found beautiful and artistic work on the part of the printer, because he knows nothing but that kind of work will be accepted and is governed accordingly. In this connection there is another practice about which much pro and con can be said. I refer to the paper used. There is a vast difference in the cost of "cheap yellow" and "ledger linen," but you will find forms intended for similar uses thus dissimilarly made. There is an average where servicability and economy can and do meet, but it requires an exacting—not petty—management of this branch of the expenses of a railway property.

Further suggestions can properly be made as to the desirability and usefulness of form numbers, whether to make them continuous or to have a set for each department as applied to a small road or a large one. And, again, as to the multiplicity of blanks burdening a small road, as compared to a large one, with not enough to properly attend to its volume of business, both external and internal. These and other questions readily occur to one while examining the collection, but I will call your attention to but one other, to which I have applied the title "Confusion," or perhaps a better one would be "Lack of care in arranging," by which I mean the jumbling together of all kinds of information upon one large sheet, and further, to place on both sides of that the information intended for the busy financial or operating man depending upon your statistics for various information, and he has to literally search for what he wants. This, it seems to me, is caused by a desire to utilize every inch of space of a large sheet, rather than to cut it into smaller ones with information of a similar nature grouped together.

Opposed to these few unfavorable criticisms there will be found very much to commend and admire and use in the mass of blanks brought together. There is many an evidence of careful thought and artistic sense which shows itself in the composition of the blanks of this or that road. There is as much need of genius in the design of blanks and forms, as much a demand for brains and foresight in the logical arrangement of columns and statistics upon paper, as there is in the management of an office, for on one side are "Stationery and Printing" and "Office Expenses," and on the other "Surplus from Operation."

A special vote of thanks was given Mr. Brockway, and it was announced that the blanks would be on exhibition Friday.

Mr. Durbin: I would like to ask, in the first place, whether it is the custom that the storeroom be under the charge of the auditor.

Mr. Hibbs: There is no question but what it ought to be. It is so in your company, Mr. Wilson, is not not?

Mr. Wilson: Yes, as far as accounts go.

Mr. Durbin: I would like to ask Mr. Calderwood what the practice is of handling scrap in accounts.

The President: The scrap goes right into the storeroom account. It is considered a part of the storeroom account and is credited to whatever it is taken from; it is taken back at a certain figure and the additional cost put on at an arbitrary price.

Mr. Durbin: For instance, if you take out a pair of wheels that are to be ground and put back under a car, do you charge those at a reduced valuation?

The President: Yes, and the difference charged off.

Mr. Durbin: Suppose a case of this kind: You have taken out a new axle with a pair of wheels that are practically new for the reason that they are to be ground down, do you charge that at reduced valuation when actually it is entirely new?

The President: No, I should put it in at the full valuation, but I should make a deduction on the wheels.

Mr. Durbin: And does your monthly statement of supplies issued represent the net amount used in each account, or does that represent the total amount?

The President: The net amount.

Mr. Durbin: You credit the storeroom account with the amount received from each department?

The President: Yes.

Mr. Ford: We used to have a report monthly from the store-keeper. We carry a stock of about $25,000, and that report comes in at the end of the month. It is expected to be in the first of the month, but it is very frequently the 10th before the store-keeper gets out his figures for disposition. So we adopted a system of daily reports from the store-keeper and his report comes in, showing the material that has been issued and the accounts that should be charged. Extensions are made and checked in the accounting office, but first this blank goes to the general manager, so that he can see what has gone from the storeroom the day before. That blank then comes up to my office and is entered in another volume which shows the heading of accounts by numbers across and dates down the edge, on the left hand side for the 31 days of the month. Then we abstract under the different accounts from this store-keeper's sheet, under these different accounts, so that we get what has taken place in the storeroom each day, the next morning. At the close of the month all that we need is the last report. We total these figures together, make our journal entry and the store account is out of our way. The store stock is balanced about every six months.

We have a system of cards showing on one side—each part in the storeroom has a number and is always known by that number after it is given. Stock that goes in that particular part goes on one side of this blank, the amount and price, and on the other side the issuance. This card lasts for six months. It was a system that we got from Buffalo and used there about five years ago.

The principal thing that concerns us as accountants in the storeroom is to get the reports directly and promptly. My experience has been that we are often delayed in getting our reports from the store-keeper. On our roads the store-keeper is under the direction of the manager or the general superintendent, but he

is responsible to me for the accounting. That plan has worked very satisfactorily with us, and I am able to keep very close check on our store account. Perhaps some of you have a much larger stock than we carry, but we find that this system works very well with a stock of about $25,000.

The President: Do you carry the card system any further in connection with the storeroom?

Mr. Ford: No, sir. The motor parts have a certain series of numbers and the track parts have another series, and the repair parts have another, and so on all through the list, and these cards we keep renewing as they run out.

The President: The receipts on one side and the disbursements on the other, so that you can take out these cards and tell just what your stock is?

Mr. Ford: Yes, and it informs the store-keeper, and when he sees that his stock is running low he can make his requisition for supplies. Now, there is one question, while I am on my feet on which I desire to speak, and that is the handling of obsolete parts. You take a stock of $25,000 of thousands of parts, and have a type of car that you were using five years ago, and now you do away with that car, and consequently you do away with the particular kind of equipment required for repairs. How do you get rid of these obsolete parts? How often do you go over them to see where you stand? We show that we have an asset of $25,000 in the storeroom. If I were asked to swear to that amount I could not do it, because we could not sell all the things and realize that amount of money, and yet they cost us that amount. I would like to have some information on that point.

Mr. Newman: In answer to Mr. Ford, I would say that we lay aside an amount for depreciation in the stock account, the same as we do for the equipment. You can bring your stock to what the actual value is, or very near it. Of course, that would have to be subject to stock taking at the end of the year, when you make the final balance sheet for the year's business.

The President: Do you take up each year's account of stock?

Mr. Newman: Yes, sir.

Mr. Wilson: To what account do you charge that?

Mr. Newman: To the different accounts. If it is cars you have to put some of it to cars, but you have to arbitrarily make a depreciation of it. You cannot get at it accurately, except by taking the valuation of the stock each month.

The President: What do you do with the depreciation, for instance, on obsolete parts?

Mr. Newman: Scrap it and sell it the same as we do in accident cases. We charge off each month a certain amount of money for accidents. Of course, at the end of the year we have to adjust it, but we can tell from our past experience just about how much that amount will run.

Mr. Ford: If we have new parts that have never been used, and are using such parts in the repair of our cars, they are full value to us. That has not been depreciated, and it seems to me that instead of figuring depreciation on that store account we could, when we make up our inventory, weed out those parts that are useless and count them as scrap, or figure a depreciation on part and let the good stand at its full value.

The President: How would you treat that depreciation at the end of the year? Suppose you had $10,000 of depreciated stock in the storeroom.

Mr. Ford: I should charge it up to each account, pro rata.

The President: And would you consider that a part of the next twelve months?

Mr. Ford: Yes, I would. I don't think that it would be right to charge it up to one month.

Mr. Hibbs: We have a way of handling that which I think is very satisfactory. We add one-half of one per cent to all stock issued to the storeroom, and at the end of the year the amount of that excess is charged out. Such as has gone into scrap, obsolete material, and we think that will cover almost all the material that is used in that year.

The President: Do I understand that you increase the price of everything?

Mr. Hibbs: Yes, everything that goes to the shop.

The President: How large a store account do you carry?

Mr. Hibbs: About $120,000. We use from $20,000 to $25,000 a month in material in our repairing, and one-half of one per cent is about $2,500 a year and that takes care of the obsolete material.

Mr. Ford: At the end of the year, when you make your inventory, what do you do with the parts that have become useless?

Mr. Hibbs: They are scrapped, not taken in the inventory at all.

Mr. Ford: Then they do not affect your account at all, that is one half of one per cent takes care of that

Mr. Hibbs: Our one-half of one per cent amounts to $2,500 or $3,000, and that takes care of it We watch our storeroom very closely.

Mr. Ford: It seems to me that is a very large amount to charge to your material account, in these days, when there is a cry coming up from our purchasing agents all the time about expenses.

Mr. Hibbs: It does not add very much to the current month — about $200, and it is distributed over a number of accounts.

Mr. Wilson: I do not see but what Mr Ford does that. He scraps his material. I do not arbitrarily put on one half of one per cent, but I add something and every account gets a share.

Mr. Mackay: Then the loss appears in the month in which it occurs and not the following year?

Mr. Wilson: Yes, and you are spreading it out over the same time that your expenses are going on.

Mr. Newman: We have a card similar to the one that Mr. Ford uses. On one side the purchases and prices and quantity, and on the other side the prices and quantity issued. Now you all know that prices have gone up all the way from 25 to 100 per cent in the last year, and you may have stocked up with a stock of, say, trolley wheels at 40 cents, and today you are paying 60 cents for them. Now, you are using so many trolley wheels a month and you want to charge them up in your statement, how do you arrive at the price for those? We take and add the total cost price and total quantity on hand and charge up the average and in that way we find that after we have used all the trolley wheels on hand just what they cost.

Mr. Wilson: Are those cards kept in the store-keeper's office?

Mr. Newman: They are kept in the office. Nothing goes out of the office that is in the general office. The storekeeper has nothing to do with that, except he is sent a copy of purchases so that he will know just what is going to the shop, but the record of the shop is kept on the card in the office and the secretary, who is the man who is making up that account is the man that handles all the charges in the month from the store-keeper.

The President: Does the store-keeper keep any books?

Mr. Newman: Except the book of stock so that he can watch what is going on.

The President: He does keep a record of receipts and disbursements?

Mr. Newman: Yes, he certainly has to do that to arrive at what he has on hand, but it is not the official record of the company.

Mr. Wilson: I would like to ask if the companies represented here carry stock in all the car houses, or whether everything sent to the car houses is charged out directly?

Mr. Ross: We charge everything to each car house.

Mr. Hibbs: Our store-keeper goes around and takes inventory of them each month—paints and oils are kept in that way. We have four or five small substations. That depends very largely on whether there is any repair work being done at the barns or not. The only supplies that are carried by us in the car barn are for replacement and not for repair work.

Mr. Ross: We do repairs at our barns.

Mr. Harder, of Kansas City: Our situation is similar to that just described. At present there is not a very good system of accounts for our storeroom. We claim, however, to use all the supplies from the main storeroom. Very few repairs are made except at the main shop, and the store-keeper's report is made monthly. The store-keeper keeps a ledger of stock delivered, and he gives us a record of the stock issued.

The President: Mr. Mackay, I would like to hear from you.

Mr. Mackay: I would like to get an expression of opinion on the custom usually followed in handling material furnished and sent direct to its objective point—whether it is taken up and handled through the storehouse, or whether it is charged out direct.

The President: Mr. Mackay, we will not have an opportunity to go into that this morning, but please state how you do it

Mr. Mackay: We are charging out direct, and in a great many cases it saves labor.

The President: You mean you do not keep any storeroom account?

Mr. Mackay: Oh yes, we carry that account, but when material is purchased it is sent directly to where it is used and does not go through the storeroom. We carry a heavy stock; our stock will run up from $25,000 to $50,000.

The President: I have reference to that which you charge out directly. Do you buy what is needed for a month, or for a particular period?

Mr. Mackay: Just as occasion requires. Certain articles are always on hand, always in stock, but what I was trying to arrive at, was whether it was customary to handle all purchases through the storeroom or pass them through the purchasing department only, without putting them into the stock. As I say we charge a great many direct.

Mr. Wilson: You spoke about power stations. What do you mean by charging direct. If you buy 2,000 or 3,000 tons of coal you do not charge it to expenses for that month?

Mr. Mackay: Oh, no, but barrels of oil that will be used up that month would be charged up direct to the several houses.

The President: In that case you would have to be very careful. I should think you would be likely to disturb your comparisons.

Mr. Mackay: Yes, if there is any great quantity. That is the question whether you want to deviate at all. We are passing through a construction period now, and it is a question whether the poles that are bought for a line should pass through the storage account or the construction account.

Mr. Goodrich, of Omaha: We are little fellows out in our country, and I would like to hear something on this subject from roads that are under the million dollar point of supplies. We are not as some of the other roads here. Are there any members as small as we are?

Our supplies are brought in and charged out instanter right to the account, and at the end of the year the invoice is taken and these accounts get their credit back. Now, we have very little to credit back at the end of the year. Take our coal account, that wipes itself out practically at the end of every month, and that is the biggest account we have, and I think our last inventory only shows something like $3,000 on hand at the end of the last year. It is from the little fellows I want to hear; is there anything better.

Mr. Newman: I think as a matter of information we ought to know just what we are all doing. Suppose we ask all the members here to vote on that point—those who are absolutely keeping storehouse accounts and those who are charging their purchases directly to the proper account as the purchases are made. I think it would let us know what the general trend of the accounting is, and I would like to know.

The President: Gentlemen, those of you who charge out direct, please raise your right hands. Those who keep a storehouse account, their left hand. It seems to be about equally divided, Mr. Newman.

Mr. Newman: I have been devoting a good deal of time during the last five years to this accounting business, working it up to my satisfaction, and I have never reached that point. That is why I want to talk so much. Referring to the able paper that Mr. Brockway has presented, and which has taken a great deal of work, it seems to me a great shame to just hear it read and then set it aside. Why cannot we do with this what the Association has done with classification of accounts. I believe those blanks ought to be got together and that we should get at a standard system of accounting, taking each branch of a road. A system of blanks which would give the greatest amount of information with the smallest amount of work, and I think that every street railroad company ought to assist in getting these blanks and adopt them, and then we would not come in here and have these discussions. We would come in here and improve the system, but we would not have these discussions, which are so short that we cannot find out really what the other man is doing, and I think that is the greatest work now before the Association. I know of accounting departments in the United States where the same amount of receipts are being taken that are being handled by a certain number of men and of another handled by another set of men just twice as large. I know the reason is that we are all striving for the same object, but do not reach it in the same way. We have not yet a method of reaching the result which the accountants have set before us all. We have been working to get at a system of classification of accounts which furnishes the information to the president, the managers and the stockholders, but we are not yet to the point where we have furnished ourselves with the information by which we can get at those results with a minimum amount of labor. I think the first start has been made in getting the blanks together. Is there anything we can do to get a standard system of blanks, and a standard system of accounting—I mean of handling all the details of the accounting system.

The President: Then your idea, Mr. Newman, would be the appointment by us of a committee on standard blanks.

Mr. Newman: Yes, but I do not think we ought to do it so quickly. It is going to be the next work, as I see it, for the Association.

The President: It seems to me the question before the Association is the handling of supplies. Possibly the committee on the standardization of accounts might take that up. What do you think of that, Mr. Duffy?

Mr. Duffy: I have been very much interested in all this discussion with reference to material and supplies. I have everything to learn about it. In St. Louis we did not have a storehouse account as you gentlemen understand it here, but we appear to have been about as near to it as some of the other gentlemen. In St. Louis we had five different companies that had about seven or eight different barns, and we had four different power houses, we were a road that took about $1,500,000 in receipts, so that we are pretty close to Mr. Goodrich's condition. I made this subject of store-keeping a matter of very great deal of consideration and investigated it among some large systems in St. Louis, but in only one of them was the absolute store-keeping system carried out. I went further, and went into manufacturing plants, notably foundries, and my conclusions were that to go into an elaborate storeroom system on that sized road and under the conditions under which we were operating, would use up a good deal of my energy directed elsewhere, and as a business proposition that I might be spending $2 in one case to save $1 in the other.

Now, I was very much surprised, in answer to the question which was asked, to hear some say that they charged out direct certain things that properly belong in a storeroom. Now, in St. Louis, in taking up the question with Mr. Atkins, who was secretary of one of the companies, I found he did not charge power house fuel, car coal, salt for track, or macadam to his storeroom. Then, I said, none of the larger items that should go into the storeroom account are in at all.

I looked into the thing close enough to find out that about 12½ per cent of our total expenses were expenses that would enter into the question of material and supplies. That included everything. Of that total 40 per cent was power house fuel. So that I concluded that the way that I was doing the thing for as small a road as we had was the best that could be done under the circumstances. Now, in the Chicago City Railway Co. I find they are doing what a number of you gentlemen are doing. As to a large number of articles of value, they carry them in their storeroom account. Now, our storeroom account is very large, nearly $100,000, made up nearly or largely of rails, poles, wire and things of that kind. Now, I believe that the classification of material and supplies is just as important as the classification of the receipt and expense account. If we want to know what our expenses are, divided up into 38 accounts, should we not want to know what our $100,000 stock material consists of; how much of it is distinctly and absolutely material that belongs to any one particular department? For instance, that is absolutely track material and only track material. Now, I approach this question of material and supplies with hesitation, because I am not familiar with it. I have had no experience with it whatever, but it seems to me that the storeroom account in your ledger ought to show, if you have on hand $100,000 worth of material, just what is track material, show what is line material, show what is car material—but there you are again, the question confronts you, what is car material. Do you mean the coal that is carried to heat a car, or the broom for the purpose of sweeping it out? and that is the reason that this classification that was presented to you suggested itself to me. Now, another thing which I might say. Take a road that has 100 miles of track and concludes to reconstruct 10 miles of it. The question of cost comes up. Your engineer makes his calculation as to the cost of tearing up and laying down is so much, and then there is the track material.

How much track material have you on hand? How much line material have you on hand? You are going to put on 10, 20 or 40 new cars, or build them; how much material have you on hand to do the work with? and so on. We have on the sheet that was presented to you this morning, down at the bottom, over 100 alphabetically arranged items. Now, I want to classify the material and supplies. Shall we classify it as it has been suggested here, or shall we ignore that thing entirely. For instance, you have the question of poles, sponges, nails, screws, iron or steel, things of that kind. Now, if you undertook to carry ledger accounts of all these thing your storeroom accounting department would be a bigger institution than your general accounting department. On this question of charging up direct I was struck by what Mr. Mackay said. Rails and poles and things of that kind he charges up directly to the construction account; that is properly chargeable there, but he has a power house that he knows will require five barrels of oil every month, and the oil company receives an order for so many barrels to such a plant. It is a question on one hand of the goods being received, because the power house may at the very end of the month be found to be without any oil, so that on the first day of the next month they would not have anything to lubricate their engines with. This matter of charging out things directly is worthy of consideration in my judgment.

Mr. Ross: I was going to say for the benefit of Mr. Goodrich, that I have three or four roads under my wing, from a hundred thousand up to one million dollars, and that everything for our company, large and small, goes through stores, and I think that is the only way that you can carry out your system properly.

Mr. Henry: With us, we send everything through the store room except such items as are consumed in the month. For instance, macadam cannot be put through the storeroom unless it was stored in a material yard, but we are now taking up the matter of making a store supply account for material in the storeroom as well as the material yard. We found that necessary because we are buying a lot of rails, poles and ties, and other material which would be impossible to charge to any special construction, consequently we will open an account in which to take care of all those matters.

Now, as to the operation of the storeroom, we use the card system. We do not have any trouble in regard to the prices on account of giving all the material that goes into the storeroom, a lot number, and that number carries right through, and it is credited according to the card prices. When that material is consumed, it is called "dead," so that all our cards in use are "live" cards.

The President: How many "live" cards do you have?

Mr. Henry: I think there are fifteen or sixteen hundred in use, something like that, and I figure we will have 2,500 lot numbers. It is increasing rapidly, and those are charged off, not daily, on the cards, but I think we will find it necessary to recapitulate three times a month. Now, if the clerk who has charge of the storeroom gets an order from the office that such an article was delivered on lot so and so, and finds that there was some of the old lot left, he would call me up. That gives a chance to keep track of all the dead material that these gentlemen are concerned about. We are trying to get rid of that all the time. This classification I cannot give you any information on, because we have not adopted any system yet. The committee's classification will help me.

Mr. Ford: How long have you been operating the card system?

Mr. Henry: About seven or eight years.

The President: With reference to Mr. Mackay's paper, we will refer it to a committee of three, consisting of Mr. Mackay, Mr. Ford and Mr. Smith, to report on at the next meeting.

I see we have with us today Mr. C. B. Fairchild, who is now connected with the "Street Railway Review." Some seven or eight years ago, when I first went into the street railway business, I had some very pleasant interviews with Mr. Fairchild on the question of street railway accounting, and I am going to ask Mr. Fairchild to say a few words on this subject.

Mr. Fairchild: Mr. President and gentlemen of the Accountant's Association: I thank you for this invitation for I am glad of the opportunity to look into your faces and to make your acquaintance. I happened into your meeting yesterday nearly at the close of the discussion and was very much interested, and could not but wish that I were a member of your Association that I might engage in the discussion. I heard the expression yesterday two or three times while you were discussing the question of a standard. "You cannot do that" "It is impossible" Now it occurs to me to say that one should never say "I cannot" It is better to say "I can and I will." "It is in me and must out."

In this matter of seeking a standard for making accounts do not get discouraged for it is possible for you to discover a natural standard or unit of measurement for the distribution of your accounts. It is also possible for you to discover or invent a standard for report blanks. It is a matter of thought. All the triumphs of skill in the development of street railways and all that pertains to them and in fact in all the schemes that men put forth, and in the organizations that are formed to carry great schemes to success, thought is exhibited. It is the application of men's thought, (and that of common men just like you and me) to the thing to be done and the conditions to be observed in every detail of daily occupation. Now, I ask, why should we continue to hold to old customs and follow slavishly past methods of accounting? The grandeur of thought is as near to you and to me as to any one. So if each one would study the precise thing to be done by him in his place, to meet the requirements of this accounting matter, he would discover or create a system that will be well fitted to every possible condition. "Insist on yourself" and you can never be discouraged, for what ought to be, ought to be. Nature always works by the shortest possible methods. So if you feel that the system of accounting that you are following is too cumbersome and too laborious then you may be sure a better and simpler method exists, and some one some where will yet find it.

All the things that men have done and are doing are evidences that they have in the past had, and that they still have, undeveloped possibilities beyond what they have ever imagined, and that the secret of developing these latent possibilities is the science and art of thinking. Thought is mind in action, and it is a power which is subtle and potent beyond any other known agency. Since ability is within each one as a truth, by concentrating his thought upon the truth, he will bring it into expression, will solve his problem.

In the science of arithmetic we have a certain relation of numbers; seven plus seven makes fourteen always, and so whenever you have a problem in this science to solve, this combination is always available. In geometry we have a certain relation of lines and angles, and by following the principles involved in these relations we solve problems in the science of geometry. These mathematical facts are merely the right relation of things in this particular science. Now it is natural for us to assume that there is a right relation of things in other lines, in all branches of business, we have facts or truths just as certain, and according to the working of things the taking of these truths into one's thought will bring them into expression. We have but to get the true idea in mind, and it will find expression. And this matter of science of accounts is no exception. So I wanted to say yesterday do not say you cannot do this or that, but be willing to work on and believe that you will yet discover the natural relation that exists in this particular line of business. Let me refer you to Kepler's experience in discovering the true relation between the orbits and the times of revolution of the planets. Believing that a relation did exist he worked for seventeen years on this problem before he found it. He tried all sorts of standards but he finally found the relations between the squares of the times of the revolutions and the cubes of the mean distances from the sun. This relation always existed, but it cost him seventeen years of hard and careful study to demonstrate it. It is not likely, however, that any of you will have to work as long as that to solve this problem on which you are now engaged.

You will pardon me if I speak of my early connections with this subject of classification of accounts, and this subject of blanks. At one of the conventions (at Cleveland, I think) long before this association was formed, I prepared and had on exhibition a large blank book with a very large collection of street railway blanks, but if I remember rightly there were no two sets that were at all alike, so I feel I am almost a pioneer in suggesting the desirability of a uniform system of blanks. Those of you who have read the book published in 1892, entitled "Street Railways or Trams" know that we published at that time a classification of street railroad accounts. When I undertook that work for this publication I found no precedent anywhere, and no forms that I could use; I simply had to invent a classification upon which your association has improved, so I claim to be one with you in this work, and I take a great interest in the accounting department as well as in the me-

chanical or electrical departments, although my attention in late years has been directed more especially to the mechanical and electrical features of street railways; but having had considerable experience in theory and practice of double entry bookkeeping in my early days, I am more or less familiar with the terms that are used in accounting, and have a keen appreciation of the difficulties that you encounter in your particular vocation.

I beg pardon for having occupied more than the minute allotted me, but thank you for your attention.

The President: I should like to ask Mr. Wilson if he will prepare a paper for the next convention on the "card" system. We want to get him on record before this association, and I think that is a very important question.

Mr. Wilson: I will not promise now, but I will consider it.

The President: The next order of business is the report of the committee on resolutions. Is the chairman of the committee prepared to report?

Mr. Burington: Mr. President and gentlemen, your committee on resolutions beg to submit the following:

WHEREAS, At this Third Annual Convention, now assembled in the City of Chicago, the Street Railroad Accountants' Association of America, desires to express its hearty appreciation of the reception given and unstinted hospitality shown its delegates by this great city, and in the same spirit it feels it is indebted to the steam railways and the street railways, which have contributed so much genuine enjoyment through their officials and the local committees having the entertainment in Chicago in charge.

To the American Street Railway Association for its unfeigned friendship and its participation in the discussions and councils of this body.

To the press of the city for the many kind expressions.

To the mayor of the city for a most cordial welcome to this Association.

To the editors and publishers of the "Street Railway Review" and the Street Railway Journal, for their personal attendance and co-operation, and to the "Street Railway Review" for its "Daily Edition" of convention proceedings, therefore

BE IT RESOLVED, That the Street Railway Accountants' Association of America, desires by this resolution to express its sincere acknowledgment of the generous offices and good will shown this body;

And further be it resolved, that these resolutions be spread upon the minutes of this Association and copies of the same given to the press.

On motion, the resolutions were unanimously adopted.

Mr. Smith presented the following report of the committee on nominations:

The nominating committee submits herewith the names of the gentlemen selected to represent the Association for the ensuing year, subject to the approval of the convention:

President—C. N. Duffy, auditor Chicago City Railway Co.

First Vice-President—W. F. Ham, auditor Brooklyn Rapid Transit Co.

Second Vice-President—W. G. Ross, comptroller Montreal Street Ry., Montreal, P. Q.

Third Vice-President—Elmer M. White, cashier, Hartford Street Railway Co., Hartford, Conn.

Secretary and Treasurer—W. B. Brockway, secretary and treasurer, Toledo, Bowling Green & Fremont Railway, Toledo, O.

Executive Committee—J. F. Calderwood, chairman, C. L. Wight and C. K. Durbin.

The secretary was instructed to cast one ballot for these names, which was done.

Mr. Duffy: Mr. President and gentlemen: I was cut in the other room trying to find out where our next session would be held, and my friends, Mr. Smith and Mr. Wilson, held me up and said it would be my pleasure and honor to preside at the next convention. I want to say to you that I deeply appreciate the honor. I want to thank you all for having elected me to the presidency of this Association, and I hope that you will all give me all the assistance necessary, and I shall need it, considering the record of my predecessors, Mr. Wilson and Mr. Calderwood. I suggested to the gentlemen when they notified me of my election, that it seemed to me that we should draw from some of the new material. We started out with 25 members; now we have got over 100, but a good many of those 25 seem to have a good deal to do with this Association, and while I appreciate the honor and thank you for it most heartily, I rather thought you should have selected some of the new material, from some of these new companies that are coming in. But be that as it may, I will do my best and use all the energy I have in the work of the Association.

Ex-President Calderwood: Gentlemen of the convention: I want to thank the gentlemen present for their uniform courtesy, and their co-operation. My trip down the presidential track has been a very pleasant one, and I now take a transfer and will let Mr. Duffy have my seat.

President Duffy, assuming the chair:

As I stated, I have just come from a meeting of the other Association, and I beg to say that the next session will be in Kansas City.

Mr. Smith: Shall we take up the matter of the shortage?

The President: As I understand from the report of the secretary and treasurer, counting $30 dues, that are due, but unpaid, as an asset, we have a net deficit of $79 and some cents. Now, one of the unfortunate conditions of this Association is that we do not get any revenue until the 1st of January, and our expenses are always created prior to this convention. This association has been very economically managed. We cannot expect to reduce our expenses, but we can increase our earnings. The American Street Railway Association at Montreal four or five years ago found itself in exactly this condition, and it very promptly and cheerfully raised enough money at that Montreal convention to more than wipe out the deficit. Now it may suggest itself to you that the raising of the dues from $10 to $20, coming right in with the statement that there was a deficit of $79 might strike you as a very peculiar condition of affairs and that we cannot be very good managers financially. We have had an income of about $1,000 a year, but we are too close to shore; we had better have a surplus than a deficit, and we had better not be confronted in this Association with the question of from where our fixed charges are to come. Now, if it is agreeable to you to make subscriptions towards this end, I will be very glad, on behalf of the Chicago City Railway Co., to subscribe $25 on condition that a sufficient sum is raised to wipe out this deficit, and any others who represent other companies, who wishes to subscribe on the same conditions, can now have an opportunity for any amount he may be willing to give.

Mr. Newman: Inasmuch as I have done so much talking I think I ought to pay for it. You may put me down for the same amount as the president.

Mr. Smith: Will it not be better to send out bills for next year's dues right away at the $20 rate, and then see if we do not have enough. If we do not, then issue a call for subscriptions.

The Secretary: Let me suggest that these subscriptions be made with the understanding if they are needed they are to be called for.

Mr. Ross: I think the subscription should be limited. I think $10 is quite sufficient for any road to subscribe.

The President: I think the idea is a good one, and I think that I will reduce the voluntary subscriptions from $25 to $10 if it is agreeable to Mr. Newman and Mr. Smith.

The convention then adjourned sine die.

CINCINNATI, NEWPORT & COVINGTON.

For the months of September, 1899, and September, 1898, the receipts, expenses, etc., of the Cincinnati, Newport & Covington Street Ry. were as follows:

	1899	1898
Gross receipts	$62,782.30	$80,394.65
Operating expenses	24,078.34	30,591.83
Net earnings	38,703.96	49,802.82
Tolls, damages, taxes, etc.	11,897.93	10,555.74
Net profit	26,806.03	39,247.08
Ratio of expenses to earnings, with tolls	49.78	45.93
Ratio of expenses to earnings, without tolls	38.35	38.05

For the first nine months of 1899 the gross receipts were $527,192.79, an increase of $13,000.63 over the corresponding period for 1898; and the operating expenses $214,269.14, a decrease of $51,649.71. For this period the operating ratios are 52.96 and 40.64 per cent as against 62.39 and 51.78. The net profit to October 1st, is a trifle more than the entire net profit for the year 1898.

AN OPEN LETTER TO MR. YERKES.

Mr. Chas. T. Yerkes, President,
Chicago Consolidated Traction Co.

Dear Sir: When I tell you I represent the smallest street railway in the United States, and possibly in the world, I am very sure you will pardon this encroachment upon your time. I read with much interest in the daily edition of the "Street Railway Review" of October 18th, your ideas touching street railway investments, and mean to treasure up the suggestions made by you and by Messrs. Wyman, Beggs and others on the same line, and hope in the near future to profit by them, not so much by investing myself, but by clear and full statements to induce others to help me.

Your description of the little horse lines, first with one, then two horses, with the fare box in one end of the car, was very good, and seemed natural to me, although it made me feel all fired poor, but remembering that you, too, had seen street railways "in their infancy and swaddling clothes," it gave me great satisfaction to be able to say that here in Hendersonville, 2,252 ft. above sea level, amidst the finest scenery and with the finest water, and best all year round climate under the canopy of heaven, is a horse street railway which has been operated eight years and does not owe a dollar.

At the date of the World's Fair, Chicago, with a million of people, stood by us like a sister, with a great number of horse cars; but she has since deserted us and only Washington, the capital of the United States, New York, and a few other small towns remain true to their first love and linger with us at the tail end of the procession. But we are coming, though we may have no cow to kick a lamp for us. Hendersonville stands upon the western border of a 10-mile square plateau, nearly as level as the lands upon which the great city of Chicago stands. The number of business houses in the place has doubled within the past year. The Flat Rock, which has been the home of wealthy southerners for more than a half century is three miles south, and the entire space between is rapidly filling up with good residences, thus increasing a demand for street car service of modern type.

I have 1½ miles of track well located in town and a 90-year city charter, with exclusive rights on all streets and avenues within the town limits, now extending one mile from a common center. We must have an electric street railway and electric lights. I will transfer my little line and franchises on liberal terms, or will aid in the enterprise to the fullest extent of my ability. Can you do anything for our good? Yours truly,

S. V. PICKENS,
Owner Hendersonville Street Ry.

Hendersonville, N. C., Oct. 22, 1899.

WARSAW TRAMWAYS.

In endeavoring to obtain information at first hand regarding the street railroad operations in Russia we have received the following from a correspondent at Warsaw:

Electric street cars are operated in Poland and in the neighboring provinces of the empire at Lodz, Minsk and Witebsk. New lines are in course of construction at Lublin and from Pabianice, via Lodz, to Zgiers. Another line is proposed between Dombrowa, Sosnowice and Bendzin. The systems used are overhead wires and trolleys. The machinery is obtained from Germany, where also the cars are constructed. No statistics whatever are to be had in reference to the mileage, number of passengers carried, rate of fare the cost per mile of transportation, the wages of employes, the regulations as to speed, etc., of the various roads in the different towns, as the builders have no reason to publish them; besides this the lines have only been in operation for a few months. The line from Pabianice to Zgiers is 18 miles in length. Americans do not have any share in extending and operating these roads. In electrical undertakings the capital stock is mostly held in Germany; in street cars it comes from Belgium.

A line of horse cars is in operation at Wilna, length 9 versts, (6 miles). The fare is 5 copecks (2½ cents). This was built in 1883 There is also one at Warsaw. The distance traversed is fully 5,3 miles. The number of cars running is 130. They carry 22 passengers in winter and 30 in summer (closed and open cars). Last year the number of passengers was 20,465,000. The fare is 7 copecks (3½ cents) in the first class and 5 copecks (2½ cents) in the second, for a run of about 3½ versts (2,321 miles). The average speed by contract is about 8 km (4,968) per hour and each passenger is supposed to travel about 2½ versts. The drivers receive 33 ruble (ruble, 51 5 cents) the guards from 36 to 42 rubles a month. The cost per mile of transport is not published, in fact it is kept a secret.

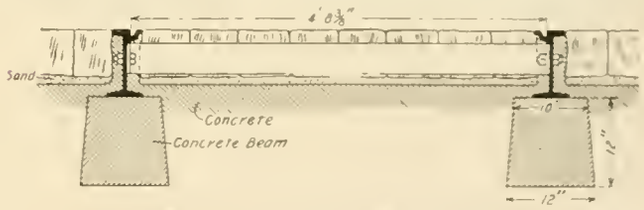
The capitalization of the principal tramway companies in Russia is, Warsaw, 6,000,000 francs; Kazan 2,100,000, Moscow, 5,000,000, Odessa, 6,300,000; Rostoff, 3,000,000, Tiflis 1,300,000; and in Charkoff, 1,500,000 francs. The net earnings are not known The Warsaw trams have paid steadily increasing dividends from 6 to 10 per cent The electric trams at Witebsk were only started a few months ago by a Belgian company They run 20 cars for 30 passengers each It is said that the gross income is 20 rubles per car, against 6 rubles working expenses. The fares are 5 copecks (2½ cents) and 3 copecks (1½ cents) The Lublin electric trams are to be built and worked by Messrs. Lameyer, of Aix la Chapelle

There is a good opening for American capital in this district German, French and Belgian capitalists are continually starting manufactories of all sorts in this country; they also put large sums of money in coal and other mines in Poland and which make this country essentially fit for industrial enterprises of all sorts.

The Belgian company which built and worked the tramway system of Warsaw is now expiring and a new company has taken its place. This is nominally a Warsaw syndicate, but is so only by name as it is really the firm of Siemens & Halske. The contract is for four years only, for it is reckoned that before the expiration of this period the electric light question for the city will then be definitely settled. Siemens & Halske would, of course, like to take the matter in hand and for this reason they have taken the four years contract at the nominal price of 20,000 rubles a year. They give the magistracy an insight into all their earnings and expenses and hand over the whole of the profits, bar the above sum.

TRENCH ROADBED CONSTRUCTION IN BROOKLYN.

The engineering department of the Brooklyn Rapid Transit Co has recently completed a section of track 1,000 ft in length or Court St., extending from Joralemon St to Atlantic Ave., with the construction illustrated in the accompanying engraving; only one track has been built in this manner. From the illustration it will be noticed that the rails rest on concrete beams without wooden ties, and are held to gage by means of tie bars as shown. The standard grooved 98½-lb. girder rail is employed and the paving is laid flush with the top of the rail on both sides. The two concrete beams con-



BROOKLYN TRENCH CONSTRUCTION.

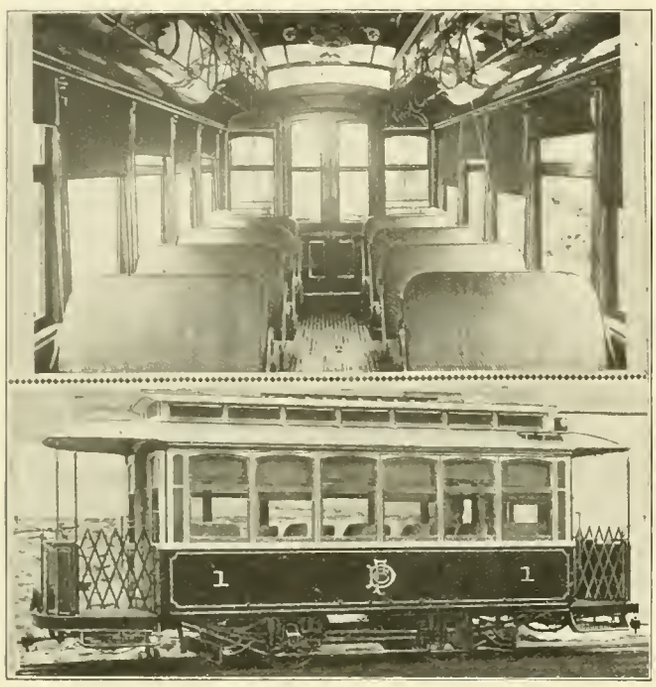
tain 1 5-6 cu. ft. of concrete per lineal foot, being 12 in. on the base and 12 in. in height, tapering to 10 in. across the top. The construction has been installed partly at the suggestion of the city engineer with the view of securing a uniform foundation for the paving blocks between the rails, for the reason that on such lines as have been constructed with concrete between the ties the paving has settled so that the location of the ties can be noted by examining the surface of the paving. Some experience has already been had by this company with rails laid directly on concrete foundation, for concrete construction was employed on the approaches to the Brooklyn Bridge. The service, however, has not yet been sufficiently extended for any report as to durability and cost of maintenance.

The Uniontown (Pa.) Electric Ry. has passed into the hands of the combine which will control the electric roads of Connellsville, Scottdale, Mt. Pleasant and Greensburg. The Uniontown road sold for $60,000, the option being just about to expire when the purchase was made.

NOVEL TYPE OF STREET CAR.

The car shown in the accompanying illustration is one of a large number recently constructed for the Ferro Carril del Districto, of the City of Mexico, by the J. G. Brill Co., of Philadelphia. These were all built on the Brill special system of construction, by which, after being entirely finished "in the white," they are taken apart and shipped, one only of the whole number being completely painted in this country. They have an unusually handsome appearance when finished, the straight side panels setting off to good advantage the gold of the monogram and lettering.

The cars, which are mounted on Brill No. 21 E trucks, equipped with two G. E. 1,000 motors, are 18 ft. in length over the end panels, and have two 4 ft. platforms, making the total length over dashers 26 ft. The total width is 8 ft. 2 in. and the trucks have a 7 ft. wheel base. By a proper designing and putting together of the side frames of the car bodies, an exceedingly strong belt was obtained the entire length below the windows; in addition, braces were also cut in the belt and posts and secured with screws, the sheathing being then put on in the usual way and glue blocked.



BRILL ELECTRIC CAR FOR MEXICO.

From the engravings, it will be seen that the cars are elegantly finished inside, with solid bronze trimmings, and possess the additional good feature of having plenty of light, there being twelve large windows, which are made to drop down into the sides, giving practically a convertible car. The height in the interior from the floor to the belt rail is 2 ft. 3 in. and from the bottom of the sill over the trolley board is 9 ft. There are eight reversible-back seats covered with woven cane and four stationary-back seats in the corners.

As these cars have to be run in trains, there is a 15-in. opening in the center of each dasher to permit of passengers going from one car to another, the openings being fitted with sliding iron doors, which go in from the top and when not in use are placed in grooves at one side of the dasher.

The signal lamps are in a rather unusual position, being placed diagonally opposite each other on the roof landings, on the right hand corner of the car when going forward. Each lamp has four spectacle glasses, presenting four different colors, red, blue, green and yellow. Brill angle iron bumpers, gates, sand boxes and two Dedenda gongs, together with electric headlights, are placed on each car.

The Hartford (Conn.) Street Railway Co. has completed a spur track into a large brickyard on the Windsor road and will put on cars for carrying brick.

MR. O. S. LYFORD.

Mr. O. S. Lyford, the newly appointed vice-president and general manager of the Siemens & Halske Electric Co. of America, was born at Cleveland, O., in 1870. He has had an unusually complete technical education, having graduated from Yale in 1890, after which he took a course in the electrical department of the Sheffield Scientific School and a post-graduate course in electrical engineering at Cornell.

He commenced his practical training in the engineering department of the Chicago Edison Co. In 1893 he entered the employ of the Siemens & Halske Co., rising rapidly to the position of superintendent and chief engineer, which office he resigned in 1897 to become chief engineer for the Westinghouse Electric & Manufacturing Co. He now leaves the Westinghouse Co., to join the executive force of the Siemens & Halske Electric Co.

A NEW ELECTRIC BRAKE.

Of the many powers that have been suggested for applying the brakes on electric railway cars, none seems to offer greater advantages than electricity itself, the greatest point in favor of electrically operated brakes, being of course the absence of auxiliary storage or generating apparatus, as on every motor car current can be taken either from the line circuit or from the motors themselves acting as dynamos. A number of methods have been patented for utilizing electrical energy for setting brakes, the latest being the Hubbard brake, brought out by the Hubbard Brake Co., of Chester, Pa.

This is an electro-magnetic device arranged to operate the ordinary wheel brake shoes by means of a large solenoid which takes the place of the cylinder in the usual air-brake equipment. The brake is operated from independent controllers, about one-third the size of the car controller, placed on each platform and so connected as to change the motor terminals when desired, converting the motors into generators. This is done independently of the position of the car controllers, whether on or off as the instant the brake controller is set the car controller is dead. The device works whether the trolley wheel is in contact with the wire or not, and will, it is claimed, entirely prevent flat wheels.

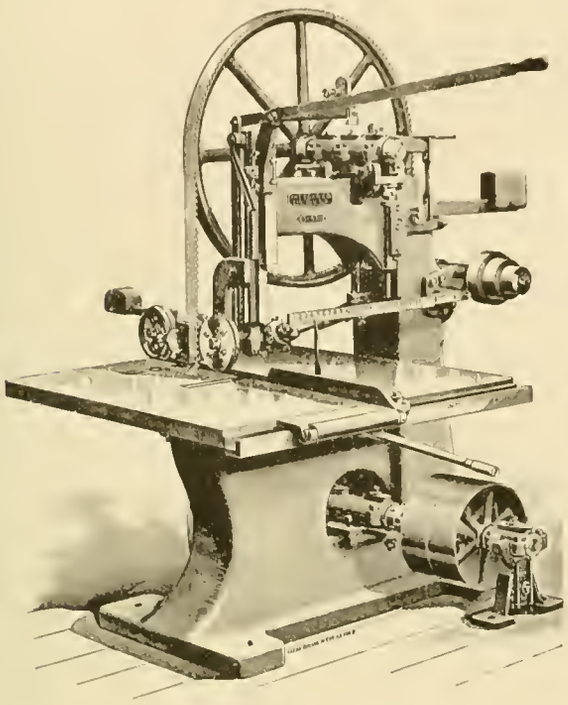
PROJECTED STREET RAILWAY IN HONGKONG.

A number of Canadians, headed by Sir Charles Ross, of Montreal, are said to be interested in the development of street railways in Shanghai and Hongkong. Recently Sir Charles Ross made an offer to purchase the electric light plants of the municipality of Shanghai, provided the municipality would allow the purchaser the right to establish street railways operated by electricity. It appears that this deal failed, for a recent issue of the China Mail says that after his failure to purchase the electric light plant at Shanghai, Sir Charles Ross went to Hongkong, where he remained about a fortnight. The article continues:

"During that time we understand the subject of a low-level tramway for Hongkong was discussed by Sir Charles with a number of influential citizens, and it is believed that a successful issue was reached. It is therefore probable that at last Hongkong will be placed on a footing of equality with the majority of modern cities by having an electric tramway service from end to end of Victoria with possibilities of extension as the colony continues to prosper and to spread. We are given to understand that it is in connection with this scheme, and the proposed addition to the capital, that the present boom is taking place in electric shares which have jumped from $12½ ex dividend, a month ago, to $15, with few shares obtainable at that figure. It goes almost without saying that a low-level tramway of any description will pay in Hongkong. An electric tramway, moreover, is better suited for the narrow Hongkong streets than any other; and given facilities for reaching the outlying districts the people would leave the city more and thus obviate the surface overcrowding which is one of the greatest evils of Hongkong. The scheme should receive the cordial support of the Government, for the reasons we have given that it will help to relieve the congestion of the city."

IMPROVED BAND RIP SAW.

The Egan Co., No. 322 to 342 W. Front St., Cincinnati, is now introducing an improved band rip saw, shown in the accompanying illustration, for which the following advantages are claimed: It is safer to operate, a less kerf is removed, wider and thicker material ripped, less power is required, work is accomplished far more rapidly, table always level and at standard height, rolls close together enabling short pieces to be fed, adjustments of fences and rolls far more quickly accomplished; there is a great saving in time each day in every adjustment made, over circular rip saws. Like all the machinery built by this company, this saw has been very carefully designed for the work it is called upon to perform, and it represents the latest achievement of the large corps of experts which the



IMPROVED BAND RIP SAW.

company has for several years employed in designing new machines and improvements for its existing ones.

There are three speeds of feed, 60, 90, and 135 ft. per minute, and faster feeds will be furnished where desired. The feed is very powerful; the driven feeding-in and feeding-out rolls are placed close together, enabling short stock to be worked to advantage. They are adjustable up and down instantly by means of the long lever above, and convenient to the operator, or they may be raised from the board, instantly stopping the feed, or lifted instantly out of the way for use as a hand-feed rip saw, all of which may be accomplished by a single movement of the long lever.

The Egan Co., as is well known, is the largest maker of wood working machinery in the world.

NEW LONG ISLAND ROAD.

The Nassau Belt Line Traction Co., known as the "Nassau Belt Line," is to build 30 miles of road connecting 12 of the largest villages and towns on Long Island, with a terminus at the famous resort, Long Beach, and the other beaches, and an outlet to New York City by two proposed connecting trolley lines and the Long Island steam railroad system which it touches at five different points and with which the new road has been fortunate enough to make agreements for interchange of traffic, both freight and passenger, by which passengers can be taken to and from their doors to New York or to their homes for a single fare. In fact, nine miles of its tracks consist of branches of the Long Island R. R. which have been leased by the Nassau Belt Line to be equipped and operated by electricity in connection with its system.

The capital stock is $300,000, shares, par value of $100.

The officers are Paul K. Ames, president; William G. Miller, vice-president; Henry L. Nichols, secretary, Fred Ingraham, treasurer. The directors and incorporators consist of fifteen of the leading merchants, bankers and railroad men of the territory covered. The offices are at Rockville Center, N. Y.

Building will begin as soon as the markets show favorable prices and material can be gotten within reasonable time.

DIMENSIONS OF PIPE FITTINGS AND VALVES.

The Walworth Manufacturing Co. has published tables giving the principal dimensions of many of the valves and fittings made by it, and thus placed in a convenient form for reference a great mass of information which is very valuable to engineers and draftsmen when laying out the details of a system of piping. Just how necessary such a set of tables is can only be appreciated by those who have had experience in the class of work mentioned.

The Walworth tables comprise 32 sheets 9½ x 13½ in., arranged in a cloth covered portfolio. They give the dimensions and weights of cast iron tees, elbows, 45° elbows, crosses, long turn tees and elbows, Y branches, flanged unions, companion flanges, riveted flanges, etc., both for 100 lb. and for 250 lb. working pressure; dimensions and weights for wrought iron and steel pipe bends, Van Stone joints, light weight babbitt seat gate valves, bronze seat gate valves, standard and extra heavy globe, angle and gate valves, check valves, Adams angle valves, and suction pipe boxes; dimensions and weights of composition fittings of all kinds; data for floor stands; and four pages of tables giving data for wrought iron, extra strong wrought iron, double extra strong wrought iron, seamless drawn brass and copper, and cast iron piping.

One of its specialties to which the Walworth company directs particular attention is the Van Stone joint for piping under 250 lb. pressure. In this joint only the best quality of soft steel piping can be used as the pipe ends are flanged out over the flanges of the joint which are made of cast iron, gun iron, cast steel or weldless rolled steel.

The company has prepared these data for publication expressly for the use of engineers and will be glad to send a set of the tables to anyone having use for it upon application. The general offices of the company are at Boston, with a branch office at 141 Center St., New York. At the convention the Walworth company was represented by Mr. Herbert L. Rideout.

A MASSIVE VERTICAL ENGINE.

The 1,000-h. p. Allis compressing engine, which is doing such excellent work at the 24th St. air compressing station of the Metropolitan Street Railway Co., of New York, is unique, both as regards its abnormal size and power and the high working pressure which is obtained.

The engine is of the vertical cross-compound type, built at the Milwaukee plant of the Allis Co., and is 60 ft. in height, including the brick foundations. It has cylinders 32 in. x 68 in. x 60 in. stroke. Working with the most economical point of cut-off, with steam at 150 lb., the horse power developed is 1,000. The bearings are 20 in. in diameter by 36 in. in length, while the flywheel, which is placed centrally on the shaft between the cranks is 22 ft. in diameter and weighs 60 tons. The crank shaft is 22 in. in diameter. The air compressor is of the four-cylinder type and placed directly under the engine, four distance rods connecting each engine crosshead with the pump crossheads. The compressor works in four stages, the final pressure of the air after cooling being 2,400 lb. The air cylinders have diameters of 46, 24, 14 and 6 in.; the stroke is 60 in.

SALE OF THE SUTRO ROAD.

A controlling interest in the Sutro Railroad Co., of San Francisco, Cal., consisting of 21,310 shares of stock owned by the estate of Adolph Sutro, deceased, was sold, October 17th, to Robert F. Morrow, president of the Sutter Street Railroad Co., after lively bidding for possession of the property by Mr. Morrow and Jas. B. Stetson, president of the California Street Railroad Co. The price was raised in a few minutes from $160,000 to $215,000, the figure at which the stock was sold.

CLING-SURFACE AT THE CONVENTION.

Messrs. F. C. Willis and A. B. Young, of the Cling Surface Manufacturing Co., of Buffalo, with Chicago office at Temple Court Building, were in constant attendance at the exhibition hall, where they made a display of samples of "Cling-Surface" and told of the good results that are being obtained with this material. As is well known this is a dressing, which when applied to a power transmitting belt, whether leather, rubber or cotton, will permit it to be run so slack that the two sides will nearly touch, without slipping or loss of power. It also renders belting soft and pliable and waterproof.

EXHIBIT OF THE CLING-SURFACE MANUFACTURING CO.

The laboratory force of Sibley College, Cornell University, early in April of this year made an exhaustive test of this material under the direction of R. C. Carpenter, professor of experimental engineering. Prof. Carpenter in summing up the results of the test says:

"The general results of the test with 'Cling-Surface' show an increased transmitting power as compared with the same belt in an untreated condition; it also shows an increased arc of contact, and very much less slip. It shows a very high transmitting power when the belt is run extremely loose or with very little tension on the pulleys, the reverse of which is true with the untreated belt."

IMPORTANT EXTENSION AT UTICA.

The Utica (N. Y.) Suburban Railway Co., of which Mr. J. W. Boyle is general manager, is about to build 10 miles of new track. This extension is from the village of Oriskany, about midway between Utica and Rome, direct to the city of Rome. Near Oriskany, where the battle of Oriskany was fought, is located Summit Park, one of the principal summer resorts of central New York, and which receives an extensive patronage from Rome, with its 18,000 population, Utica with its 65,000, and other nearby villages. The proposed extension will afford Romans the same conveniences and opportunity of reaching the park which Utica has. The line will connect Utica and Rome, making, when completed, a 15-mile ride between these two cities.

Oneida County is a double shired county, courts being held alternately at Rome, one of the shire towns, and Utica, the other. The business relations between the two cities are close and quite extensive. The only communication now is by way of the New York Central, and it is believed that this new line will prove not only a great convenience to the locality, but a decided financial success.

The three-phase transmission system will doubtless be used, the power being generated at the plant of the Utica Belt Line Co., the lessee of the Suburban road, and transmitted to a point near Summit Park, where a converting station will be placed, and also to Rome, where another converting station will be located. It is planned to construct the road in the best possible way, and to provide powerful equipment so as to permit of fast time being made between Rome, Oriskany, Summit Park and Utica.

The property owners along the route have held meetings to promote the scheme, and prominent citizens of Rome have been active in aiding the enterprise so that, although a franchise had at one time been refused the company, the sentiment has so changed that at the last meeting of the common council a very favorable franchise was obtained.

CONSTRUCTING A DOUBLE CONDUIT IN NEW YORK.

The work of installing a double conduit on that portion of the Amsterdam Ave. line in New York, which will be used jointly by the Metropolitan Street Railway Co. and the Third Avenue Railroad Co., has been attended with great difficulties, as cars were constantly passing on a two minute headway and the conductor rail had to be kept alive the entire 24 hours of the day. The Metropolitan company has been using this track for over a year and a half, and had its standard center slot conduit construction in place, but when the Third Ave. company was granted rights of way over the same street, it became necessary to push the existing conduit over to one side of the center, in order to make room for the conduit and conductors of the new comer.

To do this the pavement was first removed, and the heavy concrete foundation and conduit wall broken up. This was removed piece by piece from around the yokes and live conductor rails, the track being shored up to carry the heavy cars and street traffic. Temporary wooden yokes were then inserted to maintain the gage of the track rails, and the old yokes were loosened and pushed to one side, carrying with them the old slot rails, insulators and conductor rails. The conductor rails were then removed in single lengths and the free ends fitted with slippers to prevent the shoes on the plows from being carried away. The old yokes were next taken out, and the new ones inserted. These were fitted for the two conduits which are symmetrically placed between the track rails. Both companies will use the same track rails but will have separate sources of power.

ANNUAL MEETING, TOLEDO TRACTION CO.

The annual meeting of the stockholders of the Toledo Traction Co. was held on October 10th, at which the old board of directors was re-elected for the following year, with the exception of George W. Hale, who succeeds his brother, William E. Hale, deceased. No change was made in the officers of the company, who are: Albion E. Lang, of Toledo, president; Thomas H. McLean, of Toledo, vice-president; John B. Dennis, of New York, treasurer; Barton Smith, of Toledo, secretary. At the meeting a number of plans for improvement were discussed, and these will be made from time to time to keep pace with the growth of the city. No radical changes are contemplated at present. At the close of the business meeting the Traction company's Centennial Band gave the officers and directors a complimentary concert.

MILLIONAIRE GOES TO JAIL.

After more than two years of appeals and writs and other technicalities known to the law, W. B. Bradbury, the San Francisco millionaire, who on May 13, 1897, was sentenced to 24 hours in jail for violating an ordinance against expectorating, has at last served his time in the county lockup. When the expectoration ordinance applying to street cars was passed in San Francisco, early in 1897, Mr. Bradbury became its first victim. He was convicted, but at once commenced a legal fight for stay of sentence, that is almost unparalleled in the history of the state. The case was taken to the upper courts and after it had been passed upon by nearly every judge in the locality, it was brought to a close a short time ago by the refusal of the Supreme Court to grant a writ of review. Mr. Bradbury was accordingly rearrested and compelled to spend a day in jail.

An ordinance has been passed by the Chicago City Council instructing the Chicago Union Traction Co. to run its cars in North State St. from the hours of 7 to 9 a. m. and 5 to 7 p. m. at intervals of not more than 90 seconds. The right of the city to regulate the running schedule will be contested in the courts.

PERSONAL.

MR. TOM L. JOHNSON, it is said, will hereafter make his residence at Louisville, Ky.

MR. FRANK FRYE, of Peekskill, N. Y., has been made permanent receiver of the Peekskill Traction Co.

MR. FRANKLIN WOODMAN has been chosen general manager of the Nashua (N. H.) Street Railway Co.

MR. FRANK J. SPRAGUE was married on October 11th to Miss H. C. Jones at Hillview, New Hartford, Conn.

MR. CHARLES J. BOCKHOLDT has recently been appointed general superintendent of the Freeport (Ill.) General Electric Co.

MR. F. M. ZIMMERMAN, of Atlanta, Ga., will succeed Mr. Frank M. Haines, as superintendent of the Lorain (O.) Street Ry

MR. STEPHEN A. NYE has been chosen treasurer of the Lewiston (Me), Brunswick & Bath Street Ry, to succeed the late Hon. I. C. Libby.

MR. ANDREW THOMSON has been elected president of the Quebec, Montgomery & Charlevoix Ry., in place of Mr. H. J. Beemer, resigned.

MR. H. R. FEHR has resigned his position as city engineer at Easton, Pa., to become superintendent of the Easton, Palmer & Bethlehem Electric Ry.

MR. FRANK M. WEBSTER, claim agent of the Consolidated Street Railway Co., Grand Rapids, Mich., was a caller at the "Review" office when in Chicago last month.

MR. GEORGE MOFFAT, the well known electrical engineer of Philadelphia, has sailed for Europe and will take active part in the construction of the London United Tramways.

MR. CLARENCE E. STUMP, of New York, who is widely known through his connection with the electrical technical press, has been appointed business manager of the Christian Herald.

MR. HENRY NOTT RANSOM, purchasing agent of the International Traction Co., Buffalo, on November 21st will wed Miss Alice Gillet, daughter of Mr. and Mrs. Elmslie Morven Gillet, of New York.

MR. FRANK M. HAINES, superintendent of the Lorain (O.) Street Ry., has tendered his resignation, it is said, to accept a similar position in London, Eng., on lines recently purchased by Tom L. Johnson.

MR. FRANK E. ROWELL, of Kittery, Me., who has been the clerk and a director of the Portsmouth, Kittery & York Street Railway Co. since its organization, has been chosen as treasurer of the company to succeed the late Hon. I. C. Libby.

MR. C. E. WILSON, since 1893 in charge of the electric power stations of the National Railway Co., St. Louis, was on November 1st appointed superintendent of motive power and chief engineer of the Chicago City Ry., succeeding Mr. C. J. Reilly, resigned.

MR. W. J. CLARK, manager of the foreign department of the General Electric Co., has left Europe and gone to Argentine Republic in the interest of his company. A large demand for electrical apparatus is expected from South America in the next few months.

MR. W. W. WHEATLY was on October 21st appointed acting general superintendent of the surface lines of the Brooklyn Heights Railroad Co. in place of Mr. Ira A. McCormack, who resigned to accept the office of vice-president of the Syracuse (N. Y.) Rapid Transit Co.

MR. GEORGE M. KUEMMERLEIN is about to retire from his position as superintendent of transportation of the Milwaukee Electric Railway & Light Co., in order to take a much needed vacation. He has been with the company over 25 years, having begun as a horse car driver.

MR. CHARLES S. BUTTS, until lately with the Duluth, South Shore & Atlantic Ry., a steam road, has been appointed engineer for the St. Louis & Suburban Railway Co. We welcome Mr. Butts back to the street railway field where he had a wide experience before taking up steam road work.

MR. W. F. HAM, secretary of the Nassau Electric Ry., Brooklyn was married on Tuesday, October 10th, to Miss Suzanne Mulford; they will be at home after December 1st at the Hotel St. George Congratulations are most heartily extended, particularly from Mr Ham's many friends in the Accountants' Association

LORD KELVIN'S chair at the Glasgow University has been given to Professor Andrew Gray, a well known writer on electrical scientific subjects and at one time assistant to Sir William Thomson in the University. His appointment to the place left vacant by the resignation of Lord Kelvin, will undoubtedly meet with the approval of all concerned.

MR. CALVIN W. RICE, electrician for the New York Consolidated Telegraph & Electrical Subway Co. and the New York Gas & Electric Light, Heat & Power Co., will visit Purdee University and lecture on November 15th, before the students of electrical engineering on the "Development of High Tension Service." While in Lafayette Mr. Rice will be entertained by Prof. W. P. Goldsborough.

MR. ROBERT M'A. LLOYD, whose name has been closely associated with the development of the storage battery in America, and who was recently elected president of the Electric Vehicle Co., has been made president of the Siemens & Halske Electric Co., succeeding Mr. Isaac L. Rice. Mr. O. S. Lyford, formerly with the Westinghouse Co., has been made vice-president and general manager of the Siemens & Halske Co., with headquarters at Chicago, taking the position formerly held by Mr. C. S. Knight.

MR. J. CHARLES MOORE, who has for several years held the office of secretary of the Yerkes roads in this city, and who filled the same position under the new organization of the Union Traction Co., has resigned to go into business for himself. He has become associated with the well known firm of A. L. Dewar & Co. bankers and brokers, and will carry with him the esteem and confidence of a large clientage. His numerous friends wish and predict for him a large degree of success in his new work.

MAJ. RUSSELL B. HARRISON, inspector-general of volunteers, in Cuba, who has been dangerously ill with yellow fever, has nearly recovered his usual good health. Major Harrison was much annoyed, while convalescent, to hear a report that had been quite generally circulated to the effect that he caught the fever while carelessly, and through curiosity, handling an old coffin and clothing used by Spanish soldiers in burying their dead. This the major wishes to state is false, as he was simply obeying orders when he absorbed the fever germs.

CAPT. ROBERT M'CULLOCH, formerly general manager of the National Railway Co., of St. Louis, and now general manager of the Chicago City Railway Co., was the recipient recently of a handsome memorial from Mr. Corwin H. S. Spencer, as president of the National Railway Co., attesting his sterling qualities and capabilities as a street railway man. The memorial was bound in red morocco, with Capt. McCulloch's name in gold letters on the outer cover. On the title page appeared his name in water colors and in the scroll were representations of a bob-tailed car and a modern electric vestibule car.

MR. SIEZO MISAKI, chief engineer and superintendent of the Hanskin Electric Railway Co., of Kobe, Japan, was in attendance at the street railway convention at Chicago. Mr. Misaki informed

us his road, which will be built early next year, is an interurban connecting the city of Osaka, having 600,000 inhabitants, with Kobe, a place of about 180,000. The line follows the highway outside of the two cities named and the several large towns through which it passes. Between these towns is the richest wine district in Japan. The work involves some difficult engineering problems, one of which is the construction of 3,500 ft. of bridging and trestles in crossing a river. The road will be double track, and it is intended to install according to the very latest and best practice.

MR. IRA A. M'CORMACK, superintendent of the Brooklyn Rapid Transit Co., has resigned his position as such to accept the vice-presidency of the Syracuse Rapid Transit Co., to which office he has been elected. Mr. McCormack stands among the most practical railroad men in the country. He had 20 years' experience in steam railroad work before going to Brooklyn, and was gradually promoted from a minor position to one of large responsibility. In his new position he will have complete control of the management of the Syracuse company's lines. Mr. McCormack will reside in Syracuse, where he lived before going to Brooklyn. In the latter city he has made many close acquaintances. He is a member and trustee of the Lincoln Club, and is also the second vice-president and trustee of the Eagle Saving & Loan Co., of that city. Mr. McCormack is also an active member of the American Street Railway Association and is a member of the executive committee.

OBITUARY.

CAPT. C. E. HALL, who for many years was connected with the Chicago City Ry., died at his residence in this city October 26th. He constructed most of the steam roads in Cuba which were built prior to 1863; he served through the Civil War, and was 70 years of age.

WINFIELD SMITH, of Milwaukee, died suddenly of heart disease in London, November 8th. He was one of the early day capitalists of Milwaukee, and for many years largely and actively interested in the street railway there. He will be remembered by convention goers during the first 10 years for his excellent judgment and genial manner.

ELECTIONS.

THE PEOPLE'S RAILWAY CO. has been reorganized with officers as follows: President, John A. McMahon; first vice-president, H. J. Crowley, of Philadelphia; second vice-president and general manager, George B. Kerper; secretary and treasurer, C. L. S. Tingley, of Philadelphia; assistant secretary, Eugene Wuichet.

THE HAVANA TRACTION CO. has chosen officers as follows: President, Sir William C. Van Horne; vice-presidents, P. A. B. Widener and R. A. C. Smith; secretary, J. M. Ceballos; treasurer, Frederic Nicholls.

THE YOUNGSTOWN (O.) & SHARON ELECTRIC RY. have chosen the following officers: President, W. H. Clark; vice-president J. C Whitla; secretary, B. F. Wirt; treasurer, Thomas Patterson. Messrs. Whitla and Patterson are of Pittsburg, Pa., and represent Brown Bros. of that city.

THE DUBUQUE (IA.) STREET RY. has been purchased by Linehan & Molo, of that city and the following officers have been elected: President, Bart. E. Linehan; vice-president, C. H. Eighmeg; treasurer, William S. Molo; secretary, D. E. Lyon.

THE TERRE HAUTE ELECTRIC CO. has elected the following officers: President, W. R. McKeen; vice-president, J. G. McNutt; manager, C. B. Kidder, all of Terra Haute. The consulting engineers are Stone & Webster, of Boston.

THE WILLIMANTIC (CONN.) STREET RAILWAY CO. has been organized with the following directors and officers: Directors, W. H. Abbott, J. M. Pettis and W. Ward Tuttle of Boston, Alderman W. D. Grant and George K. Nason of Willimantic, and the law firm of Clark & Arnold, of Hartford. The officers are: President, J. M. Pettis; vice-president, George K. Nason; secretary, W. Ward Tuttle; and treasurer, W. H. Abbott. President Pettis says that the company expects to have its cars running by June, 1900.

THE JOLIET RAILWAY CO. at its annual meeting chose W. B. McKinley secretary and general manager, and C. S. McManus general superintendent. The directors are G. F. Duncan, J. E. Burnham, H. P. Cox, Walter Davis, E. Winslow, E. Woodman, A. A. McLeod, S. W. Pettit and H. J. Crowley. The line from Lemont into Chicago will be laid early in the spring over the route controlled by the Cook County syndicate, a settlement to that effect having been made with the latter.

THE METROPOLITAN RY. CO., Toronto, Ont., has elected the following officers and directors: President, C. D. Warren; vice-president, S. M. McElroy; secretary and treasurer, R. Jenkins; directors, C. D. Warren, S. M. McElroy, W. A. Warren and F. B. Warren.

THE NORTHAMPTON & AMHERST STREET RAILROAD CO. has elected the following directors: B. E. Cook, jr., H. L. Williams and C. K. Graves of Springfield; M. A. Coolidge and F. S. Coolidge of Fitchburg; E. C. Crosby and C. W. Wyman of Brattleboro, Vt. The directors organized as follows: F. S. Coolidge, president; B. E. Cook, jr., vice-president; C. W. Wyman, clerk and treasurer; F. S. Coolidge, B. E. Cook, jr., and E. C. Crosby, executive committee.

THE OFFICERS of the newly consolidated New York & North Shore and Long Island Electric R. R., to be known as the New York & North Shore Railroad Co., are as follows: President, R. T. McCabe, 29 Broadway; vice-president, Jacob R. Beetem, Flushing; treasurer and secretary, G. S. Terry, Whitestone. The other directors are Edward J. Matthews, William H. Shelmerdine and Charles A. Porter, all of Philadelphia; Clarence D. Simpson, Scranton, Pa.; William F. Hogan, 643 10th St., Brooklyn; and William E. Stewart, 19 Liberty St., Manhattan.

THE PALMER (MASS.) & MONSON STREET RAILWAY CO. on October 25th, chose the following directors: E. G. Childs, H. E. W. Clark, Andrew Pinney, E. G. Hastings and H. P. Holden of Palmer, George C. Flynt of Monson, Fred T. Ley of Springfield, and Allen Page of Bridgeport, Conn.

THE AUBURN (N. Y.) INTERURBAN RY. has elected the following directors for the ensuing year: L. S. Ebright, E. I. Edgcomb, G. B. Leonard, C. D. Beebe, George B. Longstreet, William F. Rafferty, George B. Turner, Frederick T. Pierson and A. P. Rich.

THE JERSEY CITY, HOBOKEN & PATERSON STREET RAILWAY CO. has elected the following officers: President, David Young, of Newark; vice-president, John F. Shanley, of Newark; treasurer, George W. Roe, of Newark; secretary, William C. Doubleday, of Jersey City; directors, William C. Shanley, of Newark; William J. Davis, of Harrison; Bird W. Spencer, of Passaic; Peter Hauck, jr., of Newark; Edward L. Young, of Jersey City; Philip Hexamer, of Hoboken; James J. Corbiere, of Caldwell; Halsey M. Barrett, of Bloomfield; David Young, John W. Ombersen, of Newark; Frank M. Stillman, of Rahway; George R. Waite, of Jersey City; John F. Shanley and Warren S. Hall, of Hoboken. This company is a consolidation of several street railway companies operating in Paterson, Hoboken, Passaic, Jersey City and Rutherford. Its capital stock is $20,000,000.

THE BRISTOL & PLAINVILLE TRAMWAY CO., of Bristol (Col.), has elected Mr. Albert L. Sessions a director to take the place of Mr. John H. Sessions, deceased. The others of the old board have been re-elected for another year.

NEW PUBLICATIONS.

"THE PICTURESQUE VALLEY" is the title of a handsome brochure, published by the Waverly (N. Y.), Sayre & Athens Traction Co., describing the points of interest in the country through which its lines pass. We are indebted to W. E. Case, superintendent of the company, for a copy of this pamphlet.

"AUTOMATIC LUBRICATION" is the title of a new illustrated catalog published by the Siegrist Lubricator Co. This work is carefully compiled and handsomely gotten up, setting forth the merits and advantages of automatic lubrication and showing illustrations of a number of plants where the Siegrist sysem of oiling is installed. The catalog includes testimonials from some prominent engineers, and the company will be pleased to send it on application addressed to its office, 117-119 Locust St., St. Louis, Mo.

WE ARE IN RECEIPT of the Commercial & Industrial Directory of Osaka, Japan, for 1899, which also includes the prospectus and rules of the Osaka Commercial Museum. This museum, which was established in 1890, contains a number of different departments, one of the principal ones being devoted to foreign articles. This contains exhibits of various kinds collected from foreign countries, including models of machinery, etc. Large additions are made annually and a special fund is provided to facilitate the collection of samples. Foreign merchants and manufacturers are invited to send specimens of their wares and these are readily received and exhibited in their proper department.

DURING THE LAST TWO YEARS there have been issued from the press of the Open Court Publishing Co., 324 Dearborn St., Chicago, a series of books on mathematical subjects, edited by Mr. Thomas J. McCormack, which should prove interesting to a large class of readers. Not only those engaged in studying or teaching mathematics, but also those who, having to do more with the practical applications of mathematics, can read the works with profit and pleasure. Mr. McCormack is well known to engineers and physicists through his admirable translation of Professor Mach's "Science of Mechanics."

The first of the present series is a reprint of De Morgan's essay, "On the Study and Difficulties of Mathematics"; the original was published in 1831, and is now very scarce. This work is a great assistance to students and instructors, as it points out and explains many of the difficulties which will be encountered in arithmetic, algebra and geometry, and gives practical hints on methods of study. The editor has added annotations and bibliographies of modern works on algebra, the philosophy of mathematics, pan-geometry, etc.

"Lectures on Elementary Mathematics," by Lagrange, translated from the French by Mr. McCormack, form the second of this series. The "Lectures" were delivered by Lagrange in 1795, and are five in number, treating of arithmetic, the operations of arithmetic, algebra, the resolution of numerical equations, and the employment of curves in the solution of problems; they have furnished the source for many discussions on the subjects of which they treat, but contain much that has not been incorporated in the more common text books.

"Mathematical Essays and Recreations," by Hermann Schubert, translated from the German by Mr. McCormack, contains six essays which can scarcely fail to interest everyone, mathematician or not; no extended mathematical training is necessary for a keen appreciation of this work. The first of the articles—"The Definition and Notion of Number," "Monism in Arithmetic," "On the Nature of Mathematical Knowledge"—after defining number as the result of counting, show how fractions, negative numbers, irrational numbers, imaginary numbers, and complex numbers all follow as extensions of the first results, according to what the author calls the "principle of no exception." This principle is that all operations and results are to be so interpreted that they shall form no exception to those springing from the original real results. In "Magic Squares" is a very interesting account of a mathematical diversion that is now less popular than it formerly was. The fifth chapter is entitled "The Fourth Dimension," and shows what is meant by a "dimension," what the legitimate functions of a fourth or higher dimension are, and that the claims of spiritualism to the fourth dimension are unfounded. "The History of the Squaring of the Circle" concludes the volume, and is a very complete account of an interesting problem which, though it cannot be solved, has been a most important stimulus in developing the science of mathematics.

"Elementary Illustrations of the Differential and Integral Calculus," by De Morgan, is a reprint of the book originally published in 1832, and later as a part of De Morgan's "Treatise on the Differential and Integral Calculus." Mr McCormack has re-paragraphed the text and introduced descriptive sub headings. This book discusses the difficulties met in the early study of the calculus and resolves them in a manner leaving little to be desired.

To the four books mentioned a fifth is soon to be added—"History of Elementary Mathematics," by Dr Karl Fink, translated from the German by Professors Beman and Smith.

The sizes and prices of the four books mentioned are as follows:

"On the Study and Difficulties of Mathematics," 229 pages; cloth, $1.25 net.

"Lectures on Elementary Mathematics," 172 pages; cloth, $1 net.

"Elementary Illustrations of the Differential and Integral Calculus," 144 pages; cloth, $1 net.

"Mathematical Essays and Recreations," 149 pages; cloth, 75 cents net.

ROBBED OF $81,000 ON STREET CAR.

Robert P. Jennings, secretary-treasurer and general superintendent of the Broadway Cable Co., of St. Louis, Mo., was robbed on one of the cars of that company of $81,043 on October 30th. The money, which was in an envelope in his pocket, consisted of $1,043 in cash, which had just been drawn from the bank to be used in paying company's employes, and two checks for $40,000 each. As Mr. Jennings left the bank and was waiting for a car, he noticed two rather well-dressed men standing on the curb near him. When the car came along they got on the car platform ahead of him and stood in the doorway, blocking the way while they asked the conductor, Charles Roster, if the car went to the union station. The conductor told them it did not, and they asked directions how to reach the station, continuing to block the way of Mr. Jennings. As the car was between Lucas Ave. and Morgan St., directly in front of the Union Market, the two men jumped off and were lost in the crowd.

R. B. JENNINGS.

Jennings walked into the car and sat down. As he did so he felt for the envelope. It was gone. He called to the conductor that he had been robbed. The car was stopped and Mr. Jennings got off the car and ran back to where the men alighted, but they had disappeared. He then got back on the car and went to the offices of the company, at 3710 North Broadway, and reported the robbery. The police were notified and a dozen detectives at once were put to work on the case. The company asked the bank to stop payment on the checks.

The scene of the robbery is the busiest down town corner in St. Louis, right in the heart of the shopping district. The streets were crowded at the time, the cable car was well filled and policemen stood at the corner. For boldness the hold-up is unequaled by any previous occurrence of the kind in St. Louis.

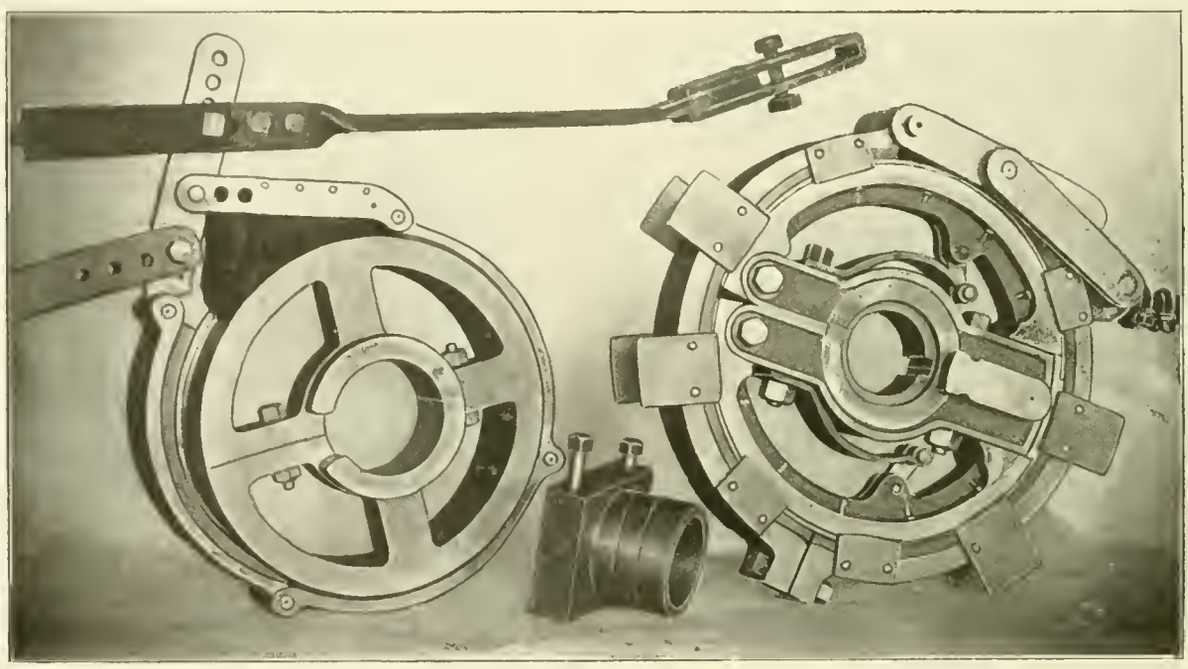
Rumor says that the Lehigh Valley Traction Co., of Allentown, Pa., is to absorb a number of outlying trolley systems connecting with its tracks.

Plans are being perfected for greatly improving and extending the street railway mail delivery service in Brooklyn. Spur tracks will be laid from the nearest lines of the Brooklyn Rapid Transit Co., directly to the dispatching platforms at the post office, so that the mail pouches can be delivered directly to the mail cars without extra handling. This will enable residents of the suburbs to receive mail regularly five times a day, and from an hour to an hour and a half sooner than they have received it heretofore. The Brooklyn Rapid Transit Co. is paid about 10½ cents per mail car-mile.

A COMPOUMD FRICTION BRAKE.

For over a year tests and experiments with a new mechanical friction brake made by the McCollum Compound Friction Car Brake Co., of Toronto, Ont., have been conducted on one of the large double truck cars of the Toronto Ry., with such success that the later company has acquired the right from the owners to equip its entire system with the new invention. Officers of the Buffalo Railway Co., and the Rochester Railway Co., have also decided to further test the device on their respective systems, and one of the large cars running between Buffalo and Niagara Falls is now being fitted for this purpose.

The invention consists of a simple adaptation of the principle of the band brake quite generally used on hoists. There are two wheels 18 in. in diameter, which when fitted closely side by side on the car axle, occupy only 6 in. The rim of one of the wheels is made in two equal sections which are hinged as shown in the accompanying cut. This wheel is keyed firmly to the axle. The other is in one piece and runs loosely on a sleeve keyed to the axle. Between the loose ends of the sections of the first wheel is interposed a rocker clutch which is simply a movable piece of metal, so placed as to spread the sections apart when given a turning or twisting motion. This piece projects far enough from the side of the first wheel to engage, at its end nearest the axle, a recess in the second wheel as shown in the cut. Both wheels turn together at the same speed, being connected by the clutch.



THE McCOLLUM COMPOUND FRICTION BRAKE.

A steel band lined with ½ in. of compressed paper encircles the periphery of each wheel, the band on the loose wheel being compressible, and the band on the expanding keyed wheel being rigid. To this second band is attached the ordinary brake chain that operates the shoes through levers.

To operate the brake the motorman, with suitable connecting rods and a draw lever on the cab, by gently pulling the lever a few inches, compresses the band on the loose running wheel, retarding its motion, and thereby twisting or rocking the loose clutch, which, in its turn, expands the other wheel within the rigid circular band, causing this band to revolve and wind up the brake chain. The wind of the chain being on a circumference 9 in. away from the center of the axle, a compression of only 1-16 in. on the loose wheel friction gives a very powerful leverage on the main keyed wheel friction.

It is claimed with the new device there is no back roll of the car when stopping on grades, in consequence of the wind being so far from the axle. It is further stated that owing to the close adjustment of the device the motorman can, by the sense of touch, tell just what the brake is doing and is able to run his car month in and month out, on any rail, in any weather, without skidding wheels.

The durability of the machine is shown by the fact, that when examined after four months' steady running, having made approximately 13,000 miles, and 106,000 stops, the band linings, upon which the frictional pressure is most severe had not worn down one hundredth part of an inch. This fact and the simplicity of replacing the wearing parts are important features. The brake complete weighs about 175 lbs.

Mr. J. B. Perry, director of the McCollum Co., Bedford Road, Toronto, is about to form a company in the United States to handle this brake.

WESTINGHOUSE ELECTRO-PNEUMATIC CONTROL OF MOTORS.

One of the latest publications of the Westinghouse Air Brake Co. is a pamphlet of 40 pages descriptive of the electro-pneumatic system for controlling railway and other motors which has been developed by that company. This system involves the use of compressed air for moving the controlling apparatus, the admission of the air to the several parts being effected by means of electro-magnets attached to air valves. The air-transmitting and applying apparatus, and the electro-magnetic devices in this system have all been tried in service, being standard parts made by the Westinghouse Air Brake Co. and the Union Switch & Signal Co.,

In this system the number of motor cars per train may be varied at will. Each motor car has the usual current-collecting and controlling devices, and, in addition, on one car at least, is a complete air compressing and storage plant, auxiliary storage apparatus being placed on all the other motor cars. The controller proper may be of any suitable type, the ordinary hand-lever being replaced by a pneumatic operating mechanism. The automatic circuit breaker in connection with each controller may be of any standard type and is also fitted with an operating device similar to that of the controller.

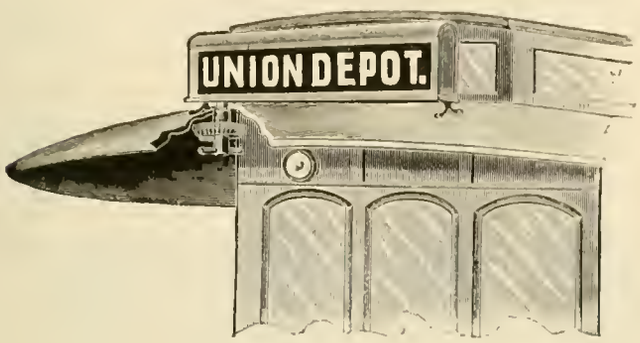
Air is taken from the reservoir which supplies the brakes, and current for the magnets is obtained from a primary or secondary battery. This makes the control independent of the power except that the air compressor is driven by the power circuit.

The operating devices move the controller shaft from notch to notch at the will of the operator just as it would be done by hand, and a complete cycle may be made as slowly or as quickly as the conditions may require. A more complete description of this invention will be given in a succeeding issue.

HUNTER CAR SIGN.

The annoyance and expense incident to the changing of designating car signs, when it is necessary to transfer cars from one route or division to another, are often considerable, especially in the case of a complicated city system, having a number of routes meeting at one central point, as under such conditions it is often desirable to send a car out over any one of a dozen different divisions at a moment's notice. To facilitate this interchange of cars and also to enable the route the car is to take to be as easily distinguished at night as at day, the Hunter Illuminated Car Sign Co., of Cincinnati, O., some time ago placed on the market its illuminated sign, which is illustrated herewith.

The device is 44 in. long and weighs approximately 20 lb. The names of the routes are printed on a strip of Holland curtain material which is carried within the sign on two rollers, the strips holding over 50 different names if desired. The Hunter signs on



HUNTER CAR SIGN.

the cars of the United Railways Co., of St. Louis, for instance, each contain 51 names, and those in Baltimore 44. At night a single incandescent light in front of a powerful reflector, makes the lettering plainly visible a block away.

Among recent orders for this sign is one from the United Railways Co., of St. Louis, for 1,700, making a total of 2,000 now in use in that city; also one from the Chicago City Railway Co. for 520. A few of the many companies which have had the device in use for some time are the United Traction Co., Pittsburg; Consolidated Traction Co., Pittsburg.; Toledo Traction Co., Toledo, O.; Birmingham Railway & Electric Co., Consolidated Street Railway Co., Grand Rapids, Mich., and the Covington & Cincinnati Street Railway Co. It is worthy of note that T. M. Jenkins, formerly general manager of the last named company, was so well pleased with the working of the sign on that system, that he has just ordered 200 for the St. Louis & Suburban Ry., of which he is now general manager.

The Hunter company will send one of its signs, free on trial, to any street railway company in the United States.

CLEANING CARS.

To keep cars bright and attractive, inside and out, requires more than an occasional cleaning down with ordinary soap and water, and this question should receive as much attention as the problem of the best way to paint and varnish a car in the first place, for it is often the case that the result of much time and expense in the paint shop, will be set at naught and made absolutely valueless within a few weeks, in the car barn, by careless and unscientific cleaning.

The Modoc Soap Co., of Cincinnati, O., has given this subject special study for several years, and has had on the market for some time a preparation for cleaning cars known as the Modoc liquid car cleaner, and which has been found by many of the leading roads in the country to be entirely satisfactory for this work. If the liquid cleaner is systematically and properly used, and applied before the car becomes too dirty, it is guaranteed to keep the rolling stock clean and bright and to add at least eight months to its time of service. The company also makes a soap for occasional use, when the car has been permitted to get unusually dirty.

PRACTICAL TESTS OF RAIL BONDS.

Harold P. Brown, of New York, took the opportunity presented by the recent street railway convention at Chicago, to make a practical demonstration of the conductivity of the Brown copper rail bonds. At his booth at Tattersalls he had available a 3,000-ampere current at 10 volts, which he passed in series through a joint of 80 lb. T rail with no bond and a joint of 70 lb. T rail with one of his solid copper bonds on each side, angle plates loosely set up. The unbonded 80 lb. joint with 2,000 amperes showed a drop of .423 volt. As the joint could not be bonded in the proper place quickly enough to demonstrate it value to each caller, Mr. Brown amalgamated the top of the rails at the inner ends and then laid upon the amalgamated spots one of his No. 0000 bonds. The drop with 2,000 amperes was then .018 volt; the drop of 1 in. of solid rail with the same current was .00223 volt. The bond was therefore equal to about 8¼ in. of rail in resistance.

The drop on the 70-lb. rail joint with 2,000 amperes was .01946 volt, and with an extra bond laid on top of the rail the drop with the same current was .00762 volt. The drop of 1 in. of this rail with the same current was .00286 and the bond was therefore equal in resistance to about 7 in. of rail. To insure accurate results the tests were made with a voltmeter reading to the fifth decimal place.

A number of readings was also taken October 24th, on bonds in place on the Metropolitan West Side Elevated Ry., with the following results:

Test No. 1. Measurements taken Oct. 24, 1899, of electrical drop between adjoining longitudinal girder on Metropolitan Elevated at expansion joint opposite stairway to electrical shop, through pair of plastic plug bonds from longitudinal girders into transverse girder. Average of eight readings .00111 volt.

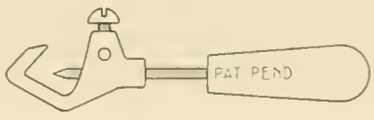
Test No 2. Measurements of same joint when plastic bonds were installed Oct. 28, 1896. Average of four readings .00112 volt.

Test No. 3. Measurements taken Oct. 24, 1899, on next expansion joint east of No. 1; joint bonded with heavy flexible copper strips, held in place by 13-16 in. copper rivet. Average of eight readings .00552 volt.

Test No. 4. Measurements taken Oct. 24, 1899, on solid riveted joint between longitudinal girders next west of No. 1. Average of eight readings .00695 volt.

NEW WIRE CLIPS FOR TESTING.

We illustrate herewith an ingenious little device made by the Star Brass Works, of Kalamazoo, Mich., for use in attaching testing instruments to insulated wires without removing any of the insulation. The device is only about 3 in. long and the method of its attachment will be readily understood from the illustration. The wire to be tested lies in the angle of the hook at one end and the screw



carrying a wooden handle is screwed forward until its point, which is in line with the axis of the wire, pierces the insulation and forms a contact with the conductor. The hook, which is nickle plated, is provided with a hole and set screw for attaching the testing wire. By the use of this device a connection to any conductor can be made in a moment and the insulation is only damaged to the extent of a small hole made by the point of the screw.

WESTINGHOUSE RAILWAY MOTORS.

In a pamphlet with this title the Westinghouse Electric & Manufacturing Co. illustrates its standard railway motors. These include: No. 46, 20 to 25 h. p. for narrow gage roads; No. 49, 35 h. p.; No. 40-B, 25 to 30 h. p.; No. 38-B, 45 h. p.; No. 69, 30 h. p.; No. 68, 40 h. p.; No. 56, 50 h. p.; No. 70, 115 h. p. at 500 volts and 150 h. p. at 750 volts; No. 50-C, 150 h. p.; 12-A, 25 to 30 h. p.

There are also included engravings of interior views of a number of Westinghouse electric railway power stations.

ECHOES FROM THE TRADE

THE GOLD STREET CAR HEATING CO., of New York, has secured a large contract for electric heaters from the Glasgow tramways.

M'GILL, POMEROY & CO., of Chicago, have closed the contract for all the overhead material for the Omaha, Council Bluffs & Suburban Ry.

THE AMERICAN STEEL & WIRE CO., recently suffered the loss by fire of one of its plants at Waukegan, Ill., but this will not seriously delay the filling of orders.

THE PITTSBURG REDUCTION CO., of Pittsburg, showed at the street railway convention samples of wire and cable for street railway purposes. The exhibit was in charge of J. A. Rutherford.

THE KANSAS CITY CAR & FOUNDRY CO., of Kansas City, Mo., exhibited at the Chicago convention various types of street car wheels, whose merits were fully described by F. W. Fisher and A. J. Fisher.

WALWORTH MANUFACTURING CO., the largest house in the East making piping, fittings, valves, etc., will on or before December 1st remove its general offices from 16 Oliver St. to 128-136 Federal St., Boston.

WILSON & CO., of Brooklyn, N. Y., report that their trolley catching device continues to meet with great favor from street railway managers and letters testifying to the satisfaction given are constantly coming to hand.

L. A. SAYRE, the punch man of Trenton, N. J., distributed souvenirs at convention which were greatly in demand. A box containing a handsome pack of cards, and a miniature punch, silver plated, made a popular combination.

THE MILWAUKEE RAIL JOINT & WELDING CO., of Milwaukee, through its agent, Henry L. Prather, of Cleveland, has closed a contract with the Rochester (N. Y.) Ry., for cast welding several thousand joints on 4½-in., 6-in. and 9-in. rails.

THE JEWETT CAR CO., of Jewett, O., has sold the Omaha, Council Bluffs & Suburban Ry. 15 large interurban cars. These cars are mounted on Peckham double trucks which were sold by Hanna & Gray, western agents for the Peckham company.

THE HAZARD MANUFACTURING CO., of Wilkes-Barre, Pa., has completed its wire covering mill and is now filling orders for covered wire as well as for bare wire and cables. It has opened a Chicago office at 1201 Marquette Building, in charge of J. B. Wallace.

THE CREFELD ELECTRICAL WORKS, of Saylesville, R. I., has been purchased by the American Electrical Works, and its plant has been removed to a substantial new three-story brick building, 130 x 60 ft., adjoining the American Electrical Works' factory, at Phillipsdale, R. I.

EXHIBIT HALL AT A. S. R. A. CONVENTION FROM THE SOUTH END.

FRANK R. COATS, until recently connected with the New York, New Haven & Hartford R. R., is now in charge of the Chicago office of the Weber Railway Joint Manufacturing Co. He will be assisted by E. W. Penfield as engineer. Mr. Penfield has been with the Weber company for some time.

THE JACKSON & SHARP CO., Wilmington, Del., was represented at the street railway convention by Mr. J. Monteith Jackson, who, though one of the younger members of the concern, found many acquaintances among both western and eastern men. He distributed a very acceptable little souvenir containing a calendar for next year, and wax coated compartments for carrying postage stamps.

THE VULCANAS FORGING CO., of Cleveland, suffered the entire destruction of its plant on October 25th. The loss is nearly $30,000. The company made street and steam railroad forgings of various kinds, and also handled the Hathaway transfer table. A. G. Hathaway is secretary of the company.

ENGINEERS WHO MAKE a trial of genuine Albany grease cheerfully acknowledge its superiority for all lubricating purposes. L. T. Snell, of Natick, Mass., writes under date of October 23d to Adam Cook's Sons, New York, sole makers as follows: "Your grease is all right. I have some of another make on hand. When used will give you a call."

THE WESTERN ELECTRIC CO., of Chicago, describes its new type "Sunbeam" incandescent lamp in bulletin No. 14001, for October. This is a 16-c. p. street railway lamp for use in series on 500, 550 or 600 volt currents and is made in three standard efficiencies, viz., 3.1 watts, 3.5 watts and 4 watts per c. p. Every lamp sent out is individually exhausted both mechanically and chemically, and the vacuum obtained is claimed to be as nearly perfect as known methods can produce.

THE BULLOCK ELECTRIC MANUFACTURING CO., of Cincinnati, O., devotes its October bulletin No. 2435 to its new type "N" direct current multipolar motors which are designed to meet the conditions obtaining in direct driven machinery in mills, factories, and workshops generally. The motors are compact, and made with either open or closed ends, the latter rendering the motor moisture and dust proof, and adapting it to service where an open motor would be impracticable.

GATES & RANDOLPH are doing an immense electrical business, having sold 30 odd complete electric plants during the past month. Realizing the extensive application of the electric motor carriage, they have also taken the agency of the Indiana Bicycle Co., of Indianapolis, which makes the "Waverly" automobiles in all styles. A number of these carriages were on exhibition at the Street Railway Convention. This firm's electrical knowledge will come into good play in the sale of these vehicles.

THE UNION BOILER TUBE CLEANER CO., of 262 Penn Ave., Pittsburg, has just completed a contract for cleaning two Hazelton or porcupine boilers with over 2,000 tubes having one end welded tight. These tubes were badly scaled and the closed end required a special tool of unique design as well as the use of the company's own design of flexible shaft. This concern is the only one on the face of the globe fully equipped with machinery, tools, and expert operators to do this kind of work quickly, effectively, and cheaply.

THE CHRISTENSEN ENGINEERING CO., of Milwaukee, Wis., has sold during the past two years nearly 1,000 air brake equipments, and during this same period, the cost of maintenance for these equipments, computed on the sale of repair parts has not equaled 1 per cent of the total cost, a record that compares favorably with any other apparatus used by street railways. The company has recently brought out a revised edition of its general catalog, which contains a discussion on the advantages of straight air over automatic or stored air for braking purposes.

THE SPEER CARBON CO., of St. Marys, Pa., is meeting with a most gratifying success in the manufacture and sale of carbon brushes. J. S. Speer, the general manager of the company, has long been connected with the manufactured carbon industry and knows the business thoroughly: his experience insures a product equal to any on the market, while the fact that the Speer company has a new plant well equipped with the latest types of machinery, and also owns its own gas wells and coal mines, enables it to put its products on the market at prices which are satisfactory to all users.

THE J. G. BRILL CO., of Philadelphia, has published a very complete catalog showing the leading types of standard American cars built by it, and indicating the lines of service to which they are adapted. The pamphlet contains styles to meet all the requirements of city and suburban and interurban service of every description from the lightest to the heaviest. This company makes a special feature of the fact that by its method of shipping cars "knocked down" and "in the white" a large saving in transportation charges to foreign countries can be made, and at the same time the danger of injury while in transit, and the labor of erection upon arrival at destination is greatly reduced.

THE CLONBROCK STEAM BOILER CO., Brooklyn, N. Y., maker of the Morrin "Climax" boilers advises us that the "Climax" boilers it had at the Trans Mississippi and International Exposition at Omaha, in 1898, and at the Greater America Exposition, this year have all been sold. The purchasers were: Omaha, Council Bluffs & Suburban Railway Co., one 500-h. p. and one 250-h. p.; Ft. Madison (Ia.) Street Railway Co., one 250-h. p.; International Packing Co., Omaha, for its Sioux City plant, three 500-h. p. and one 200-h. p. The western manager of this company is H. B. Ham, with offices at 1457 Monadnock Building, Chicago.

THE TAYLOR ELECTRIC TRUCK CO., of Troy, N. Y., exhibited one of its extra heavy 8-ft. wheel base single trucks, designed for heavy vestibule single truck cars; one of its "Empire State" radial trucks, one of its regular swing motion double trucks for double truck passenger car service, and one of its recently designed extra heavy swing motion double trucks, for long, heavy suburban cars for high speed service. The Taylor trucks are in service from Maine to California, and are spoken of in the highest terms. The exhibit was in charge of Mr. John Taylor, manager of the company, and the trucks were thoroughly examined in detail, and highly spoken of by many delegates.

THE POTOMAC TERRA COTTA CO., of Washington, D. C., which company makes the Mason vitrified salt glazed terra cotta conduits for underground electric wires, has on file and is constantly receiving letters from every part of the country testifying to the satisfaction its products are giving. The following is an example of the nature of these letters. It is from J. H. Vail, engineer-in-chief of the Pennsylvania Manufacturing, Light & Power Co., of Philadelphia, and reads as follows: "In reply to your communication I beg to say that we have laid under the streets of Philadelphia about 175,000 duct ft. of your terra cotta conduit. Up to date it is entirely free from faults."

THE TURNER OIL FILTER CO., 2777 North Lincoln St., Chicago, is receiving substantial testimonials from users in the shape of second and third orders for filters. Among such may be mentioned the Milwaukee Electric Ry., two 150-gallon filters; and the South Side Elevated, Chicago, two 150-gallon filters in addition to two of the same size in use one year. The Newark Light & Power Co. orders a 250-gallon filter, making five in use in that plant. The Elizabeth (N. J.) Light & Power Co. puts in one 100-gallon outfit, and the Yuba (Cal.) Light & Power plant orders a 100-gallon. The new Singer Building, Broadway and Liberty Sts., New York, is installing a 100-gallon filter.

THE PARIS EXPOSITION is attracting greater attention the nearer it comes to the time of holding the fair. The J. A. Fay & Egan Co., of Cincinnati, has been awarded, in the Champs de Mars, the largest space of any concern in the United States, and it expects to make one of the most elegent displays of wood working machinery that has ever been made by an American company. At the World's Fair in 1889 this company was awarded "The Grand Prix," together with the medal of the Legion of Honor. This year it expects to at least hold its own, and, perhaps, surpass the showing made in 1889 when it had 5,000 sq. ft., and received the thanks of the French Government for the great display made.

THE CENTRAL ELECTRIC CO., Chicago, has made careful preparation to supply the fall and winter needs of electric railways in track brooms, sleet cutting trolley wheels, etc. Among this company's standard lines of overhead material are Wood's trolley wire splicers, which have all the features for emergency work and at same time give lasting couplings. The "Type W" clincher ears, from the fact of the lips being cast without core, are said to per-

mit most rapid and reliable installation owing to the lip flexibility and freedom from bucking. This company expresses its pleasure with the particularly gratifying business in the Western States on its general lines of overhead and station equipment.

J. J. RYAN & CO., brass founders and finishers, 68-74 W. Monroe St., Chicago, report that the month of October has held its own in the way of trade, and in some departments made a gain over the previous two months. They have secured a number of orders for brass castings that will run from three to four months. One order was for a special lot of brass fittings for public building in Havana, Cuba, and a number of phosphor bronze castings, weighing 1,000 lb. each to be shipped South; but the most important gain was made in the babbitt metal department. Their sales on nickel "Genuine Babbitt" and "I X L Babbitt" have increased enormously. In the metal polishing and nickel plating department, they have been obliged to provide extra space in order to take care of the trade more expeditiously.

THE W. T. VAN DORN CO., of Chicago, has received during the last few weeks an unusually large number of orders for couplers, and its works are kept busy turning out contracts on hand. One of the largest orders is for 137 sets of couplings for the Northwestern Elevated, of Chicago; the trail cars for the road will have the Van Dorn, T-rail attachment and the motor cars, the standard motor draw bar. The Van Dorn Co., has also recently finished or is working on orders from the Metropolitan West Side Elevated of Chicago, for couplers for 18 motor cars and 18 trail cars; from the Boston Elevated Ry., and Brooklyn Elevated Ry., for automatic couplings; from the New York, New Haven & Hartford R. R., for couplers for the cars on its new P. W. & B. branch; and from London for 400 No. 5 type of couplers, 160 of which will be used at Bristol, Eng.

MR. FRANK ENGELHARDT, who formerly represented the American Wheelock Engine Co., in Chicago, has made new arrangements whereby he will look after the interests of the Filer & Stowell Co., of Milwaukee, makers of high grade engines for street railway and other service. He will establish his headquarters at 1232 Monadnock Building, Chicago. The Filer & Stowell Co., reports business in excellent condition. It is now erecting a large heavy duty cross compound, direct connected engine, 28 and 56 x 48 in. cylinders for the Union Railroad Co., Providence, and a similar engine for the Milford, Attleboro & Woonsocket Street Ry., of Unionville, Mass., with cylinders 16 and 30 x 48 in. It has also sold Armour & Co., two heavy duty cross compound direct connected engines, with cylinders, 23 and 46 x 48 in., and Swift & Co., one of the same type with 13 and 26 x 42 in. cylinders and one with 19 and 38 x 42 in. cylinders. These latter are repeat orders.

THE CLING SURFACE MANUFACTURING CO., of Buffalo, has received under date of October 7th, a letter from Prof. R. C. Carpenter, of Cornell University, supplementing his report on "Cling Surface" made in April last. Professor Carpenter says: "Later tests on 'Cling Surface' indicate higher efficiency of transmission and less loss of power in the case of belts treated with this material, than in the case of belts not so tested. This is due to the fact that the slipping of a belt causes considerable loss of power, the power so lost passing off in heat. The use of 'Cling Surface' reduces the slipping and consequently reduces the loss of power occasioned by the use of belts that slip. During the past six months I have had occasion to observe the practical use of 'Cling Surface' in a number of instances. In all such cases 'Cling Surface' has improved the belts by softening them, and as far as I can determine in the limited time (seven months) tends to preserve the leather of which they are constructed."

THE FALK CO., of Milwaukee advises us that it has just been awarded two additional contracts at Kansas City for the rebuilding of the 33d St. line and the Summit St. line. It has also just started welding on an 8,000 joint contract for the Anacostia & Potomac River Ry., Washington, D. C., and hopes to begin welding next week on the 42d St., Manhattanville and St. Nicholas Ave. lines of the Third Avenue R. R., New York. It is still doing other work for the Third Avenue R. R. and is about completing the interurban railway between Oshkosh and Neenah, Wis., and a further contract from the Russell House at Neenah to the lake shore. The gear and pinion department is working day and night, and the company recently shipped a carload of pinions to the North Jersey Street Railway Co., Newark, N. J. Contracts for the annual supply of gears and pinions have also been closed with some of the largest street railways in the East, and the sales of this department have increased over 100 per cent during the last year.

JOHN A. BRILL, of the J. G. Brill Co., in the course of a recent conversation with a representative of the "Review" stated that the day before he sailed from Liverpool on his return trip, October 21st, he had in connection with the foreign representatives of the company, closed an order with the Preston Car Co., of Preston, Eng., for 700 Brill trucks. This, it is claimed, is the largest single foreign order for trucks ever secured by an American firm. The order includes 100 pairs of the No. 27 G. type, which is a swing bolster center pivoted truck, having a 4-ft. wheel base, 300 No. 22 "Eureka" maximum traction trucks, and 300 of Brill No. 27 E., which is a single truck. Mr. Brill speaks favorably for the continued demand for street railway supplies from foreign roads; although he says there are several new car building firms that have started up in England and on the Continent, and that some of the old car building companies have been revived. He thinks that the demand for trucks especially will continue as foreign engineers and street railway men favor wrought iron construction for trucks, as there has been but little experience with cast steel or malleable iron construction, of any description.

THE IRONSIDES CO., of Columbus, which had a very attractively arranged exhibit at the convention of the American Street Railway Association last month, reports its doubled up business in excess of their capacity, and that much needed improvements and extensions now in progress will further double the factory capacity. Materials for preservation and protection of all classes of wire and fibre ropes through internal treatment in manufacture, and external application in subsequent use of such ropes, and also for the lubrication of all classes of gearing, among which street car motor gears seem to have received considerable attention, have heretofore been the principal specialties of this company. A metallic paint of reported great durability, capable of resisting acids and acid fumes, and to be unaffected through a wide range of temperatures is given among the more recently acquired articles of manufacture. An encouraging foreign trade is looming up, which promises to be greatly furthered through the manifested interest of many foreign visitors to the company's exhibit at the National Export Exposition now open in Philadelphia. A large and important shipment to the Hawaiian Islands was among those recently made abroad.

"NICKEL STEEL" was the subject of a report before the Railway Master Mechanics' Association at its convention in June last. The president of the Association called upon Mr. H. F. J. Porter, of the Bethlehem Steel Co., to discuss the report which he did at some length, explaning the necessity of a special equipment to make nickel steel forging and the excellence of such forgings when made by a suitable equipped plant. In conclusion Mr. Porter announced that his company would for a limited time furnish any railroad with nickel-steel forgings at a reduced price upon the condition that the road would keep a careful record of their preformance and return with a full report when they were finally broken. The following paragraph is from a circular letter issued by Mr. McIlvain, vice-president of the Bethlehem Steel Co.: "Pending the publication of the transactions of the meeting we could not take definite action with regard to this offer, but, having now received and caused to be reprinted that portion of the record which relates to it, we are distributing it and repeating and confirming the offer then made. We must limit its exceptance, however to a single month, and trust that your road, among others, will take advantage of the opportunity thus offered to obtain high grade nickel steel forgings of this character in quantities sufficient to satisfactorily determine their merits for yourselves. On receipt of drawing, blue-prints, or sketches, we will be pleased to quote prices."

FOREIGN FACTS.

A portion of the Bolton (Eng.) & District Electric Tramways will soon be opened.

The Huddersfield (Eng.) Corporation has placed the contracts for its electric power station building.

It was expected that the first electric train on the London Metropolitan Ry. would be run early this month.

The opposition of residents has prevented the grant of an order for an electric railway between Ryde and Seaview, Isle of Wight.

The Warrington (Eng.) Town Council will apply to the Board of Trade for a provisional order for building electric tramways in the borough.

Contracts for the construction of the Devonport (Eng.) & District Tramways Co., have been placed. The road will consist of 4½ miles of double line and 1 furlong of single line, and must be completed by May 30, 1900.

The Association of Municipal Corporations (Eng.) has by a formal resolution pledged itself to use every effort to defeat all electric power schemes, which offer any promise of competing with municipal electrical undertaking.

Among the English municipalities which have applied or probably soon will apply for powers to build electric lines are: Bradford, Brighton, East Ham, Rotterdam and Surrey. The Surrey scheme contemplates over 29 miles of lines.

A trolley line is being constructed to connect the scene of the decennial production of the Passion Play at Oberammergau with a railway some 14 miles distant, thus making unnecessary the former mountain ride to the picturesque locality.

In Liverpool 28 miles of tramway out of a total of 78 have been equipped for electric traction, and it is expected that next year all of the main lines will be electrified.

October 17th the London County Council resolved by a large majority to build five lines of light electric railways, and the Highways Committee was authorized to take the necessary steps in connection with the application to the Light Railway Commissioners. It is proposed to run a 5-minute service on each of these lines and the receipts are estimated at 11d. per car-mile and the working expenses at 5d.

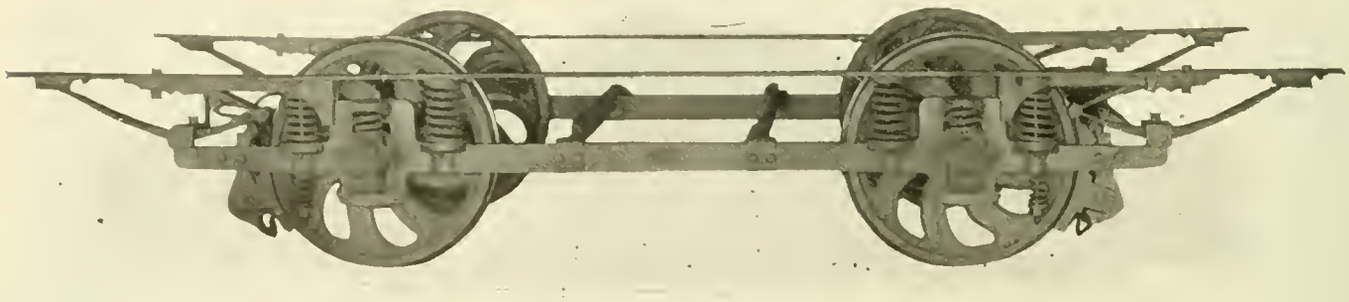
The Federal Council in Switzerland has granted a concession to Messrs. Zen. Ruffinen and Willa, of Loeche, and others, for an electric railway from Loeche, on the Jura-Simpton Ry., to Loeche-les-Bains. The first section of the road will be built on a 53 per cent grade and will be 1½ miles long. The second section has an average grade of 20 in 100 and is 5½ miles long. A water-power plant on the River Dala will be erected to give the necessary power.

Councillor Smith, of Bolton Corporation (Eng.), has compiled a pamphlet entitled, "Notes for Guidance in Organizing the Bolton Corporation Tramway System." He states that no uniform method of management for corporation tramways has been generally adopted in England, the three following arrangements having been used in various places: (1) An engineer and traffic superintendent independent of one another, which is characterized as a bad management, because responsibility can never be fixed on one man. (2) The engineer subordinate to a general manager, who is not an engineer, as on the Blackpool & Fleetwood line. This is thought to be better than the first mentioned arrangement, but causes engineering matters which are of primary importance to be neglected, through want of proper appreciation. (3) The appointment of an engineer as general manager, and the appointment of a traffic superintendent. This system has been adopted on many tramways, Blackburn, Coventry, etc., and is thought to be the best plan.

McGUIRE TRUCKS AT THE CONVENTION.

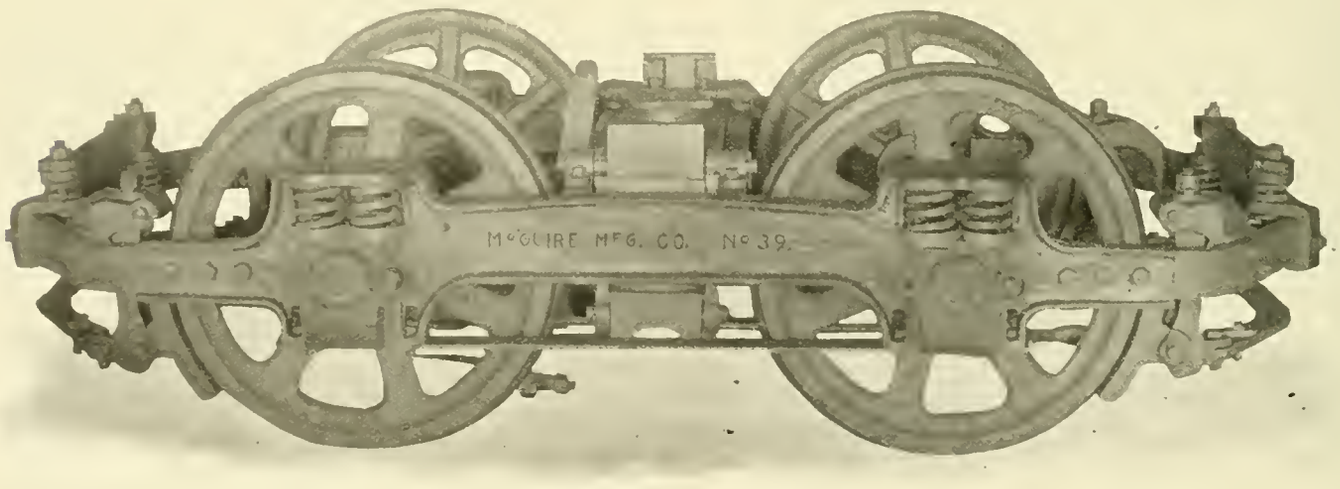
The McGuire Manufacturing Co., of Chicago, made one of the largest exhibits at the convention, its display consisting of trucks, stoves, brake handles, a sweeper, etc. Among the trucks exhibited were the McGuire No. 35 and No. 39 double truck which are shown in the accompanying engravings.

The principal departure in the construction of these is the arrangement of the springs. The frame sits upon four spiral springs over each journal box, the seats for the springs being cast on the journal box and the caps in the frame. These springs are of short movement and merely act as a cushion between the axle and the frame. The car body is carried upon a combination of spiral and elliptic springs which are arranged in a rather unique manner under the main bolster, resting upon a steel plate which is hung from the transoms by very heavy links. The bolster is so constructed as to completely house the springs. The side frames are made from cast steel, which possesses unusual tenacious qualities, samples of these side frames being shown in the McGuire exhibit, twisted and bent into the most trying and peculiar shapes.



McGUIRE NO. 35 TRUCK.

These trucks are claimed to be capable of carrying car-bodies up to a weight of 40,000 lb. at a speed of 60 miles an hour, with perfect safety. A test of one side frame of the No. 35 truck showed a deflection of ½ in. with a permanent set of 5-16 in. under a pressure of 55 tons, without sign of fracture, and the cast steel bolster under a pressure of 140,000 lb. showed a deflection of 3½ in. and a permanent set of 3 in. without sign of fracture, and it took a pressure of 160,000 lb. to break the bolster. All the bolsters used are tested up to 70,000 lb. and all side frames are tested up to 40,000 lb., and in a test of 700 bolsters and 1,400 side frames, not a single frame or bolster had to be rejected. The McGuire company claims that there is no other form of construction where so large a factor of safety is obtainable.



McGUIRE NO. 39 TRUCK.

The Union Traction Co., of Anderson, Ind., has let contracts amounting to $50,000 for the construction of four bridges.

THE ELECTRIC-CABLE OF MONT-DORE.

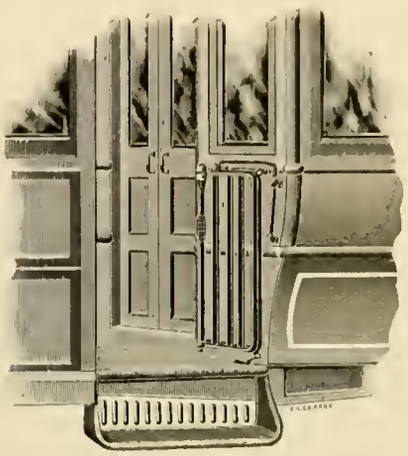
An interesting cable road was installed not long ago in the city of Mont-Dore, France, by Messrs. Guitton & Co., French representatives of the Oerlikon Co., at Zurich. The motive power for the tramway is derived from the River Dordogne and is transmitted to the point of utilization by three-phase currents by means of which an electric motor is driven.

The object of this tramway, which is described in La Nature, is to permit the invalids of an air cure establishment to follow a regime of baths and inhalations of air in a neighboring forest of pines. The River Dordogne crosses the city of Mont-Dore, and furnishes a supply of about 600 litres per second. A dam is built across the river and canal of 740 meters in length opened to the power house. The latter contains a turbine of 180 h. p. making 500 r. p. m. which is directly coupled to a three-phase generator of 138 kw. capacity, at 3,600 volts and of a frequency of 50 p. p. s. The fields are excited by a small dynamo of 600 watts at 50 volts, mounted upon the shaft of the alternator. The transmission line is composed of three bare silicon-bronze wires of 4 mm. diameter, carried on double petticoat porcelain insulators. The electrical energy is transmitted to the summit of the mountain, up which the road runs, where there is a sub-station, in which is located an electric motor which operates the cable drums. This is a three-phase synchronous motor with a revolving field of 12 poles, making 490 r. p. m. The motion is transmitted to the drum by means of two shafts and the necessary gears and pinions. The direction of rotation of the drum is changed by changing the direction of two of the three windings. The cable road is built upon the side of the mountain and the cable which carries the cars and which runs over pulleys driven by the drum motor, has a diameter of 33 mm. and weighs 3.9 kg. per running meter. There are two cars weighing 5,035 kg. attached to the two extremities of the cable.

This installation is the only one of its kind in France and is useful in permitting travelers to profit by the baths and air cures of Mont-Dore.

FOLDING PLATFORM-GATE.

In the accompanying engraving is shown a folding platform-gate, recently placed on the market by the R. Bliss Manufacturing Co., of Pawtucket, R. I., which company has been making platform gates that are sold under the trade name of Wood's patent safety gates, for a number of years, and has many thousand in use. The gate illustrated herewith embodies a number of new features developed by long experience. It consists of a light, strong frame work, made in two halves which are hinged together and which fold back,



FOLDING PLATFORM-GATE.

one upon the other, against the end of the car body when not in use. By means of a rod attachment this action is automatic, it being necessary simply to release a latch and give the gate a slight push, when the sections fold up, out of the way as shown.

The chief advantage of the device lies in the small amount of space it takes when folded up, and also in its small sweep, when being opened or closed, enabling it to be used on crowded platforms without inconvenience to passengers. It has been found where the gate has been applied to the cars of a system that the number of platform accidents has been greatly decreased.

HALF FARES.

The Cleveland (O.), Medina & Southern Electric Ry., has secured an extension of its franchise which was about to expire.

It is said contracts will shortly be awarded by the Kohaha & Hilo Railway Co., of Hilo, Hawaii, for the construction of 130 miles of electric railway.

There are reported to be seven young lady conductors on the electric cars of Chillicothe, O., and five at Vincennes, Ind. They work nine hours a day and receive $4 a week.

An ordinance has been passed requiring the Brooklyn (N. Y.) Rapid Transit Co. within six months to place board walks and a guard rail fence on each side of the tracks of the elevated road structure.

The Union Traction Co., of Anderson, Ind., is perfecting arrangements for an interurban mail service along its route as soon as the lines are completed. Each city on the route will have three mails every day.

The International Traction Co.'s line from Tonawanda to Lockport and Buffalo was opened for traffic October 25th. Manager Van Horn and a party made the first trip over the road, covering the distance in 57 minutes.

A franchise was granted last month by the city of De Kalb, Ill., to the Sycamore & DeKalb electric railroad. It contained so many restrictions, however, that the company declined to put in the road under its provisions.

It is announced that a consolidation of the United Railway & Electric Co. and the United Electric Light and Power Co. of Baltimore has been effected, and that an effort will be made to secure control of the Consolidated Gas Co., which has an exclusive franchise in the city.

The new street railway at Chattanooga, Tenn., is expected to be completed and in operation by November 10th. This line has been built at a cost of $15,000, and as soon as it is opened work will be commenced on a number of extensions, which will cost about $100,000 more.

After six weeks of mule car service the electric cars in Austin, Tex., started running on October 25th. The service was stopped by lack of water power, which has since been increased by a rise in the water of Lake McDonald sufficiently to light the business portion of the city and to run a few cars.

It is stated that in order to avoid, if possible, the trouble experienced last winter with the closing of the cable slot in cold weather, the Metropolitan Street Ry., of Kansas City, Mo., will remove the paving blocks which are adjacent to the slots and substitute therefor ashes, slack or some other yielding material.

The Brooklyn Rapid Transit Co. sometime ago offered a prize of $5 for the best paper on the duties of a motorman and on damage to electrical equipment caused by careless handling of controllers. The contest was open only to motormen attached to the Flatbush depot. Motorman Hugh Ruane was awarded the prize.

Judge Dale of the District Court at Wichita, Kan., granted a permanent injunction restraining the Wichita Street Railway Co. from operating its plant and ordering all the cars and tracks from the streets. A new company was given a franchise by the city council, but the old company refused to surrender the streets.

The Quakertown (Pa.) council sometime ago served an injunction on the Quakertown Traction Co., restraining the latter from laying new rails, on the ground that they were not girder rails. The Traction company had to obtain a letter from William Wharton, jr., & Co., testifying to the fact that the rails that were being put down were girder rails.

The Calumet Electric Railway Co., which is building an extension through Pullman, Ill., was stopped temporarily last month pending an inquiry into the validity of its franchise, which was originally granted to George M. Pullman by the town of Hyde Park, and since transferred to the Calumet Co. The franchise was decided to be valid.

A short strike of all the employes of the San Antonio (Tex.) Street Railway Co. took place in October. The trouble was finally settled by the company agreeing to recognize the union, to pay motormen and conductors $1.50 per day of nine hours, 16 2-3 cents per hour for overtime before midnight, and allow pay for time and a half for overtime after midnight.

Mr. W. J. Watson is now the New York representative for American Electrical Works, of Providence.

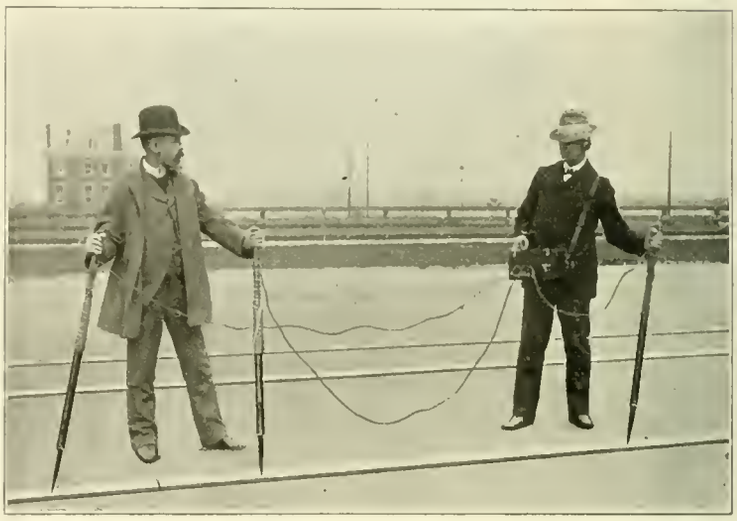
Mr. Francis E. Donohoe, agent for the American Electrical Works, of Providence, has extended his territory and will hereafter handle all the business west of Pittsburg.

We have received a copy of the new pamphlet of the Famous Filter Co., of St. Louis, entitled "Modern Engineering Practice." This should be in the hands of every one interested in the use of oil.

Mr. O. M. Hubbard, formerly manager of the electrical department of the Bradford Belting Co., has formed a new company to be known as O. M. Hubbard & Co., with headquarters at 105 East Pearl St., Cincinnati, to deal in insulating and hot surface paint, belting and general street railway supplies. The new concern desires to make agency connections with reliable manufacturers.

NEW METHOD OF TESTING RAIL JOINTS.

A simple and efficient device for determining the resistance of rail joints is being introduced by the Chase-Shawmut Co., 161-163 Fort Hill Square, Boston, Mass. The method of using the instrument is clearly shown in the accompanying illustration. The operator carries, suspended from his shoulder, the case containing a continuous interrupter in circuit, and a telephone attachment. His assistant strikes the two connecting poles into the rails, spanning the joint to be tested, with about 3 ft. between the poles. The operator then strikes his indicating pole into the rail about 4 ft. from the center pole, and by means of a switch alternately throws the telephone and interrupter into the circuit from the joint, and then from the 4 ft. of rail, comparing by means of the telephone receiver, the two sounds from the joint and rail. If he finds the sound from the joint is the louder, he shifts his pole so as to span a greater length of rail. When the sounds are found to be approximately equal, a final test of balance is made by leaving the switch



TESTING RAIL JOINTS.

on the box in the middle position, when no sound should be heard. In case a slight sound is noticeable he shifts his pole until this entirely disappears. In this way the length of rail equivalent to the joint is found, and from this, if it is desired, knowing the weight of the rail, the resistance can be calculated.

The instrument utilizes the ordinary working track current, and no matter how variable this current may be, since the variation through the joint and adjacent rail is precisely the same, it introduces no error. An intensifying attachment on the instrument permits its use with very weak currents. The invention has stood the test of continued operation in practical service, being now in use by several of the largest railways in New England, on one of which over 4,000 joints have been tested with it, and results recorded to great economic advantage.

$12.40 TO CHATTANOOGA AND RETURN.

For the unveiling of the Illinois monument on the Chickamauga battlefield, the Monon Route and C. H. & D. Ry. will sell tickets to Chattanooga and return for $12.40, November 19, 20 and 21, good to return to November 26, inclusive. City ticket office, 232 Clark St.

A MESSAGE TO GARCIA.

The New York Central & Hudson River R. R. has reprinted, as No. 25 of its "Four-Track Series," the small "preachment" by Elbert Hubbard entitled "A Message to Garcia," which has recently been attracting so much attention. Street railway managers wishing to distribute this exceedingly valuable pamphlet among their employes may obtain copies by sending 50 cents for each 100 desired to George H. Daniels, general passenger agent, Grand Central Station, New York.

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CORRESPONDENCE.

We cordially invite correspondence on all subjects of interest to those engaged in any branch of street railway work, and will gratefully appreciate any marked copies of papers or news items our street railway friends may send us, pertaining either to companies or officers.

DOES THE MANAGER WANT ANYTHING?

If you contemplate the purchase of any supplies or material, we can save you much time and trouble. Drop a line to THE REVIEW, stating what you are in the market for, and you will promptly receive bids and estimates from all the best dealers in that line. We make no charge for publishing such notices in our Bulletin of Advance News which is sent to all manufacturers.

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Two Chicago men have conceived the idea of providing a dining car service on electric railways with especial reference to the accommodation of persons living in outlying towns and having to go to the neighboring city when they would attend the theater. Such a buffet service would enable the suburbanites to dine after the play, and with minds free from the care which the necessity of "making their train" now imposes. And if operating agreements could be made with the city street railway companies, so that the patrons might take the car at the theater door, this service would also do away with an often disagreeable walk to the station.

Street railway men are not much interested in steam locomotives or car interchange rules, nor are steam railroad men at the present time to any great extent concerned with electricity as a railroad motive power, yet there are a number of points, such as shop design, equipment and management, track construction, discipline of employes, signalling, etc., which the two classes could discuss together with mutual advantage. For this reason membership in one of the railroad clubs should prove attractive to superintendents, master mechanics and track masters of the electric railways located in and near the cities where the railroad clubs hold their meetings. The New York Railroad Club meeting in New York City and the Western Railway Club meeting monthly in Chicago, both have a number of street railway men on their rolls, and it seems to us that an effort to secure more members from the electric railways would meet with success.

Companies using transfer tickets will do well to instruct conductors to give the passenger the benefit of a doubt as to the validity of the transfer ticket presented when there is good reason to believe the error was caused by carelessness of the conductor issuing the same. The Citizens' road, of Memphis, had a provision printed on its transfers, which required the passenger accepting the transfer to read and examine same and failing to do so thereby forfeited his rights in case the ticket was improperly punched. This the Tennessee courts hold to be unjust and placing an unreasonable burden upon the passenger, upon whom all the burden of the "controversy" is thereby placed.

At various times since the city of Milwaukee failed in its attempt to enforce a 4-cent fare ordinance, proposals have been made with the object of effecting settlement of the differences between the company and the city. In November, 1898, Mayor Rose and the company had agreed upon what they considered an equitable basis, but as a provision for 4-cent fares was not included the popular clamor against the plan was great, and the company withdrew its offer. On another page of this issue we give the essential features of a new ordinance presented to the council last month; this represents the latest effort to compromise, but there is no certainty that this ordinance will be passed.

The past year has been a very satisfactory one for most of the street railways of this country, as the continued and increasing prosperity of the people has made itself felt in the street railway field as well as in other lines of business. One of the effects of this has been the renewal of equipment and rebuilding roadbed on the existing lines and a great stimulus given to the promotion of new roads. It is a great pity that the orders which now overcrowd the factories making street railway supplies, to the embarrassment of old enterprises as well as new, could not have been distributed over the last three years. Of course the promoter of a new company who could not then float his securities must be excused for not building his road three years ago, but there have been many orders placed comparatively recently for supplies that were badly needed, just when the makers needed the work worst and would have done it cheapest.

We have no accurate data compiled as to the number of new companies that have actually started to build electric roads since January, 1899, but it is very large. In April last we published a list of about 400 companies, both old and new, that had been recently incorporated or were engaged in making extensions or securing franchises; since that time there has been an activity quite as marked.

The greatest activity has been in the interurban field, which is largely due to the fact that practically all the towns that could support a street railway, and also many that could not, were already supplied. The interurban electric railroad has great possibilities in the way of freight and express transportation which are rapidly being developed. Pleasure riding is an important source of income on such roads and in some parts of the country a special excursion business has been catered to with success.

Next to the building of new roads, no feature of the year has been more marked than the number of consolidations of street railway properties that have been effected. Among

the most notable of the consolidations are those at St. Louis, Washington, Baltimore, Brooklyn, Chicago, Buffalo, Akron, Pittsburg, Nashville, the 33 companies in Eastern Massachusetts and Rhode Island, and combination of roads in New Jersey, in Connecticut, in Indiana, and in Eastern Pennsylvania. There is every indication that the coming year will see further development along the same lines.

From this time on the tendency in track construction will be in the direction of a much more durable roadbed than has been the general rule with such work in this country. In England and on the continent of Europe, railways have long ago decided on a type of track which was expected to be permanent, and we predict that in this country it will be found expedient and economical to construct in the same manner. The rapidly decreasing supply of wood ties, and the expense of replacing old with new, combine to form a maintenance account which reaches into large figures. A few years ago it seemed that the metal tie was destined to solve the tie problem, but we confess to a disappointment in the results obtained in this direction, and the very limited amount of it which has been used. It would now seem that cement will be the coming factor in rail support for city work. Its adaptability, the ease with which it can be placed in position, and the certain decrease in cost of this material will bring its claims strongly to the attention of managers.

While no very great amount of this work has been completed to date in this country, the total is by no means inconsiderable, and in the several cities which have used the cement construction, the results thus far are decidedly promising. Its very greatly increased use by cities for foundations in their street paving, is strong evidence of its practicability.

In many parts of the country cement plants are being pushed to completion by men working night and day; nor are these new plants small and insignificant affairs. On the contrary, they are many of them of large capacity, having an output of 1,000 barrels per day. In addition, numerous smaller plants from 200 to 500 barrels per day are building. Both the demand and the supply will be greatly increased during the next few years.

During the past few years great care and study have been given to the question of the economical production of power, and on nearly all the large roads a system of comparative records of costs is used which enables even the smallest wastes to be detected and stopped. All the many station supplies are carefully watched and the result has well paid for the expense and trouble of keeping the records.

But we are inclined to believe that in not a few cases the idea has prevailed that the power station is the only place where this degree of care need be taken in watching expenditures, and other equally important departments have been neglected.

In the matter of car repairs, for instance, very few managers have deemed it necessary or perhaps possible to work out any such reform as has been done at the station. And yet here is a department which in the course of a year consumes a great deal of money.

It is our observation that as to car repairs, the place to save is most largely in the selection and purchase of the rolling stock. It is by no means an infrequent occurrence for a road to spend in repairs the first two years alone an amount of money, which, if it had been added to the first cost of the car, would have secured material and construction which would have saved itself many times over in 10 years, to say nothing of the indirect loss of earnings during the time the car is out of service while being shopped.

In this issue is an extremely thoughtful and suggestive article on "Quality in Car Building," which is well worth reading more than once. The rage for low-priced cars is already beginning to subside, and we call to mind several roads which are not placing orders with the lowest bidders. They have learned the lesson of saving one dollar to lose ten, and it will be a good day for users and builders alike when the managers of the country come to realize the folly of trying to get something for nothing.

Within the past few years there has been a noticeable tendency to broaden the scope of street railways by the haulage of freight, express packages, mails, etc., in addition to their regular passenger traffic. This tendency has of late been very greatly augmented with the advent of the long interurban lines which are springing into existence all over the country, and which are admirably adapted to carry on a local freight and express business, especially in the line of light freight and small packages, which can easily be handled without any interference with the regular passenger schedules.

On a number of railways where a freight service has been introduced, considerable opposition has been manifested to it and the right of street railway companies using the public highways for other than passenger service has been questioned. A decision upon this point, which seems eminently sensible, was recently handed down in the appellate division of the New York Supreme Court. Some of the Brooklyn railways occupying public streets contracted to carry the freight of the National Express Co., and suit was brought to prevent them from carrying out the contract. The court held as follows:

"The right to use the track is subordinate to the right of the public to the street, and the courts will protect the rights of the public. The street railroad company has the paramount right of the use of its tracks, but not the exclusive use. It is not clear that the transportation of goods in single cars over the Brooklyn tracks will increase the burden of use of the street; certainly there is no evidence that this method will be more burdensome than would be the carriage of the same freight on wagons."

The decision recognizes that the freight must be carried through the streets in some way, and so far as the public is concerned it makes no difference whether it is carried in wagons or in electric cars. As long as a street railway can carry freight without interfering with the public's use of the street, it should have the right to do so. This right, of course, would not include the use of long and frequent trains loaded with heavy freight that would not ordinarily be transported on wagons, as such a service would incommode both the public and the railway company even to a greater extent by interfering with its passenger traffic which on most roads comprises the principal business.

This decision in regard to light freight, however, would seem to be extremely equitable, and should prove a valuable precedent in other communities where this question may arise, as there is but little doubt that at no distant date freight and express service will form an innovation in the railway business which will eventually prove as acceptable to the public as it is profitable to the railways.

System of the International Traction Co., of Buffalo, N. Y.

Interurban Lines Niagara Falls Power Arch and Suspension Bridges Transformer Stations Spliced Cars Electric Welding of Rail Joints.

By the consolidation of 14 different street railway companies in Buffalo, as many different lines have been brought under one management, with a trackage aggregating 340 miles, and the new company is known as the International Traction Co., with headquarters at 102 Main St. The lines, however, are not confined to the city of Buffalo, but include, with all the lines in Buffalo, interurban lines connecting Buffalo with both the cities of Niagara Falls, one in New York and the other in Ontario, Lockport, the two Tonawandas, Lewiston, Lancaster and Depew, with the local lines in each city, except the Gorge road at Niagara Falls, with which the company has a traffic agreement. The relation and comparative distances of the several cities included in the system are shown in the accompanying diagram, Fig. 1, which is reproduced from a beautiful relief map in colors, which is issued by the company and contains a description of the natural attractions in and about Niagara Falls, and the neighboring historical regions.

FIG. 1. BIRD'S EYE VIEW OF INTERNATIONAL TRACTION SYSTEM.

A stranger visiting Buffalo, should he have an opportunity of meeting with many of its citizens, either in a business or a social way, will be surprised at the marked good will that he will hear expressed for the new company and its management. The liberal manner in which the company has set about improving the tracks, the extension of new lines, the long cars and increased speed, are the principal subjects of remark, and everyone will claim that Buffalo has the best street railway system in the world.

The system is operated in divisions. The lines in Buffalo proper form three divisions; there are four suburban lines, and three systems in other cities. Other divisions are: The line between Buffalo and Niagara Falls, N. Y., and the local lines in Niagara Falls except the Gorge road; the Buffalo and Lockport line, with local cars in Lockport; the Buffalo, Kenmore and Tonawanda line; the Buffalo and Lancaster and the Buffalo and Tonawanda lines; the Niagara Falls Park & River road in Ontario.

The divisions most interesting to a stranger or visitor are those at Niagara Falls and those that center about the Falls. Twelve long cars are regularly run between Buffalo and Niagara Falls on a 15-minute schedule, but, in summer, as the traffic demands, extras are run and frequently the headway is as short as five or ten minutes. The distance is about 28 miles, the fare being 35 cents one way and 50 cents for the round trip. The passengers are landed in Niagara Falls at Prospect Park near the end of the company's new steel arch bridge, which spans the river gorge just below the American Falls, Fig. 2. Here the visitor has the choice of visiting points of interest near the Cataract or transferring to the bridge cars which connect with the lines on the Canada side. From the bridge a very excellent view is had of the entire falls. This bridge was completed during the past year and replaced the suspension foot bridge which occupied the same site, but by means of which the steel arch bridge was constructed. The steel arch has a clear span of 840 ft. and the highest point of the arch is 195 ft. above the water. After crossing the river the cars continue up the river along the bank to what is known as the Queen Victoria Niagara Falls Park 2½ miles to the village of Chippawa, just above the mouth of Chippawa Creek, and which was formerly the terminal of lake navigation. This route is an attractive one for tourists, for, from the various points very fine views are had of the two falls, and the Canadian Rapids, where the river descends over its rocky and wide bed 50 ft. in a mile.

For those who wish to refresh their memory regarding the falls, the following dimensions are given: The great curve of the Horseshoe Falls is 3,010 ft., with a height of 158 ft., and it is estimated that more than 280,000 cu. ft. of water pass over the precipice each second. The American Falls are 1,000 ft. long and 167 ft. high, but the sheet of water is very thin and the direction is about at right angles to that of the Horseshoe Falls, or, rather, the water falls over the side of the gorge that has been cut by the Great Falls.

From Chippawa the cars return down the river to the bridge and continue along the brink of the cliff, forming the west side of the gorge to Queenstown Heights and the village of Queenstown, about seven miles below the steel arch bridge. This is known as the Canadian Scenic Route, and gives the tourist a panoramic view of the gorge and rapids and Whirlpool Rapids. Opposite the Whirlpool Rapids the line crosses a high viaduct over what was once one of the branches of the river flowing from this point to the lake. The width of the gorge varies from 800 to 1,500

ft., but at the base contracts to 250 ft., and is from 250 to 350 ft. deep. On this route one has a good view of the steel cantilever bridge of the Michigan Central R. R., and the steel arch bridge of the Grand Trunk Ry., which was built in 1897, on the site of the old Suspension Bridge which it replaced, the work having been done without suspending the traffic over the old bridge. This bridge has a total length of 1,100 ft., is 226 ft. above the water, and the width of the center arch is 550 ft. At Queenstown Heights the

FIG. 2—NEW STEEL ARCH BRIDGE.

cars pass near the Brock Monument, which marks the battle ground of 1812, where the Americans were defeated, and where the British commander, Gen. Isaac Brock, was killed. The column of the monument is surmounted by a heroic statue of the general in full uniform; the height above the ground is 185 ft.

From the heights the line of the track zigzags down the side of the hill and on to the terminal of the new suspension bridge, which was built by the railway company during the past year. This bridge is on the site of one that was destroyed in 1864 and spans the mouth of the gorge and connects Lewiston with Queenstown. The cable span of this bridge is 1,040 ft. and the suspended span 800 ft.; the roadway is at a height of 65 ft. above the river. The cars cross the bridge and run along the cliff above the tracks of the gorge road towards Lewiston, where connection is made with the cars of the Niagara Gorge R. R., on which the return is made to Niagara Falls. The route takes the passenger along the bottom of the cliff on the east side, near the edge of the river, so that a very close view is given of the rapids and whirlpool. In connection with this route the company has established a belt line service by which the trip can be made around the gorge without change of cars and for which the fare from Buffalo and return is $1.25. It is the intention in the near future to run the belt line cars in both directions.

The Lockport division, as above noted, embraces a line from Buffalo to Lockport, a distance of 15 miles, on which six cars are run, on a half-hour schedule, the fare being 60 cents for the round trip. The local cars in Lockport are run on a 10 and 15 minute headway, and six cars are operated. The cars lie over at Lockport 20 minutes for inspection and to give the motors time to cool off. The Lockport line leads out from Buffalo along Main St. and runs to Tonawanda, from which place it occupies the former roadbed of a line until recently controlled by the Erie R. R., and on which steam cars were operated. This is one of the few steam lines in the country on which electricity has superseded steam for both passenger and freight service. For the freight service the company has installed two electric locomotives of the General Electric type, each of which hauls 18 loaded freight cars or from 18 to 30 empty cars at a time. These trains are run on the same dispatcher system that was employed with the steam service.

The lines of the Depew Division pass through four villages, namely, Sloan, Belleview, Depew and Lancaster. This line leaves Buffalo by Broadway, and is 14 miles in length. The fare for the round trip is 25 cents. The line serves a population of over 10,000. Depew is a comparatively new manufacturing village, where about 3,000 hands are employed, many of whom live in Buffalo and ride back and forth every day.

The other divisions have no special features and will not be described in detail. Some of the suburban lines are built on the public highways and others occupy private or leased rights of way.

POWER.

One of the most interesting features connected with the International Traction System is the power equipment. Although the company owns a steam generating plant in Buffalo of 7,500 h. p. capacity, and which is known as the Niagara St. plant, a large part of the power is bought from the Niagara Falls Power Co., or, rather, from the Cataract Power & Conduit Co., which is the name of the local company in Buffalo, which receives and distributes the cur-

FIG. 3—LEWISTON BRIDGE OPENING DAY.

rent, both for light and power, that is generated by the water power at the falls, over 20 miles away. The railroad company, however, now receives a part of its power direct from the transmission line and transforms it in its own station. In this connection it is interesting to note the development in the employment of this power by the railway company. In June, 1896, the Buffalo Railway Co. purchased from the Cataract Power & Conduit Co. 1,000 electrical horse power, which was delivered from the distributing

station at a pressure of from 350 to 375 volts, 25 cycles, to rotary converters which were located at the Niagara St power station, and which converted the alternating current to a continuous 500-volt current by which the cars are operated. After one year a second block of 1,000 e. h. p. was taken and a 2,000-h. p., one hour rating, storage battery of the Electric Storage Battery Co's. type was installed at the power station to assist in taking care of the peak of the load, and render the consumption of power economical throughout the 24 hours.

After another year's use the new company made arrangements to purchase direct from the producing company sufficient power to operate all the regular cars in the city of Buffalo, which under ordinary conditions require about 5,000 e. h. p., equivalent to the entire output of one of the big generators at the Niagara Falls station. The peak of the load frequently runs up to 8,000 or 10,000, and on rare occasions to 12,000 h. p. Instead, however, of receiving the current after it had undergone one transformation as formerly, the railway company has put in five new transformer stations in different parts of the city and which were put in operation the first of the present month, and to each of which the Niagara current is delivered direct from the transmission line by means of insulated underground cables at the same pressure, namely, 11,000 volts, at which it is brought from Niagara Falls to Buffalo. Each of these stations is similarly equipped, except that some have two and others three 400-kw. rotary transformers; there are three static transformers for each rotary. The general plan of these stations is shown in Fig. 4, which is an inside view of what is known as the Cold Spring Station, located in a brick compartment 50 x 30 ft., which occupies part of the repair shop building which stands at Michigan and Main Sts. This is intended to be the model station of the lot when completed. The switchboard, which does not appear in the engraving, is a very elaborate affair, and stands at the back of the room and has the very latest improvements known to the art. The station equipment consists of six static transformers, shown on the right of the illustration, two rotary converters, each of 400 kw. capacity, and which, with the static converters and the switchboard, are all of the General Electric manufacture. The current is received through a single three-conductor cable at 11,000 volts, and 25 cycles, as above noted, and is led first through an emergency oil switch by means of which the entire station can be cut off. From this the current leads direct to the station panel of the switchboard, and through a new type of shunt fuse circuit breaker, there being one for each wire, and which are operated by a time limit relay so that an overload must be on the station three and one half seconds before the switch opens. With this arrangement there is a clock work and battery, and when the main line opens it is short circuited through an explosive fuse provided with tubes which lead the gases away and blow out the arc. From this panel the current is led to oil switches enclosed in fireproof brick compartments which are located above the switchboard and supported on steel frame work. From the oil switches the current is led direct to the static transformers from which it is stepped down to 375 volts and then goes direct through reactive coils to the rotaries which deliver it at 600 volts, direct current, to a standard direct current panel on the switchboard and then to the line feeder through wattmeters. Among the auxiliary equipment of the station may be noted a resistance box that is encased and located behind the switchboard and which is employed in starting up the converters on the direct current. A third rotary is now being installed.

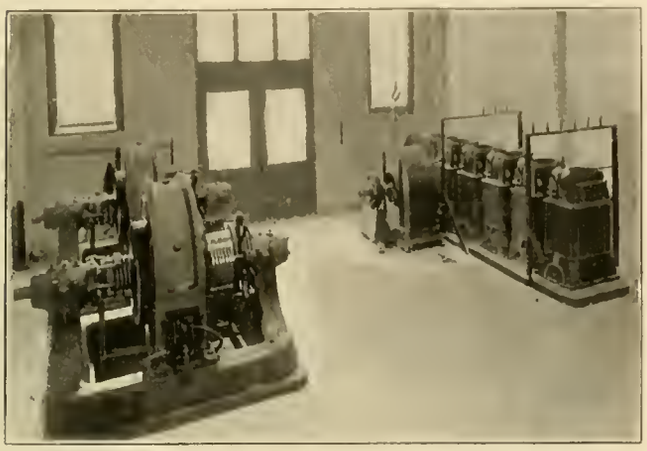


FIG. 4 INTERIOR OF TRANSFORMER STATION.

There are also two steel cased fan blowers made by the Buffalo Forge Co., and which are operated from a direct connected G. E. 3-h. p. motor. These blowers are placed one at each end of the line of static transformers and provide a blast of air which is conducted into a chamber leading under the transformers and from which it is led up about the cores and comes out through perforations in the cases. This blower with its motor is shown more fully in Fig. 5, and the 10 required for the five stations are all manufactured and installed by the Buffalo Forge Co., of Buffalo. This type of blower is the one at present employed by nearly all the General Electric transformer stations throughout the country.

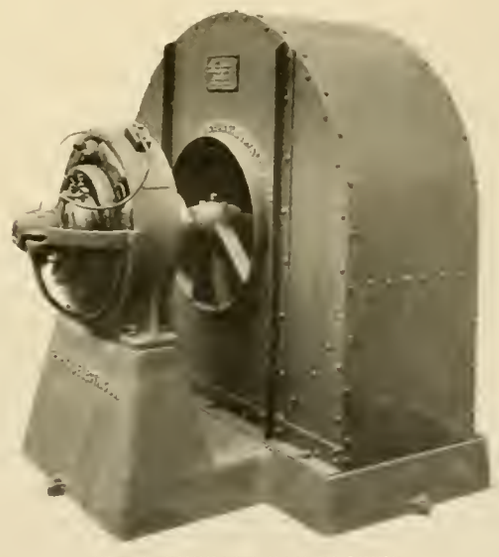


FIG. 5—BUFFALO FAN BLOWER.

In three of the transformer stations the converters are started by a direct current from the company's power station: in the other two the starting set consists of a 30-kw. induction motor with an independent set of special transformers. This motor is direct connected to a 25-kw. direct current generator which furnishes current to start the rotaries.

A special feature of the rotary is that each is provided

with an electro magnet placed in the bed frame at the end of the armature shaft and actuated by an intermittent current which gives a shuttle movement to the armature, so that the commutator moves back and forth under the brushes, thus producing uniform wear on the commutator collector, bearings and brushes.

ELECTRIC WELDING OF RAIL JOINTS.

Another interesting feature connected with the International railway system is the electric welding of rail joints. The railway company, recognizing the value of continuous rails, contracted with the Johnson Co., or, rather, the Lorain Steel Co., for the welding of 11,000 joints during the present season, by the electric welding process that has been perfected by the Steel company. The joints of all the new tracks that have been laid during the present season and a

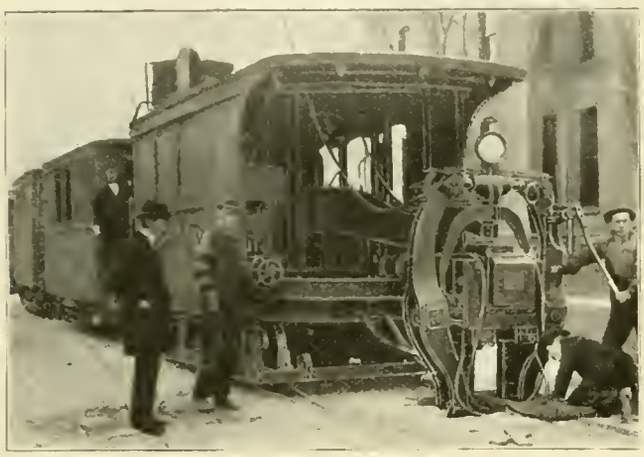


FIG. 6 WELDING TRAIN.

good many in the old track have been welded by this process, and what is still more interesting, copper conductor cables of 500,000 c. m. cross section have been provided to lead the current around all special work, and the terminals of these cables have been electrically welded to the

FIG. 7 SAND BLAST CAR.

rails each side of the special work, and the cables have been interlaced and welded together. By this means the special work is left so it can be removed or repaired without interfering with the return circuit. Although the process of electric welding has been described before in these columns, it has now become so thoroughly perfected as to details that it is regarded by its promoters as one of the cheapest and most desirable methods for uniting rail joints, both from the standpoint of durability and electric conductivity. For accomplishing the work the welding company employs two welding trains, consisting of five short cars each. The welding train proper consists of three cars, Fig. 6, while one of the other cars is known as the sand blast car, Fig. 7, and one as the emery grinder car, Fig. 8. On the last car of the welding train is mounted a 75-kw. rotary booster of the Crocker-Wheeler make. In the second car is also a rotary converter. The trolley current is led first to the booster, which holds it up to a uniform voltage of 500, when it is led to the second transformer which delivers it at 300 volts alternating to a static transformer which forms a part of the welding head shown in the figure. The secondary coil of this transformer consists of a single copper bar bent in the form of a horseshoe which terminates at the bottom of each side of the rail in a water-jacketed block, the face of which is about 3 x 4 in. In this transformer the current is stepped down to about 5 volts, but with about 30,000 amperes flowing. In the process of welding, if the rail is an old one containing punched bolt holes, the holes likely to be affected by the heat are reamed out by hand to about 1⅞ in. in diameter. The object of this is to remove the incipient checks that were formed in the metal in the process of punching and which open from the effects of the heat and form an initial rupture which has been found to give way under the stress of contraction. It is found that the rail is really stronger after the holes are reamed to the above size than before. In a test it was found that a 6-in. rail with a 2½-in. hole drilled through the web was stronger than the same rail with a punched hole of only 1⅛ in. in diameter. The breaking strength of the former was 400,000 lb., while the rails with the punched holes broke at 330,000 lb. Following the reaming, the rail ends at the welding points are cleaned with the sand blast and also the plates that are to be welded on to form the joint. The sand blast car is equipped with a 5-h. p. motor, which, in one train drives a single acting air compressor, and in the other a double acting, by which an air pressure

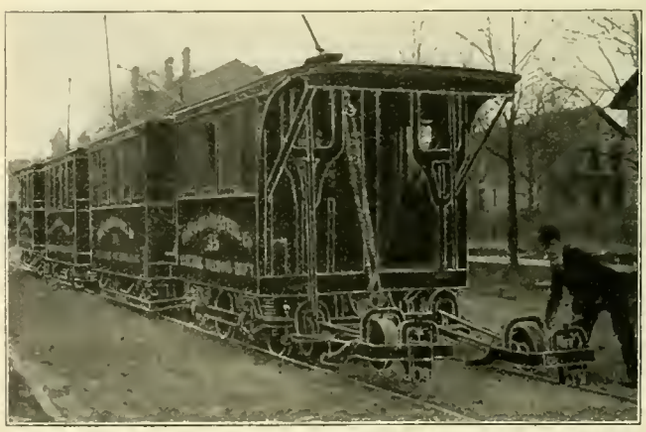


FIG. 8 EMERY GRINDER.

of 12 lb. per sq. in. is generated. This is led into a vertical tank containing sand, or an arrangement known as the Tilghman sand blast device, containing a double set of valves from which the blast is led through a 2-in. rubber

hose terminating in a ¾-in. nozzle. Sharp sand is used and it requires usually about 20 lb. to clean a joint; it is efficient and leaves the surface very fresh, insuring good electrical contact for the initial current. In the operation the attendant wears a shield over his head, as shown in the illustration. The car is also provided with an electric heater for drying the sand when it becomes necessary. The welder is next brought into position and the terminals of the movable jaws brought in position on each side of the rail. The welder proper consists of the transformer above described, and two curved pivoted jaws, which are actuated by an horizontal hydraulic cylinder which connects the upper terminals of the jaws and to which power is communicated by a small pump operated by hand power, as shown. The welding head is suspended to an adjustable jib and by means of power may be raised, lowered and turned from one side to the other, so as to operate on either rail. The splice bars that are employed are about 1 x 3 in. and from 17 to 23 in. in length. These are first prepared by having a pear shaped projection of ⅛ in. punched up at each end and a similar shaped piece fitted into the cavity on the other side of the bar. The projections form the in-

FIG. 9—OLD CAR.

itial points of contact when placed in position against the web of the rail. For the middle contact a thin strip of metal is placed between the bar and rail and the middle weld is made first. The bars being in place the terminals of the transformers are held against the base with a pressure of about 2,000 lb., and as soon as the current is well started and heat generated the pressure is slacked off until a welding heat is obtained, when pressure is increased to about 35 tons and held until the metal has cooled or become dark. The secret of success in electric welding has been found by experiment to consist in working the hot metal by pressure as is accomplished in ordinary welding by the blacksmith's hammer. The welds are made at three points on the bar, first at the middle and through the web, then at the ends of the bar. In case there is a gap between the ends of the rails it is filled by means of shims consisting of thin rail sections, which are provided in different thicknesses. An auxiliary equipment of the welding car consists of a motor to run the jib, which carries the welding head, and a motor to operate a small rotary pump, which causes the water to circulate through the welding blocks. There is also a blower driven by this motor which delivers a blast to a water cooling tank located on the roof of the car as shown, and which is provided with perforated shelves to facilitate the cooling process. Following the welding process, in case the joint is too high or uneven, the emery grinding car is brought into position and the surface is ground down to a uniform line. Two emery wheels are provided, one for each rail, which are mounted as shown, in a swinging frame, and are driven from an electric motor by means of V-shaped belts and grooved wheels. The frame is so mounted that it can be moved back and forth like a jack plane, and so bring the surface to a perfect level. With the above described equipment, from four to six rail joints can be welded in an hour. In 1897 the company welded 364 joints in a 6-in. rail at Johnstown, Pa., and up to date only one of these joints has broken, although the track has been in continuous service.

Special work with hardened steel centers is employed and is purchased of the Lorain Steel Co., Wm. Wharton, jr., & Co. and the Pennsylvania Steel Co. The Buffalo Ry. has laid about 17 miles of track with rails made by the Pennsylvania Steel Co.

SPLICED CARS.

The rolling stock includes 96 cars from 29 to 31 ft. in length, which have been rebuilt from 16 and 18-ft. cars that have seen from six to eight years' service. These long cars are not in all cases made by splicing two short cars, but in many cases the old car is expanded to the new dimension, as shown in Figs. 9, 10 and 11. The body is first cut in the middle and the parts separated. The old sills are then united by a ship's splice, when a new sill 4½ x 5 in. with entire new floor framing and end sills is placed under the whole, and the new and old sill bolted together at intervals. This plan is followed in order to give more headroom in the car and to provide strength. An 8-in. steel plate ⅝ in. thick covers both sills and is bolted to the outside, while there is a steel angle plate upon the inside at each corner extending 18 in. each way. The truss rods consist of a flat plate 2½ x ⅜ in. placed just under the window frames but bent down at each end at the second window from the end of the car, and linked into an eye bolt anchored to an angle iron on the bottom of the sill. A second straight flat bar 2½ x ¼ in. is placed just above the former and extends the whole length of the car through the end post, where it is held in position by heavy nuts. The sides of the car are filled out with new posts and panels, and the letter board in case it is wide in the old construction, is arched out above the windows. The hoods are then spliced out 12 in. The deck lights are of chipped glass and are stationary except two at each end on the opposite sides. The bumper is formed by a curved channel bar 8 x 2 in. and weighs 11 lb. to the foot. It is estimated that the cost of the spliced cars is about $700.

All the cars of the system are equipped with fenders of the type shown in Figs. 11 and 12 and which were designed by the master mechanic of the company and made in the repair shop. Quite a number of the cars on this system have an additional stationary fender consisting of steel frames placed on a line with the edge of the bumper and left to slant back to the dash.

The rolling stock of the entire system comprises 642 motor passenger cars, 98 trail cars, 72 service cars, consisting of snow sweeper, plows and levelers. All the cars are provided with vestibules of the Brill patent detachable type. Fifty of these spliced cars are mounted on Brill 27-F

trucks and equipped with G. E. 57 motors, and controlled by electric brakes of the G. E. type with a special controller and handle for operating the brake. Other spliced cars are mounted on double trucks which were rebuilt from some single trucks of the company's own make, known as the Buffalo truck, and used under 16-ft. cars. The motor and brake equipment of these is the same as for the 50 cars described above. There are 67 24-ft. cars which were built

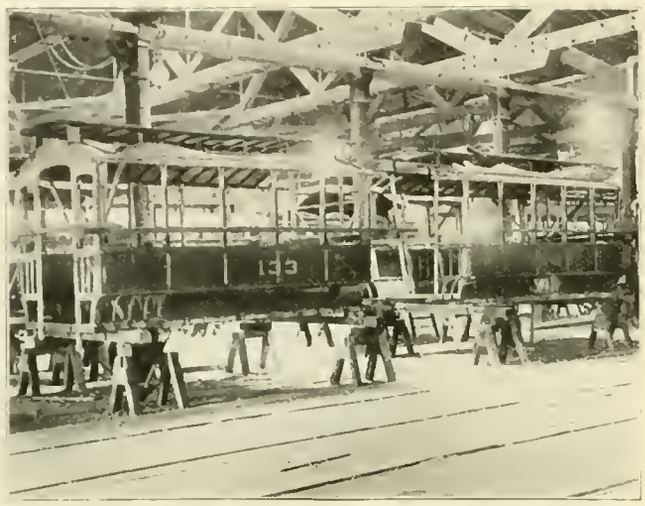


FIG. 10—PROCESS OF REBUILDING.

by the Brill company and which are mounted on Brill maximum traction trucks and equipped with G. E. 1,000 motors, and controlled by Sterling safety brakes, which are said to be giving excellent satisfaction. There are 30 27-ft. cars which were built by the Gilbert Car Co., of Troy, and which are mounted on Bemis trucks, equipped with G. E. 57 motors and electric brakes. There are five 27-ft. Brill cars on maximum traction trucks with G. E. 1,000 motors and equipped with air brakes of the Christensen type, with

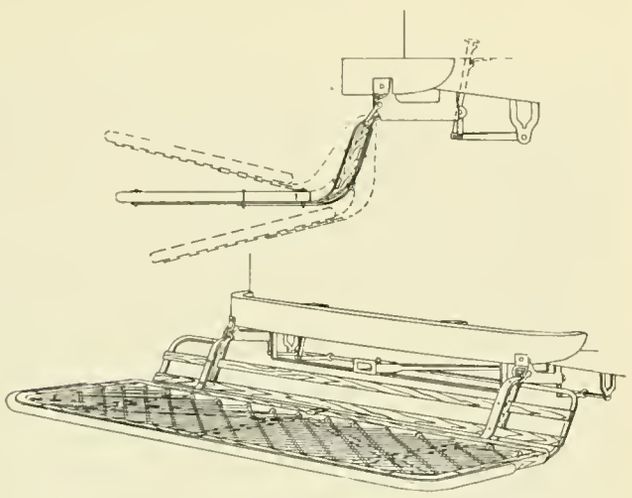


FIG. 12 FENDER.

axle driven compressors, the compressor being attached to the pony axle of the truck.

Thirty equipments of the Standard Air Brake Co's. make of axle compressors, which have been in successful operation since 1892, have recently been removed from closed cars and remounted on summer cars and the closed cars equipped with No. 57 motors and electric brakes. Thirty of Brill cars, 28 ft. in length, with Hale & Kilburn cross seats, are mounted on Brill No. 27 trucks and equipped with four G. E. 1,000 motors and hand brakes and are operated on the Buffalo & Niagara Falls line. These with some of the suburban cars frequently attain a speed of from 50 to 60 miles an hour. This speed is easily made wherever the current holds up to the full 550 volts. Ten 31-ft. cars with cross seats and mounted on Brill No. 27 trucks with four

FIG. 11 REBUILT CAR.

G. E. 57 motors, and electric brakes are operated on the Buffalo and Lockport line. On some of the other divisions single truck cars are run, some of which are 21 ft. in length, others 16-ft. and 18-ft. cars, but these are all of a style that are not suitable for splicing. It is the intention of the company, however, later on, to employ only double truck cars, and all new cars are to be mounted on Brill No. 27 trucks with four motors. Next year the rolling stock will be increased by the addition of 100 open cars, 50 of which will be 14-bench cars, the others 13-bench. There will be no seats on the platforms and the bodies will be

FIG. 13 SNOW FENCES.

mounted on 27 F Brill trucks, as stated, with four G. E. 1,000 motors. Before the Pan-American Exposition which is to be opened in Buffalo on May 1, 1901, an addition of 200 long cars will be made.

The standard color for cars operated in the city is wine color, with the exception of the 50 long cars that are run in the city limits and which are painted green. The color for the interurban cars is yellow or orange. The wheels

employed by the company are made by the New York Car Wheel Works, of Buffalo.

The snow plow equipment includes nine Ruggles rotary machines, equipped with G. E. 1,000 motors, and which were made in the company's shops. There is one McGuire plow and two old type T. H. sweepers. There are also seven double-shear plows designed by the master mechanic and made in the shops. The first of these was built last year and proved so efficient that six others have recently been constructed, with this difference that the shear of the new ones is double, so that the lower half may be lifted without raising the entire weight. These plows are equipped with two G. E. 57 motors, and weigh, fully equipped, about 13 tons. The shear is quite long and is set at an angle of about 45°. The framing is very heavy, of oak timber, with sills 12 x 6 in., set edgewise, and on the opposite sides that sill extends forward to the end of the shear near the top. The side frames of the truck are made with two channel irons which form a box and enclose an oak timber. These side bars also extend to the ends of the shear near its lowest point. The plows are provided with a fluke or leveler, which is operated from within the cab by means of worm gear and a shaft outside, around which a chain is wound, as shown in the illustration. The bracing for the shear is made from old flat and T-rails and the back of the shear is supported by vertical sections of T-rails which slide up and down in guides made to receive the head of the rail. The cab is closed with a door on each side, or an opening which on its lower half is provided with a door, with heavy curtains above, which can be pulled down to meet the door, and on the opposite side from the attendant who operates the fluke can be closed entirely, making the cab very comfortable for the workmen. The plow is operated by three men, one for the controller, one to operate and adjust the shear and fluke and one to watch the trolley pole. In addition to this equipment for snow protection, the company has erected in the city limits about 16 miles of portable snow fence, Fig. 13, which is put up in the fall and removed in summer. This fence consists of 16-ft. panels from 5½ to 6 ft. in height, and which is usually set staggered, as shown in the illustration. It is held in place by short posts driven into the ground, to which the bottoms of the panels are nailed.

The car house section adjoining the repair shop has been added to from time to time, in sections, and now is 600 ft. in length, with brick walls and steel structural roof. In constructing a new power house at Jefferson and Eagle Sts., during the present season, because of a difficulty in getting steel structural work from the mills, the company has employed old track rails, and finished up a 600 ft. structure which is 200 ft. in width, and has a capacity for 100 cars and housing for one of the emergency wagons and the horses to operate it.

The International Traction Co. is already making preparations to meet the anticipated increase of traffic incident to the opening of the Pan American Exposition, which is to be held from May 1 to Nov. 1, 1901. Both North and South America will take part, and it is claimed that this will be the first great fair exclusively American—that embraces a hemisphere. The exposition will be held on grounds embracing several hundred acres, located to the north of Buffalo, adjoining and including part of Delaware Park. The location is reached by six lines of electric cars, and it is the intention of the company to spare no expense to provide ample transit facilities.

FIG. 14 INTERIOR OF NIAGARA FALLS STATION.

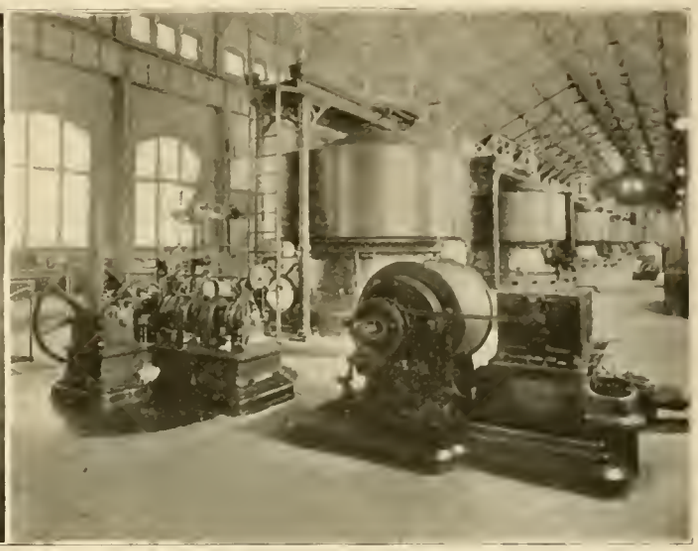


FIG. 15 GOVERNING APPARATUS

In connection with the Niagara power development, it may be stated that the companies engaged in furnishing electric power comprise the Niagara Falls Power Co., whose plant is located about a mile and a quarter above the falls. The buildings are of gray stone, the larger of which covers the wheel pit, which is about 150 ft. deep, in the bottom of which the turbines are placed, and to which the water is led by large steel penstocks. Vertical shafts support horizontal generators, as shown in Figs. 14 and 15; the latter shows the governing mechanism. The water on passing the turbines is directed into a tunnel 29 x 18 ft., located 200 ft. below the surface of the city, and discharges into the gorge just below the American end of the company's steel arch bridge, and 7,000 ft. from the wheel pit. The present capacity of the plant is 50,000 h. p., but work has already begun adjoining the former plant for a second equipment having the same capacity as the original station. A new

transmission line will also be built to Buffalo in the near future, and it is the intention of the International Traction Co. to put up a transmission line of its own.

A second company, known as the Niagara Falls Hydraulic Power & Manufacturing Co., controlled by Schoellkopf & Son, furnishes a large output of power for local manufacturers and chemical reduction works. This plant is located just below the American Falls and the water is led down the bluff in penstocks to turbines at the foot of the gorge. There is also a plant for generating power for local lighting.

On the Canadian side is the plant of Niagara Park Power Co., which was recently burned and is being rebuilt. This plant had a capacity of 2,500 h. p. The water is taken from the river just above the falls and is discharged through a tunnel leading into the gorge just below the edge of the Horseshoe Falls. This plant formerly supplied the power for operating the street railway lines on the Canadian side of the river. The turbines which were injured by the fire have been sent away to be repaired and the plant will be restored to its former capacity.

MANAGEMENT.

The affairs of the International Traction Co. are conducted by W. Caryl Ely, president; Daniel S. Lamont, of

W. CARYL ELY.

BURT VAN HORN.

Washington, vice-president; Burt Van Horn, general manager; R. S. Danforth, general superintendent, with five assistant superintendents; Richard F. Rankine, treasurer; J. E. Stevenson, passenger agent; and Robert Dunning, master mechanic.

Mr. H. H. Littell and Mr. H. M. Watson, former officers of the Buffalo Railway Co., are still residents of Buffalo, the latter being president of the local Bell Telephone Co.

By next spring the electric railway between Grand Rapids and Kalamazoo, Mich., will be in operation for the distance of 50 miles. It is said that the fare will be at the rate of one cent a mile and the line will compete directly with the steam road between the two points.

W. W. Hatch, who has been engaged in constructing and operating electric lines for the past 10 years, has organized the Goshen & Indiana Traction Co., to construct 56 miles of interurban connecting Goshen with Angola. The private right of way has all been secured and the new line will enter a large territory at present without transportation, passing through the towns of LaGrange, Lima, Orland and along the north shore of Lake James. The officers are Judge F. S. Roby, president; W. W. Hatch, vice-president and general manager; John F. Shuman, secretary; Sol. A. Wood, auditor; and T. M. Hatch, electrician. General office, Goshen, Ind.

TIE REPAIRS WITH DIFFERENT RAILS.

The following extract from a report made to one of his clients by John A. Beeler, consulting engineer, is very interesting.

The record of tie repairs extending over a period of several years, upon the lines examined, discloses the following facts, which are tabulated below. The rails have been divided into three classes, the 30-lb. and 35-lb. rail (26.83 and 2.67 miles respectively) being designated as class A. It was impossible to separate the repairs between these rails, and as the 35-lb. rail helps out the 30-lb. rail to a certain extent by it being a stiffer and better rail, it is not unfair to the 30-lb. rail at least."

The second class, B, represents but a small amount of 40-lb. rail, 3.40 miles, that has been repaired.

The third class, C, represents 11 miles of 45-lb. and 27 miles of 48-lb. rail, which are almost identical sections, the latter having the advantage of 3 lb. per yd. additional weight.

Car-house tracks, dead tracks, and other tracks, not in frequent use, have not been included in these figures, neither has the heavy T-rail track of recent construction, it having required no repairs during the period covered by the report.

	A	B	C
Total number of miles repaired	29.50	3.40	38.00
Total number of ties placed	26,867	1,249	8,637
Total cost of ties, including labor of placing	$27,355.11	$1,613.58	$9,700.43
Number ties per mile	911	367	227
Cost per mile	$927.30	$474.70	$255.27
Average cost per tie for labor placing	.52	.79⅓	.62½
Percentage of the mileage of the system covered by these repairs	29.8 per cent	3.5 per cent	34.8 per cent
Percentage of cost of the repairs	71 "	4 "	25 "
Ratio of cost per mile of track	2.30	1.14	0.68
Per each dollar expended on class "A"	$1.00	$0.48	$0.29

As is seen from the foregoing, the tie repairs have been distributed as follows:

29.8 per cent of the system has received 71 per cent of the repairs.
3.5 per cent of the system has received 4 per cent of the repairs.
38.4 per cent of the system has received 25 per cent of the repairs.

Or, for every 68 cents expended upon 45-lb. and 48-lb. rail track per mile there has been $1.14 expended upon the 40-lb. track and $2.38 upon the 30-lb. and 35-lb. track. Or, to state it another way, for every $1 expended upon class A, 48 cents has been expended upon class B and 29 cents upon class C.

This ratio will not suffice to represent the difference in joint and special work repairs, including mates, frogs, switches, crossings, etc., and as for bonds, it is almost impossible to maintain them upon the 30-lb. track. The loss in electrical return on the light rail is therefore tremendous.

Another important question arises, as to what is the condition of these various classes of rail at present. The 30-lb. rail, with nearly four times the repairs of the 48-lb. rail, it would seem, ought to be in very fair shape, but on the contrary, it is not.

The foregoing figures, based upon actual expenditures on the various classes of rail, demonstrate the necessity of employing good heavy steel rails, better than a long treatise upon this subject. Suffice it to say, that the best practice demands 75-lb. T-rail upon suburban lines, where 50-lb. T-rail was formerly used, and 100-lb. and 117-lb. girders instead of 56-lb. and 60-lb. girders. High speed and heavier cars demand this.

With a 60-lb. to 75-lb. T-rail upon lines (not requiring paving) the repairs would be much less than what a 48-lb. rail requires. The general surface and line would hold (except where interfered with by some outside agency, such as sewer, water, gas, or other excavation until the ties disintegrated.

The bonds placed under the angle bars would be amply protected, cost less, have less resistance, and give a much better return.

The weight of the rail is not only felt in the tie and track repairs, but at the power house, in decreased coal consumption; at the shops in the repairs to rolling stock; at the superintendent's office, in better time made and less interruption to the regular service; by the public in smoother track and more pleasant riding; by the stockholders in decreased expenses and increased receipts.

The electric line between Greenwood and Indianapolis was scheduled to be opened by December 15th.

CAST WELDING ON THE CALUMET, CHICAGO.

The Calumet Electric Street Railway Co., which has a total of 80 miles of track, has decided to cast weld all the joints on its system using the system of the Milwaukee Railjoint & Welding Co. under license from that company. The work to be done at once will be the welding of four miles of track laid with 7 in. 85-lb. girder rails; this is located in Pullman. The Calumet company will have the advantage of being able to prosecute the work during the daytime on all the double track sections, the traffic being such that one track will suffice for it while the other is being welded.

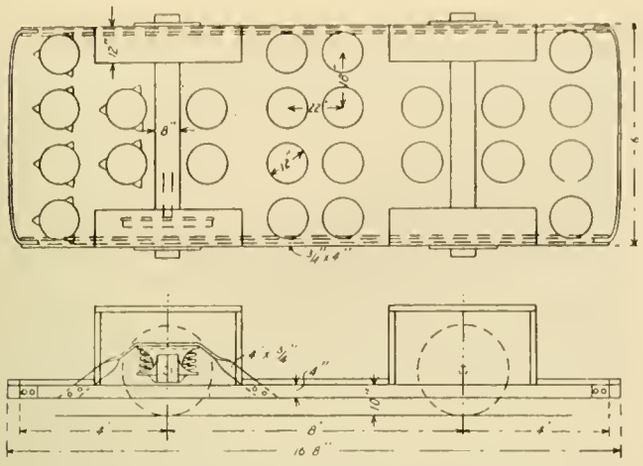


FIG. 1 HEATER CAR.

On some of the single track lines, also, there will be no necessity for night work.

Ordinarily the welding outfit is carried on a number of wagons requiring horses and teamsters, which means a considerable increase in the cost unless the road is one which has a number of horses of its own which can be put in this service. Being free to make greater use of his tracks for hauling the apparatus and supplies than could be done on most roads, Mr. H. M. Sloan, general manager of the company, designed the "welding train" which we illustrate; it was for the most part built in the company's shops, the details being designed by Mr. W. A. Harding, master mechanic and electrical engineer.

The outfit consists of four cars: a cupola car, a sand blast car, a heater car, and a supply car.

The supply car is a flat car, with a platform 6 x 9 ft. and 26 in. high above the rails; it has coupling bars so that it can be hauled or pushed by a motor car. This car is to carry the jackets, molds, clamps, etc., when they are distributed along the track; it follows the men who remove the dirt around the joints.

The heater car is a car especially designed to transport the lamps or torches used for heating the rail ends before pouring the joints. The company has 25 of the White rail joint heaters made by the White Manufacturing Co., of Chicago; the heaters were illustrated and described in the "Review" for October last, page 728. A special car body was built to carry these so that half of the torches may be burning and not interfere with each other. This car is shown in outline in Fig. 1. The frame consists of two side pieces 16 ft. long connected at the ends by iron straps ¼ x 4 in. in section. Each side piece is made up of two bars ¾ x 4 in. spaced 1½ in. apart. To the side frames are riveted the four straps, ¾ x 4 in., which pass over the pedestals. The wheels, pedestals and axles above the floor level are boxed in as shown. The heaters are 12 in. in diameter, but the pump, torch arms, etc., prevent close packing and a floor space 18 x 22 in. is provided for each heater the whole car carrying 24 of them. Each heater is held in position by blocks fastened to the floor.

CUPOLA CAR

The cupola car is about 30 ft. long and 6 ft. 10 in. wide over the side sills. It is mounted on two Cloud steel trucks which are placed 18 ft. 6 in. c. to c. The wheel base of each truck is 62 in., making the wheel base of the car 23 ft. 8 in. These trucks are fitted with the M. C. B. standard journal boxes, and differ from those made for steam railroad service only in having the transoms spaced 2 in. apart instead of 12 in. The wheels are 33 in. in diameter. The axles are 3¾ in. at the motors, 3⅞ in. in the wheelfit and 3¾ in. at the journals. The brasses are M. C. B. standard filled with babbitt. Axles of these dimensions were used because the company had them in stock, and in event of their proving too small they can be easily replaced. The brake rigging is the McGuire standard inside hung type redesigned to avoid the motors. Pressure on the brake is applied by means of a lever moving in a vertical plane; this lever connects with and gives motion to transverse shafts placed between the axles of each truck and moving the brake shoes by means of cranks and links.

The car has a metal frame, the longitudinal sills being four 7-in. "Providence girder" rails taken out of some old track in Pullman. Figs. 2 and 3 show the car before the motor and blower were housed in. The four sills are spaced 21, 38, and 21 in. between centers, and held transversely by 11 tie rods made of ⅞-in. rods, placed inside of 1-in. wrought pipes; sections of 1½-in. pipe of the proper lengths are slipped over the 1-in. pipes and act as distance pieces between the sills. The nuts on the tie rods show plainly in Fig. 2. The bolsters are trusses built up 1 x 5½-in. bars, and are arranged to get the car body as low as possible. Six diagonal braces of ⅞ x 3-in. iron are placed between the sills at the center of the car. At 9 ft. 3 in. from each end are wooden distance pieces placed between the sills and cover plates 1 x 6 in. placed top and bottom with bolts each side of each sill. The flooring of the car is of 2-in. oak planks 12 in. wide. Strap iron strips are placed along the side edges so as to protect the planking.

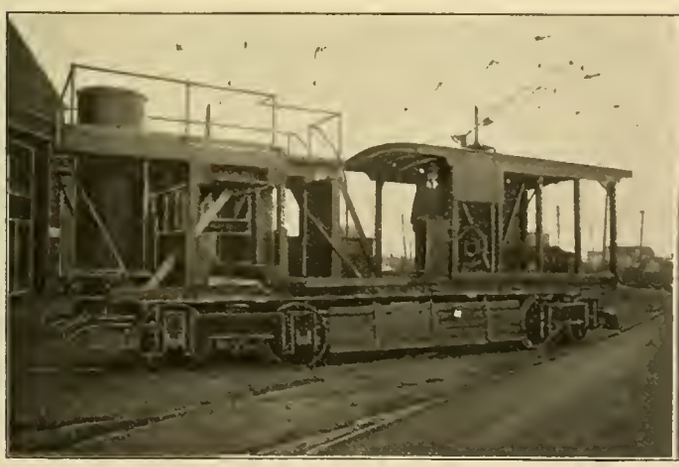


FIG. 2 CUPOLA CAR.

FIG. 3.

The cupola furnace is made of ⅜-in. boiler steel, 34 in. in diameter and 10 ft. high. The weight without the brick lining is 1,800

lb. The cupola is supended on four 4 in. x 7 in. x 7/8 in. springs by brackets riveted to the barrel aboout 2 ft. from the top. The center line of the cupola is 5 ft. 4 in. from the center of the truck. The frame supporting the cupola is built of 12 x 12 in. timbers, four sections of 7-in. Providence girder rails and bar iron. The center line of the tuyere pipe is 17 in. from the bottom of the cupola. The bottom of the cupola being only 18 in. above the rail, the doors for dumping are made double. Two spouts for the hot metal, each 20 in. long, are provided; they project at angles of 45° with the center line of the car. The charging platform is 5 ft. above the under side of the car sills, and is guarded by a railing made of pipe. The capacity of the cupola after the first charge

FIG. 4 CUPOLA CAR AT WORK.

is melted, is estimated at three tons per hour. The open space at the right of the cupola in Fig. 2 is utilized for storing the ladles and tools. The space farther to the right, under the stairway, is for the coke; a hinged platform (which is shown lowered in the cut) is provided for the man who shovels the coke up to the charging platform.

The blower for the cupola is a No. 4 Sturtevant fan belted to a 10 h. p. compound wound Crocker-Wheeler motor; these are located as shown in Figs. 2 and 3. The motor and blower are covered in the top of the box, being on hinges and sloped so that supplies and tools cannot be piled on it by careless workmen. The blast pipe is 10 in. in diameter, and at the cupola is provided with a flexible connection. The compound winding of this motor is utilized to secure a uniform speed at various voltages, to compensate for the drop of potential at the ends of the longer lines.

A special controller made in the company's shops is arranged for the blower motor giving uniform speed at three different voltages, 450, 500, 575. This is done by cutting out the series field when the voltage drops from 575 to 500, and by reversing the series winding for a voltage of 450. In series with this special "three voltage controller" is an automatic controller (Schuman & Haydon). Both of these controllers are mounted on the boards shown at the right of the car controller in Fig. 2.

The K2 controller for the car motor is at one side of the car in a position equally convenient for the motorman when running ahead or aback. The car motors are two WP. 50's, both mounted on the truck at the far end from the cupola. To mount them on the other truck would have made a greater weight available for traction,

FIG. 7 CLEANING JOINTS.

but it was deemed of more importance to have the motors where they would be readily accessible. As mounted, the end of the car may be lifted and the motor truck easily run out.

Fig. 4 shows this car as completed.

SAND BLAST CAR.

One of the things essential to cast welding is the thorough cleaning of the rail end, and nothing has been found so efficacious for this as a sand blast. The sand blast car of the Calumet is 18 ft. long by 6 ft. wide, mounted on a four-wheel truck. The truck used is a Three Rivers truck rebuilt; the length of the truck support is 17 ft. 6 in., and of the wheel base 8 ft. Extra heavy springs have been added to support the car body, which when loaded will weigh probably 10 tons. One W. P. 50 motor is mounted on each axle. The side sills of the car are of Georgia pine, 4 x 10 in. and the end sills, 8 x 10 in.

The equipment of this car consists of one 15-h. p. motor, belted

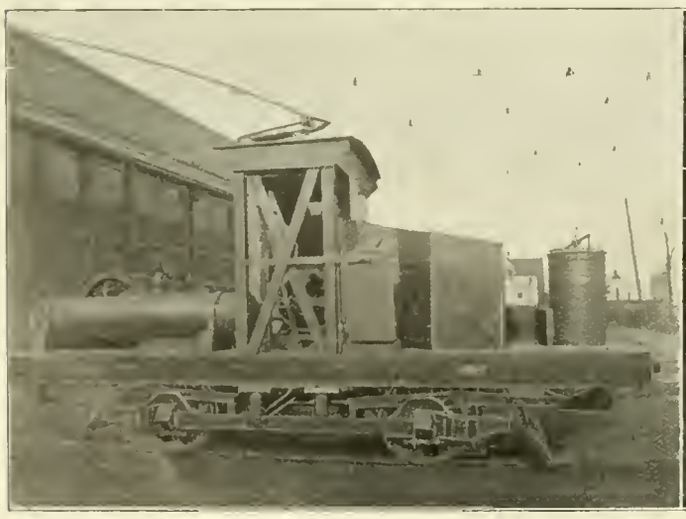


FIG. 5.

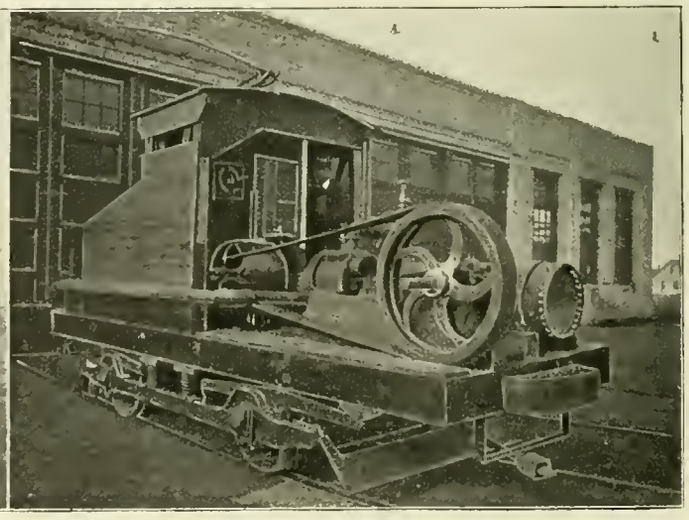


FIG. 6.

SAND BLAST CAR.

to an 11 x 10-in. air compressor, and a sand blast. The motor is located midway of the length of the car, and at one side. It is belted to the air compressor, which was made by the Geo. F. Blake Manufacturing Co., and has a capacity of 120 cu. ft. of free air per minute at 200 r. p. m. On the same end of the car is a 20-in. air tank 8 ft. long made out of an extra heavy steam header formerly used in the power house.

From this tank a 3-in. pipe leads along the outside of the car to a double feed sand blast, built to order for the Calumet company by B. C. & R. A. Tilghman. This apparatus is 20 in. in

FIG. 8 SAND DRYING HOUSE.

diameter by 5 ft. high, and is supported with the lower end 21 in. below the car floor, making it more convenient for the operator to place sand in the hopper.

Two lengths of 2-in. rubber hose are attached to nozzles below the car floor so that two joints can be cleaned at once. A water tight sand box is provided. From this box the sand runs into a tray and is then shoveled into the blast apparatus.

The position of the motorman and the location of the controllers, switch, fuse box and brake lever are shown in Figs. 5 and 6, which

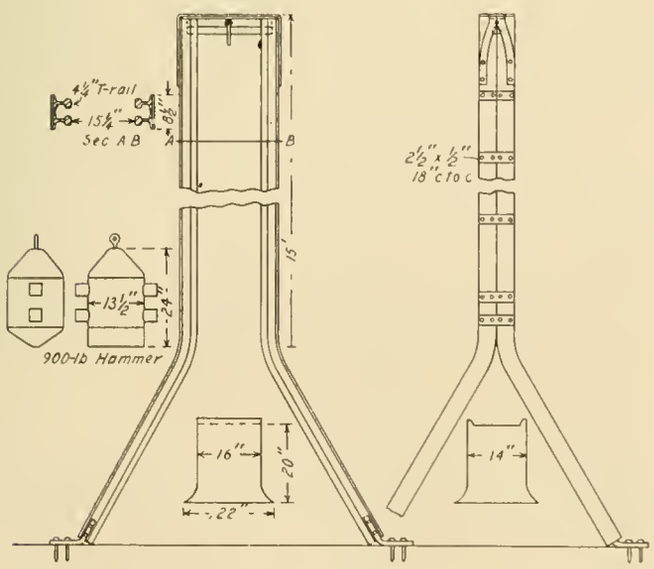


FIG. 9—DROP HAMMER.

are from photographs taken before the compressor was covered in. Fig. 7 shows the car as completed.

The men using the sand blast wear canvas helmets, as shown in one of the engravings; to further protect them small pipes are carried from the air tank to the helmets so that the sand attempting to enter under the cape will be blown away by the current of air.

As considerable quantities of sand will be required in connection with the rail welding, the chief engineer of the company, Mr. D. F. Schroeckenstein, has designed a sand drying house shown partially completed in Fig. 8. The house is 9 x 12 ft. and 6 ft. high, located near the pond and tables, for cooling the condensing water used in the power station. The hopper extends along one side of the sand house and holds 5 cu. yd. of sand. On the floor of the sand house are 53 sections of 1 in. pipe, 16 ft. long, spaced 2 in. between centers. These pipes are screwed into an 8 in. header 10 ft. long which is connected to the discharge pipe from the condensers to the cooling table. The fall from the discharge pipe to the sand house piping is 4 ft. 6 in. The water after flowing through the drying pipes is discharged into the cooling pond. This arrangement dries the sand by means of heat that would otherwise be wasted.

As one of the pieces of auxiliary apparatus a hammer for breaking scrap and pig for the cupola was desirable, and accordingly Mr. Harding designed and built that shown in Fig. 9. The standards are old 4½-in. T rails bent out at the lower end, wrought iron feet are bolted to the bottoms of the four legs for fastening to a foundation built up of cross-ties. Cement concrete cast around the legs will increase the stability. For the present the hammer will be lifted by a windlass, but it is expected later to fit it with a pneumatic cylinder.

We are indebted to Mr. J. P. Love, of the Calumet, for the photographs from which our engravings were made.

EFFECT OF BOYCOTT PASSING.

The Cleveland Electric Ry. has survived the boycott against it and has recently had to order 40 new cars. An official of the company recently said: "Our trade is coming back to us in nice shape. Saturday and Sunday, November 25th and 26th, our receipts were $2,000 more than on the same days last year. The company has not been able to take care of its patrons as it would like. Inability to secure cars has been the cause, in addition to the fact that the company is disposing of all its 16-ft. box cars. The new cars are 28 ft. long in the clear, and when they arrive we will have sufficient cars to take care of our patrons in the proper manner."

ROAD FOR WESTERN PENNSYLVANIA.

E. A. Ferrin, of Reynoldsville, Pa., advises us that the Reynoldsville Traction Co. has been organized for the purpose of building an electric railway from that place to Rathmel, Big Soldier, Sykesville and Elnora, a distance of 14 miles. The company has engaged an engineer who will complete the surveys, maps, etc., as rapidly as possible, and it is hoped sufficient progress can be made so that bids for construction can be received early in January, 1900. Mr. Ferrin is to be president of the company and the active manager.

RIGHT TO CARRY FREIGHT.

A decision by Judge Dissette, of Cleveland, recently handed down, is quite interesting, and the principle will prove an important one if it is sustained by the higher courts. The suit was brought by H. C. Herron to enjoin the Cleveland & Chagrin Falls interurban road from hauling stone over a section of its road, that class of freight being forbidden in the franchise. The court ruled that the granting of the right to use the street carried with it the right to haul whatever the company saw fit as long as it was for the accommodation of the public.

THE RAILWAYS COMPANY GENERAL.

Among the properties recently acquired by this company are the Lewisburg, Milton & Watsonville Passenger Railway Co., Milton (Pa.) Electric Light Co., Montoursville (Pa.) Passenger Railway Co., and the Philadelphia & Bristol Passenger Railway Co., Croydon, Pa. The officers of the Railways Company General are President, L. N. Downs; vice-president and general manager, John Blair MacAfee; secretary and treasurer, Taylor Faunce; general superintendent, D. A. Hegarty. The general offices are at 1002 to 1008 Hamson Building, Philadelphia, Pa.

HALF FARES.

The Rapid Transit Co., of Dayton, O., has obtained an extension of time until Jan. 1, 1900, to build its line.

Contracts have been let for a three mile extension to the Toledo (O.), Bowling Green & Fremont Electric Ry., from Mermill to Mungen.

The United States has furnished Mexico with about $340,000 worth of electrical material so far this year, according to a recent statement.

The work of relaying the street railway tracks in East Rome, N. Y., is progressing rapidly; when completed Hardie air motors will be put in service.

The Cleveland, Berea, Elyria & Oberlin Railway Co. states that it will build in 1900, an extension of its present track nine miles south of Wellington, O.

Unless unforseen obstacles arise the Greenwich (N. Y.) & Schuylerville Electric Ry., now in course of construction, will be in operation by Jan. 1, 1900.

Work on the power house of the Northampton (Mass.) & Amherst Street Ry. is progressing rapidly and it is expected that cars will be running by Christmas.

The Terre Haute Electric Co. has announced that it will sell 25 street car tickets for $1, the six for 25 cents rate, and the books of 100 tickets for $4 being withdrawn.

As a sanitary precaution the Brooklyn Rapid Transit Co. has removed the floor mattings from the smoking cars on its elevated lines.

Strong inducements are being offered by the merchants of Mound City in the shape of bonuses to the Cairo Electric Street Railway Co. to extend its service to Mound City.

A surgical department has been added to the Union Traction Co., of Muncie, Ind. This service means immediate treatment for any of the employes of the company in case of injury.

The report of the Schenectady Street Railway Co., for the quarter ending September 30th, shows gross earnings $16,505; operating expenses, $32,221; fixed charges, $3,267; deficit, $18,982.

George T. Bishop, of Cleveland, O., in connection with other capitalists, is attempting to secure permission to construct an electric road from Oak Cliff to Dallas and Fort Worth, Tex.

Abbott P. Smith, of 37 Purchase St., New Bedford, Mass., is securing franchises for an electric railway from Fall River to Cape Cod, a distance of 35 miles. The road will be constructed at an early date.

Attorney-General White, of Delaware, has commenced an action against the Delaware Electric Co. for revocation of its charter. It is alleged the company has not complied with the requirements of its charter.

The Mount Pleasant, Scottdale & Connellsville Electric Railway Co. will erect three new brick buildings at Scottdale. The car barn will be 100 x 150 ft., the power house 50 x 100 ft., and an office 30 x 32 ft.

Soda ash as a preventative of troubles from bad boiler waters received strong praise before the Traveling Engineers' Association from an officer of the mechanical department of the Chicago & Northwestern Ry.

The earnings of the Brooklyn Rapid Transit system for the month of November, 1899, were $937,849 as against $850,760 for November, 1898, and $796,614 for November, 1897.

A number of citizens of Tropico, Glendale and Burbank, Cal., are holding mass meetings relative to the construction of an electric railway through these places to Los Angeles. The need of such a line is very much felt.

The work of surveying for a new electric line between Saginaw, Mich., and Frankenmuth, has just been completed. The work of constructing the road will not be commenced this year, but will be pushed in the spring.

The street railways comprising the system of the Massachusetts Electric Companies report their gross earnings for the fiscal year ending September 30th at $4,479,122, against $4,111,132 for the previous year—a gain of $367,990.

The Syracuse (N. Y.) Rapid Transit Co. is being sued by John E. Ladd for $10,000 damages. One of the cars ran into his wagon, throwing him out. Part of the damages asked is for the bad habit which the team learned in running away.

The Toledo Traction Co. is now splicing 26 of its 16-ft. body closed cars and making 13 cars measuring 28 ft. 4 in. inside; the sills are spliced and new trusses put in. The new cars will each be equipped with two Westinghouse No. 3 motors.

Construction work on a new railway in the island of Hawaii, to be built by American capital, will soon be commenced. The road will be 130 miles long, and will be operated by electricity, which will be generated by three water power plants.

The supervisers of Middletown township have granted the Philadelphia & Delaware Electric Railway Co. the right to the highways of Middletown to extend its lines from Media along the Baltimore turnpike to Lenni. It will comprise a 5-mile extension.

Three miles of copper ground wire was stolen last month from the tracks of the Inland Traction Trolley Co., near Lansdale, Pa. The road is in the course of construction and the theft was not discovered until some time after it occurred. The wire is valued at about $300.

A trolley car belonging to the Ossinning Electric Railway Co., of Sing Sing, N. Y., ran into a wagon loaded with dynamite, recently. The dynamite did not explode, and aside from nearly scaring to death the driver of the wagon and the motorman, no serious damage was done.

A new method for calibrating the current of an alternating current instrument has been worked out by Carroll D. Jones of the physics department of the University of Michigan. A transformer is used. Less than one-twentieth as much energy is required in this method as in the ordinary industrial methods.

The American Railways Co. is negotiating for a controlling interest in the Cincinnati, Newport & Covington Street Ry. The same company has recently bought the bonds of the Dayton, Ohio, company, has bought outright the Springfield, Ohio, road, and has secured a $500,000 interest in the Chicago Union Traction Co.

The street railway company of Berlin, which is a no-license suburb of Hartford, Conn., has found it necessary to put a special car, known as the "Jag Car," on Saturday and Sunday nights to convey some of the residents home from the neighboring towns. It is manned by some of the strongest men in the company's employ.

The Aurora (Ill.), Yorkville & Morris Electric Ry., commenced operating one section of its road on November 7th. Power is purchased from the Aurora Street Railway Co., but a new power station will be erected as soon as the entire line is constructed. The completed system will comprise 36½ miles, laid with 83 lb. rails.

Oxide of iron, graphite and carbon pigment has been decided to be the best protective coatings for iron and steel by the Master Car & Locomotive Painters' Association. Pure graphite is considered excellent, but this paint is liable to be adulterated with silica, which, while being a good filler, does not give good wearing qualities.

The Nazareth & Bath Electric Railway Co. has been incorporated at Harrisburg, Pa., with a capital stock of $24,000. The directors are: Joseph J. McKee, F. W. Lembartz, Alvin Hill, C. A. Waller, Truman M. Doddson, of Bethlehem, A. S. Kick, of Allentown, G. A. Schneibelli, of Nazareth, and C. R. Horn, of Catasauqua.

A representative of the New York World, in attempting to demonstrate the possibilities of the transfer system in that city, rode for a single 5-cent fare for 24 consecutive hours, traveling 107½ miles and receiving 87 transfers. He could have probably continued indefinitely, as he had ridden over but a portion of the company's lines.

The Detroit & Northwestern Electric R. R. is fast nearing completion. There is but a small amount of track remaining to be laid, and the power house and car barns are located at Farmington. The road will be equipped with 12 50-ft. cars with center aisles, smoking rooms and toilet rooms. Some of these will also have baggage rooms.

T. Julian McGill, the Minneapolis representative of the Westinghouse Co., has been working up a project to harness the water power of Taylor's Falls and bring it into Minneapolis and St. Paul for light and power in the possible amount of 6,000 h. p. There is some doubt whether an electrical plant could be established in the center of the new interstate park.

The death of Dr. M. P. Turner, in Des Moines, Ia., recalls the beginning of the street railway system in that city. When the town was small Dr. Turner secured an exclusive franchise and constructed just sufficient roadway to maintain the franchise. Every effort was made to annul this, but unsuccessfully, and after many years of dire poverty he sold the system for $340,000 cash.

It is expected that the Lehigh Valley Traction Co. will shortly absorb a number of trolley lines that connect with its system. It is stated that the company practically controls the Bethlehem & Nazareth Railway Co. and is negotiating for the Easton, Bethlehem & Palmer and the Easton Consolidated lines. The South Bethlehem & Saucon Street Railway Co. is now practically secured by the syndicate.

A contemporary finds that the word "juice," as applied to electric currents, originated in Ireland with the employes of the electric railway running to the Giant's Causeway, one of the first street railways built in the world. Hearing the current called fluid, and thinking juice synonymous to this, they so named the electricity. It is suggested in Boston that the word ought to be changed to gravy.

A transfer arrangement has been made in Brooklyn whereby passengers on the surface cars living in the outlying districts will be transferred to the elevated lines at several points free of charge, thus enabling them to make better time to the heart of the city, and at the same time relieving the surface lines of a great deal of extra traffic, and giving more room in the cars for the shorter distance riders.

Compressed air cars have been withdrawn from service on the 28th and 29th St. cross-town lines of the Metropolitan Street Railway Co., of New York. The cars have never been popular with the residents of the neighborhood owing to the noise and greasy drippings left in the streets.

There has been considerable agitation in Cleveland, O., recently upon the subject of abolishing grade crossings between the steam and electric lines in the city. There are 133 such crossings at present and the city engineer estimates that it will cost about $10,000,000 to change them all over. The railroads are expected to bear a large part of this expense.

At the annual meeting of the Southwest Missouri Electric Railway Co. an increase in the capital stock from $650,000 to $800,000 was voted. Work on the new power house and the big barn at Webb City is progressing rapidly. The proposed extensions will be to Riceville, a double track between Carterville and Lakeside Park, lines from Joplin to Central City and Belleville, and from Prosperity to Duenweg.

The interurban electric lines entering New Brunswick, N. J., are being used by the merchants of that place as a means to increasing business by furnishing free excursions on all of them to the city on certain days. Every one wishing a free trip pays his fare on the cars and receives a ticket which is good for five cents in cash at any of the stores in the arrangement. It is not necessary to purchase anything in order to get the rebate.

W. J. Newton, president of the Mineola, Hempstead & Freeport Traction Co., advises us that his company proposes to build an electric railway from Mineola, Long Island, nine miles south to the water front at Freeport, passing through several villages. From Freeport the company contemplates running a line of small passenger steamers across the bay. Others connected with the enterprise are Benjamin F. Hamilton and Charles Hills.

According to figures given out by the Inter-State Commerce Commission, one passenger is killed for every 2,267,270 carried on steam roads, through accidents, and one is injured for every 170,141 carried, or upon a mileage basis, 60,542,670 passenger-miles are accomplished for each passenger killed, and 4,543,270 passenger-miles accomplished for each passenger injured. Of the trainmen employed on steam roads, one out of every 150 was killed and one out of every 11 injured.

Los Angeles, Cal., is about to create a department of electricity, which shall have charge of all electrical systems in the city. The board of fire commissioners will be empowered to appoint a chief officer of the department, to be known as the city electrician, whose salary is fixed at $2,000 a year, and who will be required to give a bond in the sum of $1,000. The electrician will be allowed a deputy, to be known as inspector of wiring and appliances, and who is allowed to retain out of fees collected for his services not to exceed $1,080 a year.

Another cable road has had to disappear to make room for electricity. The Third Avenue R. R., of New York, is now operated throughout its entire length by the electric conduit system, the last section of the cable road having been changed over on November 22d. Mr. John H. Robertson, superintendent, and Dr. Louis Duncan, chief engineer, deserve the highest praise for the way in which they have met and solved the various operating and mechanical problms that have arisen in the work of practically rebuilding the old roadbed and substituting electric for cable cars. This has been accomplished without interrupting the service to the public and with but little loss of traffic.

Crosby & Coolidge, who are building the Northampton & Amherst Street Ry., a line eight miles long, between the city of Northampton, Mass., and the college town of Amherst and through the town of Hadley, have the line nearly completed. The power house will be located in Hadley, near the tracks of the Boston & Maine R. R. The power house and car electrical equipment will be of

Westinghouse make. The Wason Manufacturing Co. furnishes the cars of the latest pattern cross seats. Cars will probably not be in operation before January 1st, owing to delays at the power house.

Franchises and rights of way have been secured for what promises to be one of the most valuable street railway systems in the South. The line runs without serious grades or curves from Lynchburg, Tenn., to Wartrace, Tenn., a distance of about 20 miles. A 30-ft. dam will be built at Duck Creek, and a 5,000-h. p. water plant constructed for furnishing electricity for light, heat and power to the adjacent country. Heavy freight, such as grain, live stock, etc., will be handled in addition to the passenger service. The company is known as the Wartrace & Lynchburg R. R., and the officers are: President, H. H. Evans, of Aurora, Ill.; vice-president, S. H. Case, 312 Roanoke Building, Chicago; secretary and treasurer, Frank B. Smith, of Aurora, Ill. J. Y. Garlington, of Lynchburg, Tenn., is a director and one of the prime movers in the enterprise.

JAPAN NOTES.

At the last semi annual meeting of the Tokyo Tramway Co., the report for the first six months of 1899 was submitted, showing receipts of 469,813 yen; disbursements, 253,490 yen; balance, 216,323 yen, of which 155,400 yen was paid in dividends, 32,420 yen to reserve and bonus accounts, and 28,503 yen to surplus account. The stockholders voted to consolidate with the Shinagawa Tramway Co., and to increase the stock for the purpose of purchasing the stock of the latter company. The Tokyo Tramway Co's. stock, par value 50 yen, is quoted at 245 yen.

Japan has her own way of doing things. The Sanyo Railway Co., a steam road, employs a train boy to carry an album through all its express trains for the purpose of securing the signatures of all the first-class passengers, believing "the album will soon become an interesting collection of signatures and autographs," and will form a means of whiling away the time for the passengers.

Under the auspices of Viscount Katsu Inouye and other promoters, a factory to be named the Kisha Seizo Goshi Kwaisha (Railway Rolling Stock Factory) has lately been established at Nishi-ku, Osaka, for the purpose of making cars and other railway supplies. The capital is 900,000 yen, and the officers are: President, Viscount Katsu Inouye; vice-president, Ki Hiraoka; auditors, Eiichi Shibusawa and Sadakichi Tanabe.

The Tokyo Chamber of Commerce has sent a memorandum to the home minister on the subject of street railways. The chamber's idea is that the traffic should be conducted as a private enterprise, the street railway company paying for the privilege of using the streets, besides ordinary taxes, a royalty amounting either to from 4 to 10 per cent of gross receipts, or 8 to 20 per cent of the net profit. The term of the charter should be limited to 30 years, capable of being renewed only for one term, and on the expiration of the term of the charter the city should have the right to purchase the track, rolling stock, etc., at a properly appraised price.

Several companies within the past few years have applied for permission to build electric railways in Yokoyama, but such applications have always been disapproved by the city authorities on the ground that the streets were too narrow for the enterprise. The city officials have recently announced, however, that if the rival projectors will unite into one company, the desired franchises may be granted.

A consolidation of all the tramway companies in Tokyo, including the Tokyo Denki, the Tokyo Densha, and the Compressed Air Co., is being formed, the new company to have a capital stock of 15,000,000 yen.

The city solicitor of Dayton, O., has advised the council that in the absence of state legislation on the subject the city councils have no power to compel street railways to place conductors on their cars.

A CURVED GLASS BLUE-PRINT MACHINE.

A paper read before the American Society of Mechanical Engineers by Paul Mellen Chamberlain, Assistant Professor of Machine Design, Lewis Institute, Chicago.

The desirable features of a blue-point machine are ease and rapidity of operation, such adjustment as to secure the direct rays of the sun, and means whereby close contact between the tracing and the sensitized paper may be secured. The machine here described and illustrated was designed to meet the above requirements, and was first built for, and in the shops of, the Lewis Institute.

The operation of the car and the universal adjustment is so clearly shown in Figs. 1 and 2, that explanation seems unnecessary. The iron work is all galvanized to avoid rusting after exposure to

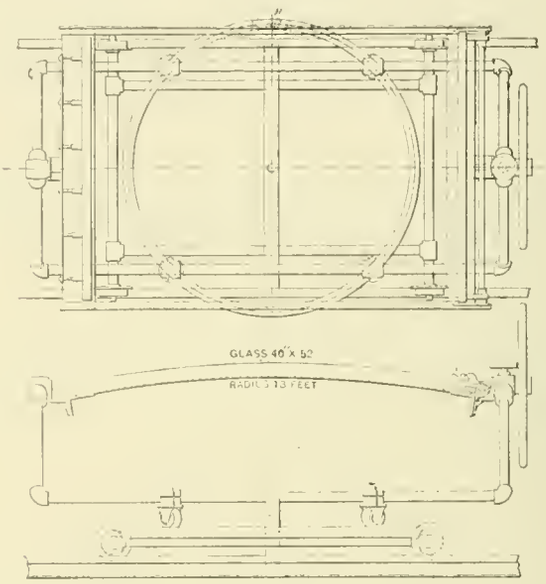


Fig. 1

rain or snow. The glass is curved to a radius of 13 ft. Attached to one end of the frame is a sheet of canvas rubber packing about 1-32 in. thick. The other end of the rubber cloth is fastened to a steel tube which serves as a roller to roll the cloth on and also as a stretcher. Square projections at each end of the roller are engaged by hook cams, which are operated by eccentrics on each end of a steel rod, rotated by a handle at one end, through an angle of 180°.

The operation is this: The rubber cloth is rolled back on the steel tube, and the paper and tracing are placed on the convex side of the glass; the cloth is unrolled with one hand, leaving the other

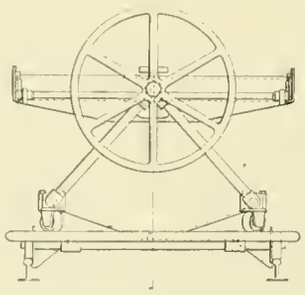


Fig. 2.

free to adjust or turn down crumpled edges of the tracing, the ends of the steel roller are engaged by the cams, and a turn of the handle stretches the cloth, giving a pressure component normal to the glass; the frame is turned over, the car pushed out of the window, and the frame adjusted to the proper angle with the sun's rays. The operation is rapid; the placing of tracings very easy, and the contact obtained between tracing and paper all that could be desired. Three years of use have demonstrated its convenience and durability.

The Easton, Palmer & Bethlehem Street Railway.

There was organized at Easton, Pa., on June 11, 1897, the Easton, Palmer & Bethlehem Street Railway Co., chiefly through the efforts of Mr. T. A. H. Hay, of Easton, who promoted the idea of building an electric railway from Easton, the county seat of Northampton, on the Delaware River, to Bethlehem, the chief manufacturing center of this section. Mr. Hay interested the Worcester Construction Co., of Worcester, Mass., in this project and when the organization was effected the Worcester company became the controlling stockholder in the new railway company.

The general direction of the route chosen was due west from Easton to Bethlehem, running through the heart of the rich and fertile valley, 18 miles in width, alongside of the Lehigh River. In locating the line of the new road, which is 12 miles in length, the route was chosen so as to offer rapid transit facilities to the 100,000 people which form the population of this section. Directly upon the main line is the township of Palmer with its dozen hamlets and villages, besides which are the towns of Farmersville and Butztown. To the south of the line are Fremansburg, Hellertown and Lower Saucon, while to the north are Nazareth, Bath, Chapmans, Wind Gap, Pen Argyl and Bangor.

At the western terminus of the road are the Ordnance Works of the Bethlehem Steel Co., where 4,600 mechanics are employed in the manufacture of armor plates and guns for the United States Navy. Many of these men reside in homes scattered along the route of this trolley road, which has proved a great convenience to them.

Work on the road was started June 15, 1898, and it was finished on November 6th of the same year. The construction was carried out in a substantial manner. Part of the rails are 64½-lb. T-rails, while in the rural districts the Siberia section of rail manufactured by the Maryland Steel Co. is used, and in the cities is a 7-in. T-rail, 72 lb. per yard, made by the Cambria Iron Co. The fine chestnut groves in the neighborhood afforded the company ample material for ties, which were hewn 7 ft. long, 6 in. face and 5 in. deep, and laid 2 ft. between centers. A foundation of broken stone was used and ordinances in the cities required that within the city limits the company place Macadam pavement between the tracks as well as one row of Belgian block outside the rails.

The overhead construction includes chestnut poles 30 ft. in length and 7 in. thick at the top, which are set 100 ft. apart with 5 ft. in the ground. The trolley wire is No. 00 made by Washburn & Moen, and is carried on span wires within the city limits and upon brackets in the rural districts. The brackets were made by the Walworth Manufacturing Co. Twelve miles of overhead feeders are carried on these poles, the feeders being No. 0000.

The company operates nine open and five closed cars, manufactured respectively by the Newburyport Car Manufacturing Co. and the Massachusetts Car Co. The open cars are 10-bench cars, 31 ft. over all, seating 50 people, having curtains between the side posts, and single trucks of the Peckham extra long style, with a 7-ft. 6-in. wheel base. These are equipped with two G. E. 1,000 motors and K 10 controllers. The closed cars have vestibules, are 30 ft. long over all and 20 ft. long between the doors, having a seating capacity for 28 people. These have Peckham "Excelsior" trucks with a 7-ft. wheel base, and are equipped with two G. E. 52 motors and K 10 controllers. Each car is lighted with a 5-light cluster, and the closed cars contains six heaters, each of the electrotherm type, made by the H. W. Johns Manufacturing Co. They also contain New Haven single fare registers and are equipped with fenders made by Louis Pfingst, of Boston; Van Dorn Dutton track scrapers are used and the company owns one Taunton snow plow.

The power plant and car barn of this road are situated at the little village of Butztown, which is located about midway between the termini of the line. The advent of this new industry in addition to the railway traffic on the new line through this village has changed its rural aspect into one of business activity and has opened up much needed communication with the neighboring towns. The power house is a brick building, 86 x 45 ft., having a boiler room 50 x 60 ft. and 26 ft. high. This room is equipped with three return tubular boilers, built by Stewart & Son, Worcester, Mass., having a maximum capacity of 250 h. p. each and containing 292 tubes. They are run at 120 lb. steam pressure. To these are connected two Deane feed water heaters and two Deane steam pumps. The main steam pipe is 10 in. in diameter, supplied by the Walworth Manufacturing Co., and is fitted with valves of the Shipman and Jenkins' makes. The boilers are connected to a 75-ft. steel stack set upon a stone foundation 8 ft. square and 8 ft. deep. The lower section of 25 ft. is 4 ft. in diameter and made of ⅝-in. steel; the second section of 25 ft. is of ½-in. steel, and the remaining section is of ⅜-in steel. The smoke flue is 4½ ft. x 2 ft. in section. No. 2 Buckwheat coal is used for firing the boilers.

The engine room is 52 ft. x 45 ft. and contains two Greene engines manufactured by the Providence Steam Engine Co., of Providence, R. I. These have cylinder dimensions of 18 in. x 42 in. and run at a speed of 104 r. p. m. The shafts are 9 in. in diameter and the fly-wheels weigh 18 tons each and are 18 ft. in diameter. These engines have been running constantly since they were started nine months ago without any delays or stops whatever. The engine room also contains one jet condenser of 600 h. p. capacity, built by the Deane Steam Pump Co., and two steam pumps of the same make, 6 x 6 x 4 in. The steam piping of the engine room is run overhead. There are two G. E. generators of 240 kw. each, which are belted direct to the engines with 26-in. 4-ply belts. The switchboard which is located between the generators is of the Standard General Electric railway type, having panels 8 x 2½ ft. on which are mounted the usual switches and instruments.

The water used in the plant is drawn from a well and pumped into a reservoir located 300 ft. from the boiler room. The water is hard, containing considerable lime, and it has been found necessary to treat it with an "emerald" compound before taking it into the boilers. This compound has proved very satisfactory in softening the old scale and preventing the formation of new scale in the boilers.

The company has established a pleasure resort just beyond Butztown known as Oakland Park, which has proved a very attractive feature of the road and is visited by thousands of people daily. It is located on the crest of a hill in an immense grove of oak trees, and scattered about the grounds are numerous attractions for visitors. At night hundreds of electric lights illuminate the grove, and wide cinder paths are laid out leading to all parts of the park.

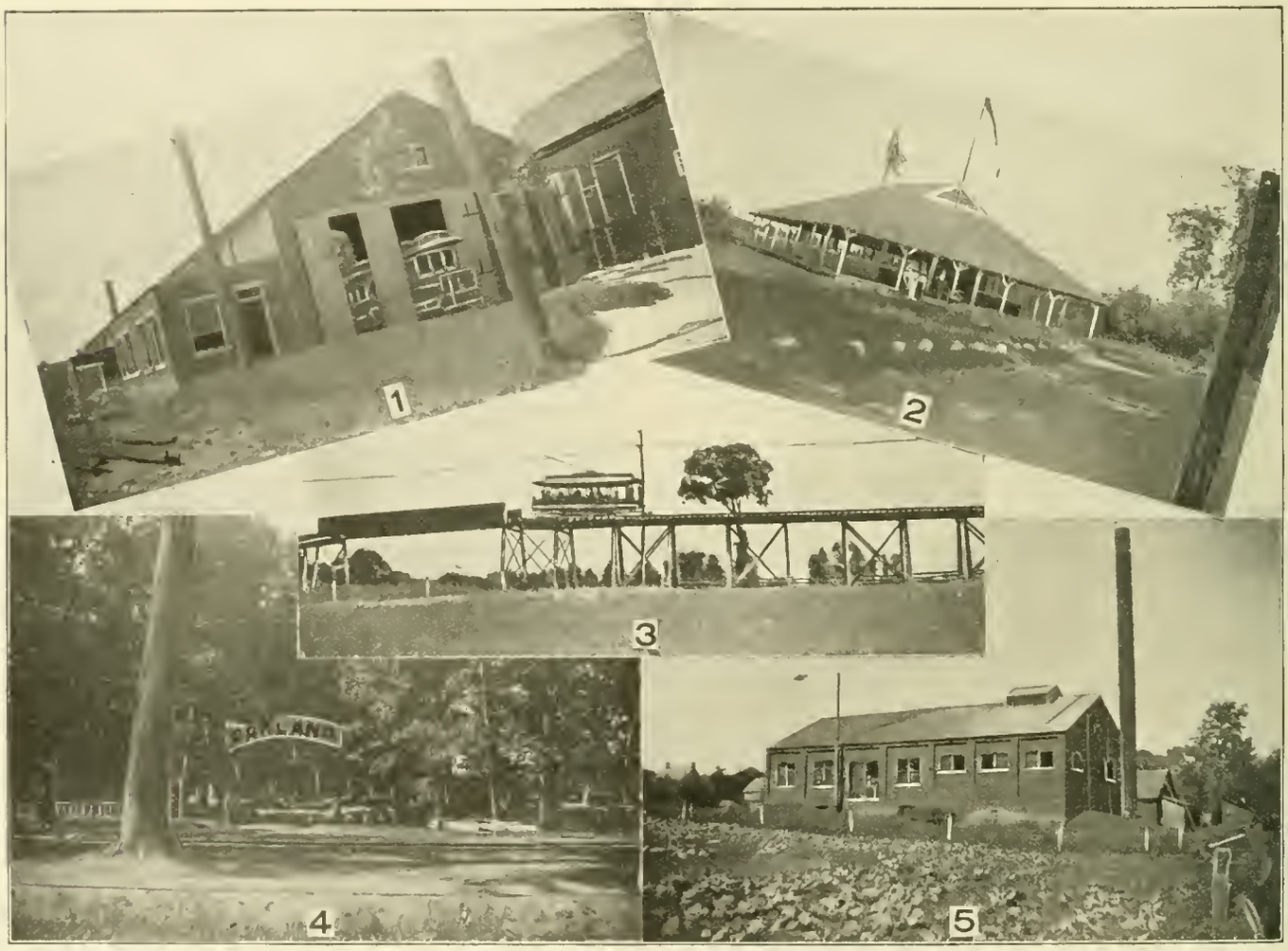
A splendid and abundant water supply has been provided by means of an artesian well, which was bored 150 ft. deep through solid rock, and everything possible has been provided for the comfort and pleasure of visitors. Centrally located is a large combination stage and band stand, where entertainments are given and bands are heard in daily concerts. Surrounding the stage is a natural amphitheater easily accommodating 3,000 people. There is a baseball diamond, lacrosse and football field, as well as a tennis court and a large dancing pavilion with a promenade walk hidden in natural shrubbery. The park is less than half an hour's ride from the heart of Easton and Bethlehem with their 60,000 population.

The park was laid out in just five weeks by landscape gardeners from Boston under the direction of Supt. Charles H. Cox and according to his own ideas, and he also rushed the construction of the road through quickly, having started the work in July, and opened it for traffic on November 6th.

Among other innovations that have been introduced by Superintendent Cox, which have made the road popular with both the public and the employes, was the opening of a motorman's school at the car house. Here the motormen in the company's employ as well as advanced students from both Lafayette College and Lehigh University take a prescribed course of lectures on electricity, with Mr. Cox as the instructor. Matters pertaining to car motors are discussed in the pits of the car house where the motors are assembled and repaired. The class at times numbers 50 students. Through Mr. Cox's efforts the fare between the terminals of the road was reduced to 15 cents; he also established a telephone system along the line, introduced electric lighting at every street crossing on the road, and converted the original 4-car schedule into the present one in which 12 cars are operated.

The officers of the Easton, Palmer & Bethlehem Street Railway Co. are: J. S. Rodenbough, president; A. D. Chidsey, treasurer; J. B. Bull, S. H. Hackett, W. A. Stern, E. B. Smith, W. Hinkle Smith, and Geo. W. Norris, directors; Charles H. Cox, superintendent.

The company was organized with a capital stock of $200,000, one-half being common stock, and one-half preferred stock, all of which was subscribed before the building of the road. There were $200,000 of bonds issued. From the date of opening until January 1st, 113,652 passengers were carried, the receipts being $4,925.90 and the operating expenses 59 per cent of the earnings. The operating force consists of 35 employes.



EASTON, PALMER & BETHLEHEM STREET RAILWAY.

1—Car House and Shops. 2—Dancing Pavilion, Oakland Park.
3—Bridge near Easton.
4—Entrance to Oakland Park. 5—Power House, Butztown.

The Bradford (Pa.) Electric Street Railway Co. is about to run its cars by the block system, which though simple, is very effective. It is self operating, being connected with the electric power which operates the cars, and mistakes will be impossible. Only one car can be in the same block at the same time.

Children Passengers on Street Railways.

The carrying of children passengers upon street cars, whether free, at half fare, or full fare, is a subject which calls for special regulations by street car companies upon which no special unanimity exists. With a view to inquiring into the general practice upon this subject, the "Review" has secured data from a large number of roads in regard to their regulations for children passengers, and from the 61 typical roads selected for comparison, one is led to the conclusion that practically no general practice exists in this regard.

On all of the roads reporting, children are carried free up to certain ages and under certain conditions. The free list is confined in some cases to infants in arms and extends on one road to children eight years old accompanied by parent or guardian. Forty-one of these roads have no half fares whatever and 25 roads give 3-cent fares for children between certain ages, while five roads limit their ½ fares to school children and during school hours only. Out of the roads having no ½ fares 11 demand fares for children of whatever age if they occupy seats to the exclusion of passengers paying fares, while on a few roads the regulations seem to imply that children under a certain age are carried absolutely free whether they are accompanied by a passenger paying fare or not. As to the number of children carried free in charge of one passenger, no limitations are generally given. One manager writes: "A parent rarely has more than three children under the age of five, but we have found cases where teachers of a Sunday-school or kindergarten expected that their classes, being under paying age, should be given free transportation, but such cases are not frequent. Under such circumstances not more than three children are allowed to ride free."

There is a wide difference of opinion between managers of street railways in regard to the advisability of 3-cent fares for children, and in most cases the adoption of ½ fares for children of certain ages, where not prescribed by city ordinances, varies with the individual opinions of the railway managers. Some of these consider children a very undesirable class of passengers on account of their tendency to play in the cars, standing upon the seats, annoying other passengers and in general enjoining much more care and trouble on the part of the conductor than do adult passengers. Another argument which is brought forward against 3-cent fares is the complication which they introduce in the accounting department and the difficulty which they involve in checking up the conductors returns. These troubles seem to warrant upon the majority of roads the establishment of a single 5-cent fare, and children under a certain age are regarded in the light of necessary evils and carried free.

Among those roads on which ½ fares are charged are a few in which this question is determined by city ordinances to that effect, but aside from this the question of ½ fares does not appear to bear any relation to the size of the roads or the amount of the population from which their traffic is derived. Out of the 25 roads selected for comparison upon which ½ fares are charged, 10 roads fix the age for 3-cent fares between 5 and 12 years. These roads vary in mileage from 8 to 475 miles, in number of cars operated from 16 to 3,276, and draw their traffic from populations varying from 5,000 to 2,000,000 people. Of the other roads charging 3 cent fares, two fix the age limit at from 5 to 10 years, three from 6 to 12 years; two at from 4 to 12 years; two from 2 to 10 years; one at from 4 to 10 years; one at from 4 to 8 years; one at from 7 to 10 years; one at from 3 to 12 years, and one at from 6 to 13 years. These examples are taken from roads in every section of the country, and as we have said before, seem to follow no special rule.

On a few roads on which ½ fares are not generally charged, special rates are given to school children going and returning from school. Figure 1 illustrates the school childrens' tickets issued by the Newton & Boston Street

FIG. 1. FIG. 3.

Railway Co., which are furnished in quantities of 1,000 for $25 to the superintendents of schools. These tickets are good for school children only, under the age of 10 years, and are paid for by the city of Newton, Mass. The tickets are 1⅞ in. long, by ⅞ in. wide, and are printed in black, as shown, upon white cardboard. No tickets are issued direct to school children, who must either obtain them from their school superintendent or pay full fare.

Figure 3 shows a sample of the school ticket used on the Austin Rapid Transit Ry., of Austin, Tex. These are supplied to school children under 12 years of age, and are made up in books of 40 tickets, which sell for one dollar. The tickets are 2 in. by 1 in. in size and are printed partly in black and partly in red ink, on cream colored cardboard. The words "school ticket" and the serial number are printed in red.

The Ashland & Catlettsburg Street Railway Co., of Ashland, Ky., uses the school ticket illustrated in Figure 4. This company has been selling these tickets at ½ price for several years, and finds that it pays, as there are a great many poor children who could not afford to pay full fare who use the ½ fares liberally. The tickets are 2⅛ in. long

FIG. 4.

by ⅞ in. wide, and are printed in red on white cardboard. Under the company's rules the ½ fares are confined to travel to and from school, and are not good on Saturday or Sunday, nor to and from the company's park at any time.

The school ticket of the Ogden Electric Railway Co., of Ogden, Utah, is illustrated in Figure 5, together with the book in which 40 tickets are bound. These books are sold for the use of children attending the public schools at $1 each. The book measures 1⅜ in. by 2⅛ in., and the tickets are 1 in. by 2⅛ in. The tickets are printed in black on

green paper, the serial number being in red. These tickets have been found to be a source of considerable income to the company, and a great many of them are used where otherwise the children would walk. The company has issued these tickets for several years and is thoroughly satisfied with the results. Inside the cover is printed the following instructions: "Good only to and from day school.

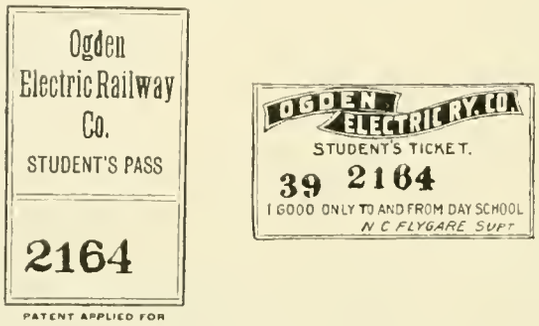


FIG. 5.

If presented at any other time the conductor will take two fares." The tickets are not good if detached from the book.

Figure 6 illustrates the school tickets furnished by the Union Traction Co., of Anderson, Ind., and the book in which they are bound. The book measures 5 in. by 2 in., and contatins 10 pages of four tickets each, the book selling for $1. At the close of the school term any tickets which may not have been used are redeemed by the company. The covers and tickets are red, and printed in black. The following rules for conductors are printed inside the cover: "Do not accept detached tickets for fares. Do not accept tickets from this book for fares only between hours named on front hereof, and for person to whom this book is issued. When last ticket is used from this book return the back to the office."

A special method of handling ½ fare passengers is in use on the Southwest Missouri Electric Railway Co., of Webb City, Mo., which is as follows: The conductors buy from the office a pad of ½ fare tickets—20 in a pad—for which they pay $1. These tickets are sold on the cars to ½ fare passengers at 5 cents each, and the conductor punches the ticket and hands it to the passenger but does not ring up the 5 cents received. The punched ½-fare ticket is then good for another ride when presented by a passenger, from 5 to 12 years of age, and it is then rung up and turned in by the conductor receiving it. These tickets are illustrated in Figure 2. They measure 3⅛ in. by 1¼ in., and are printed in black on yellow paper.

The most troublesome feature of carrying children, either free or at half fare, arises out of the difficulty of determining the age of the child, and on this point numerous disputes arise between conductors and passengers on almost all railways. One manager, on whose road children are carried free under five, writes that his experience is that most children from the time of their birth up to seven years, remain at the stationary age of four years. Another one states that children riding on his road seldom attain to the age of three years, or if having unfortunately become three years old, they never get to be 12.

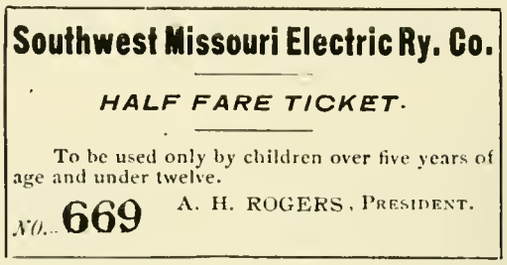


FIG. 2.

The instruction to conductors on the majority of roads on this point is to use their own judgment; collect the fare if possible, and avoid arguments with the parent or guardian; but never to eject a passenger for this cause. On a number of roads, however, where this trouble is more frequent, the orders to conductors are somewhat more stringent. One road writes: "Our experience is that the parent or guardian will never admit that a child is over six years of age and voluntarily pay a fare for it, but wait for the conductor to demand the fare. We expect our conductors, when in their judgment they consider a child six years of age, or over, to collect a fare, and the judgment of our conductors must be absolute, otherwise we would find it impossible to enforce the rule."

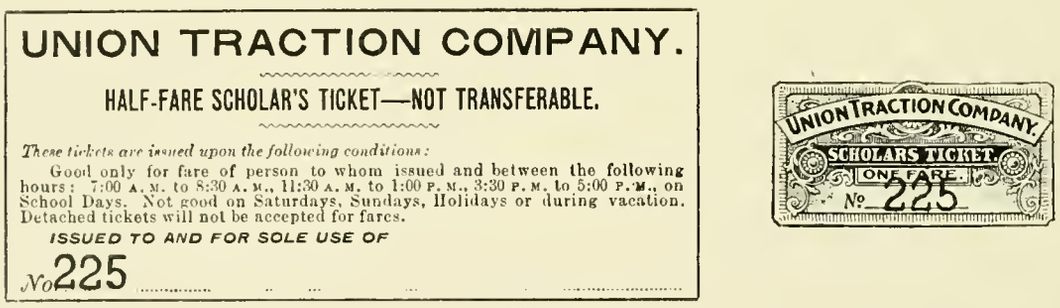


FIG. 6.

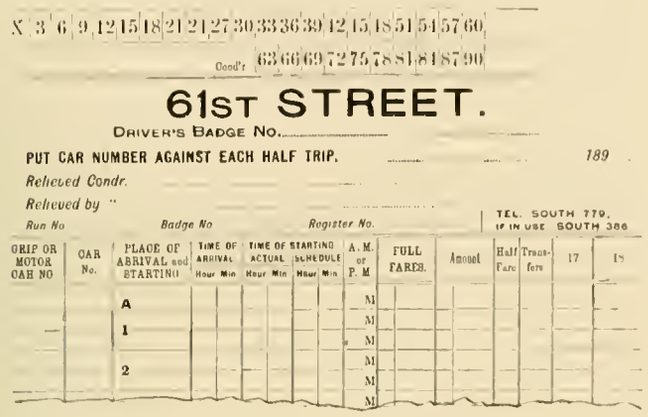
On another road the following orders are issued to conductors:

"Children under five years of age, not occupying seats to the exclusion of paying passengers, may be carried free, providing each such child is accompanied by and in charge of a paying passenger. Children will not come under this rule when placed on the car in charge of a passenger who has boarded the car at another point, nor when taken on the car by a passenger and put off at a point other than that where such passenger leaves the car. Conductors will not ask the age of children nor have any discussion whatever with parents or those in charge of children. They will be guided entirely by the size and general appearance of children, demanding fare for all those who are clearly over five years of age and giving the benefit of the doubt to any about whom they may be at all uncertain."

In addition to these instructions the cars of this company contain a printed notice to the following effect:

FARE, FIVE CENTS.

"Children free only when under five years of age, not occupying seats and when accompanied by grown persons. But one such child will be carried free with each grown person. Full fare will be charged for all others. Parents and guardians will be required to pay fare for all children who are of the size and general appearance of five-year-old children, regardless of actual ages, as conductors are forbidden to discuss the ages of children with parents and instructed to be guided entirely by size and general appearance."



CHICAGO CITY RAILWAY TRIP SHEET.

The method of accounting for ½ fares by the conductors varies on different roads, that of Chicago City Railway Co. being given as an example.

On this road when two ½ fares are collected at once from one person the conductor rings up one 5-cent fare, but where a single ½ fare is taken it is punched on the trip slip by the conductor and not rung up on the register. A row of numbers beginning with X, 3, 6, 9, etc., is printed across the top of the slip, which is illustrated below. The first ½ fare is punched at X, the second at 3, the third at 6, and so on, so that the number following the last punch mark shows the amount in ½ fares to be turned in for the trip. The slip is 7¼ in. wide and 13 in. long with spaces to report 17 full trips. On the back of the slip is a column for registering the number of passengers carried for each ½ trip on passes and badges.

In the case of a few roads conductors are obliged to take the name and address of a passenger refusing to pay a fare for a child, and a letter is forwarded to the party from the office of the company stating what the rules are in this respect. On almost every road orders are positive to conductors to avoid disputes on this head. What we believe would prove a sure method of avoiding all disputes on the question of age was recently described in one of our contemporaries as follows:

"On one of the Bavarian lakes there is a steamer which formerly carried children under five, free, and those under 12 at half price. American railroad conductors will be astonished to learn that 5 and 12-year-old children traveling on this steamboat very often were found to be astonishingly large for their ages. Suspecting some error and unwilling to call in question the accuracy of the memories of the mothers who bore these children, and who answered the question, 'How old is this child?' the steamboat authorities gave up any attempt to discriminate in fares according to ages, but with the malignity worthy of an American soulless corporation, substituted a discrimination according to size! Children under 24 in. high travel free, and those between 24 in. and 4 ft. 3 in. pay half price, and the ticket collector goes around with a 5 ft. rule. This is said also to be the practice in India, where, for Europeans at least, it is exceedingly difficult to judge of the ages of children by their appearance, and the native parents do not know how to speak the truth."

QUALITY IN CAR BUILDING.

BY A CAR-BUILDER.

There are two generally prevailing and firmly fixed ideas among railway men in regard to cars and car building, and unfortunately neither of the ideas is correct. The first one is, that one car builder is as good as another, providing the price is right. The other one is, that if a road undertakes it it can build better cars than can be obtained from any contract shop.

The first idea results in the placing of every contract with the lowest bidder and allowing the price to be the controlling element in the selection of the builder. Most large roads, and some of the small ones, possess most elaborate sets of specifications. They reason that if their cars are built in accordance with these specifications they cannot fail to be satisfactory. They believe that with careful inspection it is possible to make the work correspond with the specifications. This is a great mistake. No matter who the inspector may be nor how carefully he goes over the work, cars must be built after the general practice of the shop. A man on piece work cannot change his method of work to suit the whim or the orders of an inspector. He is controlled entirely by the price he is getting. Men who are working by the week know that they must turn out the usual quantity of work regardless of the special demands of the inspector. One man cannot look after the workmanship of a large establishment. There are innumerable details in filling an order for cars which cannot be seen until they are so far completed that the quality cannot be ascertained without taking the work down. The inspector may exercise a general supervision over the quality of lumber and the iron and the soundness of the castings. He can throw out the radically bad, but the inspector finds himself handicapped and at the best can only get the average work of the shop.

If an inspector undertakes to materially improve the workmanship of a shop he is called too particular and a complaint will be lodged against him by the car builders. Final argument between the inspector and the builder is reached when the builders say that if his style of complaining and inspecting is kept up they will throw up the contract. As the price is probably much below that of any competing contractor this threat settles it, because with a new contractor the price will be considerably higher. The inspector, therefore, is told to be a little easy "while the work or the material is not quite up to our standard, we think it will answer, and you can allow it to pass." After this it will invariably be passed. The inspector's influence, unless he is a man of unusual strength of character, is at an end. He may be able to have a cracked casting thrown out or a manifestly unsound piece of timber rejected. Under these conditions the value of the inspector to the railway company is very small. Of course the car builder does not have an altogether easy job; if the inspector is retained the cars cost him somewhat more than he expected, but when the

contractor has reached this stage he is over the hard places and builds the car practically to suit himself.

After a car builder has appealed to a railway against an inspector, and the company turns the inspector down, he is careful never to repeat the experience. His inspections never go so far that there is likely to be an appeal to headquarters. Occasionally some old hand gives the new inspector a hint in regard to these matters and he takes it in the beginning and so never has the unpleasant experience. After this point has been reached inspection takes a new phase, only such materials as are manifestly rotten, unsound or beyond all reason bad, are thrown out. Palpable departure from construction shown in drawing are made the subject for reports to the railway superintendent. In such cases the decision is reserved until the home office can be heard from. Usually the answer is that the change does not seem to be material and can be passed, so the car builders vote the inspector "very sharp," but a pretty good fellow. The company says: "He is looking after those fellows very closely—we shall have very fine cars." Every one concerned is pleased except the poor inspector, and he knows more than he is willing to tell the newspapers.

For many reasons the detailed car specification by the railway company is a mistake. In itself it is usually the result of some official's desire to show off what he knows about car building. In many cases what he does not know comprises the whole of human knowledge on the subject. His method of procedure is to correspond with various car companies and street railway superintendents and get as many specifications as possible, then he sets a clerk at work to pick out all the good things from each one. The detailed drawing is made up from the blue prints which accompany his collection of specification. The result is something to make angels weep, if they know anything about car construction. The specification itself, being a heterogeneous collection of things which look well on paper, is mechanically bad as a whole.

Every car builder of any repute has a series of specifications suited to his own methods of manufacture and construction. He can build to these to better advantage probably than to any other. They suit his shop system and the organization of his force. By using them he can secure the greatest economy in production. Usually his designs embrace good features of construction. They are the result of a wide experience and more study than is within the reach of any single railway company, because no railway system, no matter how large, has such facilities for gaining experience as the ordinary car building establishment. These shop specifications can be easily modified to suit the special ends of each road and to conform to such parts as it may be necessary to standardize. If the railroad company wishes for the best car possible, it will select the shop where the workmanship and the material used are of the best character and then leave the detailed specifications to the builder, merely exacting the best quality of work which the shop turns out. In such a case the superintendent will not have an opportunity to display his great apparent knowledge of car building, but the road will get a car of as good a quality as the establishment where it is ordered can produce.

For many reasons the car produced from a company's own detailed specifications is a great mistake. It may be called a failure both mechanically and commercially.

A street railway will also get a contract car at a much lower figure than one built upon its own specifications. This will result from the entire harmony of the design and the organization of the shop. A case might be cited of two street railway companies in a large city which ordered a large number of open cars during the past season. They were of the same size and general character. The cars in one lot were built to the detailed specifications of the road. They conformed in fact to the smallest particulars. The other lot were constructed according to the builder's regular specifications, and they cost at least 12 per cent less than the others. In quality and durability the builder's cars were certainly somewhat ahead of the others.

When it is decided to accept a builder's specifications all that is necessary in the way of inspection of the establishment is one visit, in which the general methods, quality of workmanship and quality of timber habitually used are carefully gone over. The resident inspector then becomes unnecessary. The work is accepted on the general character of the establishment.

The idea that the railroad company can build a better car than a contract shop is one which has in the past taken a deep hold upon railroad men. It probably grew out of the fact that years ago, when roads were more frequently building their own cars than they are at present, the railroad workmanship in its details was always of the highest character, while the contract work was frequently doubtful in this respect. It is true that railroads have occasionally produced better cars than some of the contract shops, but it is also true that the cars built by the railroads have in every instance cost much more than those of the same class in any contract shop.

The great difficulty in railroad car building is a lack of business competition. The master car builder is only controlled by his judgment, and being human, he is prone to indulge in costly mechanical fads. Mechanical human nature is the same the world over. When a superintendent is building for his own road he has nothing but the quality to think of, and he measures the increased cost against what he imagines is to be an increased durability or an increased advantage. He also has the repair shop to carry part of the expense and will almost invariably do things which would never be dreamed of if he had the car to build for so much money and was forced by his employers to get a profit out of the sum.

The railroad shop is always hampered and handicapped by a lack of experience. Of course no railroad man is willing to admit this, but no matter how large a road may be the experienced gained upon it is limited and but a small fraction of what can be gained in the smallest contract shops in the country. The cars suffer accordingly in design. The strong point of the railroad shop is always the workmanship and usually an unnecessary amount of labor is expended upon details. The cost of this is out of all proportion to the results obtained. Fine joints, fine varnishing, unlimited rubbing down and other things of the same kind eat up money. In the end, however, the car is usually much less durable than a very common quality of contract work

Some years ago the writer had an opportunity to inspect several hundred cars built "upon honor" by a railroad company for itself. They had been in service some five or six years. The workmanship had been all that could be desired, but as is usual with railroad cars, the design was faulty, and after the six years of use those cars were of no value except for old glass and scrap iron. They were not worth carting away for chicken coops. If these cars had been built from a design furnished by any first or

even second class contract shop, they would have been good in such a service for 25 years of wear.

When it comes to a matter of first cost the argument is all on the side of the contract shop. There are a dozen large railroad systems in this country which have sufficient facilities for building a large proportion of their own cars. A little alteration or remodeling of machinery would make them ready to begin such work. All of these companies have in past times done a greater or less amount of new work. One extensive system in the West some years ago built all the new cars which it required. Its repair account, however, showed $300 per year expended on every car operated. This, of course, was in one sense a fraudulent record. Probably the repairs were normal in amount. The method employed was undoubtedly to charge the new cars at what they would have cost if purchased outside. The excess went into the repair account and made the showing of $300 per car per year. It was the usual plan of roads to charge the cars they built at a current market rate for the given kind of car, and then smuggle the difference into the repair account. This was general practice a few years since, when many roads were engaged in building new work.

With the old horse car construction the life of a car, where the roof and exterior paint were properly attended to, seems to have been indefinite. Twenty-five and 30 years was no uncommon matter. Three years ago on the old Steinway road on Long Island the writer inspected a number of old and disused motor cars. They had been made by utilizing horse car bodies for the electric service. They had had two, three or four years, as the case might be, of electric service of an exceptionally severe kind, and of course were wrecked. They were from the shops of Jones, Stephenson and Brill, and many of them were of the lightest possible construction. One of the Brill cars was of the old open type, with a canvas roof, and yet this light roof had successfully carried a trolley pole for some years. It was said that the Stephenson cars in this lot were built in 1866, which would give them a total service of 30 years. None of the cars had seen less than 20 years' service, and all of them had finally given out from the results of abuse. Paint and canvas had been neglected, and water finding an entrance had so rotted the structure as to produce the final disaster. This may be taken as a fair illustration of what old contract work would do. It is not quite fair to compare horse car construction with the electric work of today, which more nearly approximates steam car practice. The electric cars have not been running a sufficient length of time for us to know how long they will wear. To get some idea of what may be expected of them we can go to steam practice. On the Erie Railroad there are many light cars still in operation on local trains, which were built in 1872 or previously. These cars are from 27 to 30 years old. They were built with extreme care by the railroad company itself. On the branches and local trains of the Central Railroad of New Jersey there are a large number of cars which were built by the Wason Manufacturing Co., of Springfield, anywhere from 1865 to 1872 or 1873. They are somewhat out of date, but the external paint and varnish having been well cared for, so as to exclude water, these cars are practically as sound as they were when they were turned out of the shop. The conclusion, therefore, is that the contract electric car of today is good for a life of from 25 to 30 years. In the large cities the cars will probably last until fashion or interior dinginess calls for a change in the rolling stock.

In the matter of durability reference has been made only to the Erie and the Jersey Central. Several other steam roads could be cited in which the cars built at home would not show as good a record as those obtained from contract shops. Careful bookkeeping has demonstrated the fact that the home made cars are not only more costly to build, but more costly to operate than those purchased outside. The question has been definitely settled by the accountant, and it would be well for railroad men who are turning over in their minds the scheme of utilizing their own shops for construction to give these matters most careful attention.

RAPID TRANSIT IN NEW YORK.

One of the greatest obstacles standing in the way of a rapid transit railway for New York City, was removed on November 11th, when the Appellate Division of the Supreme Court, on the application of the Rapid Transit Commissioners, reduced the amount of the bond required for the construction of the underground road from $15,000,000 to $5,000,000. The application was accompanied by affidavits by the City Comptroller, the President of the Rapid Transit Commission and the Corporation Counsel, setting forth the necessity of reducing the bond, and it would therefore appear that for once the various officials having authority in the matter had reached an harmonious agreement upon one point at least.

Acting on the decision, the Commission on November 13th published an invitation for proposals to construct and equip a rapid transit railroad in the City of New York, and to use and operate the same under a lease from the city for the term of 50 years, with a right to a renewal of the lease for a further term of 25 years. The invitation describes at length the proposed route and the conditions under which bids for construction will be received.

The main route is to run from the corner of Broadway and Park Row, northward underground on the west side of the city, to 124th St.; thence by viaduct to 134th St.; thence underground to Ellwood St., and over Ellwood St., Kingsbridge Road and Riverdale Ave., to Kingsbridge Station of the New York & Putnam R. R. A branch is to leave the main line at 103d St., and run east, crossing Central Park to Lenox Ave., thence northward under the Harlem River to Boston Road and Bronx Park. A loop under City Hall Park is also to be included.

All bidders must submit their proposals in sealed envelopes, accompanied by a certified check for $150,000, which will be returned in the cases of contractors whose bids are not accepted. The proposals will be opened Jan. 15, 1900, at 12 o'clock, noon. The successful bidder must pay upon completion of his contract, an annual rental equivalent to the interest on the bonds issued by the city to cover the cost of construction of the road, and in addition 1 per cent on such cost of construction as a sinking fund; also a percentage of gross receipts when receipts exceed $5,000,000 per annum, such percentage to be part of the proposal. He must deposit when his bid is accepted, $1,000,000 in cash as security for construction, a continuing bond of $1,000,000 to secure all other obligations of the contractor, and an additional bond of $5,000,000 to insure the satisfactory construction and operation of the road. He must also leave his certified check for $150,000 as a guarantee of good faith.

RECENT STREET RAILWAY DECISIONS.

EDITED BY J. L. ROSENBERGER, ATTORNEY AT LAW, CHICAGO.

LESSEE NEED NOT MAKE TRANSFERS REQUIRED OF ONE CONTRACTING FOR USE OF ROAD.

Roosa v. Brooklyn Heights Railroad Co. (N. Y.), 59 Supp. 664. July, 1899.

Judge Maddox, at a trial term of the supreme court of New York, Kings county, makes a distinction between a contract for the use of a railroad, or part thereof, and a lease. In the former, he says, the parties use in common the road, or part thereof, while a lessee, subject to the restrictions of the lease, gets an absolute and exclusive possession of the leased property. Consequently, he holds that section 104 of the New York railroad law—which provides that one party to a contract for the use of a railroad or part thereof shall carry, and that the other party shall permit any other party thereto to carry, a passenger so desiring to ride for one single fare not higher than the fare lawfully chargeable by either of such corporations for an adult passenger between any two points on the railroads, or portions thereof, embraced in such contract—does not apply to a company in operating as lessee the roads or routes leased from another company.

NOT TAXABLE ON ACCOUNT OF STOCK-TRUST CERTIFICATES.

Commonwealth v. Union Traction Co. of Philadelphia (Pa.), 43 Atl. Rep. 1010. July 19, 1899.

The supreme court of Pennsylvania affirms, in this case, the decision of the court of common pleas that the commonwealth is not entitled to recover any tax from the defendant in respect of Electric and People's Traction stock-trust certificates, under the state law imposing what is commonly known as the "tax on loans." Such certificates the court does not consider constitutes or represents any indebtedness on the part of the defendant, within the meaning of the statute in question, the 4 per cent paid by it not being regarded as interest, but as rentals; or, rather, the court makes the point the money with which the so-called interest was finally paid was derived from the rentals paid by the defendant. It also holds that the commonwealth was not entitled to recover from the defendant any tax in respect of mortgages issued by private parties and secured upon property subsequently purchased by the defendant.

ADMISSIBLE EVIDENCE OF EXCESSIVE SPEED.

City Railway Co. v. Wiggins (Tex.), 52 S. W. Rep. 577. July 1, 1899.

That cities, in providing for the safety of their inhabitants and visitors, have the right to pass reasonable enactments regulating the speed of street cars, the court of civil appeals of Texas says, is not longer to be questioned. The structural capacity of a car, and the voltage of electricity at the time applied, being peculiarly within the knowledge and power of the company to produce, the court considers that the best evidence attainable by a person suing the company for damages for personal injuries sustained in a collision alleged to have been caused by its negligence in running the car at an excessive rate of speed would be the estimate of those riding on the car at the time, and others having reasonable opportunities for observing and of judging. And the court declares that it cannot say that, in an effort to convey the idea of the existing velocity of a car, it was error to permit a witness to illustrate by reference to the speed of a trotting team and buggy, which, it adds, among a people of "our" history and habits ought to be within the common observation and judgment of all.

WHEN NO PUNITIVE DAMAGES FOR EJECTION OF PASSENGER.

Forhman v. Consolidated Traction Co. (N. J.), 43 Atl. Rep. 892. June 12, 1899.

The plaintiff's case was that he was ejected from a car of the defendant without cause and with unnecessary violence. The case went to the jury upon conflicting testimony, with special instructions upon the question of punitive damages.

Punitive damages, says the supreme court of New Jersey, are in the nature of a penalty, especially designed as a punishment for the wanton conduct or malicious motives of a wrongdoer, and can lawfully be imposed only when the reprehensible act is brought home to the defendant.

A principal, whether an individual or a corporation, cannot be charged with punitive damages for the illegal, wanton or oppressive conduct of a servant, unless the principal participated in the wrongful act of the servant, either expressly or impliedly, by his conduct authorizing or approving it either before or after it was committed.

This doctrine, the court holds that the defendant was entitled to the benefit of, in this case, and, because it thinks that the defendant was presumably injured by the submission of the question to the jury, as the verdict was for $5,000, it makes absolute a rule to show cause why a new trial should not be granted.

AFFIRMS JUDGMENT FOR $20,000 FOR LOSS OF USE OF BOTH LEGS.

Fonda v. St. Paul City Railway Co. (Minn.), 79, N. W. Rep. 1043. Aug. 1, 1899.

This action was brought to recover damages for personal injuries alleged to have been sustained by reason of the negligence of the defendant in operating its cars when the plaintiff was about to take passage on one of them. The injuries were serious, resulting in the loss of a portion of both legs. The jury, upon a retrial ordered by the supreme court of Minnesota, rendered a verdict in favor of the plaintiff for the sum of $20,000. The trial judge said with regard to this: "Defendant contends that the damages are so excessive as to show that the jury was influenced by passion and prejudice. I do not think so. While the verdict is a large one, it must not be forgotten that the plaintiff's injuries were very serious; that he lost the use of both legs, and is a cripple for life; that he never will be able to work or enjoy life as others do; that he was nearly a year in the hospital and suffered much pain; that his mental suffering, by reason of his condition, must have been, and must always be, great. In view of these and other facts, I am unable to say that the verdict is so excessive as to warrant the assumption that the jury was influenced by passion or prejudice." This language is adopted by the supreme court, which holds the damages not to be excessive, and affirms an order of the court below refusing a new trial.

A VOTE IS NECESSARY TO RENDER STOCKHOLDERS LIABLE ON BONDS.

Boyd v. Heron (Cal.), 58 Pac. Rep. 64. July 24, 1899.

This was an action brought against stockholders of the Consolidated Piedmont Cable Co., a street railroad corporation, for the purpose of enforcing their liability as stockholders for an indebtedness arising upon 10 bonds for $1,000 each, issued in part payment for the construction of the company's road. The plaintiffs suffered nonsuit, and the supreme court of California affirms the judgment of the court below. It holds that, construing sections 456 and 359 of the Civil Code together, under section 456 the directors may prescribe reasonable regulations which shall govern a proposed bond issue, but before the issue can be legally made the assent of the required number of stockholders thereto must be had in compliance with the mode laid down in section 359. Section 359 is a general section, applicable to all corporations, and was not complied with before the bonds in question were issued. Hence the supreme court holds that, without considering whether or not the bonds are void, so as to cast no liability upon the corporation, it is quite plain that those who were stockholders at the time of the bond issue may be heard to say that, because of the irregularity of the issue, and of their deprivation of an important right to vote upon the bond issue, no liability against them has been created.

BOUND TO KEEP EYES AND EARS OPEN FOR NEW DANGERS.

McGovern v. Union Traction Co. (Pa.), 43 Atl. Rep. 949. July 19, 1899.

A foot passenger crossing a street, especially a wide one with double tracks, the supreme court of Pennsylvania holds, does not do his whole duty by a single look before starting. In the space where cars and other vehicles have concurrent rights with his own, he is bound to keep eyes and ears open for new dangers, and to use reasonable care in avoiding them. Moreover, the court holds that how far a person's standing "some time" on the curb after looking before stepping into the street may have modified the act of looking, is clearly for the jury. And where the distance of the car and the rate of speed were the subject of testimony not entirely uniform, and there was no evidence as to the action at this point of the person struck in regard to the approaching car, the court holds that it was not one of those clear cases that should be taken from the jury. There are two classes of cases, considered with regard to the kind of accident, it says, in which nonsuits are properly entered: First, where a person, not looking, or claiming to have looked and not to have seen what was manifestly and unavoidably visible, steps directly in front of a moving car; and, secondly, where a person, seeing a clearly impending danger, accepts the risk, relying on his own judgment that he can escape it. In either class the negligence of the injured must be the clear and unavoidable inference from the undisputed facts, before the court can pronounce it as matter of law.

NO "MIGHT" ABOUT IT IF PASSENGER TRIED TO GET OFF MOVING CAR.

Neff v. Harrisburg Traction Co. (Pa.), 43 Atl. Rep. 1020. July 19, 1899.

Two disinterested witnesses testified positively that the plaintiff and her sister left the car while it was in motion, and before it stopped. She and her sister testified that they did not leave the car until it stopped, and that it started with a sudden jerk while they were getting off, and that this was the cause of the plaintiff's fall. If the testimony of the witnesses first mentioned was believed, the supreme court of Pennsylvania declares that the plaintiff certainly could not recover damages, all of its decisions being to that effect. And so it holds that it was error for the trial judge to instruct the jury that "if you take the version given by the defendant, that the car had not yet come to a stop when the plaintiff undertook to get out, then you might find her guilty of contributory negligence, and in that case she would not be entitled to recover." This it considers fatally defective, because, while it was altogether probable from the context that the judge did not intend, by the use of the word "might" in this connection, to put or to intimate a qualification upon the defendant's right to a verdict in case the jury found that the plaintiff left the car while it was in motion, yet the jury would be at liberty to understand from the words of the charge on this subject that the plaintiff's act of leaving the car while it was in motion would be no bar to her recovery of damages. As there was no evidence to show that the car was going so slowly as to be subsequently stopped when the accident occurred, the court further holds that it was a mistake to introduce that element into the answer to an instruction asked by the defendant.

ADMISSIBILITY OF PHOTOGRAPHIC AND OTHER EVIDENCE OF PROJECTION OF RAILS.

Cunningham v. Fair Haven & Westville Railroad Co. (Conn.), 43 Atl. Rep. 1047. Aug. 1, 1899.

Where an accident occurred at a point about midway between two cross streets through an alleged defect in the track consisting in the rails projecting several inches above the surface of the roadway immediately adjoining the same, the supreme court of errors of Connecticut holds that testimony as to the condition of the road at places other than the place of accident, such as testimony as to the condition of the road from the one cross street to the other, was inadmissible. On the other hand, it does not consider that there was any error in allowing a witness to testify as to the condition of the road at the place of the accident for some time prior to the accident, as the existence of a defect there for some time prior to the accident would tend to establish negligence in the failure to repair it.

As to photographs. The court does not believe that any case can be found which would warrant the admission of them to prove the height of the rails, without evidence of their accuracy. It says that a photograph offered for the purpose of proving the appearance of a physical object which cannot be produced in court nor inspected by the jury is secondary evidence. Its correctness or accuracy, like that of a map or diagram, must be proved, before it can be received. The accuracy sufficient for the admission of a photograph as evidence," it goes on to state, is a preliminary question of fact to be determined by the trial judge. The testimony of the photographer is not essential if other evidence is produced which in fact convinces the court. The proof of accuracy varies with the nature of the evidence the photograph is offered to supply. Thus, when it is offered as a general representation of physical objects as to which testimony is adduced for the mere convenience of witnesses in explaining their statements, very slight proof of accuracy may be sufficient. But the mere fact that the identity of the place photographed has been proved, is not enough.

PRESUMPTION OF NEGLIGENCE FROM COLLISION BETWEEN CARS.

Madara v. Shamokin & Mt. Carmel Electric Railway Co. (Pa.), 43 Atl. Rep. 995. July 19, 1899.

A car stopped on an up grade, from some defect in machinery or power, and could not be moved. A man who was there at the time assisted in trying to get the car started, giving directions as one in authority. Not succeeding, he said to the motorman that he would go to the car barn, a short distance off, and get another car, into which the passengers could be transferred and carried to their destination. He soon returned with another car, approaching the disabled and standing one on a steep down grade. From some cause the car he was on became unmanageable, ran into the disabled one standing on the track, and seriously injured the plaintiff. To the charge of negligence made against the company it set up the defense that the man who brought the second car was a mere intermeddler, who acted without any authority from the company. It offered no evidence to establish that fact, but relied on that of the plaintiff to make it out. It was conceded that the man was an employe of the company, though not a conductor or motorman, but in just what capacity was not clear.

The supreme court of Pennsylvania affirms a judgment against the company. It says that the plaintiff was a passenger to whom the company owed the utmost degree of care. Being injured by one of its cars while occupying that relation the presumption would be that it was through the negligence of the carrier. The burden was on it to rebut the presumption by showing that the man in question was a mere intruder upon the relieving car, acting wholly without authority. The burden was not upon the passenger to prove that one apparently in authority, having access to the car barn, and the power to assume control of a car, and run it on the road to the relief of the stalled car, was a servant of the company. If the accident had been apparently caused by the act of a stranger, while the plaintiff was a passenger, as in the case of a collision with a wagon, the burden would have been on her to show negligence on the part of the company. But when it arose from a collision between the defendant company's cars on its own rails, the court repeats, the presumption of negligence arose, and the burden was on the company to rebut it.

AGAINST KISSING AND HUGGING ON STREET CARS.

Sailors v. State (Ga.), 33 S. E. Rep. 813. July 18, 1899.

Where, in the trial of a criminal case, the proof shows that a man and a woman, in an intoxicated condition, were riding upon a street car, using profane language and kissing and hugging each other to such an extent as to attract the attention of other passengers upon the car, upon which were also other females, the supreme court of Georgia holds that this is sufficient to sustain a verdit of guilty, under section 396 of the Penal Code of that state, notwithstanding the female passengers may not have heard or witnessed such conduct. The latter part of the section mentioned is as follows: "By indecent or disorderly conduct in the presence of females on passenger cars, street cars, or other places of like character, shall be guilty of a misdemeanor."

This salutary statute, the supreme court says, was enacted for the purpose of preserving peace and good order in the public conveyances of the state. The members of the legislature, besides many others who were in the habit of riding in public conveyances, it somewhat startlingly continues, had doubtless witnessed many scenes of disorderly conduct upon passenger cars or street cars in which females were also passengers. They had doubtless seen vulgar and drunken creatures acting in such disorderly and indecent manner as to attract the attention of the other passengers, and using oaths in the presence of ladies who were also passengers on the cars. This law, it therefore reiterates, was enacted for the purpose of punishing for such disorderly and indecent conduct, and preventing its repetition.

But it was argued in this case that, inasmuch as the females, who were sitting in the front portion of the car, had their backs turned to the accused persons, who were in the rear, the offense was not complete, because not "in the presence of females." With this the supreme court does not agree. It holds that, under this statute, if the females were in the car upon which the disorderly conduct took place, it was not necessary, to make the offense complete, that they should be eyewitnesses of the disorderly or indecent conduct. Certainly they could hear oaths as well with their backs turned as though they were looking at the persons using them.

So the court holds that the true construction of the statute is that, if the disorderly or indecent conduct takes place on a street car on which females are riding, it is in their presence, although their backs may be turned to the offenders. And it insists that it is too clear to require any discussion that being drunk, cursing and hugging and kissing, in an offensive manner, as was here shown to be the case, by a man and a woman on a street car, is disorderly conduct.

ACCOUNTED PROPERTY BENEFITED BY STREET IMPROVEMENTS.

City of Shreveport v. Prescott (La.), 26 So. Rep. 664. April 17, 1899. May 15, 1899. Rehearing denied June 29, 1899.

To begin with, the supreme court of Louisiana holds that the matter at issue in this case, being a question of local assessment or charge upon property of abutting proprietors in a municipality, levied upon compulsion of law alone, to pay the cost of street improvement, and without their knowledge or consent, was a tax, in the sense of the constitutional provision conferring appellate jurisdiction on the supreme court.

The uniform current of judicial opinion, the supreme court goes on to say affirms the principle that the right of occupancy of a portion of the streets of a municipality by a street railway corporation is property which is benefited by a street improvement to the extent of the space occupied by its roadbed and tracks, which renders same liable for its proportionate share of its cost, just as the property of abutting owners is liable; that the railway company using the streets for the operation of its cars is in duty bound to pay for the work on the streets which its track alone makes necessary—that is to say, all expense for that portion of the work lying between the exterior rails of the tracks of the road, and for a distance of 2 ft. from and exterior to the track on each side thereof.

That in no case can any portion of the cost of such improvement be attributed to, or assessed against, the abutting property owners.

That, when a statute or municipal ordinance makes provision for the assessment of a street railway corporation for the pavement of such space as its tracks and roadbed occupy, such provision is mandatory, and any portion thereof which is put upon the abutting property owners is illegal and void.

Here was involved an interpretation of an ordinance of the city of Shreveport which required that abutting property holders throughout the length of a street that had been paved should pay two-thirds of the cost of same, each one paying in proportion to frontage; that the street railroads should pay in proportion to the space occupied by their roadbed, compared to the width of the street; and that the city should pay the remainder. The ordinance was founded upon the supposed authority that is conferred by the second section of Act No. 10 of 1896, which provides that abutting owners shall pay two-thirds of the entire cost, and the corporation shall pay one-third from its general resources, and provided that, where a railway bed or track occupies a part of the street, it shall pay in proportion to the space occupied by its roadbed, compared with the width of the street. The supreme court holds the ordinance and statute irreconcilable in that the ordinance transposed the terms of the statute by stating (1) the share of the abutter to be two-thirds, (2) that of railroad companies in proportion to the space occupied by them, (3) the city should pay the remainder, whereas the statute states (1) the share of the abutter shall be two-thirds, (2) the city one-third, and, (3) provided that a street railway occupies a portion of the street, it shall pay in proportion to said space.

Entertaining this view, that the ordinance was not in keeping with the terms of the statute, the true import of which is to require the portion of the cost due for street improvements by railroad companies to be first deducted from the total amount, and the remainder distributed between the abutters and the municipality, two-thirds to the former and one-third to the latter, the court declares the ordinance null and void.

The space occupied by a street railroad company, the court further holds, is matter of proof, to be administered and determined in some proceeding contradictorily between all parties in interest—the municipality, the abutting owners and the street railway companies; and, it adds, the ordinance which arbitrarily fixes said space, without a contradictory hearing, cannot be sustained as valid.

LIABILITY FOR INJURY TO EMPLOYE OF INTERSECTING LINE.

Bailey v. Citizens' Railway Co. (Mo.), 52 S. W. Rep. 406. July 14, 1899.

This was an action for damages growing out of personal injuries sustained by a conductor on a cable car on a line that intersected the defendant's line of cable railway. The defendant was repairing the crossing. Somehow the slot rail got displaced, so that the grip of the plaintiff's train ran against the obstruction thereby caused, throwing the plaintiff against a seat, quite severely injuring him. He obtained a judgment. But this the supreme court of Missouri has reversed, remanding the case for a new trial.

First of all, the supreme court condemns an instruction given the jury that even if it should appear in evidence to its satisfaction that there was negligence on the part of the gripman of the plaintiff's train in attempting to move his train over said crossing at an improper or reckless rate of speed, and that such rate of speed caused or contributed to the displacement of said slot, yet the finding of such facts would not, and could not, under the law, prevent the plaintiff from recovering in this case, unless the jury further found from the evidence that said gripman was at the time under, or subject to the direction and control of the plaintiff, as to such rate of speed.

The error in this, the supreme court points out, was in making the defendant liable for the independent negligence of the gripman, over whom it had no control, and to whom it did not bear the relation of master, in any degree, without proof of negligence by the defendant or any of its employes. And it declares that to hold a defendant liable for a pure tort, or wrongful act, of one over whom it had no control, to make it liable for the negligent or mischievous act of a stranger, as the gripman of the plaintiff's car was to the defendant,—would be to violate every principle of natural justice, and finds no support in "our" laws. The law makes each man liable for the consequences of his own negligent or wrongful act, but does not attempt to hold him for the misconduct of another, over whose acts he has no control, or unless his negligence concurs with that other in causing damage.

So the court holds that if the defendant could establish that the gripman was under the control of the plaintiff, and that the plaintiff directed the rapid running, and that caused the displacement of the slot rail, it was clear that the plaintiff could not recover, because his own negligence had directly contributed to the act which produced his injury; or, if the defendant was not able to establish that the gripman was under the control of the plaintiff, still, the defendant was not liable, if the jury found that the rapid running of the plaintiff's train was the sole cause of the displacement of the slot rail.

Then, it was urged that because the work was entirely under the care of the defendant, and because an accident happened, the presumption arose of its negligence. But the supreme court does not think that doctrine ought to be applied here, because, while it was true that the defendant had charge of the work, it was well known

to the operatives of the intersecting line that it was repairing, and that, in order not to stop traffic altogether, the conductors and gripmen of that road must go over the junction very carefully. The burden of the case, it says, was on the plaintiff to establish negligence, and not one entirely of presumptions. Certain risks are inevitable in making repairs of this nature, and if those charged with notice of the conditions will disregard the common dictates of prudence, and are hurt, they must bear the consequences. In this case the defendant was only required to exercise ordinary care; that is, such care as a reasonably prudent person would have exercised under the same circumstances.

The court also holds that another instruction was erroneous, in leaving to the jury to find that the unsafe condition of the crossing was exclusively with the knowledge of the defendant's workmen, when there were facts showing it was not.

Again, it says that it was at least a controverted fact that the misplacement was caused by the defendant's servants, and, combining the character of the work with the proof that rapid running of cars over it would produce a displacement of the slot bar, it was error for the judge to declare that it was a presumption of law that it was the defendant's negligence that caused the displacement.

When, it says, an independent factor or agency is introduced into the otherwise exclusive management of a work like this, and its action is uncontrolled by the defendant, and its negligence is also liable to cause a disarrangement of the defendant's plans, or interfere with the safety of the work, then the presumption growing out of the exclusive management of the work no longer obtains, but it is a question of fact, to be resolved in the light of all the circumstances.

DUTY TO FURNISH SUITABLE MACHINERY AND KEEP IT IN REPAIR.

Meehan v. Judson (N. Y.), 59 N. Y. Supp. 578. July, 18, 1899.

This was an action brought to recover damages for personal injuries sustained by the plaintiff in being struck by a motor that slipped off a block of wood placed on a plate on the top of the piston rod of a jack which he had operated for about two days in removing and replacing street car motors taken off to be cleaned. The trial judge granted a nonsuit on the ground that the testimony, as he viewed it, failed to show any specific cause for the falling of the motor, and no connection between it and the defect shown to have existed in the jack. But in nonsuiting the plaintiff on the ground that the evidence failed to show that the motor sagged at this particular juncture, the fourth appellate division of the supreme court of New York holds was reversible error. With the proof establishing that was its condition almost daily, and no other efficient reason being suggested for the accident, the court holds that it was for the jury to pass upon the question. It adds that this would not be permitting the jury to speculate upon what caused the accident, for there were facts which fairly justified the deduction that the accident was due to the sloping of the piston rod of the jack and the motor.

The burden is incumbent upon the plaintiff always to establish that his injuries are due to some specific negligence of the defendant. That negligence, however, the court goes on to say, may not in every instance be susceptible of direct proof by an eyewitness; but, if the facts proved warrant the inference that the injuries are attributable to the failure of the defendant to perform his precise duty, then it is the province of the jury to decide whether or not the defendant is chargeable with negligence.

Commenting further on the case, the court says that it was not contended that it fell within the class where the risk is an obvious one to the employe. The business was not of itself hazardous. If the piston rod remained erect, there was very little danger of the motor falling off. If the machinery was in proper condition, then the risk was the plaintiff's. It is elementary, however, that the fact that he assumed the risk incidental to the business is upon the hypothesis that the master performed his duty by providing an adequate appliance and reasonably safe machinery. The doctrine of obvious risks has never included the danger resulting from inadequate machinery and appliances, where the defects were known to the master, and he failed to remedy them. The duty of the master to exercise reasonable care, both by furnishing suitable machinery and keeping it in repair, is one always in force. Of course the superintendent, in the performance of this obligation, was the alter ego (another self) of the defendant.

In conclusion, the court declares that it cannot say, as matter of law, that the plaintiff should have discovered that the motor tipped forward. He was inexperienced in the use of the jack. His work took him to the bottom of the pit containing the jack which was under the main track in the car barn, and he was bending over, working the lever, as directed by the employer. He had a right primarily to assume that the appliance was in proper repair and in a reasonably safe condition. While an inspection might have apprised him of its condition, yet the short time of his employment upon it, the fact that it had been long in use, as he knew by casual observation, and his position in the prosecution of his work, were circumstances which made it proper for the jury to decide whether he exercised care commensurate with the situation in which he was placed.

OVERHEAD BRIDGE CROSSING CALLED FOR.

Williams Valley Railroad Co. v. Lykens & Williams Valley Street Railway Co. (Pa.), 44 Atl. Rep. 46. July 19, 1899.

In reversing a decree denying a steam railroad an injunction against a grade crossing, the supreme court of Pennsylvania remarks that its utterances on the question of grade crossings have been so frequent and emphatic that it ought not to be necessary to repeat them. Nevertheless, it does take the pains to state that it has held in substance, that the manifest purpose of the act of 1871 was to discourage grade crossings, and to absolutely prohibit them where it is reasonably practicable to avoid them; that what is reasonably practicable, under such circumstances, is determined largely by what is physically practicable, and not by what is practicable to the treasury of the road seeking to cross; that the cost of avoiding a grade crossing is a matter to be considered in projecting the new road, and that then sufficient capital should be provided to avoid that which the law in effect condemns. It further recalls that it has held that neither the street railway act of 1889 nor any subsequent legislation repealed the crossing provision in the act of 1871.

But before taking up the question of practicability, the supreme court states that the lower court was clearly right in holding that the ownership of the land in fee by the steam railroad company, whereon rested its superstructure, gave it no right to exclude subsequent grantees of the commonwealth from the use of the highway or public road which crossed it. Further than that, however, it does not agree with that court, which held that prima facie, under the act of 1889, the street railway company had the right to cross at grade; that the burden was upon the objecting steam railroad to establish that other than a grade crossing was reasonably practicable, and that not having established that fact, the court must allow the crossing. The supreme court says that it does not think that the case should turn on a rule of evidence applicable to a common law action.

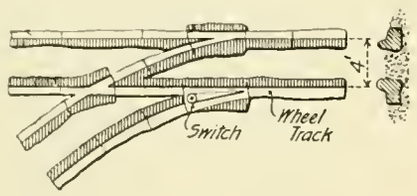
The first and second sections of the act of 1871 make it the duty of the court to inquire and ascertain the facts with reference to the authority of the corporation, and especially, as a basis of information for a proper decree for a crossing, to ascertain whether one at grade can be avoided. The commonwealth intended by the act to protect the lives and limbs of citizens as well as the property rights of litigating corporations. Therefore, the supreme court goes on to say, there is a duty upon the court to inquire in the interest of the public, which is not directly a party to the issue, whether it is reasonably practicable to avoid a grade crossing. And so it holds that the court cannot lightly assume, as here, because the steam railroad, in the main, rested its case on the ownership of the fee of its right of way, that there was no duty of further inquiry. To this it adds that the learned judge was wholly mistaken in assuming that judicial opinion as to the danger of grade crossings is largely prompted by that incident to the ordinary public road crossing of a railroad; and it declares that no local sentiment favorable to increased facilities for local travel and communication should swerve a court from its duty to carry out strictly the intent of the statute.

Furthermore, the supreme court holds that the evidence before it showed that it was reasonably practicable to avoid a grade crossing at the point in question. An inspection of photographs showed that the public road, for between 300 and 400 feet on each side of the railroad, was almost level, and that an overhead bridge presented no engineering difficulties in construction or use. Consequently, when it is known by everyday observation that such bridges are built to avoid just such grade crossings, the supreme court asked why was not the avoidance of this one reasonably

practicable? Referring to the fact that, while the engineers of the steam railroad company testified that it was, those of the street railway company testified that it was not founded in the main on a possible obstruction of the highway by a bridge and the want of authority to deflect it, the supreme court cites the Fairmont Park trolley railway, which is absolutely prohibited from crossing the park roads at grade, as demonstrating the practicability of avoiding this grade crossing. Besides, it holds that the cost of an overhead crossing,—seven to ten thousand dollars,—when compared to the peril to the public thereby avoided, is trivial.

THE HEYTOR GRANITE TRAMWAYS.

An interesting account of an ancient tramway is given by W. B. Paley in the Railroad Gazette, and a considerable portion of this unique road is still to be found in an out-of-the-way corner of the West of England. What there is left of it extends from a point on the Moreton Hampstead branch of the Great Western, about one mile south of Bovey Tracy, in Devonshire, up to the quarries at Heytor, on Dartmoor. These quarries produce a splendid quality of granite, and in 1820 their owner, Mr. George Templer, laid from them a railroad composed of granite blocks, and of nothing else. These blocks formed both the rails and the sleepers in themselves, the outer half of the top surface being cut away longitudinally to form a wheel track. This track averages about 4 in. in width, but is often 5 or 6 in., whilst the depth of the cut is somewhat less.



HEYTOR GRANITE TRAMWAY.

The inner raised portion, of course, formed a flange to keep the wheels on the line. No means of preserving the gage are anywhere adopted, and owing to a tendency of the blocks to tilt, from the weights coming nearest their outer edge, the gage varies about 3 in. On the best preserved portions of the line, however, it is 4 ft. and from many measurements the writer believes this may be taken as the actual gage. The granite blocks are quite roughly hewn all over, the ends being only sufficiently dressed to enable a fairly close fit to be made between one block and the next. They are not in any way joined. In length the stones differ considerably, from 4 ft. or so to nearly 8, but perhaps 5½ ft. is the most usual size, by about 1 ft. square.

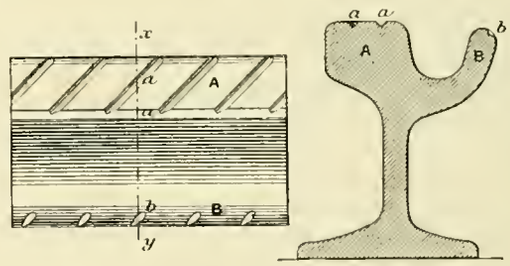
Commencing on the north side of Heytor Rocks, in five or six working faces, the branches unite with the main line, as the longest branch may be called, on Heytor Down, at about 1,200 ft. above sea level. At each of the junctions the hole which contained the heel of a switch may still be seen, but the switches have long since disappeared. No other ironwork seems to have been used. On these breezy downs nothing grows except grass and furze bushes and the bare white stones of the old tramway are as clean as if scrubbed every day. The line runs along the road from Bovey to Widecombe. Here some portions have been dismantled, the blocks lying about in disorder. At Lower Down the line is about 500 ft. above sea, having fallen 700 ft. in 3½ miles. Through the woods and on the down the line is greatly grown over with moss and furze, and, in fact, it is difficult to find it here and there. Near Bovey Grammar School the line crosses a small stream by what is surely the most primitive railroad bridge in the world, simply four large stone slabs thrown across. Two of these have a groove cut in for the wheels to follow. The stream is about 10 ft. across, the bridge itself being 14½ ft. At the Newton Abbot high-road the line crosses another stream by a broken-down wooden bridge and then ends at the Great Western Ry. at Bovey Gas Works. Originally it went on two miles further to the head of a short canal near Teigngrace, but this portion was used in making the Moreton Hampstead line, in 1862-6. On the parapets of the bridges over the latter may be found portions of the old granite blocks of the Heytor tramway, used as coping stones. The canal in question was made in 1792-4, branching from the River Teign for the convenience of the pottery works.

The stone was taken by the canal in barges to Teignmouth for shipment. Most of the granite in the western face of London Bridge (built 1825-31) came down over the Heytor tram, as did the columns of the General Post Office (1829) and the Waithman obelisk at Ludgate Circus, 1833. Rough and ready as it is, the tram was capable of real work and was in use more or less for nearly 40 years. Since then it has been disused for another 40. The quarries are now only worked when some specially large and long piece of granite is wanted, which is brought down by road. The line probably falls another 400 ft. from the center of Lower Down to the present termination, or about 1 in 30, so that considerable brake power must have been needed in coming down. The remains of an old wagon or truck are to be seen in one place; it is quite flat and without sides, consisting of three longitudinal timbers with close cross-pieces on the top. It runs upon four cast iron wheels of 2 ft. diameter, 3 in. wide on the tread, with six spokes curving outwards to a journal 10 in. long. The wheels, of course, run loose on the axles, with a liberal amount of side play. The truck is lightly constructed, is 13 ft. long, 4 ft. wide, with a wheel base of 10 ft. A smaller truck or cart having shafts for a horse was used as the leading vehicle of a train.

There is not a single passing place or siding throughout the line, which may now be considered as 7 miles long, including 1¼ miles of branches at the quarries. Altogether it is an exceedingly curious and interesting piece of work, but having been made by a private individual for his own purposes, without an act of Parliament, it has never attracted the slightest attention or notice. It was opened for traffic Sept. 16, 1820. Mr. Templer was his own engineer. In 1829 the line and quarries were sold to the Duke of Somerset, in whose family they still remain.

A SAND RAIL.

The accompanying illustration shows a plan and section of a Vignole rail especially designed for use on heavy grades, or in damp subways where the use of sand is habitual. The improvement,



SAND RAIL.

which is the invention of M. Vez-Mairet, of Geneva, Switzerland, consists in providing diagonally placed grooves, aa, and the smaller indentations such as b to receive the sand.

We are informed by Isaac S. Cook, of Chillicothe, O., that the Chillicothe, Mt. Sterling & Columbus Electric R. R., of which he is president will be built between the cities named, a distance of 50 miles. The company is fully organized and the survey has been made through Ross County. Rights of way are now being secured after which the survey will be continued. The officers of the company are Isaac S. Cook, president; S. F. Secrist, secretary; and Jacob Houk, treasurer, all of Chillicothe, O.

The ordinance at Atlanta, Ga., for preventing electrolysis contains the following salient features: (1) All producers and owners of electricity must use appliances to retain it within its proper channels and not allow any to escape and injure any pipes or other structure or property of the city; also keep all such electric appliances in good order and use improvements thereon. (2) Penalty for each violation $100. It is not necessary to show that the whole of any injurious electric current comes from any one source! Each contributor to the injury shall be fined. (3) The city may collect damages in addition to each and every fine imposed.

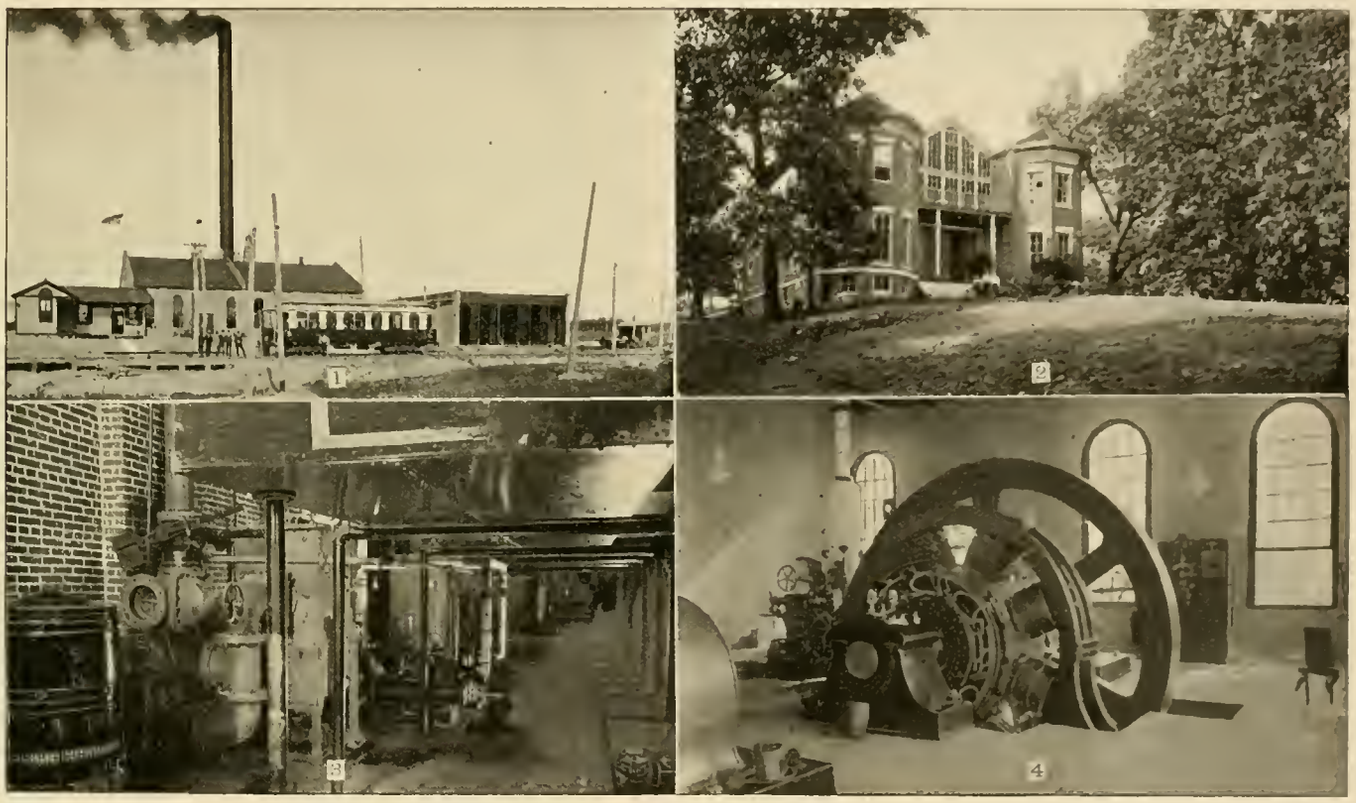
THE ST. LOUIS & BELLEVILLE ELECTRIC RY.

Of all the interesting interurbans from east to west none gives a stronger first impression of having been exceptionally well built than the St. Louis & Belleville, and as one more closely inspects the line and plant the impression is still further strengthened and confirmed. What cannot fail to be noticeable is the extreme simplicity of it all; there seems to have been a carefully studied effort to avoid all unnecessary complications of construction and the result is pleasing to the eye.

The road was under consideration for some two or three years by prominent Belleville men, but little headway was made until Maj. L. N. Downs, of Kalamazoo, was induced to take an active interest in the enterprise. From that day dates the beginning of activities, and a vigorous pushing of the preliminary arrangements and later construction.

The line is double track and all upon a private right of way outside of the two towns. The local road in Belleville has been absorbed by the new interurban, and the local service there continued with the former car equipment; the cars of the interurban run to the public square, which is in the center of town.

In the construction of the track several engineering problems were encountered—none of extreme difficulty, but expensive. Long, deep cuts were made to reduce a grade, which most builders would have climbed or cut but little. In one of these cuts, some 600 ft. in length, at a depth of about 20 ft. a strata of what appears to be a mixture of quicksand and greasy clay, was struck, and this exhibited a tendency to flow in times of rain, with the result that the track would "hump up" in a single night, or move out of line to an extent which would make things interesting to everybody. Surfacing and lining failed to produce any last-



1—POWER HOUSE.
2—CLUB HOUSE.
3—BOILER ROOM.
4—ENGINE ROOM.

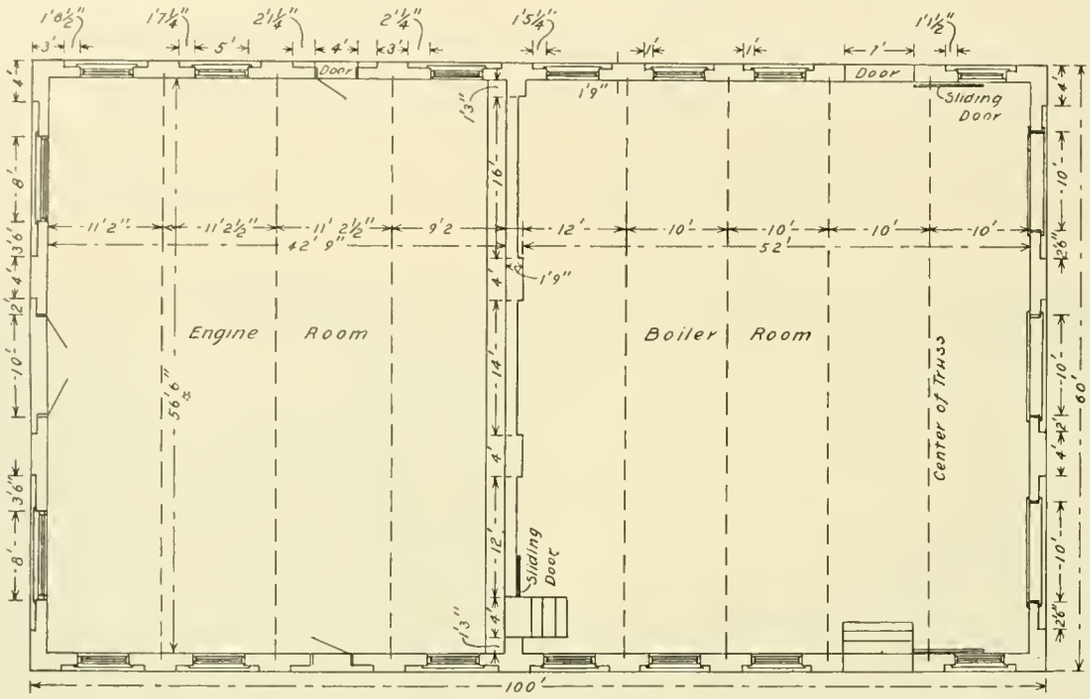
East St. Louis has had a rapid growth during the past decade and from a transfer yard for switching freight trains has grown to be a thriving city of nearly 40,000, with its street railway, paved streets and other evidences of metropolitan life. The whole town practically is built on raised land, which has been brought up from 10 to 15 ft. above original grade.

Belleville, the other terminus of the line, is 14 miles distant and has a population of some 25,000. It is one of the oldest settlements in the state of Illinois, and on its business streets today quaint landmarks of 60 years ago are side by side with modern, up-to-date business houses. There is much business intercourse between the residents of Belleville and the cities at either end of the big Ead's bridge, and the new and improved facilities for inter-communication are already seen to be appreciated, and travel is increasing daily.

ing results, and it was not until tiling was resorted to, that any permanent relief was found. The remedy, however, proved highly satisfactory. A line of 8-in. drain tile was laid at a depth of 2 to 3 ft. in the two traci ditches on either side, and one line between the tracks, all for a distance of 600 ft. Several laterals were also introduced, and a retaining wall of rejected wooden trolley poles and 2-in plank, run for a distance of 300 ft., since which time the hill has shown no disposition to play tricks with the track. Rail of 60 lb. weight and 60-ft. lengths was used and a considerable portion of it laid during the past winter. Although what was thought to be more than ample space was left between the rail ends, the early hot weather produced an expansion, which in a few days made many snaky spots where it was necessary to cut out a section. The steel laid during extremely cold weather was, of course, the worst, and here

the shortening process was resorted to as many as five times before the cure was complete. Major Downs says if he were to lay 60-ft. exposed T-rails again in very cold weather he should leave from 5/8 to 3/4-in. space between rail ends. The work of ballasting the entire 14 miles of double track with cinders is progressing rapidly, and when completed will protect the rail from further excessive expansion. To sight the track at present one would never imagine it was train of steam cars in the country. At one point, where a highway passes below, a platform has been built and steps lead down to the road.

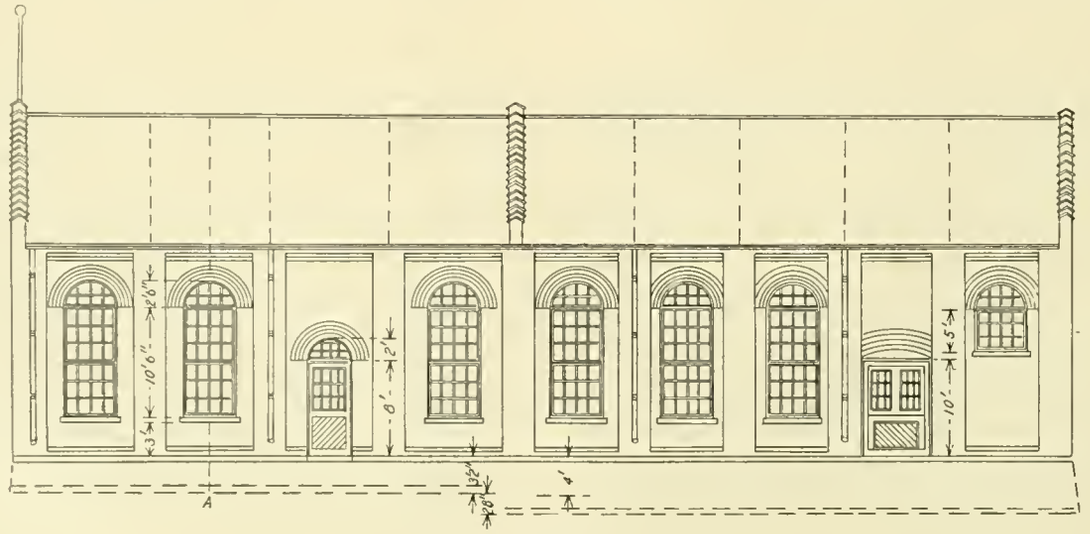
The long trestle is shown in two of the reproductions from photographs, and a sketch of one bent is shown in the line drawing. There are 95 bents of six piles each spaced 15 ft. 9 in. c. to c., making a total length of 1,485¼ ft. The piles are from 22 to 30 ft. long, except at Creek Crossing, where



PLAN OF POWER HOUSE.

once a series of connected S's. The ballast is of excellent quality and to be had in abundance from a burnt out culm bank from a mine about midway on the road. With selected oak ties 6 x 8 x 8 spaced to 2 ft. centers, the track is as smooth and true as most roads at the end of their second year, and the high speed attained makes delightful riding. The curves are nearly all of large radius and are passed at full speed.

At another point a trestle, starting at 6 ft. high and rising to 22 ft. extends for a distance of nearly 1,500 ft. It is built in a most substantial manner and would easily carry any there are some piles 40 to 45 ft. long; they are all of white oak, driven plumb, about half the length being in the ground. The caps are long leaf pine, 12 x 12 in. x 24 ft.; the stringers pine, 7 x 16 in. x 15 ft. 9 in.; chuck blocks, pine, 3 x 14 in.; guard rails, pine, 6 x 8 in; ties white oak, 6 x 8 in. x 8 ft. The caps are drifted to the piles with 1 x 24 in. iron bolts; the stringers are bolted with 5/8 x 26 in. bolts and have 3/4 in. cast iron thimbles between the wood. The packing block between the stringers are pine, 3 x 18 in. x 6 ft., and are mortised 2 in. deep in the stringers. The ties are spaced 18 in. c. to c. and every fourth one is mortised 2



SIDE ELEVATION.

in. on the stringers; the guard rails are mortised 1 in. on all ties and bolted to every key-tie with ⅝-in. bolts.

The trestle and bridge work was all done by the Myers Construction Co., of St. Louis, and we are indebted to Mr. W. S. Henry, vice-president, for the data and photographs of the trestles. Mr. James A. Tiernan, of St. Louis, was chief engineer and drew the plans and specifications.

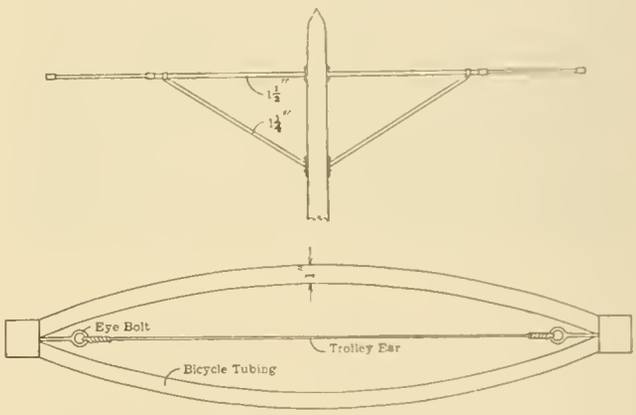
Another trestle is 180 ft. long, with 24 ft. in the clear

TRESTLE 1,500 FEET LONG.

where the Air Line tracks cross below. The proposition was completed by the middle of the trestle coming at the highest point of a 2-mile grade and by a curve which takes in more than half the bridge work. From a distance a car appears to be climbing a roof, but in reality the grade is less than 7 per cent.

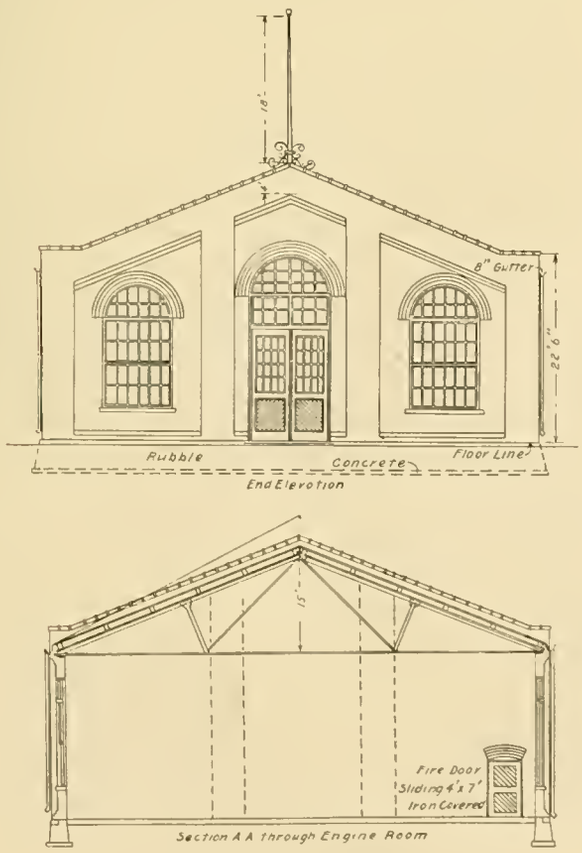
The tracks are 11½ ft. c. to c., which gives ample clearance for the cars, the windows of which, however, are guarded with a wire screen. The line construction includes cedar poles 32 ft. long, with the trolley wire 20 ft. from the rails. Our illustration shows the form of bracket, the arms of which are each 6 ft. long of 1½-in. piping, and the supporting brace of 1¼-in. stuff. The hanger is flexible, made of two pieces of bicycle tubing 1 in. diam. pressed into caps at each end and a wire cord 2 ft. 10 in. long run through, being held at one end and drawn taut with a turnbuckle at the other. The insulation suspending the trolley wire has an adjustment of over 2 ft. Arms and hangers were furnished by the Ohio Brass Co.

The trolley wire, furnished by Ansonia Brass Co., is No. 0000 of the Figure 8 type, and serves the double purpose of feeder also. A voltage of 550 is used, and with the power house situated midway on the line, abundance of current is delivered to both terminals.

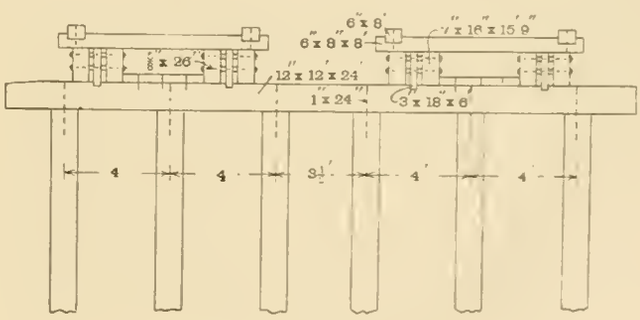


BRACKET AND DETAIL OF HANGER.

The power station, 60 x 100 ft., and car house, 66 x 200 ft., are of a handsome red brick; the general office adjoins, and is a frame building. In the station are two "St. Louis corliss" engines of 625-h. p. each, built by the St. Louis Engine & Machine Co.; they are direct connected to General Electric generators of 425 k. w. each. The four boilers are Babcock & Wilcox, in two batteries, with a nominal



END ELEVATION AND SECTION.



SECTION OF TRESTLE.

capacity of 1,000-h. p. The water supply is abundant, obtained from two deep wells 12-in. drain, and 550 ft. deep. It is soft and clear and remarkably free from impurities. The pumping is done with an air lift of 30-h. p. furnished by Allison & Bremer, Port Carbon, Pa., which delivers water into a 35,000 gallon wooden tank set on iron framework 50 ft. high. Two Warren-Webster 500-h. p. feed water heaters are installed and two Worthington hot water pumps. The oil fillers are the "Famous," made by the Famous Oil Filler Co., of St. Louis.

The switch board is General Electric, with Western Electric Instrument Co.'s instruments. The line station and cars are equipped with Garton lightning arrester.

The fuel supply is close at hand in a mine directly on the line of the road less than a mile from the power house. It is owned by parties who are interested in the road, and the railway is furnishing current for lighting, mining and hoisting, the revenue from which more than pays for the coal used. Other mines have applied for power and a very considerable revenue will be received from this source.

CROSSING OVER AIR LINE TRACKS.

The car equipment comprises 14 cars, of which 6 are open, 6 are closed and 2 closed combination. Each car is equipped with Christensen air brakes, New Haven registers, and the Wilson-Thompson automatic trolley catcher. The cars are certainly models of beauty within and without. The cross seats have leather cushions and are large and comfortable. Seats are provided for 56 persons, with standing room for easily 100 more. The cars are all equipped with improved hand brakes, which are used twice each trip to insure their being in working order, but aside from these applications all the braking is done by air. Circuit breakers instead of fuses are used on the cars. The cars and trucks were built by the St. Louis Car Co.; the trucks have solid 33-in. wheels. Arc headlights of 2,000 c. p. are used. This road carries the mail between Belleville and East St. Louis.

The construction of this road will furnish a delightful pleasure resort to the people of both Belleville and East St. Louis, and will also draw largely from St. Louis. For the two first named cities it is practically the only accessible place. The company has secured a most delightful park directly opposite the power station, and a spur track is being laid which will connect the grounds to main line. The park was laid out some 20 years ago by a very wealthy St. Louis gentleman, who also erected a mansion costing $40,000. This building will be turned into a grand cafe and used as a club house. Artificial lakes, a theater, building and other usual means of outdoor entertainment have been provided, and the whole place made one of the most attractive in the country.

The active work of construction was commenced in October, 1898, and the line opened to travel on May 20th, which was the day originally set. The mainspring of the enterprise was Major Downs, who has carried it through to completion in the face of obstacles which would have long ago discouraged most men. In charge of electrical and mechanical work has been Mr. A. C. Thompson, who was for eight years with the Missouri Railroad Co., of St. Louis. A. D. Marhoff was engineer for the construction company.

Since the completion of this road a consolidation has been effected which, under the name of the St. Louis & Belleville Traction Co., includes the St. Louis & Belleville Electric Railway Co., with 22 miles of track; the St. Louis & Belleville Suburban Electric Railway Co., a competing line, with 22 miles of track, and the Belleville Electric Railway Co., with 6 miles. The company will build a line from Edgemont to Collinsville, about 7 miles, making its total trackage 57 miles.

The officers are: President, John Day; vice-president, George J. Kobush; secretary and treasurer, Z. W. Tinker.

SOME PARK ADVERTISEMENTS.

The Northern Ohio Traction Co. and the Cleveland, Painsville & Eastern R. R. have some rather novel advertisements to call the attention of patrons to the parks on their respective lines. The cards are 11 x 12 in. and bear two lines printed in type ½ in. high.

The Northern Ohio, the old A., B. & C. road, has some cards with the legend:

"With heavy baskets and light hearts
The Gorge-bound Akron car departs."

Others read:

"When the Gorge is green with Nature's bounty
Other Parks are green with envy."

The C., P. & E. cards say:

"Where are you going to, my little man?
To Willoughbeach, sir, as fast as I can."

NEW TRANSFER TICKETS IN WASHINGTON, D. C.

The new transfers recently put in use by the Washington Traction & Electric Co. have been specially designed to allow the conductors to issue them rapidly and with but little loss of time on account of numerous punches. In the old transfers used six different punch holes were necessary: for the month, day, hour, fraction of the hour, junction and direction in which transfer was good. To do away with so many punches the new transfers are issued daily, bearing in print the day and month with the addition of the letters a. m. and p. m. for morning and afternoon tickets. The direction in which the transfer is good is denoted by its color, the tickets being issued in four different shades.

Only two punch holes are required for these tickets, one for the time and the other for the junction. An ingenious device has been planned which makes only one punch necessary for the hours and fractions. Three circles, divided into 12 sections and numbered to represent the 60 minute periods of the day, enclose in separate cases the figures 15, 30 and 45. If the figure 6 be punched in the first circle it will indicate that the transfer is good up to 6:15 o'clock; if punched in the second circle, it will be good up to 6:30 o'clock, etc. The other punch for the transfer junction is all that is required for the conductor to do. The transfers are issued only at the time of the collection of a fare, or of a transfer ticket in such cases where a second transfer is permitted.

AN ESSAY ON PUBLIC OWNERSHIP.

Mr. Edward Wisner, of Toledo, O., in an extremely interesting little pamphlet discusses the question of municipal ownership as applied to his own city, and in doing so gives utterance to many facts of general application. We have extracted portions of an essay which really deserves to be printed in full. He writes:

Toledo is a city of nearly 150,000 people, the equal in intelligence and enterprise of any similar community in the world. It is a city of beautiful homes and thriving industry; the second railway center in the world, and situated to command a large share of the commerce of the unsalted seas. In no city in this country are the masses better clothed, better fed and better housed.

Toledo has had some experiences in owning public utilities, and the balance sheet is interesting reading at the time.

Toledo built what is known as the Woodville R. R. It cost $448,000. The city sold it to the Pennsylvania Railroad Co. for $225,000, or $223,000 less than it cost. The city borrowed $432,000 of the original cost and gave her bonds bearing 7 3-10 per cent. payable in 30 years. The bonds will become due next year, when due the city will have paid $946,080 in interest and the principal will have to be carried along until the present generation shall have bequeathed to posterity both the debt and municipal problems.

Toledo owns a natural gas outfit consisting of pipe line, gas leases, etc. The city borrowed $1,500,000 to go into the gas business. This enterprise has paid $100,000 gross to the city, but not one cent of interest, which is running at the rate of $67,500 per annum. By the time the natural gas bonds are due the city will have paid over a half million dollars in interest in excess of the $100,000 received, and will leave its taxpayers burdened with the original debt of $1,500,000.

The value of the natural gas plant is the subject of much discussion at the present time. The city has recently refused a cash offer of $256,000 for it and has entered into a contract with a New York syndicate for the manufacture of fuel gas to supplement the natural gas supply, agreeing to pay 20 cents per thousand up to 2,000,000 cu. ft. per day; when the gas taken exceeds that amount the price is to be 18 cents. The city reserves the right to buy the supplementary gas plant to be erected by the syndicate at any time after two years capitalized on a 5-per cent net earning basis, but not to exceed $250,000 for a plant capable of making 3,000,000 cu. ft. of gas per day. In any event the natural gas experiment has been a costly one.

It is only fair to state that the advocates of municipal ownership excuse this failure on the ground that the natural gas supply became exhausted or nearly so—a disaster which no foresight could provide against. It should also be stated that a competitor under private ownership, occupying the same field has made the business profitable and is still paying dividends, thus demonstrating the superiority of private business management over public management.

Toledo owns its own water works.' Financially this has been a fair success and affords a great contrast to Toledo's other business investments. Its service, however, is not such as would be tolerated were it conducted by a private corporation.

Toledo has the usual complement of overpaid and under worked officials. Public office in Toledo is both a public trust and a private snap. Some of the officials earn their money. Some of them get from two to five times as much as they could earn in private life. Some offices pay what would be only a fair salary if the official were kept busy, but which is extravagant when compared with the service rendered.

In this respect, however, Toledo is no worse than other cities, all of which proves that the people do not want more politicians, but that they have their hands full in watching those they already have.

Public ownership is a question of degree only. That the government should own the public highways, bridges and navigable streams; that it should own and conduct the postal system are matters already beyond the range of controversy.

It may also be said that a very considerable portion of the people—perhaps a majority—believe that government ownership should be extended in certain lines so as to include the postal savings bank, the parcel post and the telegraph, but it does not follow that because the government does some things well that it can do everything well. It is a well-known fact, and one which will hardly be disputed, that what is done by the government now is done wastefully, and it is possible for the government to conduct its business as it does only because through its taxing form it commands the profits of all of the productive industry of the country. The postoffice department, which is so often held up to us as a fine example of government business ability, is able to run only because it has the United States treasury back of it; as a business proposition it loses directly about $40,000 per day every day in the year—indirectly it undoubtedly loses as much more. From a business standpoint there should be considered interest on its plant, which would swell the deficit enormously. There should be charged a large sum annually for depreciation, repairs and renewals of public buildings; at present no charge is made to the postoffice department for janitor service, heat and light in the government buildings, these expenses being charged to the treasury department. If everything were charged to the postoffice department which is a legitimate business expense, it would undoubtedly double the direct deficit, making a net business loss of approximately $80,000 per day—a sum which for the year equals the total average wealth of nearly 30,000 American citizens; in other words, the accumulated savings of nearly 30,000 average Americans are required every year to make good the losses sustained in the admittedly best conducted business enterprise in which the government is engaged, and this amount has to be supplied by forced contributions from the people of the United States who know enough to conduct their business on business principles. It must, of course, be admitted that the benefits of the postal system are ample compensation for all it costs the people in the way of government taxation to make up deficits. But while the people are able to pay the losses sustained in the conduct of the most economically run department of its government, it need hardly be stated that were all productive industry run as socialism would have it, by the government, and all of it run as the best of it now is, it would be only a short run to bankruptcy of both government and people. It is a fact notorious and beyond dispute that in pretty much all of the ordinary business transactions the government gets woefully swindled. It pays more for any piece of land it may happen to want than individuals or corporations pay under similar circumstances. It pays $125 a head for mules and sells them a few months afterward for $40 or $50 per head. Any wholesale grocer who would do business on the same plan that the commissary department does, would be bankrupt in less than a month. The possession of a government contract is looked upon as a bonanza, because from a business standpoint the pay for property or service furnished is both sure and liberal. Indeed, so universal is the rule that it will be generally admitted without either argument or citation of example. Nobody will contend that municipal government fares any better from a business standpoint than does the general government. The experience of every large city between the two oceans is but an illustration of how municipalities conduct business.

Government of all kinds comes high, but we must, nevertheless, have a certain amount of it. We can stand some waste and extravagance, but good sense indicates that we should keep such losses down by keeping the government out of all kinds of business which private enterprise can do more economically.

Government business methods will improve with the improving civil service, but unfortunately the sense of duty to the public is not as strong as self interest, and the time will never come when any kind of government can conduct business as economically as private business is done.

If you had an agent conducting a part of your business and that agent had uniformly been expensive, profligate and corrupt, what would you think of a proposition to turn over to him conduct of all of your business affairs, and to place your fortunes in his keeping. Your answer must be that such a thing would be preposterous. But that is exactly the proposition of the socialist. The state and municipality necessarily have to conduct some business, but such business has always been done with an expense and extravagance which would mean hopeless bankruptcy were all business so conducted. Common sense and common prudence require a positive "no" to the demands of the socialist.

Business conduct of great enterprise by the state is nothing new, and we have abundant example in this country.

The state of Michigan built the Michigan Central R. R. from Detroit to Kalamazoo at a cost of $2,500,000, and sold it for $2,000,000, and that is one of the brightest examples of railroad building

by the state in this country. Illinois built 58 miles of railroad from Mendosia to Springfield at a cost of $1,000,000 and sold it for $21,000. Illinois' experience in the railroad business cost her $6,000,000. Massachusetts sunk $14,000,000 in the same line. The state of Pennsylvania built and operated what was known as the Allegheny Portage R. R. While operating it the running expenses amounted to $3,161,000 and its gross receipts to only $2,985,000. In "Railways and Republic," by J. F. Hudson, may be found the following:

"The canals and railways built by that state (Pennsylvania) and operated by it for nearly 20 years, are well known as an illustration of the evils of political management in business enterprises. They are salient examples of the demoralizing effect which politics and public works can exert on each other; and the constant strife for their patronage, its use for political rewards, and the expensive administration and unsatisfactory revenues of the roads finally led the state to part with them."

It is not necessary to inquire why men will not do business for the public as economically as they will for themselves. The fact that they do not is sufficient.

In these days of the political demagogue it may sound strange to the working man to be told that he has no more rights than other people; than bankers, merchants, railroad presidents and mayors, all of whom are in the true sense workingmen. Of course he has exactly the same rights and the working classes will have taken a long step in the direction of their own emancipation when they quit demanding special privileges for themselves, and use their energy and ability in seeing that nobody else gets special privilege.

The full grown workingman is no baby—no ward of the state. What he wants is just laws and a fair show. That granted, he can take care of himself, and only in case of such disaster as no economic system can provide against, will he have occasion to ask alms of anybody. He needs not more government, but less. Government has no Aladdin's lamp; no magic wand; no way to get wealth except to take it from its subject. The honest workingman whose mind and muscle directs the machinery of modern civilization cannot afford to ignore the teachings of all past experience and join with ne'er-do-wells in a scramble for the accumulated wealth of the world.

"Nothing should be done by the general government which the state can do as well; nothing should be done by the state which the county, township, or city can do as well; and nothing should be done by any government which private enterprise can do as well."

These are the words of an honored American statesman of the last generation and they are good enough for a whole political platform.

If the city owned the street railway for whom would the street car employes vote?

For the party in power.

How could a corrupt administration intrenched behind thousands of votes of employes be dislodged?

By revolution.

Who would pay the losses caused by extravagant municipal conduct of business?

The same man who pays it now—the taxpayer.

Who is the taxpayer?

Every man who owns or rents a home.

When will it be possible for an honest man to say that he wants a high office because it is a good thing to have, and that he is willing to render honest service in return for the suffrages of his people, instead of lying about it and pretending to not want it; appearing to accept it with reluctance and at great personal sacrifice?

When molasses fails to catch flies.

When will the masses of the people learn that what they want is not special privileges for themselves, but to see that nobody gets any privileges?

Nobody knows.

When will the municipality or state be able to get property or service as cheaply as an individual?

In the Millenium.

When will socialism be practicable?

When the small boy of his own accord gives to his playmate the biggest and reddest apple he has; when the ardent lover yields to his rival the girl he loves and at the same time honestly loves that rival; and when the young miss does not want the prettiest spring bonnet in the neighborhood. And then

"Life will be ravished of its zest,
And shorn of its ambition
And sink into the dreamless rest
Of inanition."—Holland.

SUCCESS OF "THE FOUR CORNERS."

The following communication is from a gentleman in Rochester, incidentally connected with the street railway there, and who has followed the company's weekly publication with much interest.

Rochester, N. Y., Dec. 11, 1899.

Early last spring Mr. H. H. Windsor, editor of the "Street Railway Review," Chicago, suggested to his friend, Mr. T. J. Nicholl, general manager of the Rochester Railway Co., the publication of a weekly paper to be distributed gratis on the cars, at summer resorts and on suburban railways. He thought it would be mutually advantageous to the company and its patrons, that the interests of both were identical; that a well conducted street railway is a city maker, and to be financially successful must have the confidence and patronage of the public. Mr. Nicholl readily fell in with the suggestion, and in April ordered the issue of the first paper in quarto form, 7 x 9 in., and dubbed it "The Four Corners," the point in Rochester from which all the car lines radiate. A photo-engraving of Hose & Engine Co. No. 10, at Driving Park Ave., adorned the first page. The issue was such a decided success it was continued. It struck the public fancy and brought many commentary letters to the officials.

The "Kickers' Column," in which the chronic street car grumblers were ridiculed and made to occupy the amusement seat in the public mind, seemed to be enjoyed by all, even the lampooned kickers. Mr. Nicholl continued the paper until November 1st, when publication was suspended temporarily. The "Four Corners" gave the time tables of all the street and suburban railways and it became indispensable to the cottagers at the White City Windsor Beach, Summerville, Charlotte, Manitou Beach and intermediate stations on those lines and on the Glen Haven road. It advertised in an attractive manner, special excursions on all the Rochester railway lines. It proved a medium for extensive publicity, that could not have been attained otherwise without incurring ten times the cost. It was also a great advertising medium for the city merchants. Elegant illustrations of local scenes were given each week.

The "Four Corners" put an absolute stop to the kicking business. This, of course, pleased the employes of the road. The editor of the little sheet was aided in his work by the suggestions of Mr. Windsor. The press of the whole country made free extracts from the paper and brought it into enviable notoriety. With the close of the summer season and the advent of cold weather, publication was suspended. It will probably be resumed in March, when the "Four Corners" will sing the praises of the Rochester & Sodus Bay Electric line, now being constructed, and which will open to the people of Rochester an ideal summer resort on Lake Ontario, 30 miles from the city, and the numerous intermediate stations, besides furnishing the farmer and market gardener on the line of the road a ready market in Rochester.

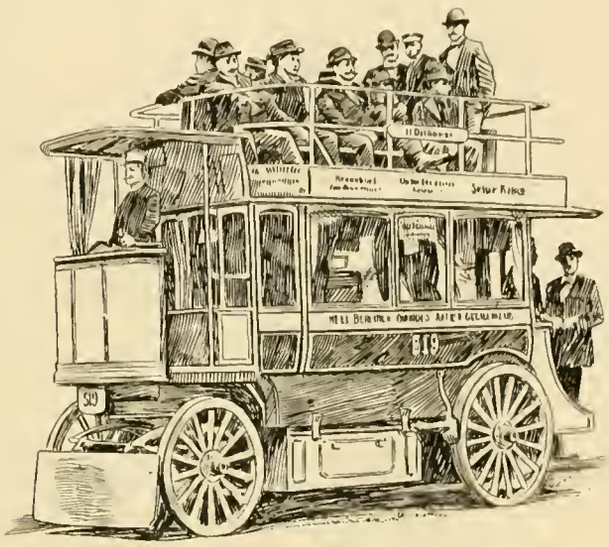
A. E.

NARROWING GAGE WITHOUT PERMISSION OF COUNCIL.

Early in November the Carbondale (Pa.) Traction Co. started the work of changing the gage of its tracks through the boroughs of Archbald, from 5 ft. 2 in. to standard. The object of the change was to enable the Scranton Railway Co., which now controls the Carbondale lines to run through cars. In changing the gage the company did not ask permission of the borough council, as it was thought unnecessary, because the ordinance under which the line was built said: "The gage shall not be more than 5 ft. 2 in." The council of the borough interfered and prevented the change of gage being made, whereupon the company petitioned for an injunction. November 24th the borough was restrained from further interfering in the work, and the change will be made at once.

NEW TYPES OF ELECTRICAL OMNIBUSES.

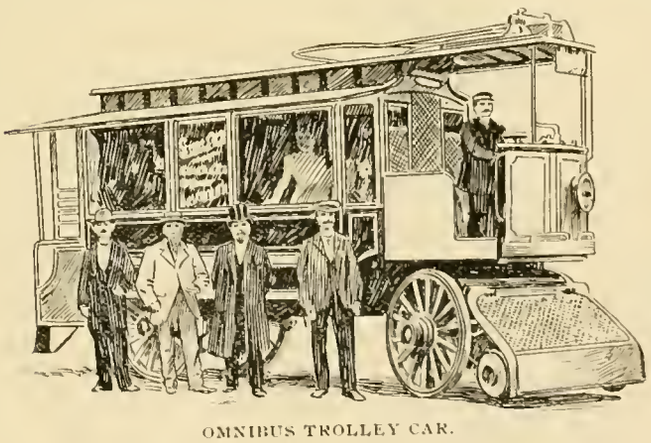
Among the numerous types of automobiles which were exhibited at the International Motor Carriage Exposition held at Berlin recently was the one shown in the accompanying illustration. Electrical omnibuses of this character are now being used in Berlin to supplement the street railway service, and are made by the Union Electrical Co., of Marienfelde. The first of these vehicles was put into service on the 1st of September in the city and has been from the start so popular that its seating capacity of 28 persons is constantly filled. A large number of them are to be put in service on Friedrichstrasse and other principal streets in the city, and the



ELECTRICAL OMNIBUS, BERLIN.

hope is generally expressed that they will eventually entirely replace the two-horse omnibusses which on account of their low rate of fare still carry more than a million passengers a year. The new omnibusses run swiftly and silently over the asphalted streets and seem to fulfill every expectation.

Another type of electric omnibus to be found in Berlin is shown in the following illustration, taken from the Electrotechnische Zeitschrift, and is made by Messrs. Siemens & Halske. The designers



OMNIBUS TROLLEY CAR.

of these vehicles have adopted a system by means of which the accumulators at certain periods of the run will receive a charge from the overhead wires of the tramway company. For this purpose a collecting bow is placed at the top of the car for making connection with the trolley wire, while on the front of the bus two wheels are provided to make connection with the tramway rails.

An omnibus of this type is designed to seat 15 passengers inside and to carry 6 more on the rear platform. The front platform is reserved for the driver only. The weight of the buses complete with batteries and passengers is 6½ tons. The accumulators weigh only 1½ tons. It will be seen that the proportion of the weight of the accumulators to the total weight carried is much smaller than is usually the case. Two motors are used on each axle, making four in all. These are so arranged that the wheels are driven independently. The motors drive by means of single reduction gearing with a ratio of 1 to 7.5 on the front wheels and 1 to 8 on the back. The regulation is effected by means of series parallel controllers in the usual way. The whole object of the design is to keep down the weight of the accumulators and at the same time to have a bus which will run over routes which are not equipped with overhead wires.

The guide wheels are attached to a light axle which is held in position by powerful springs. In a forced run of 30 km an hour during the trial of the first vehicle built these springs and the entire apparatus proved admirably adapted to their uses. Sharp curves were turned without difficulty or danger.

TRACK WITHOUT WOODEN CROSS TIES.

During the last five years a number of the larger street railways have experimented with what has come to be known as the concrete trench construction for roadbeds, where the rails are supported on (and usually partially imbedded in) concrete beams. This construction is only adopted where the paving is laid on a concrete substructure, the rails being held to gage by this sub structure and by tie rods placed at intervals of from 6 ft. to 10 or 12 ft. The "steel tie" construction used by a few other roads is a modification of the trench construction, the metal ties being placed only at intervals of 6 ft. to 10 ft., where if wooden ties were used they would be spaced 2 ft. or 2½ ft. between centers; the metal ties serve principally as additional tie-rods.

The cities where the trench or metal tie construction has been used to considerable extent include Toronto, Detroit, Minneapolis, St. Paul, Kansas City, Scranton, Pa., and Rochester, N. Y. We believe that the Montreal Street Railway Co. also has some of this work.

In the paper on "Pavements between Street Railway Tracks" published elsewhere in this issue Mr. C. H. Rust, city engineer of Toronto, states that the concrete trench construction which has been used with "permanent" pavements in that city since 1895 is much superior to the wooden cross tie construction.

Mr. F. A. Little described the metal tie and the trench work at Detroit in the "Review" for January, 1897, page 44, and in the issue for the following May, page 328, added further data concerning the use of plates under the joints. He then stated that after two years of service, cars being run at intervals of from two to four minutes for 18 hours per day, the track laid on concrete beams with tie-rods every 10 ft., was in a condition at least 25 per cent better than the tracks laid with oak ties on a 6-in. concrete foundation but using no tie-rods and extra support for the joints.

The Twin City Rapid Transit Co., of Minneapolis and St. Paul, in 1896 laid 5-in., 80-lb. T-rails on concrete beams as an experiment (St. Ry. Rev., Feb., 1897, p. 73) and now has some 20 miles (single track) of this construction in the two cities, it being put down wherever paving and other permanent improvements are ordered. In answer to a recent inquiry Gen. Mgr. W. J. Hield stated that the cost of this work was approximately $1,000 more per mile (single track) than would be the wooden cross tie construction. As to the relative cost of maintenance there are yet no data. The city engineers of both cities are very much pleased with the results.

In March, 1897, page 140, we described the concrete construction used in Kansas City, Mo., and additional data were given by Mr. Edward Butts in his paper before the A. S. R. A. at Chicago in October last (St. Ry. Rev., Nov., 1899, p. 766). The Metropolitan company regards this construction as satisfactory in every way as is shown by the fact that it is putting in more of it every year.

The Rochester (N. Y.) Railway Co. put down some of this work in the summer of 1898 which was described in detail in the "Review" for November, 1898, page 792. In a recent letter Gen. Mgr. T. J. Nicholl says:

"The rails were laid on the concrete beams. We have had two miles of single track laid in this way, but we do not contemplate laying any more until such time as we are certain of the success of this style of construction in this climate. The cost of construction is about the same as wooden tie construction, where 6 in. of concrete is laid under the ties, and first class ties used. The track has been laid too short a time to form any idea as to cost of maintenance.

and also to be able to tell of its advantages or disadvantages. We have used metal ties, pieces of old 4½-in. rail fastened to the rail by little cast iron clips and bolts. Most of the track laid in this way was laid in 1898, and, as I said before, we shall lay no more until we have further experience. Our city engineer is very much in favor of concrete work under the track of any kind."

The Brooklyn Rapid Transit Co. recently laid a short section, 1,000 ft., of track to determine whether the trench work was adapted to its conditions. This was described in our last issue and in the same number was a paper by Mr. Frank Silliman, jr., general manager of the Scranton (Pa.) Railway Co., describing the track built at Scranton last summer. The Scranton construction is with 5-in. T-rails held to gage by tie rods and metal ties (made of old rails). It differs from the other types of roadbed mentioned in that the concrete is but little if any thicker under the rails than elsewhere in the street.

TROLLEY WIRE THIEF.

We publish herewith the features of an expert trolley wire thief, who though now suffering the penalty of his misdeeds will be out again before long; he is believed to have been responsible for a large number of losses electric roads have suffered in having their trolley wire stolen.

FRED SCHMIDT ALIAS FRED NEWMAN.

His most recent experience was on the line of the Delta Electric Ry., Cairo, Ill., where he was discovered at work by the conductor of an owl car on the line of the Cario Electric Ry. shortly after midnight. The Delta people were disposed to take no trouble over the case, but not so E. W. Halliday, general manager of the Cario Electric. He too had been greatly troubled with the trolley wire thieves and determined to make an example of the guilty party. He therefore had him followed up and the arrest was not made until he had reached Memphis, where he was found to be an escaped convict from the Tennessee penitentiary, to which he was returned.

His name is Fred Schmidt alias Fred Newman; age 34; height 5 ft. 3 in.; weight 115 lbs.; hair, chestnut; complexion medium fair with hazel eyes.

MECHANICAL TRAINING FOR ELECTRICAL ENGINEERS.

Apropos of what work should be included in a college course of electrical engineering, an eminently successful electrical engineer, who is the electrician of a large electric light company, recently said to Prof. R. A. Smart, of Purdue University:

"I believe the popular judgment in regard to the necessity for mechanical work in the electrical course is wrong. I was graduated from the Massachusetts Institute in the electrical course, and my professional work has been of a purely electrical nature. I have had but little to do with the mechanical side of electrical engineering, and would be, therefore, more likely to favor the electrical side of such a course. In my opinion, however, the electrical students cannot get too much mechanical work; they need all they can get and more than they get, and if any addition is to be made to the electrical course, in which the choice is between electrical and mechanical work, the mechanical work should be added even at the expense of the electrical work. The mechanical end is where the electrical graduates fail."

A new electric locomotive has been built in Tacoma, Wash., under the direction of Supt. Frank L. Dame, of the street railway. The locomotive was built for the purpose of hauling wood trains on the Puyallup and Steilacoom lines and will haul a good sized train with ease. The wood hauling is done mostly in the early morning before passenger traffic begins.

PAVEMENTS BETWEEN STREET RAILWAY TRACKS.

Read before the American Society of Municipal Improvements by C. H. Rust, M. Am. Soc. C. E., City Engineer, Toronto.

In 1891 the exclusive privilege of operating the street railways in the city of Toronto, for a period of 30 years, was disposed of to a company now known as the Toronto Railway Co. The clauses of the agreement, made between the city and the company, that refer more particularly to this paper, read as follows:

"The purchaser shall maintain the ties, stringers, rails, turn-outs, curves, etc., in a state of thorough efficiency and to the satisfaction of the city engineer, and shall remove, renew or replace the same as circumstances may require, and as the city engineer may direct. When a street upon which tracks are now laid is to be paved in a permanent manner, on concrete or other like foundation, then the purchaser shall remove present tracks and sub-structures and replace the same, according to the best modern practice, by improved rails, points and sub-structures of such description as may be determined upon by the city engineer as most suitable for the purpose, and for the comfortable and safe use of the highway by those using vehicles thereon, and all changes in the present rails, tracks and roadbed, construction of new lines or additions to present ones, shall be done under the supervision of the city engineer and to his satisfaction

"In the event of the purchaser desiring to make any repairs or alterations to the ties, stringers, rails, turn-outs, curves, etc., on paved streets, the purchaser shall repave the portion of the roadbed so torn up at his own expense.

"When the purchaser desires or is required to change any existing tracks or sub-structures for the purpose of operating by electric or other motive power, approved by the city engineer and confirmed by the council, the city will lay down a permanent pavement in conjunction therewith upon the track allowance (as herein defined) to be occupied by such new tracks and sub-structures. This shall first apply only to existing main lines and thereafter to branch lines or extensions of main lines and branches, as and when the city engineer may from time to time recommend and the city council may direct and require; but such tracks as are now laid on a permanently formed roadway must, when so required as aforesaid, be changed by the purchaser as hereinbefore provided, without any change of roadbed being made or any expense occasioned to the city thereby."

Under the terms of the agreement the company pays the city treasurer $1,600 per annum per mile of double track and 8 per cent of the gross receipts. When the receipts exceed $1,000,000, 10 per cent is to be paid.

To raise the money for constructing these permanent pavements debentures were issued, payable in 10 years, and the revenue derived from the mileage and percentage of gross receipts is used to pay its interest and sinking fund upon these. The total amount of bonds issued up to the present time is $1,210,776, and the annual payment to provide interest and sinking fund is $149,136. This is at present very nearly the amount received from the street railway company, but as these pavements between the tracks will last for a much longer period than 10 years, in a few years there should be a considerable revenue derived from this source.

A great diversity of opinion has arisen as to the meaning of the word "permanent," used in connection with pavements. In 1888 this question was in the High Court of Justice before Judge Rose, in a case brought by the corporation of Toronto against the old Toronto street railway company, and after considerable litigation it was finally settled, without, however, the judge giving his opinion as to the meaning of the word "permanent." When the present company obtained its franchise the interpretation of the word was again subjected to a great deal of discussion, and in 1893 the work of changing the rails by the company and the construction of the pavements was postponed from April until August, pending a settlement as to the meaning of this word. The writer has always taken the ground that in this case the word "permanent" refers to pavements with a concrete foundation, and this has since been taken as the meaning of the word as mentioned in these clauses. It is a great pity that this word should be so frequently used in connection with pavements. It would certainly be better in future cases to state explicitly what is a permanent pavement.

In compliance with the provisions contained in the previously

mentioned argument, in the spring of 1892 plans and specifications for paving the track allowance on King, Queen, Yonge and other streets were prepared, and on June 28, 1892, the street railway company laid down a temporary track on King St., west of Simcoe St., and the contractor for the pavements commenced work. The work of changing the tracks and constructing permanent pavements on these streets was carried on continuously until winter set in (with the exception of a week's intermission during the time of the Industrial Exposition). The amount of track taken up and relaid that season was 29.9 miles. The rail adopted by the company and approved of by the city was a 6½-in. steel girder rail, weighing 70 lb. to the yard, and having a web ⅜ in. thick and a base 4½ in. wide. A slight alteration was afterward made in the size of the base, it being made 5 in. instead of 4½ in. The rail now weighs about 73 lb. to the yard. From experience since gained a heavier section of rail should have been used. The following are the quantities of materials and weights required to build one mile of single track:

128 tons of rails.
5.85 tons of fish plates, 17 lb. per pair.
1,800 cedar ties.
1 ton of spikes, ¾ lb. each.
1 ton of bolts and nuts, 1 lb. each.

The work of constructing these pavements and of laying new rails was carried on continuously until the work was practically completed in 1894, there being only a few extensions constructed since. In constructing these new pavements the street railway company took up the old rails, tamped the gravel under the ties, put down new rails and lined and leveled them and the paving contractor did the rest of the work.

It may be of some interest to give the amount of work done in each year, the average cost per lineal foot (the width paved being 15 ft. for a double track), the average rate of progress per day, and the different classes of paving material:

1892—29.9 miles single track cost.....$322,555.00
1893—26.1 miles single track cost..... 302,030.00
1894— 9.8 miles single track cost..... 116,942.61

The average cost per lineal foot of double track for the different classes of pavement during these years was:

Asphalt $5.23
Granite 2.43
Brick 4.21
Cedar blocks 3.83

This includes the cost of stone or scoria toothing. Where granite was used the contractor was permitted to use the blocks that were on the street.

The average amount done per day was:

Asphalt .....131 lin. ft. of double track
Granite ..... 56 lin. ft. of double track
Brick ..... 73 lin. ft. of double track
Cedar block ..... 96 lin. ft. of double track

In 1894, on McCaul St., the method of construction was slightly altered as to the system of laying the granite or scoria toothing. It was found that when the blocks were laid as headers and stretchers the water lodged next to the block and assisted in destroying the asphalt. To prevent this it was decided to lay scoria blocks, 4 x 5 x 9 in., with their length parallel to the rail and then lay the asphalt. The practice had been to lay the first 6 in. of concrete up to the bottom of the rail, then lay the scoria blocks in mortar and finally put in the remainder of the concrete. On this street a change was also made in this respect. The whole of the concrete was put in at once and while it was still wet scoria blocks were pounded into it and left to consolidate with the concrete before the asphalt was laid down. In any extension constructed since 1895 wooden ties have been dispensed with and steel tie bars, 2 x ⅜ in., placed 6 ft. apart, have been used, the rails being laid on a solid bed of concrete 8 in. in depth by 20 in. wide. This method of construction is much superior to the first type adopted and is largely used in other cities.

After an experience of six years with the different materials used, it is evident that with the conditions existing in Toronto, asphalt is not a suitable paving material to be used between street railway tracks. After having been down only four years, the asphalt commenced to disintegrate. This was at first more noticeable where the asphalt joined the toothing, but it was not long before the rest of the material between the rails commenced to wear into holes. This was due probably to the following causes:

The lack of a proper foundation under the ties, which was shown by the settlement of the rails in several places. The impossibility of properly tamping the asphalt; and the constant watering of the asphalt, rendered necessary by the dust caused by the passage of the cars, and also by climate conditions. Upon King St., which was the only asphalt pavement laid without toothing, a rut was soon formed, rendering constant repairs necessary. The fact of the lip of the rail not being quite as high as the head and the gage of the track being 4 ft. 10⅞ in. instead of 4 ft. 8½ in., probably had a great deal to do with the forming of this rut.

As previously mentioned, the first pavements were laid in 1892 and in 1897 it became necessary to commence tearing up the asphalt and replacing it with granite, scoria or brick, depending upon the amount of travel upon the street, and by 1900, all the asphalt between the rails will have been replaced by a more permanent material. Up to the present time 7¼ miles of this work had been done. At first as these asphalt pavements were guaranteed for five years, arrangements were made with the contractors whereby they substituted brick for this asphalt, and were paid $1.50 per sq. yd., but afterward when the guarantee expired the price paid for substituting scoria for asphalt averaged about $2.40 per sq. yd. This includes taking up the old asphalt and also 4 in. of concrete. The amount of money spent up to the present time in substituting a more permanent material for asphalt is $137,340.19. In putting in blocks in place of asphalt, the asphalt was first taken off and then the concrete had to be picked out so as to afford room for the blocks, which were bedded on a cushion of sand. Fortunately on most of the streets the concrete was put in between the rails just to a depth of 4 in., and it was not a very difficult operation to take this out. Granite is no doubt the most durable material to use between street railway tracks, but owing to the very strong opposition of the cyclists not so much of it was used as the department would have liked, and scoria blocks, imported from England, were used instead. On streets where there was not a great deal of travel, Canadian bricks were used. Cement grout was used almost entirely for this work; some filling was done with paving pitch, but cement was found to be the more satisfactory. Owing, however, to the impossibility of stopping street car traffic while this work was in progress, it was very difficult for the filling to become properly set. On King St., during the past summer, where scoria block was substituted for the asphalt, a portion of the pavement between the tracks was laid with concrete. It has been down now for some two months, but not long enough to know the results.

WATER GUARDS FOR TROLLEY POLE AND ROPE.

The accompanying illustrations show the trolley rope water guard and the trolley pole water guard invented by Mr. Thomas Hawken, superintendent of the Rockland, Thomaston & Camden Street Ry., of Rockland, Me. Fig. 1 is the pole guard; it catches the water which is discolored by the corrosion of the trolley wire, and prevents it from running over the roof

FIG. 1.

FIG. 2.

of the car and down the sides and discoloring the paint. Fig. 2 is the rope guard which prevents water from the overhead wires from running down the trolley rope and dripping onto the platform and the clothing of the passengers. Mr. Hawken states that both of these devices have been tested and their usefulness demonstrated on the road under his charge.

IN THE POWER HOUSE.

This department is devoted to the construction and operation of electric railway power houses. Correspondence from practical men is specially invited. Both the users and makers of power house appliances are expected to give their views and experiences on subjects within the range of the department.

ACCIDENT AT THE BIRMINGHAM (ALA.) POWER HOUSE.

An accident occurred last month at the power house of the Consolidated Electric Light Co., of Birmingham, Ala., which shut off the city's lights and stopped the electric railway system for some time. The 52-in. belt on one of the engines parted and one end of it flew over against the piston rod of another engine, bending it and breaking the piston head. In this way both engines were disabled at once. The accident occurred about the time that people began returning to the city from the state fair, and the number of heavily loaded cars on the line is thought to be the cause of the belt breaking. As soon as the accident occurred the management put quite a number of dummies into service, which gave a fair schedule on part of the line. The feed wires of the Birmingham Traction Co. were also tapped, from which sufficient power was obtained to run eight cars on one of the lines. It required a large force of men from the time the accident occurred until the next morning to repair the damages.

MANIPULATION OF WATER RHEOSTATS IN TESTING GENERATORS.

Mr. Edward J. Willis, in a paper before the American Institute of Electrical Engineers, giving the results of tests of a 300-kw. railway generator, gives the following information concerning the rheostat used: "The water rheostat was composed of two sheets of boiler plate 5 x 6 ft. each. By means of soda the conductivity of the liquid was brought to the desired point. With light loads and before the water commenced boiling completely, there was some fluctuating in amperage, but after the water got to boiling thoroughly, the load could be maintained perfectly steady. At 500 amperes there was about 15 sq. ft. of each plate submerged. The water evaporated by the boiling was replaced by a hose connection and the water level in the rheostat tank thereby maintained constant. The writer would state that in his experience with rheostats of any size, if a steady load is required, it is better to let the water come to a boil and the plates remain steady, replacing the evaporated water with a running connection, than to attempt the continual raising and lowering of the plates."

DISCREPANCY BETWEEN COMMERCIAL AND EXPERIMENTAL RESULTS IN BOILER TESTS.

The final result sought by manufacturers, in initiating tests of steam or other machinery in actual use, is the value of the work done measured in dollars and cents. In some cases the broad question is raised as to the saving that may be accomplished by installing improved boilers, engines, or other machinery; but more generally it is desired to ascertain what can be done to produce saving with the apparatus already in place under the actual conditions that prevail at the particular location. In both these cases it is necessary to ascertain the average cost of the work done commercially previous to the test. Frequently, in fact, generally, this important fact will not be ascertained by an elaborate trial, for the reason that everything will be put in order for the test, and all details of the trial be conducted so carefully that the losses due to average carelessness or want of skill in the past will be eliminated, the engineer making the test will not receive proper credit, and the owners, on seeing the report, may conclude that they are already doing very well, and perhaps continue old methods with fancied security. If the cost of the output of the factory for a given time were ascertained in terms of the coal burned during the same time, and compared with the corresponding cost for the time of the trial, the latter would frequently be found to be one-eighth to one-third less than the former, and it might not be possible to tell what had caused the difference; for instance, whether it was due to putting in order the machinery prior to the tests, to greater care exercised by the fireman under the spur of careful watching, or whether, as is usually claimed, the coal was different, etc., etc. The losses are generally due in the main to the carelessness of the firemen. It follows, therefore, that the cost of the power under average conditions must be obtained in some quiet way preliminarily. Frequently the comparison of the output of the factory with the coal burned will not be sufficiently accurate, and it will be necessary to devise some corresponding check which will not interfere with the regular routine of the establishment. The work of the boilers may be checked by arranging a meter so as to continuously measure the feed water; and its record, compared with the total weight of coal purchased, will frequently give the check desired. Such a check becomes more difficult when it is desirable to ascertain the performances of particular boilers, and the coal supply is common to all boilers; but by assigning particular weighed carloads of coal to the particular boilers, without any intimation to the firemen that they are being watched, it may be possible to ascertain the average performance of the boilers used for the particular purpose. Preliminary experiments of this kind conducted without notice to employes, and continued through a long period, will furnish a basis for comparison with elaborate tests, and it will then be possible to point out clearly where the several losses have taken place, and the testing engineer will get the credit for the saving shown.—Appendix XXV, Proposed Revised Code for Boiler Tests, American Society of Mechanical Engineers, by Dr. Charles E. Emery.

FRICTION OF STEAM PACKINGS.

Read before the American Society of Mechanical Engineers by C. H. Benjamin.

It is generally conceded that one of the most serious frictional losses in engines and pumps is that due to the rubbing of piston and valve rods in their stuffing-boxes, and that this loss varies with the kind of packing employed, the steam pressure, and the judgment of the engineer.

The writer is not aware, however, that any experiments have been described which would show the extent of this loss and the law of its variation. The experiments described in this paper were made at the laboratories of the Case School by senior students, under the direction of the writer. The apparatus used was constructed by Mr. E. O. Lieghley of the class of '98, and a few experiments made by him.

During the past year, Mr. G. S. Beckwith, of the class of '99, made a large number of tests with different varieties of packing, and the results seemed of such interest as to justify their presentation to this society.

The general character of the apparatus is shown in Fig. 1. It consists of a cast-iron cylinder, 6 x 13 in. inside, fitted at each end with a cover and stuffing-box suitable for a 2-in. rod. The proportions of the gland, etc., were taken from those of a well-known engine. The rod was given a reciprocating motion by means of a slotted cross-head and crank; a pulley on the crank was connected by a belt with the pulley of a transmitting dynamometer; steam was admitted to the cylinder by the vertical pipe shown in the figure, and the water of condensation was drained off from time to time at the bottom.

A steam gage attached to the cylinder showed the internal pressure at each instant. The adjusting nuts of the glands were usually

COST OF POWER FOR ELECTRIC RAILWAYS.

Output Measured by Wattmeter in Each Case.

Station.	Month. 1899.	Monthly Output, Kilowatt-Hours.	Cost of Electrical Output per Kilowatt-Hour—Cents. Fuel.	Labor	Supplies, Oil, Waste, etc.	Water.	Repairs.	Total.	Gals. Cylinder Oil per 10,000 k. w. h.	Gals. Lubric't-ing Oil per 10,000 k. w. h.	Lbs. Water per Lb. Coal.	Lbs. Fuel per k.w.h.	Price of Fuel per Ton of 2,000 Lbs.	Kind of Fuel
1	July	1,433,006	.271	.169	.031	.032	.026	.529	3.99	1.09	11.77	2.51	$2.16	Bituminous
1	Aug.	1,410,678	.263	.175	.042	.032	.039	.551	4.07		11.88	2.51	2.10	"
5. Metropolitan Elevated, Chicago.	July	1,377,600	.380	.181	.031	.031	.030	.653	5.00	1.47 3.92	7.49	4.53	1.68	"
5. "	Aug.	1,363,511	.375	.190	.029	.030	.035	.659	4.00	4.05	...	4.43	1.69	"
6	July	611,090	.579	.237	.034	...	.285	1.135	...	...	...	2.41	.7024**	Oil
6	Aug.	588,952	.590	.250	.051	...	.255	1.146	...	...	...	2.40	.7575**	"
8	July	806,814	.607	.261	.018	.052	.010	.948	...	...	...	...	...	Bituminous
8	Aug.	856,723	.612	.240	.023	.050	.014	.938	...	...	...	...	...	"
9	July	670,135	.429	.194	.017	.036	.003	.680	...	...	...	...	...	"
9	Aug.	656,225	.458	.202	.023	.035	.011	.730	...	...	...	...	...	"
10	July	454,914	.252	.122	.006	.011	.019‖ .006‡	.419*	1.77	2.22	...	4.44	1.14	"
10	Aug.	454,122	.319	.125	.006	.009	.015‖ .005‡	.480§	1.9	2.2	...	5.82	1.10	"

*Miscellaneous, .008. §Miscellaneous, .001. **Cost of Oil per Barrel.
‖Engines. ‡Generators.

tightened only by the fingers, but when a wrench was used, it was turned by a spring balance and the turning moment noted.

The travel of the rod was 4.25 in., and the usual speed about 200 r. p. m., giving a piston speed of about 140 ft. per minute. Seventeen different varieties of packing were tested, made by nine different manufacturers. The materials present were rubber, asbestos,

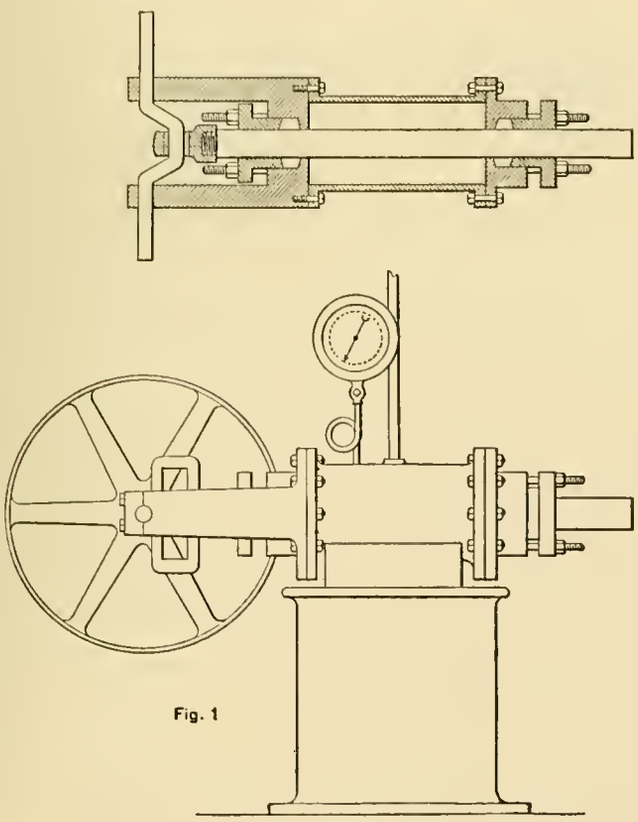


Fig. 1

TESTING APPARATUS.

cotton, flax or hemp, lead, mica, graphite, and paraffin. No metallic packings, strictly so called, were tried.

The following brief description will show the general characteristics of each variety:

1. Square, ring, 7/8-in. Layers of canvas and rubber, saturated with graphite and oil.

2. Sectional, ring, 7/8-in. Composition similar to No. 1. Each ring consists of an inner and outer cone, fitting together, and so wedging under pressure as to fit tightly to rod and box.

3. Similar in shape and composition to No. 1.

4. Metal face packing. Alternate soft and metallic rings. The metallic rings contain lead band, backed by rubber and flax, the whole wound with cotton braid.

5. Two kinds: (a) a sleeve composed of woven flax, rubber, and canvas; (b) a spiral packing of woven flax backed with rubber.

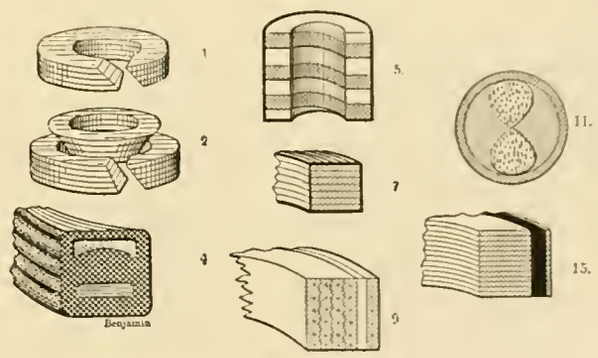
6. Spiral, square, 7/8-in. Alternate layers of rubber and canvas.

7. Spiral, square, 1/2-in. Layers of canvas and rubber, saturated with graphite and oil.

8. Similar to No. 7, but of a different make.

9. Spiral, square, 1/2-in. Composed of rubber and asbestos compound, with elastic rubber inset. Slightly impregnated with graphite.

10. Spiral, circular, 7/8-in. Red rubber core, wound with layers of rubber and flax, and coated with graphite.



PACKINGS TESTED.

11. Spiral, round, 1/2-in. Two wedge-shaped strands of woven flax in center, and two strands of canvas, the whole surrounded by a woven cover saturated with graphite and oil. There seemed to be also some paraffin present.

12. Spiral, round, 1/2-in. A rubber core, around which are braided three thicknesses of hemp or flax, soaked in oil. The whole coated with paraffin.

13. Spiral, round, 1/2-in. A rubber core, surrounded with layers of woven cloth and rubber, impregnated with ground mica.

14. Square, 1/2-in., pump packing. Alternate packing. Alternate layers of canvas and rubber. No lubricant.

15. Square, 1/2-in. Similar to preceding, but having a rubber back about 1/8 in. thick.

16. Square, 1/2-in. Alternate layers of rubber and canvas. No lubricant.

17. Spiral, square, 1/2-in. Woven flax, soaked in oil. As at first constructed, the gland was adapted for packing 7/8 in. thick. The flat

ring and sectional packings of this size, such as Nos. 1, 2, and 3, worked well, but it was found that no spiral packing 7/8 in. thick, would coil easily around a 2-in. rod. Accordingly, the box was bushed and a new gland made to accommodate ½-in. packing.

In cutting and inserting each kind of packing, careful attention was paid to the accompanying directions, and an endeavor was made to ensure the most favorable conditions. It was not practicable to make endurance tests, but each packing was allowed to remain in the box long enough to get into fair working order.

The routine of each trial was about as follows: The apparatus was first tested empty of packing to determine friction.

The packing was then inserted and adjusted in each end, according to directions, and the steam turned on. The very least pressure which would prevent leakage was used on the gland nuts. The packing was then tested under various steam pressures, each run lasting from fifteen to forty minutes. The nuts were then tightened to various pressures, and other sets of readings taken. Cylinder oil was next applied to the rod, the only lubrication in the tests so far having been that contained in the packing itself. Finally, a last run was made with the boxes empty, as at first. A Flather recording dynamometer was used on a few of the runs, so as to determine the nature of the variations in power. The majority of the tests were made with a Webber box gear dynamometer, readings being taken at short intervals and averaged.

TABLE I.

Kind of Pack'g.	No. of Trials	Total Time of Run in Minutes.	Average Horse power Consumed by Each Box.	Horse-power Consumed at 50 Pounds Pressure.	Remarks on Leakage, etc
1	5	22	.091	085	Moderate leakage.
2	8	40	.049	.048	Easily adjusted; slight leakage
3	5	25	.037	.036	Considerable leakage.
4	5	25	.159	.176	Leaked badly.
5	5	25	.095	.081	Oiling necessary; leaked badly.
6	5	25	.368	.400	Moderate leakage.
7	5	25	.067	.067	Easily adjusted and no leakage.
8	5	25	.082	.082	Very satisfactory; slight leakage.
9	3	15	.200	.182	Moderate leakage.
10	3	.	.275	....	Excessive leakage.
11	5	25	.157	.172	Moderate leakage
12	5	25	.266	.330	" "
13	5	25	.162	.230	No leakage; oiling necessary
14	5	25	176	.276	Moderate l'kage; oiling necessary
15	5	25	.233	.255	Difficult to adjust; no leakage.
16	5	25	.292	.210	Oiling necessary; no leakage.
17	5	25	.128	.084	No leakage.

TABLE II.

Kind of Packing	Horse power Consumed by Each Box, when Pressure was Applied to Gland Nuts by a Seven-inch Wrench						Horse power Before and After Oiling Rod	
	5 Pounds	8 Pounds	10 Pounds.	12 Pounds	14 Pounds.	16 Pounds	Dry.	Oiled
1	120	. .	.136					
3	. .	. .	. .	....	....	. .	.055	.021
4	.	.248	. .	.303	....	.390	154	.123
5	....	220						
6	....	.348	.430	....	. .	....	.323	.194
7	. .	126	228	.260	330	.340	.067	.053
8	. .	.363	.500	535	.520	.533	.533	.236
9	. .	666	....	....	....	....	.666	636
11	.	405	.454	. .	....	....	454	.176
12	.	161	.242	.359	.454	....	454	122
13	.	.317	.394	.582				
15	.	526						
16	....	.327	.860					
17	. .	198	277	380				

Table I. gives a summary of the results, showing the average horse-power consumed by each packing box at varying pressures and, for purposes of comparison, the power at 50 lb. pressure of steam. The friction of the machine has been deducted.

Table II. shows the effect of tightening the gland nuts on the friction of the packing and also the effect of oiling the rod.

In most of the experiments detailed in Table I. the nuts were tightened with the fingers only, and then just enough to prevent leakage, and no lubricant was used except that incorporated in the packing itself. With some of the dry rubber packings it was necessary to use oil from the first. A good quality of cylinder oil was applied.

The effect of varying the steam pressure is best shown graphically, as in Tables III. and IV. The numbers at the ends of the

TABLE III.
VARYING STEAM PRESSURE
SCALE 1 INCH = 0. 1 H. P.

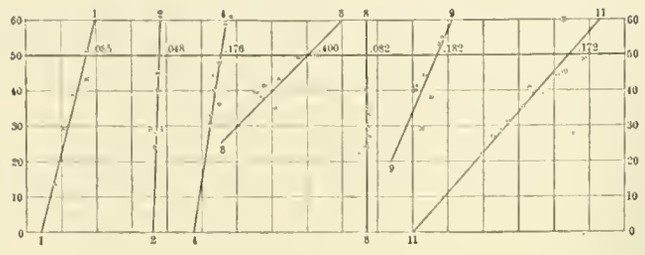
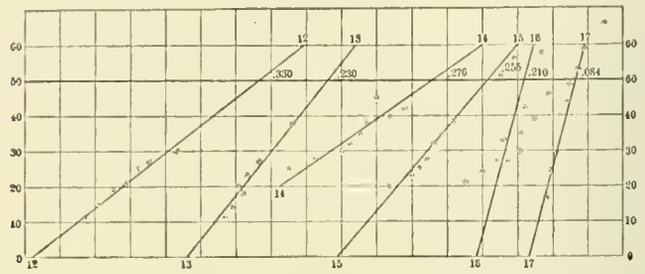


TABLE IV.
VARYING STEAM PRESSURE
SCALE 1 INCH = 0. 1 H. P.



lines correspond to the numbers used in the other tables. The ordinates indicate the steam pressures observed, while the abscissas represent the horse-power consumed by each box. The points where these lines cut the line of 50 lb. pressure are those used for comparison of the different packings. It will be seen that the friction varies with the pressure in approximately straight line ratios in many of the cases.

GENERAL CONCLUSIONS.

1. That the softer rubber and graphite packings, which are self-adjusting and self-lubricating, as in Nos. 2, 3, 7, 8, and 11, consume less power than the harder varieties. No. 17, the old braided flax style, gave very good results.

2. That oiling the rod will reduce the friction with any packing.

3. That there is almost no limit to the loss caused by the injudicious use of the monkey-wrench.

4. That the power loss varies almost directly with the steam pressure in the harder varieties, while it is approximately constant with the softer kinds.

The diameter of rod used—2 in.—would be appropriate for engines of from 50 to 100 h. p. The piston speed was about 140 ft. per minute in the experiments, and the horse-power varied from .036 to .400 at 50 lb. steam pressure, with a safe average for the softer class of packings of .07 h. p.

At a piston speed of 600 ft. per minute, the same friction would give a loss of from .154 to 1.71 with a working average of .30 h. p., at a mean steam pressure of 50 lb.

It is the intention of the writer to make a series of tests with water packings, and also to try some of the standard forms of metallic packings. He would be glad of any criticisms and suggestions from builders and users of pumps and engines, in regard to any further experiments.

A large consignment of cars went through the New Haven (Conn.) freight yards last month bound west. The trains which came from the Laconia Works in New Hampshire were about 40 cars long, each freight car containing a trolley car.

On November 21st the Western Society of Engineers visited the Lewis Institute, Chicago, at the invitation of the trustees and faculty. The different departments of the Institute were visited in the afternoon and at 6 o'clock an informal dinner was given in the Institute building. The after-dinner speeches were on the subject of technical education in general and a general discussion followed in which many of the guests took part. During the evening the work of the night classes, in which over 900 students are enrolled, was explained.

ELECTRICITY ON CANALS.

Up to within the past year or two, canals have been very much neglected since the introduction of railroads, and no attempts have been made to introduce modern engineering methods upon them.

Some of the most modern canals are to found in Germany, which country has taken a leading part in the development of canal traffic. It is evident that in order to compete with the railways boats of considerable tonnage must be used. The old English canals were at first built for vessels of from 30 to 80 tons only, and later ones were designed for ships of 100 to 150 tons. To still further reduce freight rates by increasing the size of vessels, the Prussian government adopted a canal profile capable of taking ships of from 600 to 800 tons burden. The first of these larger size canals is the one now completed from Dortmund to Emshafen, a description of which is given in the Electrical Review, of London. The latest advances in engineering are to be found in the mechanical devices upon this canal, all of which are expected to have an important influence on the cost of transportation of goods. Electricity plays an important part in the equipment of this canal whose principal cargoes consist of Sweedish iron ores and Westphalian coal.

At the terminal harbor of the canal at Emden, a central station has been erected by Siemens & Halske, which supplies a 500-volt continuous current for power and a 3-wire system, of 220 volts on each side, for lighting. A battery of accumulators serves for subdividing the voltage for lighting. The central station in course of

CANAL TOWING BY ELECTRICITY.

construction will contain three sets of machines each of 100 h. p., two sets of which are already erected. In the harbor there have been erected three traveling cranes driven by electricity, each of which is capable of lifting 2,500 kg. Other cranes are projected, also a floating dock with pumping machinery operated by electricity.

The work at the locks is all done by electricity. Motors with switches are placed in iron casings at each side of the gates. These open and close the sluices for connecting the lock with the upper or lower canal, work the lock gates and pull ships into and out of the lock by means of capstans. The motors may be driven from a switch at the motor, or from a steering house, from which the whole lock can be overlooked, and all the movements of gates, etc., be operated by levers. The power being supplied by a small turbine is very cheap.

The towing locomotive recently introduced by Siemens & Halske it is thought will contribute greatly to the economy of canal traffic. This machine has been thoroughly tested in several places. For medium size and small canals one rail is sufficient, the stability of the machine being secured by slightly loading latteral wheels which run on the ground. A general view of this machine is shown in the accompanying illustration, and an important feature of the invention is the remarkable economy which is claimed for it. It is estimated that for a traffic of 10,000,000 tons per annum, a saving of from 40 to 50 per cent as compared with steamers would be effected, besides which, the great destruction of the canals by the back wash of steamers is entirely avoided.

Considerable attention has recently been drawn to the neglected condition of the Erie canal in New York, and a company has been experimenting for some time on various kinds of traction machines for towing vessels economically. It has recently been given out by members of this company that two machines have been experimented upon by them, one of which is shortly to be put to practical service on the canal. This traction machine is operated by means of storage batteries and is somewhat in the nature of an automobile, as it runs upon the tow path without the use of any track. The other machine is similar to the one manufactured by Siemens & Halske, running upon a single rail and receiving its energy by means of the overhead trolley system.

It is understood that the storage battery traction motors are being manufactured in considerable quantities and will be put in practical operation next season when the canal opens.

ANOTHER FAKE ACCIDENT OPERATOR.

For several months past a man calling himself James Neary, has been endeavoring to secure money from different street railway companies and insurance companies by pretending to have received injuries when alighting from cars. In an eastern paper of June 18th last the following details were given concerning Neary's career since March:

"Fell from trolley car, Paterson, N. J.; injured kneecap; threatened suit for $10,000 damages against New Jersey Electric Railway Co.; settled for $50.

"Two weeks later was knocked off a Main St. trolley car in same city; threatened suit against the Paterson Railway Co., and secured $50 in settlement.

"One week later somersaulted from a trolley car in Newark, N. J., again injuring his kneecap; settled with Union Traction Co. for about $50.

"Two weeks afterward was jolted from a car of the New Jersey Electric Railway Co., at Jersey City, and seriously injured. Made affidavit that he had never been in an accident before or received money for an injury. Company refused to settle and encouraged damage suit, but Neary detected the trap laid for him and failed to appear in court at the trial.

"Three weeks ago (May 23d) changed the scene of operations to New York City; injured hip while alighting from car of the Metropolitan Railway Co.; started suit for $10,000 damages; company doctors found injury to be an old fatty tumor, which Neary doubtless had for 20 years. Secretary John J. Scanlan, of the New Jersey Electric Railway Co., was in court at the trial prepared to reveal the real identity of the injured man, but the latter failed to appear. His lawyers were disappointed.

"Present whereabouts unknown."

In October last doctors representing the Travelers' Insurance Co., of Hartford, and the Fidelity & Casualty Co., of New York, were searching for Neary in Scranton, Pa., he having given them an address in that place. He had made two applications to the New York company, alleging that he had sustained injuries in alighting from a street car, and one to the Hartford company. The insurance people stated that they had information that Neary had successfully played his game no less than 15 times.

GRADE CROSSING ACCIDENT IN CHICAGO.

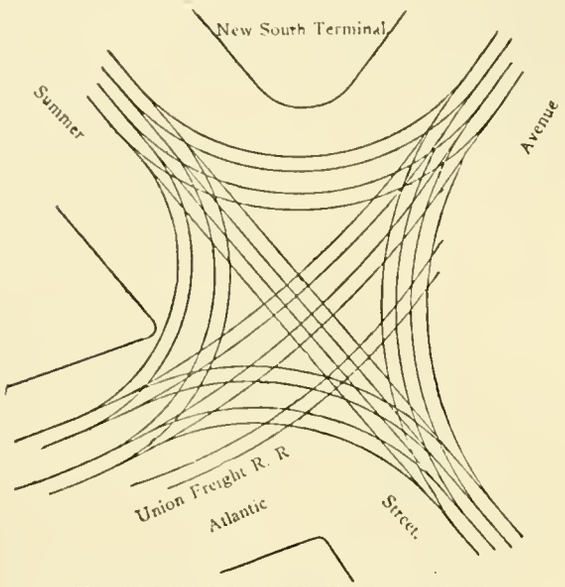
A train on the Wabash R. R. struck an electric car of the Chicago City Ry. as it was crossing the Western Indiana tracks at 31st St., at 5:45 p. m. December 4th. About 25 passengers were on board, 11 of whom were injured, one fatally. The conductor of the electric car, finding the crossing gates open, went ahead, and as the approaching train was two blocks away signalled the car to cross. When on the crossing the trolley left the wire and the car was struck by the approaching train. The crossing flagman claims that he attempted to warn the motorman of the electric car not to attempt the crossing.

It is stated that $100,000,000 will be required to complete the various underground electric systems now building to give London rapid transit.

The Philadelphia Electric Co. has been incorporated at Trenton, N. J., with a capital of $25,000,000. This concern is to absorb the Pennsylvania Manufacturing, Heat, Light & Power Co. and the National Electric Co., of Philadelphia. The incorporators are Edward Hand, jr., of Germantown; J. Morton Fulz, of Frazer, Pa., and Wm. H. Jolley, of Camden.

COMPLICATED SPECIAL WORK IN BOSTON.

The Boston Elevated Railway Co., which has a great many extensive and complicated pieces of special work in its surface tracks, has recently completed its most important installation of curves and crossings. At Dewey Sq., near the new Southern Terminal Station, the Summer St. tracks and the Atlantic Ave. tracks cross, the latter being curved at this point; both tracks are connected by double curves and in addition the crossing is intersected by a single track of the Union Freight R. R., making the layout shown in the illustration. The contract for this work was let to Wm. Wharton, jr., & Co., of Philadelphia, in February last, for, it is stated, about $15,000. Wharton & Co. did not receive the working plans until about September 1st, and considering the crowded condition of



TRACK LAYOUT AT DEWEY SQ., BOSTON.

the works the promptness with which this order was filled is remarkable.

There are 183 points of intersection of the track lines and the crossing when made consisted of 190 rails, frogs and switch pieces, the whole weighing about 170 tons; mangenese frog centers are used. The tracks were all put together at the Wharton works before shipment. Seven freight cars were required to transport this crossing to Boston, where it arrived on November 17th. The work of laying was begun on Saturday evening, November 18th, and practically completed with cars running by the following Tuesday. Men were worked in three gangs, over 200 being on the job.

The Wharton company is also making layouts for the crossings and junctions at Broad and High Sts., and at Atlantic Ave. and Beach St.

TRAMWAYS IN NORTHERN SPAIN.

Julius G. Lacy, United States consul-general at Barcelona, sends the State Department the following data concerning the tramways of northern Spain.

The Compania Anonima de Tranvias de Barcelona, now under the management of J. Kennedy, is the pioneer company of Spain and began operating about 25 years ago with a 99-year concession from the city. In May last this line was changed to electricity, the Dickinson overhead trolley being used. The power house equipment and the electrical car equipment were purchased in the United States. The company has 12 miles of track and 85 motor cars. The fare is 1½ cents for a ride of 5 or 6 miles. The capital stock of the company is $2,400,000, mostly owned in England.

The Compania de Tranvias de Barcelona a San Andres has 5 miles of line. The motive power is soon to be changed from steam to electricity and two extensions, one of 10 miles to the manufacturing town of Sabodell, and one of 5 miles to Horta, built. The manager is Oscar Schmidt-Corr. The present capital is $520,000.

The Compania de Tranvias de Barcelona a Sans has a 3-mile line to the suburb of Sans now operated by mules, but application to change to electricity has been made. The capital of this company is $470,000. Manager, Francisco Esdeve.

The Compania de Tranvias de Barcelona a Badalona is a steam line 6 miles long connecting Barcelona and Badalona. The capital is $320,000. Manager, F. Gillis.

The Compania General de Tranvias has a steam line 4 miles long connecting Barcelona and the suburb of Sarria; electricity is soon to succeed steam.

The Ferrocarril de Barcelona a Sarria, the only double track railroad in Spain, about 3 miles long, has made application for permission to change the motive power to electricity.

The Campania del Tranvia Electrico de San Sebastian has 5 miles of track running through the town of Pasages, the commercial port of San Sebastian, to the manufacturing town of Rentiri. The electric plant is of Swiss make and the cars Spanish. The president is D. Antanasio Osacar and the manager M. L. Carlier.

There is one electric tramway in Bilbao with an aggregate length of 19 miles. Last year 2,700,000 passengers were carried.

At Valencia all the city and suburban tramways have been bought by a French company and a plant for operating by electricity is now being erected.

SAFETY THIRD-RAIL TEST.

A test of a new third-rail system was made in New Britain, Conn., before a party of electrical engineers and railway promoters last month on a stretch of about 300 ft. of track in the yard of the New York, New Haven & Hartford Co. The system is known as the McElroy-Grunow safety third rail and is applicable to roads built for steam service. It comprises a third rail divided into sections which may be of any desired length, the sections slightly overlapping each other side by side, and each section being connected to an automatic magnetic circuit closer of special design. Each of the latter automatically switches the current upon its respective section as the motor car passes upon it and cuts off the current from it as the car leaves the section. During the test the manner in which the current was switched on and off each section was shown by the lighting and extinguishing of incandescent lamps connected to the third rail. A special shoe is used upon the car for collecting the current from the rail and the overlapping of the sections allows the shoe of the motor car to carry current from one section to the next, the contact box responding to the presence or absence of the shoe. The operation of the contact box machinery, which is an electro-magnetic circuit closer, weighing about 16 lb., is through two plates or disks one above the other, the contact of the shoe with the overlapping part of the third rail bringing the lower plate in contact with the upper one by magnetic attraction. Whenever the connecting shoe passes from the section controlled by any particular contact box, contact ceases, the lower plate drops with a click by gravity, the energy has left the section and gone to the next succeeding one, each section being provided with a contact box which thoroughly controls the feed of current from the power house to the rail.

The showing made by this test was in every way favorable to the system, and its inventors claim that it is specially applicable to street railways, as by putting the contact boxes only as far apart as the length of a car no current would ever be upon the surface of the streets except upon the section of rail directly under the car.

LONDON STRIKE ENDED.

The strike of the employes of the London (Ontario) Street Ry., which was inaugurated early last spring, has finally died a natural death. The claims of the men had neither reason nor right to support them, and had it not been for the sympathy extended by the city council for personal political reasons, would have been short lived. Encouraged by this, acts of violence were resorted to, and supported by a local newspaper the fight has been waged for months. Citizens and the city have suffered much pecuniary loss, business has been diverted to other places and the former employes are still looking for jobs.

Modern Mexico says: "The city of Mexico will enter the new year riding in her new electric cars and automobile coaches."

SIGNALS ON THE DOVER TRAMWAYS.

An interesting description of a novel method of signalling between turnouts on the single track railway in Dover, England, is given in the London Electrical Engineer, from which the following is gathered. The details of the system are due to Mr. H. E. Stilgoe, the borough engineer, and the object is to maintain the schedule time of the cars and to avoid the vexatious delays at crossing places.

The streets of Dover at the harbor end of the town are so narrow that there is hardly room for a single line of tramway at some places. The route of the railway is also so circuitous that it was

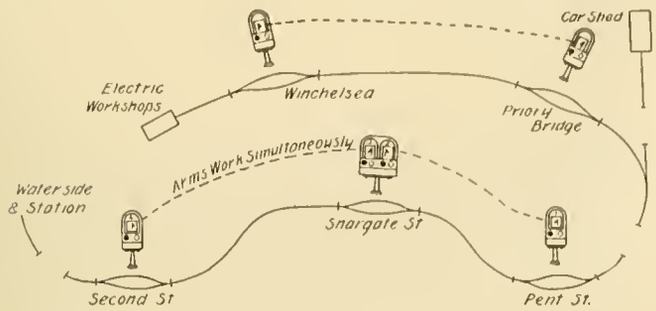


FIG. 1.

impossible to arrange the turnouts within sight of each other. The result of this was that the conductors in certain places were obliged to run on in front of the car to see if the single track was clear, which caused considerable delay to the cars which is quite unnecessary with the present system. The position of the signalling points on the road are shown in Fig. 1, while Fig. 2 illustrates the connections of a pair of instruments controlling one of the single-line sections. It will be seen from the first illustration that there are three of the single-line sections, the turnouts of which are so situated that a car entering cannot see the whole of the line to the next turnout. At these points, therefore, signalling pillars, with switch gear, have been erected on the footpaths. The signals at either side of a single section are so connected that they work simultaneously, and are either both up, indicating that the section is being used by a car, or both down, signifying that the section is

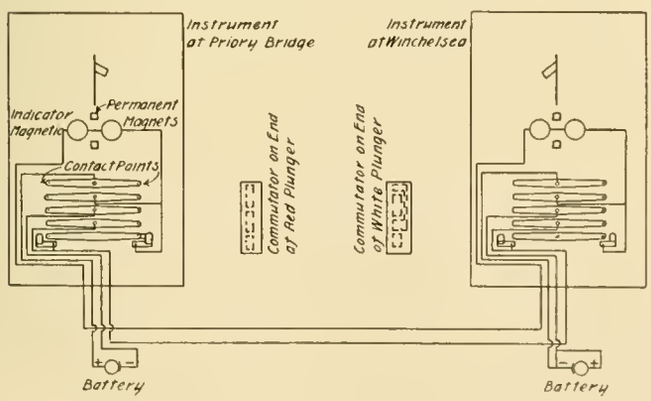


FIG. 2.

clear. The method of working is as follows: On the arrival of a car at the Pent St. section, if the driver finds the signal up he has to wait till a car arrives from Snargate St. As soon as this car has passed, the driver of the first car can proceed, but when he gets to the Snargate St. signal, No 2, he presses the white plunger, which lowers both signals 1 and 2, indicating that the section is free. If the signal No. 3 is down, he can proceed at once after having pushed the black plunger to prevent a car coming on in the opposite direction. Then on passing the fourth signal at Strond St. he will have to press a white button to liberate the signals. It will be seen therefore that in crossing at Snargate St. it is often unnecessary for the drivers to get down to work the signalling apparatus, but that at all the other points he has to unlock the door of the containing case and push a button. This, it would seem, would cause considerable delay, but this is really not the case, as the signals are placed at points where the cars generally have to stop for passengers. In the diagram of connections, Fig. 2, the method of connecting up the apparatus is shown, and it will be seen that no current is used except at the instant the signal is sent. The signal arms are moved by means of a polarized armature between electromagnets. This system has been found to work exceedingly well at Dover, so much so that each car is able to make two more complete trips, or four times the full length of the line, per day more than could be made before these communicators were fixed. Mr. Stilgoe estimates that this is equivalent to an extra profit of at least £1 per week, as the earnings on the two extra trips thus made have not to be debited with any increased labor charge. The other route on which the signals are applied—between Winchelsea and Priory Bridge—is not used so much as the route through the main street, and hence the saving is not quite so much. It is found, however, that the cars can be kept much more closely to their schedule time.

CONESTOGA TRACTION CO.

The Pennsylvania Traction Co., which has been operated under a receiver, was sold under a decree of the United States Circuit Court on November 15th, being purchased by a number of gentlemen from Lancaster, Columbia, Philadelphia and Williamsport. In all probability, after the sale is confirmed by the court, the company will be reorganized under the title of the Conestoga Traction Co., with William B. Given as president, and Samuel R. Shipley, of Philadelphia, president of the Provident Life & Trust Co.; John D. Skiles, president of the Fulton National Bank, Lancaster, Pa.; J. W. B. Bausman, president of the Farmers' National Bank, Lancaster, Pa., will be among the directors. It is contemplated that lines will be built from Lancaster to New Holland, 14 miles; Lancaster to Manheim and Ephrata, and extended to connect with the Reading & Northwestern Ry. at Adamstown, Pa. A line has also been surveyed from Lancaster to Strasburg, eight miles, and the Columbia & Donegal division will be extended from Marietta to Maytown, and in all probability via Elizabethtown to connect with the Harrisburg system.

Frank S. Given, general manager of the road, will continue in the same capacity.

The Pennsylvania Traction Co. operated the following roads: Lancaster City Street Ry., Lancaster & Lititz Ry., Lancaster & New Holland Ry., Lancaster & Millersville Ry., Lancaster & Columbia Ry., Columbia & Ironville Ry., Columbia & Donegal Ry.

TESTING THE SPEED OF STREET CARS.

Several weeks ago the common council of Racine, Wis., passed an ordinance regulating the speed of street cars within the city limits at not to exceed the rate of 8 miles an hour on single tracks and 10 miles an hour on double tracks. It has been claimed that the street railway company has been violating the ordinance. To determine the facts a test was arranged.

Two city officials boarded a car and accompanying the car was a third official mounted on a bicycle provided with a cyclometer, the two officials in the car acting as time keepers.

According to the test made the general speed of cars between stops was never less than 12 miles an hour, and at several places it reached 20 miles an hour, while in one instance it reached as high as 26 miles an hour.

Since these tests were made warrants have been issued against the respective motormen running cars above speed, and the penalty for each and every offense is a fine of from 5 to 25 dollars, or a jail sentence of from 10 to 60 days. Since this test by the chief of police was made there has been a noticeable decrease in the speed of cars throughout the city.

What the Racine authorities should do is to repeal their foolish speed limitations and take their city out of the list of slow going towns.

The Union Elevated Railroad, of Chicago, reported a surplus November 30th of $83,430. This taken in connection with previous reports and the 4 per cent dividend paid indicates a surplus for the 12 months ending Nov. 30, 1899, of $121,355, which is 2.77 per cent on the outstanding stock.

SURFACE CONTACT SYSTEM AT TOURS.

An interesting surface contact system of electric railways has been in operation for several months in Tours, France, which is the first practical application of the Diatto surface contact system with underground conductors. These lines have run uninterruptedly since they were opened for traffic and their operation is reported to have given entire satisfaction. The Tours tramways comprise a number of urban lines having an aggregate length of 12 km., approximately, and suburban lines to Luynes, Saint Avertin and Vouvray. The Diatto system is installed only in the heart of the city, the remainder of the lines being equipped with the overhead trolley system. The power house contains four boilers having a heating surface of 165 sq. m. each, giving 2,000 kg. of steam per hour. There are three simple condensing engines of 300 h. p., belt connected each to a generator of 200 kw. capacity, giving currents of 550 volts pressure. The system of distribution, which is described in La Nature, is comprised of cables buried directly in the ground from which are connected all the branches which operate through the surface contacts.

On the surface of the road, between the rails, are placed surface contact blocks at short intervals apart, each having in its center a metallic piece E, Figs. 1 and 2, which is slightly raised above the surface. In the interior of the block is a pipe connected with the

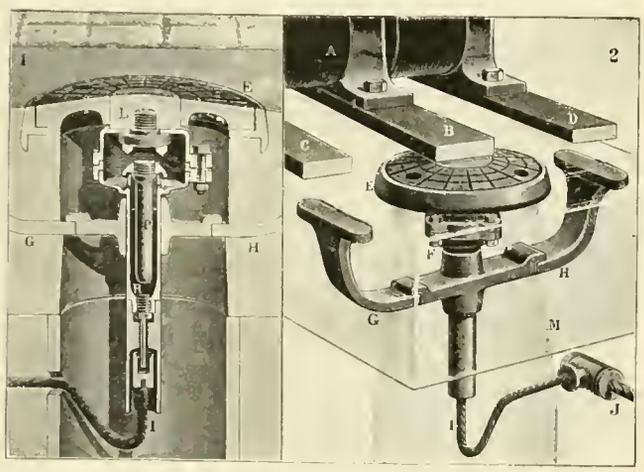


FIG. 1. FIG. 2.

branch I from the cable J coming from the power house. The car carries an electromagnet A which magnetizes the pieces B, C and D. These in gliding over the metallic surface piece attract a movable piece in the interior of the pipe which establishes electrical communication between the bar B on the car and the cable J from the station. The blocks are thus put in electrical connection with the cable only at the moment that the magnet bar of the car is above them, and the circuit is broken as soon as the car has passed. The blocks are placed sufficiently close together so that the magnet bar is always over one of them and the electrical connection between the cable and the car remains continuous. The contact block forming part of the pavement is made of asphalt, as shown in the transparent design, Fig. 2, the middle of it being hollow and the opening to the surface containing a tube. At the upper part is a fixed plug E, of anti-magnetic metal having at its center a cylinder of soft iron L. A little below this is a pair of iron brackets G, H, embedded in the block, which support on their ends an ebonite cup filled with mercury. In the bottom of this cup is screwed a copper plug carrying a small copper rod, which is immersed at its lower end in another small cup of mercury. The latter is connected through the cable I to the cable J from the station. In the mercury which fills the ebonite cup floats an iron plunger P, the weight of which is properly adjusted. The head of the plunger is formed of a truncated cone of homogeneous and very hard graphite and the axis of the iron L also carries a piece of the same kind of carbon which is hollowed out to perfectly fit the cone on the plunger. These two pieces of carbon join accurately and make an excellent electrical contact. The place where this contact is made is enclosed, as shown in the illustration, in a special chamber.

The magnet bars B, C, D, are connected by horizontal electromagnets A which make the central bar B a north pole and the bars C and D south poles. The magnetic circuit is thus established from the bar B through the plunger P and the bracket G to the bar C, and a similar circuit is established on the other side of the bar D. The magnetism draws the plunger P to its upper position. Each electromagnet carries two windings, one of which is traversed by the current which operates the motors and the other by a current from a small storage battery giving 5 amperes at 30 volts. At the moment of starting it is the current from this battery which energises the magnets and raises the plunger. Arcing is avoided when the current is broken at the carbon contacts by reason of the good quality of the carbons, and the rear end of the electromagnet bar is slightly raised in order to avoid a two sudden breaking at the contact. The blocks are set in the paving, so that no water can possibly penetrate beneath them. The return current is carried to the power house by the track rails, and it may be added that defective blocks can be removed and replaced within a few minutes.

OFFICIAL REPORT A. S. R. A.

Secretary Penington with his usual promptness had his official report ready for distribution in exactly one month from the adjournment of the Chicago convention. It makes a neat volume of 220 pages, and contains several new features, one of which is a reproduction of the banquet menu in the same colors as the original. The usual steel engraving of the president is an excellent likeness of Mr. Sergeant. The classification of names of attendants is conveniently arranged and a complete index in the front of the report is specially acceptable. The report is altogether the neatest and best arranged in the history of the Association.

CONTRACTS FOR MANHATTAN ELEVATED, NEW YORK.

November 29th, President Gould, of the Manhattan Elevated, New York City, announced that the Westinghouse Electric & Manufacturing Co. had been awarded the contracts for the power house generating machinery and sub-station apparatus. The contract includes eight three-phase alternating generators of 6,650 h. p. each, together with such step-down and converting devices for the sub-stations as will be necessary to transform the alternating current generated in the power house into a direct current at 500 volts, which direct current will be fed to the third rail of the elevated system.

CONSOLIDATION AT ALBANY, N. Y.

On November 29th the Albany Ry., the Troy City Railway Co. and the Watervliet Turnpike & Railroad Co. arranged for a consolidation as the United Traction Co. with a capital of $4,000,000. The 40,000 shares of stock are apportioned as follows: Albany Ry., 26,760; Troy City Ry., 13,000; Watervliet company, 240.

The amount of the present securities of the united companies is $4,000,000 stock and $3,474,000 bonds. The companies lease and own about 59 miles of street railways. The earnings for the year ending July 1st, last, were $1,250,000.

These officers will serve until the first election in June, 1900: President, Robert C. Pruyn, Albany; vice-president, Charles Cleminshaw, Troy; secretary and treasurer, John W. McNamara, Albany.

The consolidation of these railroads companies, under the controlling influence of the Albany Ry., places under the jurisdiction of what now constitutes that company the direction of the lines of street surface railway operating in and connecting Albany, Troy, Cohoes, Watervliet, Lansingburg, Rensselaer, Green Island and Waterford, and constitutes one of the largest street surface railway systems outside of Greater New York.

Beginning December 1st the following rates of street railway fare were put in effect at Tiffin, O., by order of the city council: Regular fares, 5 cents; strips of 6 tickets, 25 cents; books of 30 tickets, $1.00, good between the hours of six and eight in the morning, and five and seven in the evening.

DOUBLE DECK CARS FOR SOUTH AMERICA.

La Capital Tramway Co., of Buenos Ayres, is putting in service a new type of car recently completed by the J. G. Brill Co. and shown herewith. These cars differ quite materially in details from Brill cars recently built for export to Europe and South Africa, the principal difference being in the protection for the motorman by the gangway leading to the stairs. He is so placed as to be under a hood. Owing to the warm climate it is not found necessary to bulkhead the ends of the upper deck nor to provide stationary sides.

The body is 18 ft. long, 6 ft. 1 in. wide at the sills and 6 ft. 9½ in. at the posts. The platforms are 5 ft. in length, making a length over the dashers of but 28 ft. The car is equipped with two G. E. 1,000 motors and is mounted on a Brill No. 21-E truck with a 6 ft. 6 in. wheel base and 33-in. wheels.

BRILL CAR FOR BUENOS AYRES.

The seats are longitudinal both on the lower and upper decks and are of cherry and maple slats. One feature of the imperial made necessary by the hot climate is a lambrequin around the top, materially increasing the amount of shade, and adding greatly to the comfort of the passengers. The hand rails around the roof and at the stairs are made very high to give ample protection. The car weighs without motors 13,195 lb., and the truck alone weighs 4,590 lb.

These cars were put together complete, painted, taken apart and shipped in sections. The details of this design have been worked out with much care and they are especially adapted to the peculiar conditions of South American street railway service.

ANOTHER NIAGARA ROAD.

The commissioners of Victoria Park, on the Canadian side at Niagara have given the Fort Erie Ferry & Niagara Falls Electric Railway Co. the right to build an electric road between Fort Erie and Chippewa, Ont., over the 66-ft. strip along the upper river, which is controlled by them. When the company builds, it is provided that it shall at the same time construct a carriage-way 40 ft. wide, with ditches on each side not less than 4 ft. deep, which road must be properly graded and kept in repair. The company will also contribute to the revenue of the park by the payment of an annual rental, but how much is not stated. When this road is built it will be possible for Buffalonians to travel up or down on either side of the Niagara. It is expected to have the road in operation next year.

The night of November 25th fully 2,000 ft. of trolley wire was cut from the lines of the Northern Electric Ry., Chicago, and carried away by thieves.

It is thought by the Rapid Transit Commissioners of New York, from the number of blank specifications called for, that there will be considerable competition in the bidding on the underground lines. At least a half a dozen bids are expected.

THE PHILADELPHIA-ATLANTIC CITY STREET RAILWAY.

The plans of the Delaware River & Atlantic Railway Co., which have been previously mentioned in the "Review," have been gradually matured up to the point where the company was ready to start work on the line; but the company is now confronted with local obstacles which again threaten to postpone the completion of the road for an indefinite time. The first legal obstruction had only recently been overcome by changing the right of way when the company was again confronted with a writ restraining it from completing any of its new plans until after the New Jersey Legislature convenes. The opponents of the road believe that they now have the company in a position where it will be impossible to complete the road at all. The company was incorporated under the laws of New Jersey with a capital stock of $9,000,000. The road was to be 52 miles long. Under the New Jersey law the company is required to deposit with the state treasurer $2,000 per mile before a certificate of incorporation can be issued. This has already been done.

The route of the road as planned is a straight line between the termini and will be built with a double track the whole distance and operated on the third-rail system. The trains will consist of standard railroad coaches equipped with all the modern luxuries and are intended to be run every 15 minutes or half hour during the day. The trip is scheduled to be made in one hour including the ferriage across the Delaware River, and the fare is to be 50 cents.

In order to maintain this rapid schedule with safety the block signal system is to be installed along the road. The roadbed is to be 100 ft. wide with double tracks 8 ft. apart, and each side of the right-of-way is to be protected by a fence to keep out cattle, vehicles, etc., and to avoid collisions. The road as planned was to contain neither curves nor grade crossings, every wagon crossing being either depressed or elevated. No stops will be made between the termini, but the company contemplated eventually building a third track to accommodate local traffic, upon which track frequent stops will be made. Plans for the power house, which is to be situated at Winslow Junction, have been completed.

The directors of the company are as follows: Gustav A. Muller, W. M. Boyer, E. E. Pennock, Richard Y. Filbert, Virtue C. Sweatman, C. William Bergner, all of Philadelphia; Louis Kuehnle, H. S. Scull, Atlantic City; Ernest Longstreth, Elias Davis, Camden; Hon. Albert R. Talman, Swedesboro; Rudolph V. Kuser, Trenton; James B. Reilly, Atlantic City.

NEW WATCH AND CLOCK FACE.

The serious consequences sometimes resulting from an error on the part of street railway or steam railroad employes when reading the time from a station clock or their watches have led to the designing of the watch and clock dial shown herewith, and which is intended to do away with a number of the errors most frequently made. The Arabic system of numerals is used instead of the Roman and each minute of the hour is numbered separately; this, it is believed, will prevent the mistakes of reading time five minutes too early or too late, as for instance, taking 1.29 for 1.24, as is often done with the ordinary dial. With the new face the minute hand rests upon the minute figure.

The Railway & Engineering Review, to which we are indebted for the above information, states that the dial is the design of R. D. Montgomery, watch inspector for the Atchinson, Topeka & Santa Fe R. R., and has been adopted as standard on that system.

The Indiana Electric Railway Co. is arranging to carry mail between Goshen and South Bend, Ind., a distance of 26 miles, on its trolley cars beginning January 1st. Elkhart, Mishawaka and other intermediate points will be served.

HOW TO TIE A ROPE.

The Massachusetts Institute of Technology has made a number of tests on different kinds of rope for the purpose of determining the relative strength of various forms of knots for uniting two end. Cotton rope ⅞ in. in diameter and manila rope of three strands 2 in. in circumference were tested, each in a dry condition, the length of the rope between holdings being 4 ft., with the knot in the center. In each case the specimens broke in the twists of the center knot.

From a summary of the tests published in a recent issue of the Railway & Engineering Review, the following figures are taken:

With cotton rope, whose strength was taken at 4,420 lb., four tests on the Englishman's tie gave 2,520 lb. as the maximum load at breaking, and 2,410 lb. as the average strength, an efficiency of 55 per cent for the knot; four tests with a square knot gave 2,470 lb. as maximum, and 2,330 as average, an efficiency of 53 per cent; four tests with a weaver's knot gave 2,460 lb. as maximum and 2,090 lb. as average, an efficiency of 47 per cent; three tests with on open knot gave 2,240 lb. as maximum and 2,110 lb. as average, an efficiency of 48 per cent.

Fig. 1.—Square Knot.

Fig. 2.—Open Hand Knot.

Fig. 3.—Weaver's Knot.

Fig. 4.—Englishman's Tie.

Fig. 5.—Ordinary Tie.

FORMS OF KNOTS TESTED.

With manila rope in seven tests with an Englishman's knot the maximum load at breaking was 3,540 lb., the average strength 2,910 lb., and the efficiency of knot 61 per cent; in five tests with an "ordinary tie" the maximum load was 2,910 lb., the average strength 2,700 lb., with an efficiency for the knot of 57 per cent; in six tests with a square knot, the maximum load was 2,680 lb., the average strength 2,480 lb., and the efficiency of the knot 52 per cent; in five tests with an open hand knot, the maximum load at breaking was 2,370 lb., the average strength 2,180 lb., and the efficiency of the knot 46 per cent.

NEW RAILWAY PLANT FOR READING, PA.

The United Power & Transportation Co., which owns electric railways in a number of cities and of which John A. Rigg, of Reading, is president is about to build a large machine shop and foundry in Reading. It is proposed to introduce the most improved machinery adapted to the company's requirements. All cars or trucks used on any of the company systems will be equipped at these shops and all rebuilding and repairing of electrical street railway machinery will also be done here. This company intends to turn out in this shop everything which is necessary for the repair of the street railway. There will also be established storage battery cars of about 4,000 ampere-hours capacity.

The new machinery shop will give employment to several hundred mechanics and all apprentices will be taught mechanical and electrical engineering in a school maintained by the company in which motormen, conductors and other employes will be instructed in their respective branches. The plant is estimated to cost in the neighborhood of $300,000.

It is announced that parties intimately connected with the Wheeling (W. Va.) Ry. have purchased a controlling interest in the Moundsville, Benwood & Wheeling Ry., a 9-mile suburban line.

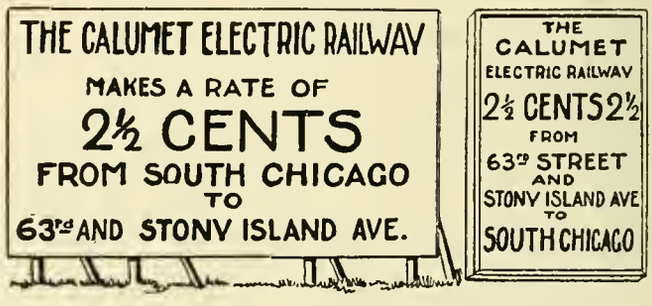
ANALYSIS OF A NICKEL.

President Vreeland, of the Metropolitan Street Railway Co., of New York, in his school of instruction for motormen and conductors recently gave the following analysis of a nickel, which is made in accordance with the company's bookkeeping records. The proportions of a nickel are divided as follows: Labor, .0195 cent; materials, .0048½; taxes, .0026½; interest, .00144; total, .0414; leaving for stockholders, .0086 cent. It will be seen that less than ⅞ of a cent out of every 5-cent carfare goes to the stockholders of the property.

Another point of interest is shown in the fact that out of every dollar spent in operating the system 80 cents goes for wages and only 20 cents for material.

2½-CENT FARES ON THE CALUMET.

Gen. John McNulta, receiver of the Calumet Electric Street Railway Co., on December 1st, ordered that special emergency tickets good for passage between South Chicago to 63d St. be sold at the rate of 2½ cents each. This cut was not intended as the beginning of a rate war, but as a necessary measure for keeping the road's traffic. The Calumet road formerly crossed the Calumet River on a bridge at 95th St., in South Chicago, which collapsed sometime since. Strenuous efforts had been made to get permission from the South Chicago City Ry. to use its tracks and cross at 92d St., and these having failed, General McNulta decided to provide a ferry at 95th St. and cut the rate of fare on this line. The receiver reserves the right to stop the sale of emergency tickets at any time without notice. The low fare was widely advertised by handbills and on bill boards; one of the latter is shown in our illustration.



The Youngstown (O.) & Struthers Electric Ry. was opened for public traffic on November 11th. It is expected that this line will soon be extended to Lowellville and New Castle and will eventually form a part of a through electric railway from Cleveland to Pittsburg.

BUFFET CARS FOR TROLLEY PARTIES.

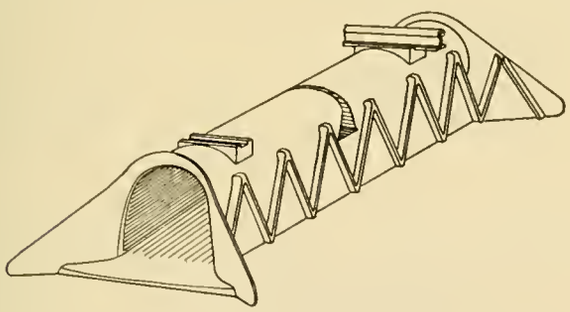
Messrs. J. T. Thompson and George J. Atkins, of Chicago, were recently in Indianapolis in consultation with several local financiers in regard to a new electric road which they are promoting in the northern part of the state. No details of the road have been made public, but in connection with their plans they have mentioned an inovation in the way of an electric car equipment which is calculated to promote a class of trade not now touched by interurban railroads.

They propose to bring into Chicago a large number of passengers from the neighboring cities, and the car mentioned has been devised with the object of making theatre parties from outlying towns into Chicago more popular than they have been in the past. In addition to having large and comfortable cars they will be provided with a dining and cafe service in which out-of-town parties may enjoy a first class supper after the theatre while on their way home, and at no greater expense than would be involved in dining at a restaurant in Chicago. The projectors think it would be greatly to the advantage of the passengers to have a first class restaurant at their disposal without being compelled to stay in Chicago until a late hour before starting home.

It is understood that arrangements were made with the Union Traction Co. for running some of these cars on its lines to Anderson, Muncie and Marion, over which it is expected there will be a considerable theatre traffic.

CULVERT CROSSINGS.

A portable metal culvert built especially to meet conditions arising in electric railway construction work is made by Wm. A. Nichols, of Philadelphia. In cities having surface drainage or wherever it is necessary to lead a small stream or a sewer under the roadbed, this culvert will be found an economical substitute for the ordinary round pipe, brick, wooden or stone crossing. The opening is wider at the bottom than at the top and this with the outwardly diverging wings or approaches effectually prevents leaves,



NICHOLS CULVERT.

driftwood or other obstructions from becoming lodged and causing overflow and washouts. These features will be particularly appreciated in times of floods and freshets.

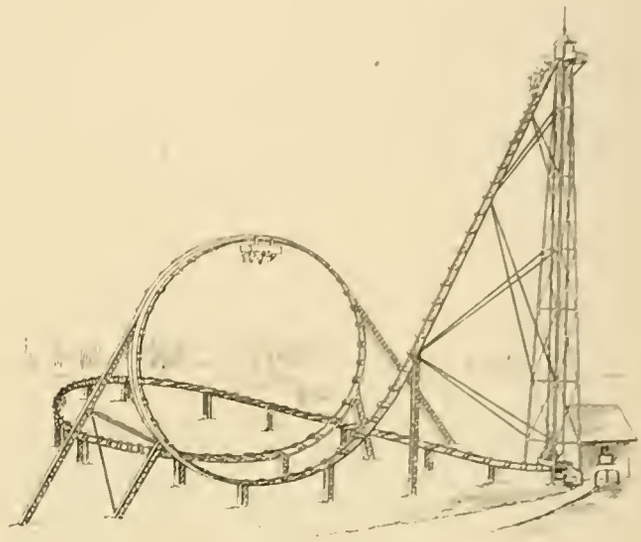
The culverts are made of steel or iron plates, or of cast iron, means being provided at the top, bottom and sides for anchoring or otherwise securing them firmly in position. They are capable of withstanding severe strains in all directions. The model shown herewith has a transverse conduit to permit the passage of a cable or electric conductor and is also provided with supports for holding the rails in position where the railway crosses the culvert at grade. Other types are made to suit various requirements.

RAILWAY TO PAY FOR CHANGING GRADE.

Judge Yerkes, of Bucks County, Pa., has recently rendered a decision to the effect that the Bethlehem-Nazareth electric railway must bear the expense of changing the grade of the highway to conform to the grade of the railway. The county has contracted for rebuilding the highway and the extra cost due to making its grade conform to that of the railway is about $10,000.

CENTRIFUGAL RAILWAY FOR PARKS.

A Toledo man has invented a startling device for pleasure resorts which consists of a monorail track operated by gravity. The car runs upon a single rail with two additional guide rails which prevent it from leaving the track whatever its position. The same can



CENTRIFUGAL RAILWAY.

hardly be said of the passengers who at a part of the trip are seated heads down with only centrifugal force to keep them in their seats. Should for any reason the car fail of its maximum speed the results might be disastrous. The elevator is designed for 80 ft. high; the loop 40 ft.

EXTENSION OF THE UNION TRACTION CO.

The Union Traction Co., which is largely controlled by Mr. Chas. L. Henry, of Anderson, Ind., and his associates, has at present about 100 miles of electric railway in actual operation and also has contracted for the building and buying of 65 miles more. The territory covered by the present lines lies between Anderson, Muncie, Marion, Alexandria, Elwood and other neighboring cities. The company is to build at Anderson what it is stated will be the largest and most complete power house in the world outside of that at Niagara Falls.

The company has devised a new plan for handling the express business, and at the same time adding to its passenger receipts. The arrangements which are being made with the leading stores in Indianapolis are to deliver purchases made by out-of-town people to any town upon the entire system. The plan is to make the rate for delivery just sufficient to cover the cost of handling the business, with the expectation that in this way a large number of passengers will be carried to Indianapolis. The company will erect offices and waiting rooms in each town along its lines, the one in Indianapolis to be fitted up very elaborately.

SODUS BAY R. R.

The Sodus Bay R. R., a new electric line now building between Rochester, N. Y., and Sodus Bay, will be 38 miles long. On portions of the line there are numerous curves and grades. The main power house will be on the east side of the bay and there will be two sub-stations; the line voltage will probably be 625 volts. The road is single track with turnouts; two figure 8 trolley wires will extend the entire distance.

The Decatur (Ill.) Traction & Electric Co. has purchased the property rights and franchises of the City Electric Ry. of that city and proposes to rebuild the line in the spring and add one-half mile of new track. Contracts have been closed for cars, motors, trucks, etc., and in the spring the company will probably build a new power station.

ELMER MORRIS ENTERTAINS.

Elmer Morris, treasurer of the Morris Electrical Co., gave a dinner to members of the press and friends, at the Bingham House, Philadelphia, November 14th, to celebrate the unusual event of a 50-car train of terra cotta ducts for electrical conduit work. The ducts were manufactured by the Potomac Terra Cotta Co., Washington, D. C., and were sent to Philadelphia via B. & O. Ry. to be included in the ship load of materials which the Morris company is purchasing for the railway construction work in Havana. The shipment is probably the largest single shipment of one commodity for electrical purposes ever exported from this country.

Mr. Morris presided in his usual graceful manner at the dinner which was an elaborate repast, there being present the following: W. H. Antrome, Philadelphia Record; A. B. Umstead, Earn S. S. Co., Philadelphia; W. E. Harrington, Camden; manager City & Suburban Ry.; D. A. Hegarty, Railways Company General, Philadelphia; Geo. F. Porter, Kerite Co., New York; Geo. E. Pratt, Hubbard Brake Co., Chester, Pa.; C. C. H. Bent, superintendent B. & O. Ry.; U. B. Macafee, Railway Company General, Philadelphia; S. H. Harrington, New York; George Mason, Potomac Terra Cotta Co., Washington; Edward S. King, Philadelphia; C. B. Fairchild, eastern representative "Street Railway Review"; W. K. Beard, Street Railway Journal; T. B. Franklin, and J. L. B. Haehulen, B. & O., Philadelphia; S. Goddard, Electrical Review; and Franklin Stevens, Keystone Electric Co., Philadelphia.

After a hearty welcome by the host, toasts were responded to by several of the guests. Mr. Macafee speaking on "The Future of the Electric Railway Industry"; Mr. Bent, of the B. & O., on "The Future of Electric Traction in the Field of Steam Railway Practice"; Stephen Goddard for the "Technical Press"; C. B. Fairchild, of the "Street Railway Review" on "The Present as Compared with Early Street Railway Work"; and Geo. F. Porter on "Electric Conductors." Speeches were also made by Mr. Mason of the Potomac Terra Cotta Co., and Mr. Hegarty.

The occasion was a highly enjoyable one, the menu carefully selected and nicely served, and all present hope that Mr. Morris will have 50-car trains of material at frequent intervals.

MAGNETIC BLOW-OUT CASE.

Judge Thomas in the United States Circuit Court, Eastern District of New York, has decided in favor of the defendants in the case of Thomson-Houston Electric Co., vs. Nassau Electric R. R. Co., for alleged infringement of patent No. 283,167, issued to Elihu Thomson in 1883 for a magnetic blow-out device. The suit was in reality defended by the Lorain Steel Co., of Lorain, O.

Judge Thomas said in part:

"It is certain that the influence of a magnet upon an arc was well known long before the complainant's patent.

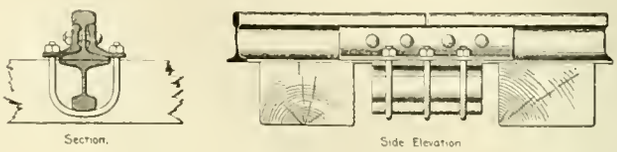
"Long afterwards (after the issue of Thomson's patent) the operation of trolley cars required the quick extinguishment of electric arcs, on a scale not before contemplated. Thereafter Prof. Thomson devised a structure, which involved the use of a magnet to extinguish electric arcs. He had formerly embodied this old art in a patent, and in consequence at the later period sought to monopolize it, without any legal justification, as it appears to the court. Since the letters in truth reveals no use, function, mode of operation, or manner of application new in the art, the complaint should be dismissed."

NEW COUNCIL BLUFFS COMPANY.

The controversy between the Omaha, Council Bluffs & Suburban Railway Co. and the Omaha & Council Bluffs Railway & Bridge Co. as to their rights to lay tracks over certain tracts of land has been amicably settled, both companies getting locations satisfactory to all parties. A number of suits have been brought to have the franchise of the Suburban company forfeited.. On November 28th articles of incorporation of a new company, the Lake Manawa & Manhattan Beach Railroad Co., were filed with the recorder; the directors of this company are the men controlling the Omaha & Council Bluffs Railway & Bridge Co., and they propose to build a summer resort at Lake Manawa.

TORREY RAIL JOINT.

The accompanying illustration, for which we are indebted to the Engineering News, shows the rail joint designed by Mr. A. Torrey, chief engineer of the Michigan Central, and which is being laid on a portion of the Canada Southern Division. It has four-bolt angle bars and a piece of inverted rail under the joint; this piece is 10



TORREY RAIL JOINT.

or 11 in. long and slightly cambered so that there is at the ends about 1-16 in. clearance between it and the base of the rails. The angle plates do not touch the ties; they project beyond the bottom flanges of the rails and have holes to receive the U bolts for clamping the inverted rail section in position.

DUTIES AND RIGHTS.

In the course of what is a short sermon on obedience by Mr. Alsop Leffingwell, of Trinity Parish House, Toledo, published in pamphlet form under the title "Another Message to Garcia," this quotation occurs: "The trouble with the working classes is they aren't half so anxious to do their duty as to claim their rights." The author then discusses the Cleveland strike as follows:

"As a matter of personal curiosity, I would like to know how many men in the late Cleveland car strike, for instance, fulfilled the injunction: First do your duty, then claim your rights. How many had really done their duty, their whole duty, and nothing but their duty, and were now claiming their rights?

"Not knowing, myself, I ask the question merely for information, and to get a concrete illustration of the principle. How many men had a right to smash up the street cars, tear up the rails, and block the way? How many were right in injuring the new employes, and even the officers of the road?

"Supposing you had asked:

"'What is your purpose in thus destroying and wounding?' Why, every mother's son of them would have promptly replied:

"'To compel the company to acknowledge our rights, of course!'

"Very good, perhaps the company, with just as much justice, might have retorted:

"'Yes, but haven't we some rights, too? And isn't one of them to operate cars on our lines whenever we please? And if you don't stop interfering, haven't we a right to compel you to acknowledge our rights by smashing you, just as you smash us and our company?'

"Permit me to repeat that I don't profess to know anything about it. All I do know is, there are always two, and often a half dozen sides to every question, and what I am after is the principle —first, do your duty; then, claim your rights."

TERRE HAUTE-BRAZIL LINE.

The Terra Haute (Ind.) Electric Co. has completed the surveys and begun grading on the 15-mile electric line between Terra Haute and Brazil. The route is along the National Road (Washington to St. Louis) but the track will be laid at one side of the right of way where the ordinary road traffic will not interfere with it. The company will lay 60-lb., 60-ft. T-rails.

The Terre Haute Electric Co. will build a new car house and power station in the spring and abandon the present plant. The installation contemplated will include four 300-kw. direct connected units, one for the railway and three for the lighting.

The Massachusetts Street Railway Association held its monthly meeting on November 8th, at which the subject of discussion was "The Best Design for Electric Cars." Ex-Mayor Sears, of Quincy, and C. E. Foster, of the Lynn & Boston R. R., were guests of the Association and spoke upon "The Relations of the Public to the Corporations."

A SUCCESSFUL PASSENGER AND FREIGHT INTERURBAN.

The constantly growing interest in the transportation of miscellaneous freight on electric lines makes a study of the Chicago, Harvard & Geneva Lake Railway Co. a timely and instructive one. This road, which was completed during the past summer, extends from Harvard, Ill., to the shores of Lake Geneva, in Wisconsin, passing through the towns of Big Foot, Ill., Walworth and Fontana, Wis. It not only makes a short cut to this popular resort, saving from 30 to 90 miles travel each way for some 200,000 people residing in the large manufacturing towns to the west and northwest, but is the only means of rail transportation for the territory through which it passes, the nearest steam line being some eight miles distant, or quite inaccessible on account of high and very steep hills.

Lake Geneva is conceded to be one of the most beautiful bodies of water in the whole country, being entirely spring fed, and the water, which is very clear, reaching a depth of 300 ft. in places. Along its 37 miles of wooded shores extends a fine gravel beach, and here the wealthy residents of Chicago have expended over $10,000,000 in elegant mansions and park improvements. During the summer season the lake is thronged by thousands to enjoy the clear bracing air for which this region is famous; and its blue waters are covered with sailing craft of every kind, and some 40 superb steam yachts. The Yerkes Observatory is also here and an object of interest to hundreds of visitors from our own country and abroad.

The country traversed by the electric line is densely settled for a farming community, and is one of the largest dairy districts in the country. Every foot of land is under cultivation or in use for herds, and farms sell for $100 an acre. From this territory thousands of pounds of butter and cheese are shipped daily, and thousands more of milk sent into Chicago. The country is like one great garden, and to travel over it in summer presents a picture of rare beauty.

The road has conditions in some respects unlike any yet constructed. Most interurbans either connect two large towns or cities, or terminate in one of considerable size. In this case the largest town on the line has but 3,500 population and the combined population of the others and the local residents within walking distance of the line does not exceed 6,000 more. As the road is operated throughout the year, the freight problem as a feature of the winter business is an important one.

The line, which is 12 miles in length, occupies one side of the public highway except for about one mile of private right of way. It is built under highly favorable franchise conditions, and its grants run for the full term of 50 years in both states; the portion in Illinois having been constructed under the Allen law, now repealed. It is incorporated under the general railroad acts of both states, and its franchises particularly authorize it to carry not only passengers, mail and express, but all kinds of freight. This latter feature is rapidly becoming an important one, not only to the road, but to the community it serves. Piece freight includes dressed veal, eggs, spring water, milk, vegetables, and other farm products going out. An elevator has been erected and is shipping out grain from Fontana. Track connection with an important steam line enables it to receive heavy freight, such as lumber, coal, etc., in the original cars and these are hauled to destination. Our illustration shows a car which contained 42 tons of coal, and was the largest ever brought into the county. It was taken out 12 miles to a coal yard recently established at the terminus of the line. Several of these coal yards have been opened by local parties, and as many lumber yards, one alone of which will pay the road $1,500 in freight the present year. The company has erected ample stock yards and is daily shipping all kinds of live stock, of which there will be some 300 carloads this winter. In general local such a line works as a feeder to a steam road, and as a creator of business may be mentioned a recent shipment of a car load of baled hay, which was sent into Chicago, but which it would not have paid the farmers to have

FREIGHT TRAIN ON THE C., H. & G. L.

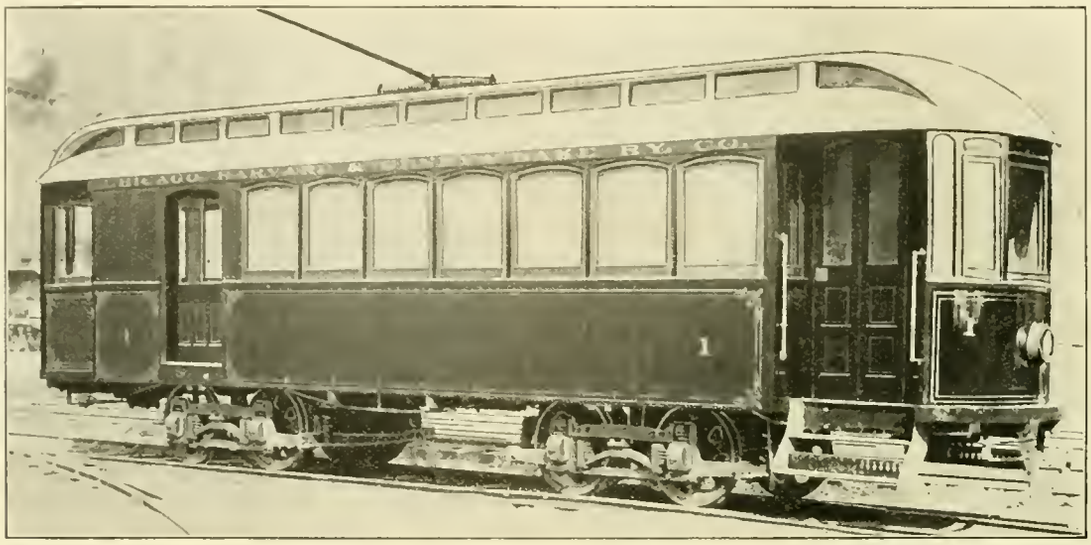
hauled 10 miles into town to the nearest market, even had there been a demand there for any such amount. The same with milk: a farmer cannot afford the time and expense of hauling his milk 8 and 10 miles to a railroad shipping point, so has been delivering it to local factories; but since the electric line opened nearly every farmer along the line has erected a platform in front of his house, and here are set out the cans of milk which the milk car picks up and delivers to the steam road at 7 a. m. each day. At 10 o'clock, just four hours from the time it left the farm it is in Chicago and being delivered to consumers. As the city price is considerably in excess of that paid by the local country factories, the benefit to the producers amounts to a very considerable sum in the course of the year. Other farm products have been raised and shipped which never before were possible on account of lack of rail transportation, and the variety and volume of this business will increase largely each season. Another advantage is the improved mail service: two mails each way daily to Chicago against one, one way, when the service was furnished by teams. The daily papers were quick to take advantage, and a hundred copies of Chicago papers are now distributed at 7 a. m. each day where previously they arrived 24 hours old and consequently few were taken. Thus it will be seen the

POWER HOUSE—CHICAGO, HARVARD & GENEVA LAKE RY.

freight business, which has only been mentioned in a few of its most important branches, is destined to constitute a large part of the winter earnings, and there is no reason to doubt that within a few months the revenue from the milk freight alone will pay the entire bond interest of the road.

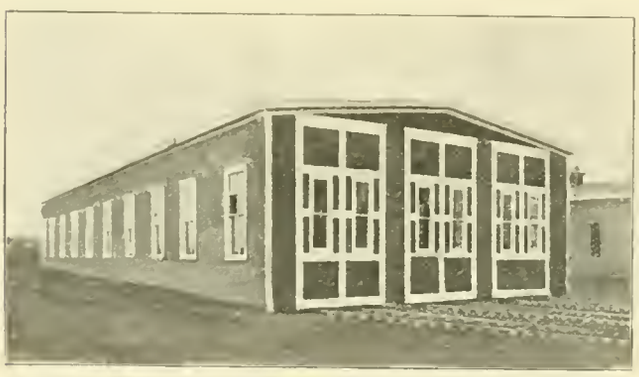
As to its physical construction, little is left to be desired. The Lorain Steel Co. furnished the rails, which are 60-lb. T in 62-ft. lengths, laid on ties spaced 20 in. c. to c. The rails are bonded with Atkinson bonds. Quite fortunately there were no other roads or streams to cross. The switches were made by the Paige Iron Works, and are automatic. The overhead work is extra strong; the trolley wire furnished by the Western Electric Co. is 00 and the feeders 0000. The brackets were from the Ohio Brass Co., side pole construction being used except through towns where the track is laid in the middle of the street. Trains are operated on a telephone dispatching system from the main office which is at the power station in Walworth.

The car seats 36 passengers and leaves ample room for trunks, light freight and express. These cars are equipped with two G. E. 57 motors and have a rated speed of 40 miles an hour, although this has been considerably exceeded on occasion. Two 40-ft. passenger cars with G. E. 1,000 motors on McGuire trucks, and one double truck parlor car and two 24-ft. single truck motor cars complete the passenger motor equipment. The freight locomotive is on McGuire trucks and hauls 100 tons at a load. All the motor cars are equipped with Christensen air brakes and whistles. There are also six open trailers for excursion business in summer. Although it was impossible to complete the line in time for much excursion business the past summer, several were handled, one of 1,000 passengers. The Meaker portable fare register is used.



COMBINATION CAR FOR REGULAR SERVICE.

The power house is a substantial brick structure 50 x 100 ft. with a fire wall separating the boiler and engine rooms. A battery of two boilers made by the Murray Iron Works supply two engines; one a 200-h. p. high speed Ball and the other a 300-h. p. Providence Greene Corlis. The generators are 200 and 220-k. w. Westinghouse, belt connected. At the swichboard 600 h. p. is easily indicated. The car house is a frame building adjoining, 50 x 125 ft., with three tracks. It is connected with the station by a system of



CAR HOUSE.

both water and steam pipes for fire protection. The repair shop is also frame and is 40 x 50 ft. in dimensions.

In the power house and along the line are some 20 Garton lightning arresters.

The equipment includes both summer and winter cars. There are two combination baggage and passenger cars 40 ft. long on Brill trucks and Griffin wheels, built by the Jackson & Sharp Co.

At the lake terminal four acres on the shore have been secured and large docks built from which all the public steamers on the lake sail. Restaurant and depot buildings have been erected here with facilities for taking care of large crowds.

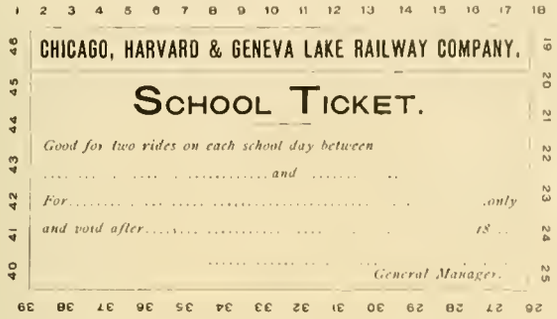
While the travel and freight are at all times sufficient to pay operating expenses and interest, the summer travel to the lake coming from Chicago and the surrounding cities and country will tax the road to its utmost. Owing to delay in completing the line on account of difficulty in getting construction material shipped, only a small part of the business offered could be handled last summer, and that after two of the best months were past. Notwithstanding this, the road with two passenger cars as its entire available rolling

DELIVERING COAL—42 TONS.

stock, in six weeks not only paid operating expenses for that period, but cleared 10 months bond interest, and this with the further handicap of construction work still in progress. The earnings for the lake period next summer is conservatively placed at $20,000. While the road has cost nearly $150,000 to build, it has been bonded for only $100,000. These bonds run 20 years, and are first mortgage gold bonds drawing 5 per cent. With interest charges of only

$5,000, and operating expenses of $10,000 per year, the expectation of the projectors that the line will clear 10 per cent on its capital stock of $150,000 has every prospect of being realized.

Quite a considerable business arises from children and young people going into town to attend the public and high schools and business college. For these a school ticket has been placed on sale so arranged that at time of sale as many rides are punched out as equal the holidays, etc., in the month for which it is sold. This saves printing a different ticket for each month. A similar arrangement is made to carry whole families from their farms to the several churches along the line and is found to work very nicely and secures a large amount of riding which otherwise would be lost. The local cash fare over the line is 30 cents each way; round trip, 50 cents; 10-ride commutation tickets 40 cents for the round trip.


CHICAGO, HARVARD & GENEVA LAKE RAILWAY COMPANY.

SCHOOL TICKET.

Good for two rides on each school day between

..... and .....

For ..... *only*

and void after ..... *18* ..

..... *General Manager.*

The construction has been a wonderful stimulus to everything along its line. Farm properties have advanced in value; the people now attend the theater and other gatherings, and social visits of both individuals and societies along the line are rapidly increasing. At Walworth where the power station is located, over 30 new dwellings have been built during the past 90 days and the demand is still larger than the supply.

The company also has valuable lighting and power grants, and it will put in a lighting plant to supply some 2,000 incandescent lamps at the lake for the coming summer.

The construction work was in charge of H. T. Windsor, who is now managing the road. The president is W. F. Furbeck, of Chicago, for many years vice-president of the Yerkes lines in this city; and the treasurer, A. L. Dewar, of Chicago.

BRITISH JOTTINGS.

(From Our Own Special Correspondent.)

The notices published last month of intended applications to Parliament for powers to build light railways or tramways (all such notices are required to be published during the month of November) number about 70. Most of the applicants are municipalities and in all cases electricity is the motive power specified. Extensions in Manchester, Liverpool and several Yorkshire towns are the largest schemes. Manchester is buying the local tramways and these with the proposed lines will require 600 cars. Fully as many cars will be required by the adjoining towns which will work their own lines. Current will be distributed to sub-stations on the three-phase system at 6,500 volts, similar to the plan adopted at Glasgow where also 600 electric cars will be provided.

The London County Council is seeking light railway orders for a number of new lines, but it is thought that they will not be granted because of the opposition of parish authorities and railway companies.

The underground schemes now before Parliament are confined to short extensions to authorized lines, applications for an extension of time for completion, and for the electrical equipment of the Metropolitan and District underground steam roads.

One of the applications is for a Behr monorail road from Manchester to Liverpool. (For a description of this system see St. Ry. Rev., July, 1898, p. 429.)

It is proposed to equip a number of short steam roads for electrical working.

The few private companies seeking powers wish to build interurban electric lines, the most notable being for roads in South Lancashire and the valley of the Clyde, below Glasgow.

A uniform 2-cent fare has been inaugurated on the cable tramway in Birmingham (three miles long) with the result that the traffic has increased enormously, requiring cars to be run on a headway of 1½ minute. The gross receipts have also increased. The tramway company would gladly equip all its lines with electricity were it not that the city insists on taking over the road when the lease expires a few years hence.

The tramway committee of the Glasgow council has recommended that the Westinghouse company be awarded the switchboard contract for the main power station for £33,593.

ACCOUNTANTS' REPORTS.

Secretary Brockway has mailed to all the members of the Street Railway Accountants' Association a printed copy of the proceedings of the third annual convention, held at Chicago, Oct. 17-20, 1899. The report, which has been put through the press without delay, is typographically all that could be desired and contains a list of the Association's officers, all the papers and reports presented at the meeting, together with a complete verbatim report of all the discussions and remarks, a list of those in attendance, the constitution and by-laws, etc. Mr. Brockway is to be congratulated upon the promptness with which he prepared his report.

There has been such a demand for the proceedings of the organization meeting of this Association held in Cleveland, March, 1897, that the Association has decided the reprint the proceedings of this meeting in a style uniform with the other reports.

PENNSYLVANIA REPORT.

The annual report of the Pennsylvania Bureau of Railroads, of which Maj. Isaac B. Brown is superintendent, shows that there were 380 street railway corporations in Pennsylvania at the close of the fiscal year ending June 30th last. The total capital stock outstanding of operating street railway corporations is $103,122,319; bonded indebtedness outstanding, $31,139,149; current liabilities, $13,139,149. There was a reduction of the bonded indebtedness of operating street railway companies during the year of $1,131,425. The reduction in current liabilities was $1,090,342. From the total income received by operating companies amounting to $31,646,808, there was paid out during the year in the way of disbursements for operating expenses $10,519,810, or substantially 50 per cent of the income. There was paid in dividends during the year, $9,133,647. The total mileage of street railways operating in Pennsylvania is 1,493.21. The total compensation for the year to employes was $6,596,904.

MONEY COST OF OVER CROWDED STREETS.

In his address before the Society of Arts, London, last month, Sir John Wolfe Barry attempted to roughly estimate the annual money loss suffered by the people of London because of the delays in congested thoroughfares. Countings were made in October and he found that in one hour 992 vehicles passed Cheapside, 1,228 the Strand, 1,497 Piccadilly, and 661 Tottenham Court Road, the number of pedestrians varying from 3,910 at Piccadilly to 6,358 at Cheapside. Similarly, he found by another enumeration that the number of omnibuses varied from 384 an hour at Cheapside to 487 at the junction of Oxford St. and Tottenham Court Road.

On three of these streets the overcrowding was for about 9 hours per day and on Piccadilly about 11 hours; the retardation in different parts of these streets varied from 10 to 44.8 per cent. Taking 20 per cent as the average, and the retardation of pedestrians (25,514 individuals per hour on all four streets) at one-third as much, with conservative estimates as to the value of the time, the annual loss due to the crowded condition of these four streets is as follows: Trade interests, £900,000; vehicular traffic, £1,180,000; pedestrian traffic, £65,000; total £2,154,000.

John Feeny, a former motorman on a Brooklyn road, whose mind had become unbalanced by reason of brooding over his misfortunes, the loss of a leg in a trolley accident and inability to get work, on November 29th opened fire with a revolver and very slightly wounded a fellow passenger on the car on which he was riding. He then attempted to shoot himself but failed.

MECHANICAL DEPARTMENT

MAINTENANCE AND REPAIR OF ROLLING STOCK.

BY J. W. GREER, GENERAL MANAGER YOAKUM TEX. IMPROVEMENT CO.

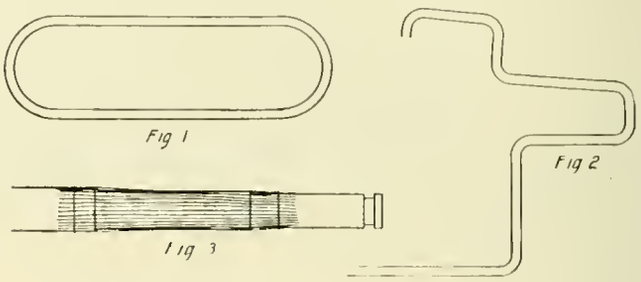
PART V.

In order that no one may be misled by the statement made in a previous paper that five men and two apprentices are all the men needed in the shops of a 100-car road it would perhaps be as well to explain that in the operating department of street railways it is usually the custom to designate a road by the regular number of cars constantly in operation; thus while a road operating 20 cars continually would be known as a "20-car road," the equipment of such a road would probably be 22 closed cars, 22 open cars, and at least 6 trail cars, making (from the shop man's point of view) a 50-car road. Those not familiar with the details of shop practice will, therefore, please bear in mind that the statement made refers not to a road operating daily, continuously, 100 cars, but to the total equipment of a road owning 100 cars, the work on which must be done in the shops at some time during the year. The equipment of the road which the writer had in mind (and which has been operated for the past seven years with the labor roll enumerated) consisted of 40 closed motor cars, 40 open motor cars, and 20 open trail cars; as 10 cars were kept constantly in the shops (five cars out of season being given a thorough overhauling, and five seasonable cars held in reserve for minor repairs) it will be seen that 35 cars were or could be operated continually. When motors were very high priced, it was customary with some roads to have a double equipment of car bodies only, shifting the trucks and motors as the seasons required; this is a practice not to be recommended, as with the full equipment under all the cars there will be sufficient increase in the gross receipts, by being able to run an increased number of cars on special occasions to more than offset the interest on the investment. Of course if there are roads which still practice the semi-annual change of trucks and motors from open to closed cars and vice versa, the work can be greatly simplified and expedited by the use of the simple and efficient air hoist previously described.

Three ground, and one overhead hoist, the cylinders of which are constructed as detailed in a previous paper, have been in successful daily operation for more than two years in the shops of the S. A. & A. P. Ry. Co. (a 700-mile subdivision of the Southern Pacific) in this city. The writer has seen car bodies lifted from the trucks with a level made of 4 x 6 in. scantling 20 ft. long; he has also observed the operation as performed with four screw jacks, and has occasionally witnessed the performance of a chain hoist, the modus operandi of which involved the use of two or four pair of differential pulley blocks.

The writer (who is a street car builder by trade) after years of daily experience with compressed air, pefers it for all purposes of the nature previously described and for the reason heretofore given.

In discussing the practical work relating to this subject, let us begin at the wheels and axles, and go up. *We all know that wheels will flatten and flanges break; one wheel will have a hollow face, while its mate gets too much bevel; one flange will wear thin, while that on its mate is abnormally thick; one wheel will get loose on the axle, while the mate remains tight. The axle will break at one end, next the hub or at the key seat, whichever happens to be the weakest point, etc., through all the ills to which wheels and axles are subject. It is an axiom among medical men that if you remove the cause the disease will disappear. The same thing applies largely in mechanics. The cause of your troubles with wheels and axles and a great many other troubles with your rolling stock, is the fact that one side of your track is longer than the other, and that you never turn your cars around to equalize the strain caused thereby. In street railway practice the wheels are made of exact size, and pressed rigidly on the axle; with these rigid wheels and axles as a base the whole structure is built, and it follows that undue or unnecessary strains or torsion put upon the base must affect the whole structure. Since we cannot prevent one side of a street railway track from being longer than the other, and since it is equally impossible to make two wheels of the same size on a rigid axle travel different distances simultaneously without slipping and torsional strain, let us at least double the life of the parts affected by turning the cars, and causing both sides of all the parts to bear their proportionate share of the insurmountable strain. But you say I operate a belt line and my cars are turned every trip! Glance at



the belt line shown in the sketch, Fig. 1, and see how much further your outside wheels will have to travel than your inside ones. Buy a turntable or put in a Y (the latter is preferred), and if you operate only in one direction over your belt, turn your cars each trip. It is much better, however, if possible, to run your cars both ways around a belt, and turn them only every other trip. This gives you the strains in reverse each trip on the same side of the car and tends more nearly to neutralize the bad effects than when the wheels go only in one direction over the track though different sides are turned each trip. If you are operating a single track line do not overdo the thing by putting a loop or Y at each end of the track, and turning the car each half trip, for while you get the sides of the car changed relative to the track you keep the wheels turning in one direction all the time. Turn the cars only at one end of the line, thus allowing them to go back and forth over the same inequalities and irregularities. Even if you have a track which is perfectly straight, it is better to turn the cars at one end of the line each trip to counteract "hammer" due to constantly striking the same joints and irregularities, and the result of which is eventually to crystallize the axles and flatten the wheels.

Some years since the writer kept a careful record extending over a period of three years and embracing the cars operated on two divisions of the system, of the relative life of wheels and axles on a line where the cars were turned once each round trip, and on a line where they were never turned. The track conditions and loads were slightly in favor of the line where the cars were never turned, but the result showed the axle breakages to be five to one, and the cast-off wheels to be three to one in favor of the line where the cars were turned. The axles would of course break on the T. H. cars at the key seat, and on the Sprague cars at the wheel seat next the inside end of the hub, these being their respective weakest points. Instead, however, of tinkering with a new style key, or enlarging the wheel seat, we sought the origin of the trouble and eradicated it as far as possible. As long as street railways continue to operate there will be some broken axles and some flat wheels; we can only hope to minimize the number. When the cars are properly operated and the track conditions of the best, still the hammer blows due to passing over the joints will eventually crystal-

lize the axle, and it will break at the weakest point, unless the average length of life has been ascertained as it should be on each division separately and the axles be removed before the danger point is reached. A coil spring placed between the frame of the truck and the top of the oil box directly over the bearing, tends greatly to lessen the severity of the hammer, and lengthens the time necessary to produce crystallization. The life of wheels which have soft spots in them, is greatly lengthened also by this, as the flattening of such wheels is largely due to hammer.

A prolific source of flat wheels is "skidding" them by the too sudden application of the brakes, or by reversing the motor when the car is at speed and heavily loaded, the wheels of course cease to revolve under such conditions, but the momentum of the car carries it forward, greatly to the annoyance of the passengers and the detriment of wheels and rails. It is almost impossible to get two wheels with the chill of the same depth on each, and the metal the same degree of hardness, consequently under the best conditions the face of one wheel will wear off faster than that of its mate. Wheels should therefore be trammed for size every time the truck is removed from the car for cleaning the motors, and if a material difference (¼ in. or more) in the circumference of a pair on the same axle is observed, they should be re-mated to prevent torsional stress on the axle, and the eventual flattening of the large wheel.

The writer is not an advocate of grinding wheels to make them mate, but rather inclines to keeping a good assortment of extra wheels, partially worn on hand, and pressing off one or the other of the two wheels which no longer mate, and substituting another. It is a saving of labor and often results in getting together a pair of wheels so nearly the same in quality as to never again give trouble until both are completely worn out. Whereas, if two wheels that have worn unequally are ground to again mate, the trouble will surely recur.

The wheel makers have brought the state of their art to a degree of perfection not hoped for a few years since, and by their combinations of different grades of iron, are enabled to turn out a product which they guarantee for a life of 60,000 miles. Careful experiment and close record have convinced the writer that proper attention to the details as given in this paper will enable one to get as high as 150,000 miles out of these same wheels. Don't abuse your wheel and axle maker till you have given his product a chance by trying to operate your cars properly.

In tramming wheels for size, it is better to use a "traveler" such as is used by blacksmiths, than to use a steel tape or string measure, as is usually done. Make a chalk mark on the tread of the wheel, another on the side of the traveler, and put the two marks even, roll the wheels along the track, if on the axle, or run the traveler around them if off the axle, make a mark on the traveler when it returns to the mark on the tread; try the other wheel, and the difference between the stopping marks on the traveler is the difference in circumference of the wheels.

The cause of much flange breaking is lack of knowledge on the part of the track foreman in setting switches, or on the part of the engineer who designs them. The throat of the switch and its mate will be designed to give just enough room for the flange to pass through and the track which is usually spiked to a gage ¼ in. greater than the width between wheel flanges (which is proper), is brought to exact gage at the switch.

The engineer has designed the throat of the switch a close fit for the flange, in order to prevent vehicle wheels from catching in it. The track man very properly spikes the switches to exact gage in order to get the wheels to pass through, but there is an element neither of them sees, or knows about; it is almost impossible to bore a perfectly straight hole through wheels of different degrees of hardness and keep the hole at right angles with the face of the wheel all round. A variation of 1-32 in. from a right angle will throw a 36-in. wheel 5-16 in. out of plumb, and in a pair of wheels might make the difference in the wheel gage ⅝ in.

Wheels in this condition passing through switches set as above described, will either break the flanges or spring the axles. Guard rails for leading a car round curves or into switches, for the same reason should never be used on both sides of a track, and the space in the mate at a switch should always be such that a variation in or out of ¼ in. is allowed for inwheel wabble. Another serious trouble with wheels is the nicking of the face edge of the tread, due largely to the fact that in a mistaken effort to save power the manager has adopted a wheel the tread of which is 2¼ in. when it should have been 3 in. or more

Theoretically, if the ball of the rail is 2 in. wide, and you use a wheel the tread of which is 3 in., you have 1 in. overhang on the dirt or pavement adjoining, and a greatly increased current consumption to pull a given load in consequence. Practice, however, shows that narrow-tread wheels have a greater tendency to spread the track, and that where the track is bad will fall in quicker; and with wider treads that after two or three trips over the road the pavement and dirt will conform to the height of the rail, and no increase in consumption of power is perceptible

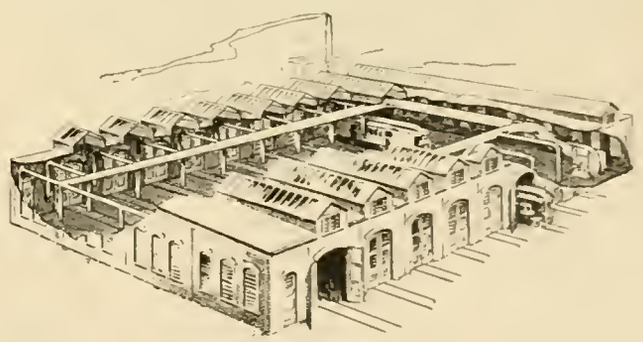
Nicking results where the track is spread, not enough to let the wheel fall in, but enough so that the whole load carries on the edge of the rim. Put a little more metal in your wheels and avoid both "nicking" and track troubles. Very few small street railway shops have a first class wheel boring machine; the writer does not advocate acquiring one, but strongly recommends that boring wheels be not attempted in a small shop. It is better to buy the axles slightly larger than needed and turn the wheelfit on the axle; set your calipers the exact size of your wheel bore, and then make a spring fit (i. e., screw the calipers up tight, and turn off the axle till the spring of the calipers will allow them to pass by shoving hard), this will give you a fit requiring from 40 to 60 tons pressure to put the wheel on.

If you have a wheel which is loose or has been turning on the axle, and you desire to use it again, don't rag the axle with a round nose chisel or shim the hub with tin, but take some hard drawn steel wire, No. 20 to No. 16 gage, cut it in lengths 6 in. longer than the hub of the wheel, place these wires lengthwise, and ¼ in. apart around the wheelfit (see Fig. 2) of the axle; let 3 in. extend back of the point of the hub, and 3 in. in front of the hub; pass a wire round the journal to hold the bundle of wires in place around the wheelfit, and another wire around the other end of the wires; then press the wheels on in the usual way and you can rest assured that you have one wheel that will never get loose again. The small hard wires imbed themselves, half in the softer steel of the axle, and half in the cast iron of the hub and act as so many keys to hold them from turning.

The writer would like to see the beveled tread abandoned and the tread made slightly concave; this would render track repairs materially less and give better wheel life results.

HEATING AND VENTILATING CAR PAINT SHOPS.

The efficient heating and ventilating of a car paint shop greatly increases the capacity by reason of the more rapid drying of the paint and is therefore one of the important things to be considered in designing such a building. The blower system whereby heated air is forced throughout a building by means of a fan is well adapted



PANHANDLE PAINT SHOP.

for buildings of this class, though the usual method of distributing the air horizontally from overhead outlets is not practicable. The illustration shows the blower system of ventilation and heating as applied in the passenger car paint shop of the Pittsburg, Columbus, Cincinnati & St. Louis Ry. at Columbus, O. Here the apparatus is located in one corner of the building, and the air is distributed through an overhead system of galvanized iron piping, extending entirely around the inside of the building at some distance from the walls. Between each pair of tracks pipes are brought down, so as

to deliver the air very near the floor, where it naturally spreads, and whence it gradually rises in a well-distributed mass.

This plant was installed by the B. F. Sturtevant Co., of Boston, Mass., and is the arrangement recommended as best for buildings of this class. In the "Review" for July last, page 484, we illustrated the Sturtevant company's system of heating street car barns.

ADVANCE IN COST OF MATERIALS.

In the fall of 1897 one of the large street railways rebuilt a number of cars, keeping a careful record of the materials and cost. In October, 1899, comparisons were made between the prices obtaining in 1897 and in 1899, with the following result:

Material.	Advance, per cent.
Wages	10
D. T. glass	20
Clear dry ash	10
Clear white oak	20
Whitewood	10
Maple	15
Georgia pine flooring	10
Common pine lumber	20
Wrought iron	118
Cast iron	12.5
Mild steel	110
Brass screws	85
Iron screws and iron nails	100
Carriage bolts	60
Machine bolts	100
Stove bolts	25
Sheet steel, No. 14	67
Brass tubing, ½-in.	50
Brass trimmings	66
Curtains	15
Ducking, 8-oz., 72-in.	25
Bell cord	12
Rubber belting (for tread) and sash rubber	50
White lead	5
Russet leather	10

BENDER FOR T-RAILS.

The Q & C Co., of Chicago, is introducing under the trade name of the "Samson," a new bender for T rails, which is claimed to be an improvement over the ordinary forms of jim crow benders in that the power is applied at the end of the rail, instead of at the

Q & C RAIL BENDER.

center. In most machines of this nature, the rail is held at two points, and pressure is applied by means of a screw at an intermediate point, but in the new type the rail is held by a claw on one end of a heavy lever, and pressure is applied by a capstan-headed screw at the other end. The screw is fitted with a cap, which bears against the head of the rail, and in which the end of the screw revolves on a roller bearing.

The frame is made of an open hearth steel casting, and the screw is of steel working in a bronze nut and is provided with anti-friction washers. The weight of the machine is 113 lb.

The Metropolitan Street Railway Co., of New York, has notified the Continental Telephone Co., that its conduits would be placed at the Telephone company's disposal for telephone purposes of the combined independent companies. The territory now covered by this combination, which is a rival of the Bell company, reaches from the Ohio River to the lakes and from New York to the Mississippi.

PROPOSED MILWAUKEE ORDINANCE.

A special committee appointed for the purpose has reported a street railway ordinance to the city council of Milwaukee which is designed to define the rights of the city and the Milwaukee Electric Railway & Light Co. to the satisfaction of all parties. The principal features of the ordinance are:

The company is given certain additional streets.

If the city limits are extended the company is to extend all lines running to the old limits to the new limits if there shall be any reasonable need thereof.

All rights and franchises in the streets are to terminate Dec. 31, 1934.

The rates of fare shall be 5 cents, except children under 10 years of age, for whom the rate shall be 3 cents or two for 5 cents. One free transfer is to be given when desired. Tickets shall be sold 6 for 25 cents and 25 for $1, good from 5:30 to 7:30 a. m. and from 5 to 6:30 p. m. each day till Jan. 1, 1905, and at all hours after that date. Passengers presenting tickets are to have the same transfer privileges as those paying cash fares.

The company shall provide a clock in each car.

The city shall have the option to purchase the property of the company during the year 1934, paying therefor its actual value (excluding franchises) as a going concern as may be determined by mutual agreement or by a board of arbitration, two chosen by each party and the four to choose a fifth. The decision as to whether the city will purchase must be made between July 1, 1930, and Jan. 1, 1931. If the city does not purchase all franchise rights expire Dec. 31, 1934.

The company is to furnish electric power to operate the drawbridges crossed by it.

The company is to carry policemen in uniform and detectives free of charge.

HEAVY SPECIAL WORK FOR CHICAGO.

The accompanying engraving shows one of a lot of 10 crossings made by the Paige Iron Works, of Chicago, for the Chicago City Ry., to be used on 63d St. where the street railway lines intersect the P. C. C. & St. L. R. R. The crossings are built in accordance with the standard specifications of the Chicago City Railway Co.,

PAIGE CROSSING FOR CHICAGO CITY RY.

and are made of 100-lb. T-rails, fitted with extra heavy "Q" bars. The entire lot when completed weighed 28 tons. This is the third order for heavy crossings given this season to the Paige Iron Works by the Chicago City Ry.

OSHKOSH INAUGURATES FUNERAL SERVICE.

The first funeral at Oshkosh to use an electric car instead of carriages took place on November 16th. A long interurban car having two compartments was utilized for the service, the casket being carried in the baggage compartment and the mourners riding in the other. Funeral cars will hereafter be a regular feature on the lines of the Citizens' Traction Co., of Oshkosh, of which E. E. Downs is general manager.

FOREIGN FACTS.

Electric lines will probably be constructed by the Bath (Eng.) Town Council.

An electric railway will be constructed at Patras, Greece, by the Greek Electrical Co., of Athens.

The street railway running from Kozu to Ooiso, Japan, known as the Odawara Street Ry., is being equipped with electricity.

St. Petersburgh may soon have a new system of electric trams, a commission having been appointed to investigate the subject.

Para, Brazil, will have seven miles of new electric railway. The tramways at this place are owned by the Compania Urbano.

The electric lighting and tramway system of Szakadka, Austria, has been purchased by the Reuni Tramways Co., of Brussels.

A commission to enquire into the advisability of electric tramways for Tokio, Japan, has been appointed by the authorities of that city.

The Glasgow Tramways has given an order for $500,000 worth of steel rails, special work, etc., to the Federal Steel Co., of America.

It is stated that the city of Moscow has been offered a loan of 20,000,000 rubles by a Berlin bank, for the purpose of building electric tramways.

A bill will be introduced in Parliament asking for power for the Barnsley Town Council to construct and operate tramways for the borough and suburban districts.

The District Council of Aston, England, has decided to purchase and operate the tramways owned by the Birmingham & Aston and City of Birmingham Tramways Cos.

An electric tramway will probably be built at Teneriffe, Canary Islands, by the Electric Tramway Co., of Teneriffe, which has been organized by capitalists at Brussels.

Messrs. Kincaid, Waller & Manville, of Westminster, have been asked to prepare plans and estimates for an electric railway to be built by the Town Council of Cambridge, England.

Dawson City, in the Klondike, is to have an electric railway. According to newspaper reports, a line is now being built through the city, and will be extended across the Klondike River to Klondike City.

The Ceylon Government Railways is asking for bids until Jan. 4, 1900, for the constructing of 200 miles of light railways. Information can be secured from the Crown Agents for the Colonies, London, England.

The first section of the Seville (Spain) Tramways Co., Ltd., has been opened to traffic. This road has just been changed from horse traction to electricity, and several extensions built, by the General Electricity Co., of Berlin.

A resolution was passed some time ago by the Dewsburg (Eng.) Town Council agreeing to promote a bill in Parliament, in conjunction with other authorities, to obtain powers to construct a local scheme of tramways.

Frankfurt, Germany, has been empowered to purchase the existing tramways in the city, extend them in several directions and equip them for electrical operation. It is stated much new material will be contracted for at once.

The owners of the Federal District street railway in Mexico City have purchased the street railways of Guadalajara for $700,000 after prolonged negotiations. The same company has purchased the street railway in the city of Puebla.

The Seine Municipal Council will grant permission to the Compagnie des Tramways Electriques de la Rive Gauche de Paris to build two electric railways from Boulogne-sur Seine to Vincennes, and from Montreul to Boulegne, France.

The Buenos Ayres Tramway Co. at a recent meeting declared a dividend of £25,875 and increased its capital stock £100,000. The City of Buenos Ayres is asking for bids for the construction of electric tramways to certain suburbs.

Most of the surface lines of Berlin, Germany, are operated by a company with a franchise still having 20 years to run. The policy of granting no more franchises has been decided upon, and hereafter the city will build all new roads itself.

Sanction for an electric tramway 15 miles long connecting York, England, with Cliffe Common Station, has been given by the Light Railway Commissioners, and a permit for the construction of the line will probably be issued at once to the Escrick and Riccall Rural District Councils.

A school of instruction for inspectors has been established on one of the Berlin Tramways, and all employes of this class will be required to take a three weeks' course of lessons on the care and repair of car equipment, so as to be able to make minor repairs in cases of breakdowns and thus avoid prolonged blockades of the line.

Consul Millner, of Calais, under date of Oct. 30, 1899, informs the department that a company organized at Paris is arranging to establish an electric railway in Calais. The equipment has not yet been purchased, and the consul thinks that United States manufacturers may wish to bid. The old tram cars now in use are of American make.

The city of Mannheim, Baden, Germany, is about to establish a new system of electrical tramways, to be owned by the municipality. It is announced bids on equipment and installation will be asked for in the near future. The municipal council has appointed as director of the system Otto Lowitt, who is now general manager of the tramways at Basel, Switzerland.

A new company has purchased the property of the Tramway & Omnibus Co., of Bordeaux, France, and will immediately proceed to improve the lines and substitute electricity for horse power. Further particulars can be obtained from M. Breterton, managing director Tram & Omnibus Co., Rue Tivoli, Bordeaux, France. The chairman of the board of directors is M. Mercet, 10 Rue de Londres, Paris.

The Port Stanley Electric Street Railway Co. is the title of a concern which is to build and operate an electric railway from Port Stanley to London, Ontario, a distance of about 26 miles. The former place is a popular summer resort on the north shore of Lake Erie and is the summer place of residence of a great many St. Thomas and London people. The railway will follow the route known as the London and Port Stanley gravel road, and a charter has already been obtained from the Ontario government.

Consul Skinner writes that the Paris, Lyons, and Mediterranean Railway Company, headquarters at 88 rue St. Lazare, Paris, has undertaken the construction and operation of an electric railway between Fayet and Chamounix, at the foot of Mont Blanc. The line is to be in operation within twenty months, and it is to be presumed that the company will be interested in propositions for machinery and equipment. Power is to be furnished by the River Arve. Contracts for the road bed and water power have been let.

United States Minister Herbert W. Bowen, Persia, writes the department as follows: "The only tramway lines existing in Persia are those in Teheran, which were laid 10 years ago, and are the property of a mixed society of Belgians and Russians, although at the present time most of the stock is held by the firm of Poliakoo, of Moscow. The lines are about six miles in length, and are laid with ordinary rails." He adds: "Until some better and more expeditious means of communication has been provided, it will be impossible for American manufacturers to compete with Russia for the supply of tramway materials."

TWO NEW ROADS NEAR HAMILTON, ONT.

The Hamilton Electric Light & Cataract Power Co., Ltd., intends to build an electric railway from Hamilton to Guelph, a distance of 30 miles, and also one from Hamilton to Waterloo, through the cities of Galt and Berlin, a distance of 44 miles. The power for both these lines will be supplied by the Cataract Co., and will be derived from DeCew Falls, about 35 miles from Hamilton, so that the total transmission in the longest case will be 75 miles. The roads will be built with 80-lb. rails, and there will be no grade over 2½ per cent, the intention being to run at 60 miles an hour and give an hourly service between Hamilton and Guelph.

The Cataract Co. now owns the large power plant at DeCew Falls, the Hamilton Electric Light & Power Co., the Hamilton Street Ry., the Hamilton & Dundas Electric Ry., and the Electric Power & Manufacturing Co., of Hamilton.

COMBINATION CARS FOR PEORIA, ILL.

The Peoria & Pekin Terminal Railway Co. will soon place in operation on its 10-mile line connecting Peoria and Pekin several combination cars of the type shown in the accompanying engraving, for which we are indebted to the Railway Age. The cars were built by the American Car Co., of St. Louis, and are 43 ft. in length, with baggage and express compartment. They have a seating capacity of 40 passengers, and are mounted on double trucks with a 25-h. p. motor on each of the four axles. The cars are run in trains consisting of a compartment car and a passenger trailer 43 ft. in length with a seating capacity of 48.

The company also do a freight business over the same tracks by means of steam locomotives, having three 60-ton Baldwin dummies and large modern freight cars for this service.

NEW PUBLICATIONS.

THE ELECTRIC STORAGE BATTERY CO. has reprinted the article on "The application of Storage Batteries in Railway and Power Plants" that appeared in the electric railway number of Cassier's Magazine and is sending it to interested parties as Circular No. 55.

THE RIDGWAY DYNAMO & ENGINE CO., of Ridgway, Pa., has recently issued a very handsomely printed pamphlet of over 100 pages devoted to illustrated descriptions of the Thompson-Ryan dynamo and the McEwen automatic engine, which are made by this company.

COPP'S SETTLERS' GUIDE, the 21st edition of which is before us, is a popular exposition of our public land system in the United States. The work is by Henry N. Copp, of Washington, D. C., and is sold at 25 cents. Mr. Copp desires the address of all Union settlers who make entries before June, 1874, of less than 160 acres. The chapter on surveys tells how to decipher township and section corners and the book gives the latest rulings on homestead and other laws.

CONSTRUCTION AND REPAIR OF COMMUTATORS is the title of a 29-page illustrated pamphlet by L. C. Sharp, of Omaha, Neb., which treats of the electrical and mechanical repairs of commutators. The work shows the operation of a commutator making by a series of illustrations which are accompanied by lucid explanations which clearly explain the method of commutator building. The work contains 14 illustrations and is sold for 50 cents.

COMBINATION CAR FOR PEORIA & PEKIN TERMINAL RY.—AMERICAN CAR CO.

GARCKE ELECTRICAL DIRECTORY.

The Garcke Manual of Electrical Undertakings for 1900 is just out, and it will be welcomed by all who are interested in the development of tramways and other electrical industries in Great Britain and her colonies. It is a volume of 1,036 pages, comprising a directory of all companies and manufacturers that pertain to the following subjects: Telegraphs, telephones, electricity supply, traction and manufacturing. Also a directory of all officials, including directors and engineers of corporations.

The work is published under the direction of Emile Garcke, of the British Electric Traction Co., Donington House, London, England. It is evident that the data have been compiled with great care, and the directory is certainly the most complete ever published in England. The Manual sells for $3 net, and may be obtained through C. H. Perrine, 825 Monadnock Building, Chicago, Ill.

The Chicago City Ry. has declared its usual 3 per cent quarterly dividend payable December 30th.

THE ARTICLES announced to appear in the Engineering Magazine for 1900 include papers from the pens of some of the ablest writers on engineering subjects on both sides of the Atlantic, including such authorities as J. Slater Lewis, Sir B. C. Browne, J. H. Biles, Philip Dawson, Dr. Louis Bell, and others.

"NEW TYPE SUNBEAM" is the title of a handsome pamphlelt by the Western Electric Co., describing the "Sunbeam" lamp for which it is exclusive agent. A complete new type has been developed, and the styles of the same are shown in the illustration in the catalog.

THE LIGHT RAILWAY & TRAMWAY JOURNAL is the name of a monthly published at London and devoted to tramway interests in Europe. The issue for November contains several articles of unusual interest, including a description of the Carlisle Electricity Works and the Darwen Electricity Works, Notes on the Light Railways and Tramways of London, and shorter articles dealing with live operating problems.

PERSONAL.

MR. W. C. HELLER, formerly of Montgomery, Pa., has assumed the duties of general manager of the Rapid Transit Ry., of Xenia, O.

MR. THOMAS E. MITTEN, general superintendent of the Milwaukee Electric Railway & Light Co., has returned from an extensive trip in the East.

MR. JOHN M. ROACH was on November 20th chosen vice president of the Chicago Union Traction Co., succeeding Mr. Walter H. Wilson, who resigned.

MR. A. K. BAYLOR, MR. H. F. PARSHALL AND MR. ROBERT W. BLACKWELL, the well-known electrical men of London, arrived in this country last month.

MR. N. C. DRAPER has left the Central Railway Co., of Peoria, Ill., to take up the duties of mechanical engineer for the recently completed Peoria & Pekin Terminal Ry.

MR. J. H. CARSON, formerly president of the Sterling Supply & Manufacturing Co., and now president of the Sterling-Meaker Co., was a caller on the "Review" in Chicago recently.

MR. E. P. SHAW, JR., on December 1st resigned his position as general manager of the Manchester Street Ry., Manchester, N. H., and Mr. J. B. Smith has been elected to fill the vacancy.

MR. CHARLES G. WINGATE has been appointed assistant superintendent of the Metropolitan Street Railway Co., of New York; he was formerly superintendent and chief engineer of the Huntington (N. Y.) Railroad Co.

CORNELIUS JEROME SIMMONS, JR., second vice-president of the Collins Park & Belt R. R., Atlanta, Ga., son of Pres. C. J. Simmons, of that company, is probably the youngest street railway official, being only 12 years old.

MR. HENRY N. RANSOM, purchasing agent for the International Traction Co., of Buffalo, was married on November 21st to Miss Alice Gillet. The "Review" joins with Mr. Ransom's many friends in heartiest congratulations.

MR. JAMES BOYD, well known to many of our readers through his former connection with the "Review" as assistant editor, has been admitted to the Chicago bar and opened an office at 1218 Ashland Block. We wish him the deserved success we feel sure he will attain.

MR. C. J. REILLY resigned his position as chief engineer and superintendent of motive power of the Chicago City Ry. on November 1st, to become superintendent of the Sandusky Portland Cement Co., at Syracuse, Ind., where the company is now building an extensive cement mill. The new mill will be operated throughout by electricity, the three-phase system being used.

COL. G. B. M. HARVEY, who has been placed at the head of the extensive publishing interests of Harper & Brothers, is financially connected with a number of important street railway properties in the United States and Cuba. He has been associated on several occasions with Mr. W. C. Whitney in the latter's railway enterprises, and is at the head of the Harvey syndicate, which owns the street railway system of Havana.

MR. JOHN PATTERSON, of Hamilton, Ont., is known as the "electrical man" of that city, and in this field he has achieved great success. In the 80's he began to develop the electric undertakings which have since done so much for the city. In 1895 the electric line around the beach to Burlington was completed and the next year Mr. Patterson organized the Cataract Power Co. to develop power at DeCew's Falls and transmit it to Hamilton. This company now has a capital of $3,750,000 and controls the Hamilton Electric Light & Power Co., the Hamilton Street Railway Co., the Hamilton & Dundas Electric Ry., the Hamilton Radical Electric Ry., and the Electric Power & Manufacturing Co., of Hamilton.

MR. W. J. JOHNSTON, the well-known publisher, now making a tour of the world, was given a complimentary dinner at Tokyo, Japan, while visiting that city by Professor I. Fujioka, president of the Tokyo Electric Co., and Mr. S. Katom, editor of the Electrical Friend. The dinner was served in true Japanese style, with the usual accompaniment on such occasions of singing and dancing by geisha girls.

MR. ALFRED FAIRBAIRN, for several years paymaster of the Montreal (Can.) Street Railway Co., has been appointed comptroller of the West India Tramway Co., Kingston, Jamaica.

OBITUARY.

MR. F. J. O'DONOGHUE, superintendent of the Nashua (N. H.) Street Ry. and well known in street railway circles in the East, died on November 10th.

VICE-PRESIDENT HOBART, who died November 21st, was quite as prominent in financial circles as in politics, and among his wide interests were large investments in street railway properties. Mr. Hobart was president of the Paterson Railway Co., of Paterson, N. J.

MR. V. C. TURNER died at his home in this city on December 2d, of apoplexy. Mr. Turner was born in Malta, Saratoga County, New York, Feb. 25, 1823; he came to Chicago in 1848 and engaged in the practice of law. In 1860 he became interested in North Chicago City Ry., and was president of the company from 1867 to 1886.

MR. ROBERT F. FOX, who was for some time superintendent of the Scranton (Pa.) Railway Co., and more recently general manager of the Wilmington & Chester Traction Co., of Wilmington, Del., and the Chester (Pa.) Traction Co., died last month at his home in Meadville, Pa., after an illness of several weeks. Before going to Scranton, Mr. Fox held the position of assistant engineer of the Brooklyn (N. Y.) roads.

MR. J. H. VANDERVEER, superintendent of shops of the Brooklyn Heights Railroad Co., died at his home in Bay Ridge, N. Y., December 3d, of typhoid fever. Mr. Vanderveer had an extensive experience in both railroad and street railway work and was considered an expert on the subject of maintenance of rolling stock. In November he read a paper on "Care of Car Equipment" before the American Street Railway Association at Chicago. He was at various times connected with the Central Railroad of New Jersey, the Erie R. R., and the street railway lines at Scranton, Pa., leaving this latter position in 1893 to enter the engineering department of the Brooklyn City R. R., where he remained through the various consolidations, and was finally promoted to the office of superintendent of shops.

FIRST HONORS FOR PANTASOTE.

The highest award, a silver medal and diploma of merit, was conferred by the National Export Exposition, of Philadelphia, upon the Pantasote Co., for products exhibited in competition. The committee of award was appointed by the Franklin Institute, which has an enviable reputation for impartial and thorough investigations.

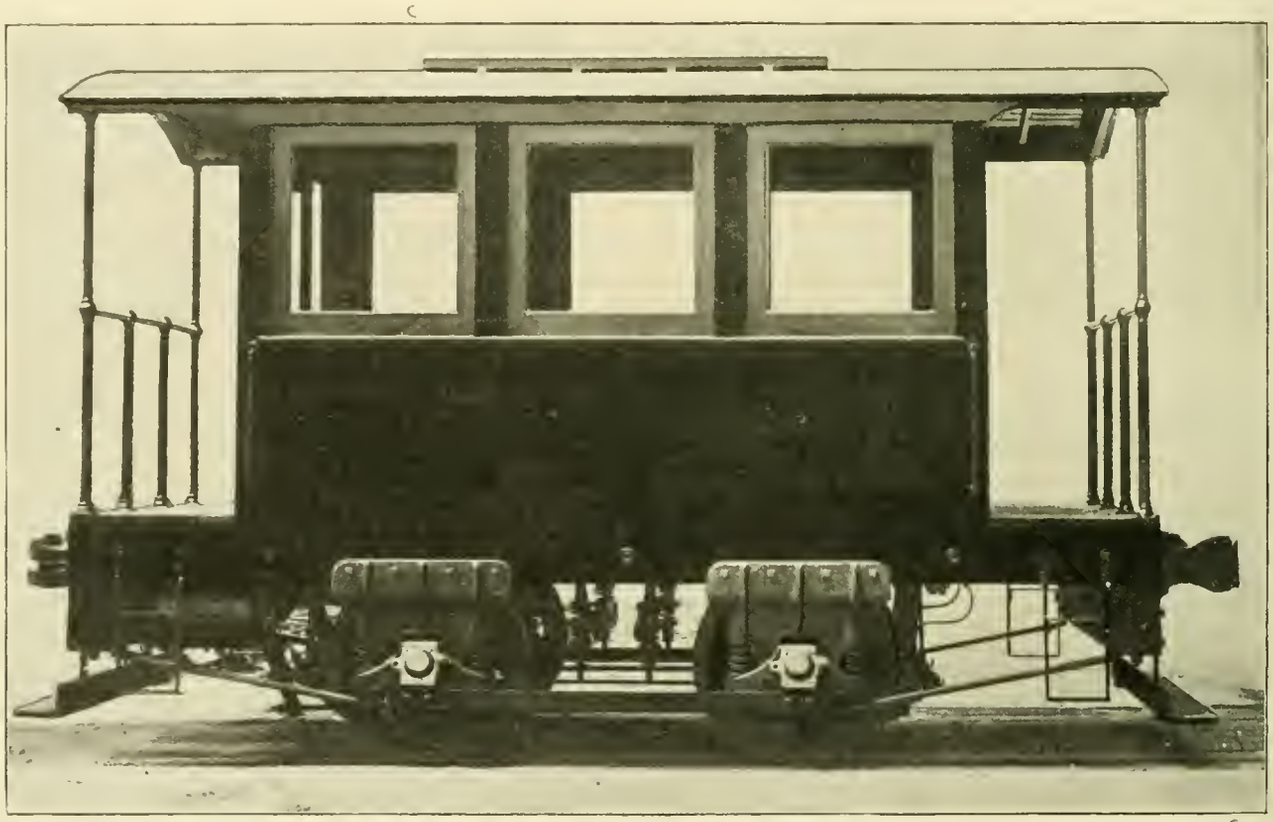
The award thus obtained will doubtless be exceptionally gratifying to the recipients whose products have attained a widespread popularity and sale in this country and in Europe as materials for upholstering car seats, furniture, carriages, etc., and for car curtains. The fact that the United States Government, during the Spanish War, adopted Pantasote for all ambulance upholstering and for other army uses was a high testimonial to its merits. Its freedom from liability to rot, peel or crack, its non-inflammable quality and the fact that it is germ proof makes it extremely desirable for the purposes for which it is intended and renders it a most satisfactory substitute for leather, and in some respects its superior.

NEW M'GUIRE LOCOMOTIVE.

The McGuire Manufacturing Co. has just delivered to the General Electric Co., of Schenectady, N. Y., one of the most compact electric locomotives that this company has yet turned out. It is only 14 ft. over all and weighs complete about 22 tons. It is fitted with Westinghouse automatic air brakes, Trojan couplers, chime whistles, General Electric air compressors, and two G. E. 51 electric motors of 150 h. p. each, giving the machine a capacity of 300 h. p.

The largest one of these locomotives yet turned out by the McGuire company weights 60 tons, and is in operation at Yonkers, N. Y., for hauling steam cars through the tunnel at that point, and the company has made several weighing only 4 tons, for mining purposes. The McGuire company is busy this month with orders for points so widely separated that it is noticeable. It is building 60 trucks for San Francisco, 120 for Havana, Cuba, 30 pair for the Australian Government, and finishing the order for 300 for the Northwestern Elevated of Chicago, with smaller orders from every part of this country. It is just closing up the largest snow plow business the company has ever done in one year, with two orders. 10 for Washington, D. C., and 15 for St. Louis, besides a large number of single orders, among them being one for Spokane, Wash., and one for Burlington, Vt.

Plans are being prepared for an additional building to be added to the McGuire plant this winter. It will cover the piece of ground on the corner of Kinzie and Morgan Sts., being 116 ft. on Morgan by 166 ft. on Kinzie. This building will be five stories high and devoted entirely to sweeper, electric locomotive, and sprinkler woodwork. The McGuire company will introduce a new sprinkler the coming year, which will be distinctive in design and construction. It is to be equipped with sweeper as well as a sprinkler, which for traction purposes will certainly be a great advantage and will be appreciated by managers who realize the economy of having a clean rail.



McGUIRE LOCOMOTIVE FOR GENERAL ELECTRIC CO.

The city council of McKeesport, Pa., passed an ordinance last month placing a tax of $100 a year on all street railway cars in the city used for carrying express packages.

KANSAS CITY-TOPEKA ROAD.

The Kansas City Lawrence & Topeka Railway Co. was organized in September last under the laws of the state of Kansas, with an authorized capital of $2,000,000. The company has authorized the issue of $1,500,000 of 5 per cent first mortgage bonds. It has purchased the Lawrence & Emporia Ry., known as the Carbondale road, and also the Kansas City, Bonner Springs & Topeka road, the Lawrence Street Car line and the East Side Circle Ry., at Topeka. The line between Kansas City and Topeka will be 68 miles in length and the company expects to make arrangements with the Metropolitan road at Kansas City to use the latter's tracks as an entrance to the city; also with the city line at Topeka for enrance to that city. It is now constructing the road the whole distance between Kansas City and Topeka. The officers of the company are: President, Henry G. Pert, of Kansas City Mo.; vice-president, C. C. Baker, Topeka, Kan.; treasurer, W. A. Bunker, Kansas City; secretary, Geo. J. Kensinger, Kansas City, The directors include the four officers and J. D. Bowersock, Lawrence, Kan.; W. C. Endsley, Kansas City; J. W. McDanield, Bonner Springs, Kan.; J. W. Hirst, Omaha, Neb.; Willard E. Winner, Lansing, Kan.

FOREIGN AGENCY DESIRED.

Messrs. E. H. Cadiot & Cie., 12 Rue St.. Georges, Paris, France, who make a specialty of general electric supplies, wish to become the French representatives of American companies making steel rails and street railway poles, and desire that such companies will enter into correspondence with them.

PAVING THE DEVIL'S STRIP.

The Hamilton (O.) & Lindenwald Electric Transit Co. is required to pave between the rails and 8 in. outside, and it contends that its portion of the devil's strip between double tracks is only 16 in. The company recently sued to restrain the city treasurer of Hamilton from collecting for more than for the 16 in. of this strip, and the court granted the injunction.

ECHOES FROM THE TRADE

THE CHRISTENSEN ENGINEERING CO., Milwaukee, through its European agent, J. S. Hamlin, has sold the Compagnie Generale de Traction, of Paris, 180 sets of air brake equipment.

THE CLING-SURFACE MANUFACTURING CO., of Buffalo, N. Y., reports rapidly increasing sales of "Cling-Surface," both domestic and foreign. A recent letter from the Union Traction Co., of Philadelphia, Pa., says: "We herewith order a second can which is evidence that we consider 'Cling-Surface' entirely satisfactory."

THE GARL ELECTRIC CO. has completed its new factory at Akron, O., and recently elected new officers as follows: Hugo Schumacher, president; and M. Garl, superintendent. An office has also been established in Chicago, at 1015 Monadnock Building. The specialties manufactured include electric supplies and a full line of telephone material and equipment.

THE JOSEPH DIXON CRUCIBLE CO. announces that from this time forth it is an out and out "expansionist." The reason is that one mail recently brought five orders from Manila for Dixon's graphite pencils, graphite crucibles and graphite lubricants. The company believes that the "open door" will swing easier if the hinges are lubricated with Dixon's graphite.

THE HUNTER ILLUMINATED CAR SIGN CO., Cincinnati, is now working upon several large orders which will keep its factory busy for five months to come. The company has recently received orders from the Washington Water Power Co., Spokane, Wash.; Holyoke, (Mass.) Street Railway Co.; Metropolitan Street Railway Co., Kansas City; Decatur (Ill.) Traction & Electric Co.

THE SCARRITT FURNITURE CO., St. Louis, is rapidly securing the trade in car seats, not only because its product affords so large a variety to select from, but because its prices are attractive. Its location in the largest street car building city in the world also has a tendency to favor the Scarritt Co., as the car builders do not have to wait for annoying delays in shipment of seats by freight. The popularity of the Scarritt seat is unquestioned.

JUDGE PUTNAM, of the United States Circuit Court, on Oct. 4, 1899, in the case of the Duff Manufacturing Co. v. Norton, at final hearing, again sustained the Barrett lifting jack patent 455,993 of July 14, 1891, as valid and infringed by Arthur O. Norton, of Boston. He ordered the preliminary injunction granted last spring against Norton made perpetual. In so doing, the judge followed the several decisions made at Pittsburg, Philadelphia and Kalamazoo.

THE BIBBER-WHITE CO., which was some time since temporarily embarrassed by having furnished a large amount of construction material to a road which failed to meet its payments, has arranged with its creditors for payments on installment plan, which will soon clean its accounts up, and is now doing a large and prosperous business. The many friends of the gentlemen engaged in the company will be pleased to learn of their good prospects.

THE CHICAGO MICA CO., miner, importer and manufacturer of mica for all purposes, has just moved into its new factory at Valparaiso, Ind. The main building is a three-story structure 100 x 60 ft., and a second building 100 x 40 ft. is arranged for making "micabond" cloth, paper and "Champion" compound. The steam plant occupies a separate building. This company was organized a year ago and has been remarkably successful. The officers are: President, Milton A. Snider; vice-president, J. W. Sefton; secretary, W. F. Hatch; treasurer, Henry E. Miller.

THE CARPENTER STEEL CO. is one of the largest manufacturers of crucible steels, which it makes with the greatest care from the best and purest iron to meet the demand for superior fineness and durability. The executive offices are at No. 1 Broadway, New York; the works are at Reading, Pa., and sales offices and warehouses are maintained at New York, Chicago and Toledo, where large and well assorted local stocks are carried, enabling prompt shipments to be made. The Chicago office is at 9 Canal St., and is in charge of F. W. Lane. A recent publication is a 30-page pamphlet descriptive of Carpenter steels, which will be sent on application.

THE Q & C CO., Chicago, under date of November 27th, sends us the following notice which will be of interest: "Referring to the articles now appearing in the mechanical papers pertaining to litigation on pneumatic tools, and in order to make clear the position of the Q & C Co., we wish to distinctly state that we are not in any way involved in this controversy. The line of tools manufactured by us are protected by our own patents, unique and broad in themselves and absolutely clear from any infringement. Full protection will be given to any purchaser of our tools from any liability on account of their use. We also wish to state that we have completed our line of pneumatic tools and in addition to hammers and riveters will shortly offer for sale pneumatic drills, both for metal and wood work, and pneumatic hoists, and trust that you will investigate the advantages of our devices before purchasing any tools of this description."

THE WESTERN ELECTRICAL SUPPLY CO., of St. Louis, has recently taken the exclusive territorial agency for the Multiplex Reflector Co. It claims these corrugated reflectors and headlights to be an entirely new departure and the latest and best thing in the reflector line yet produced, and that they produce 300 per cent more light than any other plain or parabolic reflector on the maket. Comparisons are invited to substantiate this claim. They are especially adapted for street railway work and certainly deserve the consideration of anyone on the market for a first-class and strictly up-to-date head-light.

The company makes an electric arc head-light with automatic regulation, which it is claimed is the only self-regulating arc headlight made. These head-lights are so constructed that no amount of jarring or vibration will disturb their adjustment or affect the light in the least. They are always glad to send these head-lights out on trial, or for competitive tests. Printed matter, price lists and full information furnished on application.

E. G. JOHNSON & CO., 1135 Broadway, New York, who make a specialty of electric railway construction and supplies of every description, has lately added to its regular business an agency to supply trolley and cable roads with experienced employes. All men furnished by the firm have had experience in the line that they are engaged for, doing away with the loss of time used in breaking in new and inexperienced men; also loss by damages thus incurred. All men supplied by the firm are known to be skilled and reliable. They always have the following line that can be furnished at short notice: engineers, firemen and oilers for power house; section foremen and laborers for track work; electricians, linemen and helpers for overhead work; motormen, conductors and inspectors for operating all kinds of cars and motors. No charge is made the roads for the help engaged through this agency except for strike work; terms for this will be given on application. This firm also handles second hand cars, trucks, armatures, etc.

THE M'GUIRE MANUFACTURING CO. has recently shipped one of its snow sweepers to the Wheeling (W. Va.) Railway Co.

THE FACTORY of the United States Carbon Co., of Cleveland, was badly damaged by fire on November 17th. It is believed the loss on the structure and stock will reach $10,000.

MR. GEORGE S. HASTINGS, one of the best known and most popular sales agents in the field, has resigned his position as western representative of the Brill Co. and accepted a connection with the Christensen Engineering Co., Milwaukee.

THE JACKSON & SHARP CO., Wilmington, Del., has received the contract to build 100 trolley cars to be used on the Paris Exposition grounds. The company is said to be bidding on orders aggregating more than 1,500 for various European cities.

THE REVIEW OF REVIEWS for December is a particularly interesting number; it discusses the significance of the elections, the progress of the two wars now pending and several other questions now exciting controversy in American political circles.

THE STERLING VARNISH CO., of Pittsburg, Pa., has just issued, under the title of "Sterling Extra Insulating Varnish," a little book of 84 pages with 70 reproductions of letters received by the company from different customers, each letter being either an order or a warm testimonial.

THE ORIENT ELECTRICAL CO., of Youngstown, O., points out that it is good luck to buy the Orient incandescent lamps when replenishing stock, in a little eight-page circular just issued. The company's watchword while making these lamps is, "Quality has precedence over all other factors."

THE WALWORTH MANUFACTURING CO. is sending out with its compliments a pocket map of the Philippine Islands, which contains much valuable information concerning our new possessions. The company also announces that on December 1st it moved into its new store at 130-136 Federal St., Boston.

THE H. C. ROBERTS ELECTRIC SUPPLY CO. is the title of the successor to the Franklin Electric Supply House, of Philadelphia, the Roberts company having purchased the good will, stock and fixtures of the latter company on November 14th. The new concern will have its headquarters at 831 Arch St., Philadelphia.

THE BULLOCK MANUFACTURING CO., of Cincinnati, is now advertising for bids to extend its main building 200 ft., making the machine shop 101 x 500 ft. The tremendous volume of business that has come to the company from all parts of the world during the last six months makes it imperative that this work be completed with all possible haste.

HENRY PELS & CO., of Berlin, with New York offices at 66 Broad St., have issued an artistically printed folder describing the Werner patent portable punching and cutting machines, for which they are agents. These tools are for punching and cutting by hand power, beams, channels, angle and flat bar iron, etc., and can be used to advantage in constructing bridges, viaducts, elevated railroads, roofs, buildings or other iron and steel structural work.

THE CENTRAL ELECTRIC CO., of Chicago, is well pleased with the volume of business received during the past few months, and with the outlook for the future. This company carries in stock an absolutely complete line of electrical supplies, including the smallest parts, and is therefore prepared to save street railway companies considerable expense by being able to ship everything required in the different departments at one time. The company expects to announce shortly that it has taken several new important agencies.

THE AMERICAN CAR CO., St. Louis, has recently shipped the first 20 cars of an order for the New Orleans & Carrollton Railroad Co., New Orleans, and they were put in service December 4th. The cars were built after the plans and specifications of Ford, Bacon & Davis, engineers for the railroad, and are 31 ft. long mounted on "Lord Baltimore" single trucks with two G. E. 1,000 motors. The cars are very handsomely finished both outside and inside.

THE FILER & STOWELL CO., of Milwaukee, has been so crowded with work during the past year that it has decided to enlarge its plant by building an addition to cost $60,000. In order to get room in which to erect wider buildings the company has petitioned the city to vacate the street bounding its plant on the east; the street in question has never been used as a thoroughfare. The Filer & Stowell Co. is the second largest engine building concern west of the Allegheny Mountains.

THE FAIRMOUNT CONSTRUCTION CO., of 723 Walnut St., Philadelphia, has increased its capital stock to $200,000. The present directors are: Clarence P. King, president; Josiah B. Seybert, treasurer; John G. Vogler, Frederick H. Treat, all of Philadelphia, and Hon. Robert S. Clymer, of Woodbury, N. J. The company has constructed a number of electric railways and electric light plants, and has lately secured two contracts for electric railways, which it will proceed to build at once. Joseph MacCarroll, former president, has disposed of his interest in the company.

GATES & RANDOLPH are doing a large business with their Waverly automobiles and it will pay all street railway men to see their rigs at No. 15 Monadnock Block, Chicago. The Waverly people have worked out the automobile problem on the basis of street car practice, which has been thoroughly threshed over. Gates & Randolph also report a very large trade in Le Valley carbon brushes, which, though the most expensive brushes made, give such perfect satisfaction that the price cuts no figure. Their business in street railway generators of the Triumph Electric Co's. make is also very satisfactory.

THE WESTERN ELECTRIC CO., of Chicago, has recently issued a small four-page bulletin on annunciators, in which is given a list of its latest style D hotel annunciators and return call push button board. There are also listed a line of smaller annunciators and elevator annunciators. This bulletin is numbered 22 A. The company has also a neat circular describing the pendant push button switch. The purpose of these switches is to connect chandeliers, fan motors, or other devices, with the switch by means of a drop cord, allowing the switch to hang within easy reach. They are made in two sizes, viz., 5 amperes and 10 amperes.

THE SARGENT CO., Chicago, has mailed to the trade a six-page folder which is intended to be gummed into the M. C. B. book of rules for car interchange and repairs. Four pages are devoted to an index of Rules 3 to 9 and two pages to a reproduction of the "Sargent Co. Knuckle Chart." Concerning this folder a prominent superintendent of motive power recently wrote the Sargent Co. as follows: "I have your circular regarding supply of Index to M. C. B. code of rules and beg to acknowledge receipt of the form, which is certainly a big improvement on the rules. They will serve as a guide and ready reference which will be much appreciated. I have placed it in the hands of our employes entitled to the M. C. B. rules."

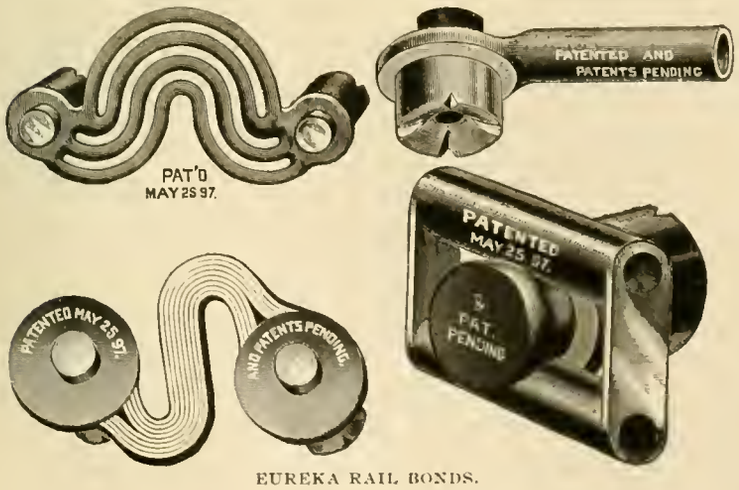
Shoveling out snow drifts commenced early this year. The Westbrooke, Windham & Naples Electric Railroad Co. had a crew out on November 11th cutting through snow drifts several feet high.

In tearing up a street in Johnstown, Pa., recently, workmen have unearthed the ties of the old horse car line which traversed that part of the city previously to the flood several years ago. The old ties, which are in a good state of preservation, are nearly 2 ft. below the surface now.

The International Traction Co. has completed the laying of tracks on the Riverway between Falls St. and Niagara St. at Niagara Falls. The erection of poles and wire will soon be finished and then there will be a belt line about the gorge.

THE EUREKA RAIL BONDS.

The Eureka Tempered Copper Works, of North East, Pa., is the maker of a great variety of the electrical specialties now in use and has lately added to its list a new rail bond, patented by James McLaughlin, of Chicago, who is well known to the electrical trade.



EUREKA RAIL BONDS.

It is claimed that the simple manner of attaching these bonds to the rail saves to the purchaser in labor alone nearly one-half the ordinary cost of rail bonds, or from 10 to 15 cents upon every bond used. The important feature of these bonds is the steel expanding pin cast solid in the head and projecting about 3-16 in. These pins are formed so that driving them flush swedges the copper into perfect contact, and turns a flange on the opposite side of the rail, making a perfect lock connection and perfect contact on both sides. The bond being a solid pure copper casting, leaves no opportunity for any waste of current. This concern makes any desired style of bond with wire or flexible cable. It also makes connectors for attaching supplementary return wires to the rail in the same manner. These bonds are on exhibition at the company's Chicago office, Monadnock Block, and also at the office of the W. R. Garton Co., No. 315 Dearborn St., Chicago. The accompanying illustrations give a better idea of these bonds to the practical mechanic than would any description. These bonds attracted much attention at the A. S. R. A. convention.

PARK FOR LEXINGTON, KY.

The Lexington (Ky.) Railway Co. has purchased the 125-acre tract of land known as Mansfield, formerly the property of Henry Clay, and will make the place into a public park and summer resort. The lines of the company will have to be extended about two miles to reach the park, and this work will be undertaken in the spring. The price paid for Mansfield was $14,000.

INDUSTRIAL CONSOLIDATION.

The Sterling-Meaker Co. is the name of a new organization which has recently been formed by the union of the Sterling Supply & Manufacturing Co., of New York, with the Meaker Manufacturing Co., of North Chicago, Ill. J. H. Carson is president, J. W. Meaker, vice-president, and W. L. Brownell, secretary and treasurer. The headquarters of the company will remain at 141 East 25th St., New York, while Mr. Meaker will have charge of the Western department with headquarters in Chicago. The company will continue to make the Sterling fare registers and the Meaker registers as well as the Sterling safety brake and general railway supplies the same as were produced by the Sterling company before the consolidation. For the present the goods will be made in both establishments as formerly, but it is contemplated that in the near future the register business will be centered in New York. The street railway fraternity is to be congratulated upon the fact that the principals in the two companies will remain in the field and jointly conduct the business.

NEWS NOTES.

ALBANY, N. Y.—The Hudson River Waterpower Co., with a capital stock of $2,000,000, has been incorporated for the manufacture and sale of gas and the sale of electricity for heat, light and power. The company proposes to dam the Hudson. The directors are: Eben H. Gay, Walter H. Trumbull, of Boston; Elmer J. West, Chas. E. Parsons, and Eugene L. Ashley, of Glens Falls, N. Y.

ALLENTOWN, PA.—At a meeting of the directors, on November 17th, the seven electric railways centering in this city were consolidated under the name of the Allentown & Lehigh Valley Traction Co. President, Albert L. Johnson; vice-president, Tom L. Johnson; secretary and treasurer, J. E. Kenney.

ALLEGHENY, PA.—Surveys have been completed for an electric line to connect Allegheny and Perrysville. The line will be five miles long and will cost about $80,000, of which $27,000 have been subscribed. Among those interested are: Geo. B. Hill, M. K. McMullen, Jas. W. Preston and Fred Schwitter.

ANDERSON, IND.—Twelve new buildings, including power buildings, car sheds and station houses, will be constructed in the early spring by the Union Traction Co., at Elwood, Pendleton, Yorktown and other places on the route. C. L. Henry, manager, Anderson, Ind.

ANACONDA, MONT.—The common council of this place has granted the street railway company a franchise for an electric road for the purpose of hauling ore and other feight, its principal object being to haul the ore from the Stewart mine to the Butte Reduction Works. The franchise is for 30 years. The company must give a bond of $25,000 to indemnify the city from all damage by reason of the construction of the line.

ATHOL, MASS.—The parties interested in the construction of an electric road between Gardner and Templeton have under consideration a plan for extending the line to Athol. P. S. Hirsch, of New York City, is one of the promoters of the plan, which would include a nine-mile extension from Templeton to Athol.

BAY CITY, MICH.—An electric railway is being projected from this place to Port Huron, by way of Caro. Ex-Mayor U. S. Boynton, of Port Huron, who is interested in the road, states that the road will be built and the only local aid asked by the company is the right of way, much of which has been secured.

BERKELEY, CAL.—The Oakland Railroad Co. has been granted a new franchise to replace a part of one granted to it last September, which it wished rescinded. The new franchise makes some changes in the route and gives the company a loop through a part of Berkeley not touched at present by any line.

BUFFALO, N. Y.—The engineers of the Buffalo & Erie Railway Co. are at work on the survey of the route, and the matter of securing franchises and rights of way from property owners along the line of the road is now well under way. Work of grading and track laying will begin early in the spring of 1900.

CHARLOTTE, N. C.—The company which is developing the water power of the Catawba River, it is announced, may interest itself in another street railway system to be built in Charlotte and suburbs. Messrs. Dekker, Mason & Co., of New York, are connected with the enterprise.

CHATTANOOGA, TENN.—The Chattanooga Rapid Transit Co. will extend its railway to St. Elmo, at the base of Lookout Mountain, and to Chickamauga Park, 10 miles from Chattanooga. W. B. Royster, secretary of the Chattanooga Rapid Transit Co. Capital for the improvements, it is reported, will be furnished by a Philadelphia syndicate, represented by Clarence P. King.

CHESTER, PA.—The Philadelphia, Swarthmore & Morton Trolley Co. has made application to the Chester city officials for the assignment of the franchise of the Media, Middletown, Aston & Chester Traction Co., the latter having rights over certain streets not occupied by the Chester Traction Co. The new company proposes to connect Chester with its line now building.

CHILLICOTHE, O.—The directors of the Chillicothe, Clarksburg & Mt. Sterling R. R. were granted a franchise on November 6th to construct and operate an electric road along the Chillicothe and Clarksburg pike and as far as the Pickaway County line.

CHILLICOTHE, O.—The commissioners of Ross County have granted a franchise to the Chillicothe, Clarksburg & Mt. Sterling Electric Co., to construct and operate an electric railway for 25 years, along the Chillicothe and Clarksburg pikes, and thence to the county line. A bond of $2,000 was given. The capital for the road is ready as soon as the right of way is secured.

CINCINNATI, O.—The Cincinnati, Lawrenceburg & Aurora Street Ry. is about to build a branch line from Valley Junction to Harrison. The ties for the line have been received.

CINCINNATI, O.—The board of directors of the Cincinnati, Newport & Covington Railway Co. have decided to push the work on an electric street car line running from this city to Crescent Springs and Highland Cemetery. Almost the entire right of way has been secured and the people along the proposed line have subscribed a bonus. The new road will begin at Bromley and run over Pleasant Run road to Crescent Springs and thence across the country to the Highland Cemetery on the Lexington pike.

CLEVELAND, O.—The work of converting the Superior St. and Payne Ave. cable lines into electric roads will begin next spring and will be completed in six months. The overhead trolley system will be installed. Superintendent Mulhern, of the Little Consolidated Co., states that the change to the new electric equipment will cost about $500,000.

CLEVELAND, O.—M. J. Mandelbaum & Co., F. D. Pomeroy, D. H. Kimberly, A. E. Akins and other Cleveland capitalists are behind a project to run a trolley railroad from Cleveland to Cincinnati. H. R. Newcourt, Jacob Mandelbaum and E. G. Tillotson have been elected directors. The capitalization of the company will exceed $2,000,000.

CLEVELAND, O.—The city council, November 6th, granted the application of P. J. Kassulker, Bernard Schatzinger and others that steps be taken to build a cross-town line, starting at Doan street. It is the intention of the promoters to extend the line to Garfield Park, also from Doan street to Glenville.

CLEVELAND, O.—The Cleveland & Eastern Railroad Co. has given a mortgage for $1,000,000 to the Cleveland Trust Co. The money will be used in building extensions.

COLUMBUS, O.—The Brice Syndicate proposes to purchase all the street railway franchises which the city of Columbus may have to sell. The company will invest $3,000,000 in the enterprise, giving a bond of $200,000 to secure the performance of its contract. J. T. Adams, of Toledo, represents the purchasing syndicate.

COLUMBUS, O.—The Scioto Valley Traction Co. proposes the construction of an electric railway from the Union Depot, Columbus, through Circleville to Chillicothe, and perhaps to Portsmouth. Rights of way have been agreed from Kingston to Chillicothe. W. J. Weaver, Scioto Valley Traction Co., Columbus, O.

COLUMBIA, S. C.—It is announced that the Columbia Electril Railway Co. will build several miles of new lines in the suburbs in addition to making improvements to the present system. W. B. Smith Whaley is president of the company.

DANVILLE, ILL.—The Danville Street Railway & Lighting Co. has been incorporated, with T. R. Samuel, Orville Cannon, and Frank Lindley as incorporators. This is a reorganization of the present railway company, and plans are in view for making considerable extensions of the railway system.

DES MOINES, IA.—President Polk and Manager Hippee, of the Des Moines City Railway Co., have just returned from the East, where they went to finance a large interurban railway scheme. They announce that they will next year build a line from Des Moines southwest to Winterset, 25 miles, thence southwest to Macksburg, Greenfield and Creston, the whole making about 75 miles. Capital for the enterprise is assured.

DOVER, DEL.—The Consolidated Public Works Co., of Philadelphia, chartered to secure possession of and interests in steam and electric railways, water works, light and power systems, etc., was incorporated on November 23d, with a paid-in capital stock of $150,000.

FAIRMONT, W. VA.—A company has been formed to build an electric railway from Fairmont to Fairview, a distance of 11 miles, for which surveys have been made and the right of way secured. Among the stockholders are Thomas W. Fleming and W. H. Fleming, of Fairmont; Wm. McKinley and J. C. Whitla, of Pittsburg.

FALL RIVER, MASS.—A company has been formed known as the Fall River & Brockton Air Line Street Railway Co., which proposes to lay 15 miles of track from Fall River through Freetown and Rochester. The capital is to be $150,000. Geo. R. Phillips of New Bedford is clerk and treasurer. The promoters are Abbott P. Smith and H. L. Smith, of New Bedford; C. H. Wilson, of Brookline, and Fred C. Hinds, of Newton.

FORT WAYNE, IND.—The Indiana & Ohio Traction Co. will construct an interurban electric railway, 80 miles in length, from Hicksville, O., to Marion, Ind., via Fort Wayne. The directors are: James H. Simmons, president; John D. Olds, vice-president; William Kaough, secretary; and John W. White, treasurer.

HAMILTON, O.—The Hamilton & Lebanon Street Railway Co. has applied to the county commissioners for a franchise to build its road over the Princeton pike to the east county line.

HARRISON, O.—A branch of the Cincinnati, Lawrenceburg & Aurora Street Ry. is to be built to this place. Several carloads of ties are already on the ground.

HEMPSTEAD (L. I.), N. Y.—The Mineola, Hempstead & Freeport Traction Co. was granted a franchise on November 10th to operate a trolley road through this town. President Newton, of the company, is quoted as stating that the company will begin work within 10 days, and proposes to connect with the North Shore trolley line.

HESPELER, ONT.—The Galt, Preston & Hespeler Railway Co. will build a new station at this place.

HOLLYWOOD, CAL.—A franchise has been granted to Philo J. Beveridge, for an electric road from the main line of the Colgrove-Sherman road, through Hollywood, and around to the main line again. The loop will be about four miles in length. The road must be started within 10 days from December 10th, and the citizens of Cahuenga Valley subscribed a bonus of $15,000 provisional upon the speedy construction of the road.

INDIANAPOLIS, IND.—Daniel Leslie and A. W. Moore, of Indianapolis, have secured a franchise for the Columbus, Brownstown & Salem Electric Ry., to be built through Cortland, Honeytown, Brownstown and Vallonia.

KANSAS CITY, MO.—Willard E. Winner, of Kansas City, is securing the rights of way for an electric railway which he will build from Kansas City via Leavenworth to St. Joseph, Mo.

KANSAS CITY, MO.—A new electric railway is projected to connect Kansas City, Independence, Lee's Summit, Lone Jack and Warrensburg.

KINGSTON, N. Y.—The Delaware & Kingston Valley Railway Co. has been incorporated to construct and operate a steam or electric railway from Kingston to a point in Sullivan County, opposite Lackawaxen, Pa. Capital stock $2,500,000. Directors: Samuel D. Ceykendall, of Kingston; Edward L. Fuller, of Scranton, Pa.; Walter Ferguson, of Stamford, Conn., and others.

KINGSTON, N. Y.—The Delaware Valley & Kingston Railway Co. was incorporated November 11th at Albany, with a capital stock of $2,500,000. The road will be operated by electricity and will be 81 miles long, running from Kingston to a point on the state boundary line in Sullivan County. Samuel D. Kay Kendall, of Kingston, is interested.

KNOXVILLE, TENN.—L. D. Dillon is interested in a proposed electric line between Knoxville and Lyons View, in the suburbs. The County Court has granted the company right of way.

LARCHMONT, N. Y.—The Larchmont Horse Railway Co., which has operated a line in this village for several years, yesterday filed a certificate of extension of its route in the County Clerk's office at White Plains. According to the papers, it is proposed to construct several branches.

MACON, GA.—The North & South Macon Railway Co. has been formed to build a street railway in the suburbs. W. B. Sparks and H. C. Bacon are promoting the enterprise.

MANCHESTER, N. H.—The Manchester Electric Co. has purchased one of the largest water powers in the state of New Hampshire. This power is located at Garvin Falls, and is at present undeveloped. The falls will develop 6,000 h. p. in seasons of the greatest drouth. The power of the falls will be immediately developed, and a large fire-proof brick power house is to be constructed. The company will do business under the name of the Garvin Falls Power Co., and the officers are as follows: S. Reed Anthony, of Boston, president; Nathan Anthony, treasurer; J. Brodie Smith, of Manchester, general manager.

MARLBORO, MASS.—J. F. Shaw, railway contractor, and one of the promoters of the proposed electric trunk line from Worcester to Boston, has made a formal proposition to buy the Marlboro Street Ry., Marlboro & Hudson Street Ry. and Marlboro, Southboro & Framingham Street Ry., and run them in connection with the new line from Worcester to Boston.

MOBILE, ALA.—A franchise has been requested of the city council for a line which would make a complete belt around the city, by Messrs. D. R. Burgess, G. S. Ohear, W. H. Mackintosh, G. B. Thamer and Jos. C. Rich.

MONMOUTH, ILL.—The street car company of Monmouth has authorized the statement that it will build an electric railway to Oquawka with branches to touch Kirkwood and Little York. Promoters of the Galesburg-Monmouth line say it is certain to be built. Both companies expect to have lines running next season.

MONTGOMERY CITY, MO.—The Montgomery City, Bellflower & Middletown Electric Railway Co. has been organized with a capital of $80,000, with John W. Schowengerdt as president, and Howard Ellis, secretary. The road is to be 22 miles long.

MT. PLEASANT, W. VA.—Right of way is being secured for the proposed electric railway between Mt. Pleasant and Bridgeport.

MUNCIE, IND.—The electric railway which is to run from Muncie to Hartford City and Dunkirk, passing through the smaller towns en route received its franchise to run through Muncie, November 6th. The franchise contains the provision that the company must be financially responsible for all damage to pipes resulting from electrolysis.

MUNCIE, IND.—Mr. Brownell, superintendent of the Muncie Interurban Railway Co., has accepted a franchise from the town of Dunkirk, which gives this company free use of the streets for 30 years. This is the last franchise necessary for the completion of the right of way of the road, which, when completed, will extend from Muncie to Hartford City. It is probable that work on the road will not begin before spring.

NASSAU, N. Y.—The Nassau Belt Line Traction Co. has applied to the Nassau County Board of Supervisors for a franchise to furnish electric railway connection to the villages in the town of Hempstead, from Mineola to Long Beach. Paul K. Ames, president.

NEW ALBANY, IND.—The construction of an electric line from this place to Paoli is being agitated. The citizens of Paoli held a public meeting recently and appointed a committee to confer with the New Albany Commercial club relative to devising ways and means to promote the enterprise. The proposed line is 42 miles long and passes through the towns of Mooresville, Galena, Greenville, Palmyro, Fredericksburg, Hardinsburg, Rego and Chambersburg.

NEW BRUNSWICK, B. C.—It is understood that work will be soon commenced on the proposed tramway station and shed for the British Columbia Electric Railway Co.

SHELBYVILLE, IND.—Chas. W. Taylor, promoter of the proposed electric railway between Indianapolis and this city, has asked the city council for a 50-year franchise. Mr. Taylor says the road will be built whether the franchise is granted or not, as a private right of way has been secured along the north side of the city. The line will run from Indianapolis to Bethel and Acton, and will then parallel the Big Four R. R. The money has been secured and work will begin in the spring.

NORTHAMPTON, MASS.—The Northampton & Amherst Street Railway Co. will extend its line from Hatfield to Greenfield, the projected route involving the construction of a bridge.

NORTH ADAMS, MASS.—It is reported that C. F. Richmond, a millionaire banker, and owner of the Hoosick Electric Ry., of North Adams, Mass., is one of the principals in a movement for an electric railway system to be constructed to connect Troy with Grafton, Petersburg and Williamtown, Mass.

OSHKOSH, WIS.—It is reported that preliminary steps have been taken towards the construction of an electric interurban road between Oshkosh and Omro and the intermediate towns. It will be under the control of the Citizens Traction Co., of Oshkosh, which operates the Oshkosh-Meenah interurban line.

OTTAWA, ONT.—The Ottawa Car Co. has purchased a property on Albert St. for the purpose of building an extension to its car shops.

PERU, IND.—Aaron N. Dukes, of Peru, has purchased 30 miles of the line of the old Wabash and Erie canal between Lagro and Fort Wayne, which purchase will complete his control of the entire line from Lafayette to Fort Wayne, a distance of 108 miles. A new interurban electric railway will be built upon the property.

PHILAEDELPHIA, PA.—The Union Traction Co. has secured a franchise to build the Germantown & Fairmount Park R. R. between Manayunk and Germantown. J. B. Parsons, president and manager, Philadelphia.

PINE BLUFF, ARK.—M. Roberts and John Georgian, of Independence, Mo., have offered to construct an electric street railway, also a lighting plant, at Pine Bluff, on certain conditions. It is probable that the charter will be granted.