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ELEVENTH ANNUAL CONVENTION

OF THE

AMERICAN STREET RAILWAY ASSOCIATION,

HELD AT

CLEVELAND, OHIO.

October 19, 20 and 21, 1892.

PAPERS.

The President's Address.

Gentlemen of the Convention: — This is a patriotic year, and its culminating point is close at hand. Friday of this week has been designated by Congress as a national holiday in commemoration of the discovery of America. Happily for us, since we cannot be in Chicago on that day to take part in the opening of the World's Fair, it is our privilege to meet together as the representatives of one of the foremost American industries in the state, whose capital is Columbus. In this way at least we are permitted to pay our tribute of respect to the memory of the bold and intrepid navigator who 400 years ago turned the prow of his vessel to the Westward and sailed forth into the unknown seas on the most fruitful voyage of discovery in the history of mankind.

It is a felicity to meet in Ohio this year, and it is a pleasure and a privilege to come to Cleveland. We have heard much of the Forest City, with its far famed Euclid Avenue, its viaduct of massive masonry, its splendid Arcade and its beautiful Lake View Cemetery whose crowning feature is the mausoleum which holds all that is mortal of the martyred Garfield.

But of deeper interest than any of the sights of the city, and more closely bound to us by the ties of common interest, are the street railway companies of Cleveland. Their officers have greeted us with such generous hospitality, and have made such excellent arrangements for our comfort and convenience, that we feel like reversing the usual order of business and to extend to them a vote of thanks at the very outset. This city offers a fine opportunity to study practical street railroading. Here we see the most advanced ideas of construction, the highest development of the electric system, and a splendid new cable plant, as near perfect as capital, invention and engineering skill have been able to make it. And by the way of contrast and historical interest, we find a few horse car lines to remind us of the meetings a decade ago, when we used to grow excited over discussions of the relative merits of the horse and the mule as a street railway motor.

The street railway interests of the United States are assuming wonderful proportions. Every day some new company is born, and every morning paper brings us rumors of consolidations, absorptions and syndicate purchases, until the statistician lays aside his pencil and sheet in despair, utterly bewildered by the mass of accumulating and shifting figures. Definite data are out of the question, and I shall not attempt to tell you how great we are even in round numbers. But while the street railways are legion, there is but one American Street Railway Association, and I know you will be glad to learn that Mr. D. F. Longstreet, one of the founders of this body, in compliance with the request of the Executive Committee, has prepared a historical paper, detailing the motives which led to the formation of the Association, and giving due credit to the gentlemen associated with him in the movement. We shall be favored with this paper a little later.

This is pre-eminently an electric age, and most of us believe that as yet we are only standing on the threshold. The horse and his half brother the mule are destined to disappear. The cable system, from its very nature and cost, must be confined to the thickly populated districts of large cities, but there seems to be no limitations to the electric railway. It leaps over the city lines wherever there is a large suburban town calling for rapid transit, it girds the summer lakes, it is forcing its way through the scenic splendors of the Niagara gorge, close beside the water's edge, and when the Convention goes to California, as no doubt it will some day, we may expect to ride around the Yosemite on a train of trolley cars. And how rapidly it has all come about!

It was just ten years ago that the president of this Association, at the Chicago meeting, with a foresight, which must have been born of intuition, ventured to predict that the lightning would some day be harnessed to the horse car. We laughed at his visionary prophecy, and dismissed it from our minds as a piece of optimistic nonsense. But the prophet of a decade ago is with us to-day, and can take revenge by saying "I told you so."

So accustomed have we become to rapid strides and the complete overturning of the existing order of things in our business, that I do not believe that one among you would venture a doubtful smile were I to assert that before the close of the Nineteenth Century, the three successive Convention cities, Buffalo, Pittsburgh and Cleveland will be joined together by a triangular electric belt line, with an immense power house at Niagara Falls, where they are even now just on the point of developing 160,000 H. P.

But this is an assembly of practical men who have come together not to vie each with the other in making extravagant predictions, but rather to contribute each to a common fund the results of his observation and experience. The congestion of traffic in our business centers, the increasing throngs of passengers of the working class nights and morning, as the day of tenement houses gives way to the age of suburban cottages, the safeguards against accidents required by the exigencies of rapid transit, the labor question, the unjust and burdensome taxation of corporations, the ways and means of increasing traffic and reducing the cost of maintenance and operating expenses, give us plenty of things to talk about. The principal subjects for discussion cover a wide range of practical matter having an important bearing upon street railroading as a business conducted for profit rather than for philanthropy, and the reports of the special committees will be worthy of your closest attention and most careful consideration.

While there are many other things which it would be a pleasure to say, I must not now trespass further on the time of the meeting. I thank you once more for the honor conferred and for your kind attention. Very respectfully yours, JNO. G. HOLMES.

Report on a "Model Electric Street Railway Roadbed and Underground Wiring."

BY GEO. W. BAUMHOFF, COMMITTEE.

Gentlemen:—Your committee on track construction and underground wiring respectfully submits the following:

This subject, embracing one of the most important questions connected with the construction and operation of a street railway, is one that should have the most thorough consideration, for, upon the condition of the roadbed more than any other item, depends the success of

your enterprise. The motto should, therefore, be : " The best is none too good."

That we are all striving to obtain the best is evidenced by the fact that reports in relation to this very important branch of street railway construction have been earnestly discussed at former conventions of this Association, and your committee feels inadequate to the task of presenting at this meeting a report that will not be a repetition of what has been so ably introduced by former committees of practical and experienced street railway managers, and the numerous articles published by those interested in street railway publications.

The mistake is sometimes made in designing and equipping a new road, or in changing from animal traction to electricity, of neglecting the track construction by apportioning the amount to be thus expended to such a sum that, in order to make both ends meet, it becomes necessary to weaken that portion of the investment where, above all others, strength and permanency are required.

Now, in no other branch of our business do the ends meet oftener than at rail joints, and when these joints are improperly constructed it results in meeting the bills for repairs to the same with monthly regularity. It is, therefore, essential that in the construction and maintenance of a perfect roadbed the best known type of rail be selected ; consequently, your committee has decided, in submitting this report, to dwell chiefly on the merits of various types of rail known as the girder system, and in order to place the same before you in an intelligent manner, will proceed with an itemized report in the order in which the construction is proceeded with.

First—SURVEY.

Having decided on the style and weight of rail to be used, and the chairs, fastenings and joints for the same, the first step, in order, is to properly survey the route, if a new road, to estimate the quantity of cut and fill where grading is necessary, and the most advantageous manner in which to provide for the same, and to locate all curves, switches and turnouts. In doing so, care should be exercised to provide for all curves the longest possible radius at points of entering and leaving the same, and to provide for the proper elevation of the outer rail of all curves, which should be elevated from one inch to two inches higher than the inner rail, where the conditions of the street will permit ; particularly in any curve of short radius, and more especially when such curve is located on a down grade.

The switches, or crossovers, should be located at such points along the route as will best provide for the following contingencies : Bunching cars for large gatherings, and to insure the constant operation of cars during fires, parades and all other blockades when, from any cause, the terminus of the road cannot be reached. They should never be placed with the switch point against the traffic ; and preferably, on up grades, thus enabling cars to cross to the opposite track by gravity.

" In ordering crossovers, care should be taken to specify that the straight track rail be continuous, for in most work of this kind the reverse is the rule." The aim should be to favor the track most used.

Second.—EXCAVATION.

The depth of excavation must be determined by the thickness of the cross tie, height of rail and height of chair, if chairs are used, plus the space allowed for tamping. The condition of the soil must govern the latter exclusively, but in the reconstruction of the roadbed, where the operation of cars will permit, and in all new work, unless the soil is of a sandy character, the following plan will not only provide a suitable sub-drainage, but insure permanency : Remove all earth to a depth of eight inches below the bottom of the cross tie the full width of the trench, then roll thoroughly with a heavy four horse or steam roller, then spread with a layer of cinders, crushed rock, gravel or furnace slag from six to eight inches in thickness, and again roll until the same is well bedded and leveled. A trench seven feet in width. with a layer of eight inches, will require for one mile in length 24,640 cu. ft. of material, estimated at 3½ cents = $862.40, and will require the removal of 912 yds. of earth, estimated at 25 cents = $228 ; add for rolling, $50 ; total $1,140 per mile of single track.

The fact that the material so placed provides a splendid sub-drainage is the best argument in its favor, and one that will commend its adoption where soil demands it ; for it must be remembered that it is far more expensive to open up and re-tamp poorly constructed track than to properly construct and provide with sub-drainage at the outset.

For surfacing, care should be taken to procure machine crushed rock or gravel, as it insures a more even bed under the tie than coarser material.

Third.—CROSS TIES.

Under this heading we have the metallic tie and various kinds of wood. The committee's remarks will be confined to the latter exclusively, for it will be seen by reference to former reports on track repairs and construction, made to this Convention, that the life of a wood tie when buried to a depth of eight inches or more is the best argument in favor of its adoption, as against the former. The various kinds of wood, and discussion of durability of the same, have also been submitted in former reports, and it is generally conceded that in the selection of the particular kind and quality of timber, the purchaser is influenced by his own knowledge of the timber best adapted for various climates and sections of country, exclusively.

The fact should, however, be borne in mind in the selection of cross ties, not only to keep in view the selection of such timber as is calculated to insure the longest life, but due consideration should be given to the particular kind that will best hold the spike ; and for this reason, the white oak possesses advantages that should merit its consideration.

The size should never be less than 5 × 8 ins. for rail fifty-six pounds and over, and if laid as closely as good tamping will permit—say twenty-seven inches from centers—will materially strengthen the roadbed and assist in holding up the joints.

For joints where wide joint chairs are adopted, one tie of sufficient width is preferable, as it is impossible to insure good tamping where two small ties are used at the joints.

If the above size is decreased, it should be in thickness rather than in width, to insure the tie from splitting, which is often caused by the spike being driven too close to the edge.

Fourth.—RAIL.

In the selection of the rail depends largely the success of perfect construction ; and a road, whether built for speculative purposes or as a permanent investment by the projectors, should not be slighted in this respect.

The requirements of a rail for electric traction are strength, joint connections, durability. In some localities there are municipal requirements specifying what the head of the rail shall be.

For strength we rely chiefly on the weight of the rail, and the thickness and depth of the web.

For joint connections, that rail which affords the best method of keeping both ends of the rail in perfect alignment is the best, and as the girder rail possesses peculiar advantages in this respect, its almost universal adoption is due to that fact.

For durability we depend on the height of the head of the rail at the gauge line over the lower flange, and the quality of the metal. The former is invariably considered by the purchaser, but your committee is not aware of a single instance in which the quality of the metal has been specified, other than the mere mention of whether the same shall be of iron or steel.

In former years, when the old style stringer construction was in vogue, when a good stringer and cross tie would outlast two or more flat rails, iron was chiefly used, owing to its higher market value as scrap. In the construction of an electric railway, where the girder system has superseded the flat rail, steel is more extensively, if not exclusively employed ; therefore, when we have closed our contract, having duly specified steel, we feel assured that the best possible rail has been provided for.

That there is a very great variance in the mixture of the metal before being rolled, is beyond contradiction. That there is also a difference of opinion among the various manufacturers as to the limit of percentage of carbon and other elements, particularly carbon, to be employed in attaining the most satisfactory results as to wearing qualities of the head of the rail, and yet prevent brittleness, is attested by replies to communications on this subject from a number of inquiries ; and whilst the matter is of sufficient importance to warrant its introduction in this report, yet we do not deem it advisable from the data now before us, to assume what constitutes the best composition for a rail. There are other elements to be considered besides carbon, as witnessed in the report of Dr. C. B. Dudley, from the proceedings of the New York meeting of the Iron and Steel Institute, October, 1890, a synopsis of which is herewith given, as follows :

" My own criticism of this work, after the lapse of ten years, and after all the discussion which followed the publication of the papers above mentioned, may, perhaps, be fairly summed up in four conclusions:

" 1. If I had the work to do again, I would certainly determine the sulphur in the rails, since all our studies during the past ten years on the influence of sulphur, point strongly in the direction of indicating that the sulphur has an important influence on steel, especially in its effect on the carbon.

" 2. The influence of silicon, and especially its influence from the metallurgical standpoint, seems to be much better understood now

than at the time when these studies were begun, and if an ideal formula, representing our views as to the best possible composition for steel rails, was to be made at the present time, the silicon limit would be raised somewhat, possibly in the favorite figure of Mr. Standberg, namely, 0.10 per cent.

"3. It is possible that in the first paper published, the influence of the chemical composition on what is commonly known as crushing or disintegration of rails in the track was made more prominent than the facts would warrant. More mature or riper studies would seem to indicate that disintegration or crushing of steel is largely a resultant of lack of soundness in the ingot, and is *more mechanical than chemical*, except in so far as chemistry may be responsible for the soundness of the ingot. However, upon this point of sound ingots, we have seen little reason to modify the views held for some time, that time is more important in securing sound ingots—especially time and certain critical parts of the process—than any other single element. If our views are correct, sound ingots, with consequently sound rails, can be made from steel of varying composition, provided time is allowed at the right points in the process, and the claim that high manganese and high carbon are essential to secure sound ingots is, in our judgment, not well founded, provided that time enough is allowed to make the steel properly.

"4. In all our later studies on the wear of metal, we have, as far as possible, avoided a method of deciding which metal is best which attempts to give what may be called absolute reuslts.

"Especially has it been hoped that some methods of chemical analysis would be devised which would enable us to determine, not only the total amount of carbon, phosphorus, silicon, manganese, sulphur, etc., in these various steels, but also how these substances were combined. For example, does the phosphorus in any given rail exist as phosphide, or partly as phosphate, or both? Is the silicon simply alloyed, or chemically combined with the iron? Does the carbon all appear as strength carbon, or is some of it graphitic, or combined with the iron in such a way as to form a *crystalline body which adds nothing to the strength?*"

One of the largest steam railroad companies in this country, whose extensive testing laboratories enable them to thoroughly test all material purchased in the construction and operation of their railway, require that all steel rails furnished them shall be subject to specifications adopted by said company. Surely, if experience has taught them the wisdom of this precaution, where their rail is entirely above ground, and therefore more cheaply replaced than that of street railways, would it not be advisable for us to pause and reflect on this subject?

A copy of the specifications adopted by the company referred to is as follows:

SPECIFICATIONS FOR STEEL RAILS.

As it is the desire of the _____ Railroad Company to have on the roads under their control none but first class tracks in every respect, and as the rails laid down in these tracks form an important part in the achievement of this result, the _____ Railroad Company have found it necessary to make certain demands in regard to the manufacture of their steel rails, with which the different rolling mills and rail inspectors will be required to comply.

1. The steel used for rails shall be made in accordance with the "pneumatic" or "the open-hearth" process, and contain not less than thirty nor more than fifty one-hundredths of 1 per cent. of carbon.

2. The result of the carbon test of each charge, of which the railroad company is to receive rails, and of which an official record is kept at each mill, is to be exhibited to the rail inspector.

3. A test bar, three-quarters of an inch wide, and about ten inches long, to be taken from the web of a rail made from each charge, is to be furnished to the railroad company's inspector, for use in making analysis and test of the steel whenever required.

4. The number of the charge and place and year of manufacture shall be marked in plain figures and letters on the *side* of the web of each rail.

5. The weight of rails shall be kept as near to standard weights adopted by the railroad as it is practicable to do so.

6. The sections of the rails shall correspond with the respective templates, showing the shape and dimensions of the different rails adopted as standard as near as practicable, after complying with section 5.

7. The space between the web of the rails and *template* representing the splice bar shall not be less than one-quarter of an inch, nor more than three-eighths of an inch.

8. Circular holes one inch in diameter shall be drilled through the web in the center thereof, at equal distances from the upper surface of the flange, and lower surface of the head, and one and one fifteen-sixteenths inches from the end of the rail to the center of the first hole, and of five inches from the center of the first hole to the center of the second hole, and of six inches from the center of the second hole to the center of the third hole.

9. The lengths of rails at sixty degrees Fahrenheit shall be kept within *one-quarter of an inch* of the standard lengths, which are thirty feet, twenty-seven and one-half feet, and twenty-five feet. When specially mentioned in the contract, and not otherwise, 10 per cent. of rails of shorter lengths, and 5 per cent. of *second-class* rails will be accepted.

10. The rough edges produced at the ends of the rails by the saw shall be well trimmed off and filed.

11. All rails are to be straightened, in order to insure a perfectly straight track.

12. THE CAUSES FOR A TEMPORARY REJECTION OF THE RAILS ARE—

1. Crooked rails.
2. Imperfect ends, which, after being cut off, would give a perfect rail of one of the standard short lengths.
3. Missing test reports.
4. A variation of more than one-quarter of an inch from the standard lengths.

13. THE CAUSES FOR A PERMANENT REJECTION OF A RAIL, AS A FIRST-CLASS RAIL ARE—

1. A bad test report, showing a deficiency or excess of carbon.
2. The presence of a flaw of one-quarter of an inch in depth in any part of the rail.
3. A greater variation between the rail and splice-bar than is allowed in paragraph No. 6.
4. The presence of such other imperfections as may involve a possibility of the rail breaking in the track.

By order of the General Manager,

.....Chief Engineer.

The subject relative to the quantity of the various elements entering into the manufacture of steel, which shall produce the rail calculated to give the most wear, and yet avoid brittleness, is one in which there is a great divergence of opinion, and the most expressive method of summing up the numerous replies received, is, that it appears to be a case wherein "doctors disagree."

The rail over which electric motors are operated through thoroughfares in various cities throughout the country is certainly subject to as much, if not more wear, than that of many of the trunk lines; and as we have patterned closely after their method of construction, we may perhaps profit by following their example in other details.

Of the various forms of the head, the center bearing rail is the most desirable, because, with a lower tram on each side, the head is kept free from dirt, and, consequently, offers less resistance to the car wheels.

In many localities the use of this form of head is prohibited. This was at a period, however, when cars were operated by animal traction, when at least 75 per cent. of all vehicle traffic along streets where cars were run were accustomed to use the track. If there ever was any valid objection from this source, the introduction of rapid transit has certainly overcome it; for drivers of vehicles generally shun the tracks of roads operated by rapid transit. The public now demand that the quickest possible time be made in transporting them to and from their homes and places of business, and where once the unruly teamster held sway for blocks at a time, ahead of a slow going horse car and patient passengers, he is now compelled by the change of motive power and a strong public sentiment, to keep to the right as the law directs, and the public demand. Passengers now figure on the exact time required to reach their destination, whereas under the old order of transportation, the street car ride was looked upon as a necessity only for the convenience it afforded. What is, therefore, of most service to the railway company, is likewise beneficial to the public; and your committee would earnestly recommend that in communities where objection is made to the use of the center bearing rail, that the authorities be asked to give the subject careful consideration, at least for a comparative test. We claim that it does not impede vehicle traffic, nor would it be objected to by owners and drivers of vehicles, when properly laid, to the extent of prohibiting its adoption.

Next to the center bearing form of head, the side bearing head is by far the most desirable, from the operator's standpoint; for the only other form made, of the girder type, is that with a groove, instead of a lower flange. The latter form of head is suitable only for curves and crossovers, when rolled with a wide groove, and should never be adopted for straight track, owing to the tendency of the groove to hold dirt, snow and ice.

In the selection of a girder rail of any form of head, and more particularly the style known as side bearing, it would be well to remember that the rail having the widest base offers the greatest resistance to turn over; and care should, therefore, be exercised in the selection of the rail, to secure the widest possible foot. This subject requires no argument to demonstrate its necessity, and your committee, knowing the desire of various manufacturers of rails not only to keep abreast of our wants, but who are constantly employed at large expense in devising new and perfecting existing styles, would urgently advise enlarging the rolls at the base of the rail, in order that the same shall at least equal in width the combined width of the tread and lower flange.

Fifth.—CHAIRS.

The less number of parts about the construction of a roadbed the more economically it is laid and maintained, and the use of a chair, the only purpose of which is to provide for the required height to the top

of the rail for paving purposes, is not recommended. It is much better to secure this height by the adoption of a rail having a higher web, thus enabling the rail to be spiked directly to the cross tie by means of a tie plate, which tie plate should be provided with a brace extending upwards to the bottom of the outer head of the rail to prevent the rail from turning. Where a plain tie plate is adopted, a cast iron brace should be spiked to each tie. No girder rail should be laid without making provision to prevent it from tipping, and the above plan, being more economical than the use of a tie rod, is preferable, as its bearing at the upper portions of the rail is more serviceable in checking the strain than a tie rod secured through the web of the rail.

If chairs are required, care should be exercised in selecting such as will insure the greatest possible bearing on the tie, and such only as will not spring under heavy loads. A chair with a narrow base is apt to cut into the cross tie, and in time work loose or cause the rail to cant. All intermediate chairs should be provided with a brace extending well up under the outer head of rail, which is the best safeguard against the rail turning or canting.

Sixth.—JOINT SUPPORTS.

There are a large number of joint supports now in the market and in use, some of which are offered by the manufacturers of rail, and some devised and manufactured by others, and it would be unfair to dwell on the merits of those of any particular manufacturer; but your committee would very urgently recommend the adoption only of such joint supports as are of sufficient length to cover at least two ties, but we consider such as secure a bearing on three ties preferable. The holes in the web of the rail should not be less than one inch in diameter, to admit the use of a bolt having a large size nut, which should be tightly secured by the use of a hammer and wrench. A six hole fishplate of sufficient height to reach from the foot of the rail to the bottom of the head, twenty-six inches or over in length, securely fastened with large size bolts, is considered by many who have used the same to be superior to all other joint fastenings.

We must bear in mind that cars, as now operated by electricity, are not only heavier than horse cars, but are operated at a much higher rate of speed, and require the most thorough construction. The slightest spring or looseness, will gradually result in a low joint, which if not soon attended to will ruin the end of the rail beyond repair. It would, therefore, be well to relieve the fishplate of much of this strain, by providing a support for the bottom of the rail extending over two or more cross ties.

The rails, when laid in hot weather, may be closely joined, but if laid in low temperature, proper allowance should be made for expansion.

There exists among railway managers a difference of opinion as to the choice between a supported or suspended joint. Your committee, however, earnestly recommends the supported joint, with a support for the bottom of the rail extending to the adjacent ties, and does not deem it advisable to adopt the suspended joint construction, unless the joint support has a firm bearing on the adjacent ties. There are a number of such joint chairs of various manufacture now in use, which, your committee is reliably informed, are giving entire satisfaction.

There is also a diversity of opinion as to the location of rail joints with respect to each other, and on this subject we do not hesitate to take a firm stand in support of the joints being laid directly opposite each other, when constructed for electric traction, as the tendency where laid with broken joints is to cause the car to sway sideways, particularly at a high rate of speed, if the joints are not kept extremely perfect.

The former plan renders it also more economical to repair joints, especially in paved streets.

Seventh.—PAVING.

In the construction of a perfect street railway this item, whilst it comes last, is by no means least, and in many instances solves the problem of economic management in electric traction; for with unpaved and poorly maintained streets it is impossible to build any track that will be entirely non-obstructive, for not only does it impede vehicle traffic and cause untold annoyances to railway managers and passengers alike, but it also offers a very great resistance to the operation of cars by reason of the constant accumulation of dirt and dust on the rail. It is, therefore, essential to the property owner fronting on the street, the railway company and the general public alike, that the street be constructed of the very best known material. Of course, paved streets are preferable, not only because they permit of a uniform level with the track, but add largely in holding the latter to gauge, and in protecting it from being constantly cut alongside by vehicles; and being much more free from dust and dirt, it also effects a large saving in current required for the operation of cars.

Of the various kinds of paving now in use, the following are chiefly adopted, and about in the order which they are named: Granite, telford, asphaltum, wood and brick. The former being by far the most durable, cheapest maintained, and least expensive to remove and replace, for the necessary track repairs, justifies the adoption of the same over that of asphaltum, wood or brick, and warrants the additional first cost, which accounts for its almost general adoption by street railway companies where paving is required, and by municipal authorities on streets where railway tracks exist, or are contemplated. In some localities the asphaltum paving is adopted on streets where railway tracks are laid; but owing to the tendency of vehicular traffic to wear ruts alongside of the rail, and the spring of the rail to loosen the paving material, together with the increased cost of repairing the same, it is not as favorably considered, for track paving, as some of the other systems.

To overcome the first named objection in some localities where this paving is adopted, a double row of granite blocks is laid, adjoining the rail, which also provides for the vibration of the rail, and renders it more accessible to get at the foundation of the roadbed for necessary repairs.

Telford paving is laid by placing stone, known by quarrymen as rip-rap, as close together as the same can be laid, and filling the interstices with macadam, or broken stone, which is laid for a depth of about three inches over the rip-rap, all of which is thoroughly rolled and covered with a thin coating of sand and gravel. This system of paving, if it can be designated by that name, is, however, not suitable for thoroughfares subjected to heavy vehicular traffic, and should only be adopted for street railway tracks on suburban divisions, where, owing to its cheapness, it is quite extensively adopted.

The first cost of paving a street is always the greatest obstacle to overcome, owing to the necessity of providing a suitable sub-foundation. This once done, the street is maintained in good repair by simply renewing the upper roadway, and on account of its cheapness in some localities, as compared to other paving material, wood is quite extensively employed; but on account of its perishableness, caused by wear from heavy vehicular traffic and decay, caused by atmospheric changes, and the further fact that, owing to the expansion of the wood when absorbed with moisture, the blocks bulge upward in places, and in some instances have caused the closing of slots in cable railways, and the breakage of various portions of the running gear of both cable and electric cars, this system is not so generally adopted.

Brick in any form, made of clay or other material, has thus far not stood the test of vehicular traffic to warrant its adoption in any climate, either by railway companies or municipalities, and should, therefore, be given a most thorough trial before it is extensively used.

With girder rail construction, it is advisable to fill in the web of the rail with moist clay just before paving, in order to prevent the paving blocks from working loose, caused by the sand surrounding the same filling up the said space, thus leaving the blocks unprotected, and tending to cause the row of blocks adjacent to the track to settle unevenly. In some localities an iron frame is constructed at each joint for the purpose of providing for repairs to the same without disturbing the paving, but with the late girder rail joint construction, ties well tamped and bolts securely fastened, the necessity for such construction does not exist.

Eighth—UNDERGROUND WIRING.

This subject is one that is usually entrusted to the contractor securing the electrical equipment, and by him sometimes sub-let together with the overhead line work. As all this work is underground, out of sight, and with paved streets made inaccessible without incurring large expense to repair and renew, the most practical method of workmanship and material should be adopted.

The object to be accomplished is to form a perfect connection from each rail along the road to the poles of the generator at the power house, the ground wire being connected to the negative poles, and the overhead wire to the positive poles of the machine; although we have read of the reverse being the rule on some lines, but, as the matter is foreign to the subject now under consideration, we will not further digress therefrom.

A large size insulated copper wire is generally adopted to form the connection between the generators and such points along the track as it is deemed advisable to reach. The return circuit—for by that name it is known—may be completed, either by connecting said wire to the rail, or to a supplementary wire extending the entire distance of the track. The latter is in all cases recommended, and should invari-

ably be of soft copper wire, not smaller in size than No. 0. In either event, however, all rail joints should be bonded with a soft copper wire not less in size than No. 6, and if the supplementary wire is laid, a connection thereto should be made to, at least, every fifth rail; and it will also be of great advantage as a safeguard against any possible break in the circuit, to connect both sides of the track with a No. 6 wire, and if a double track, to cross to the opposite track, and to the supplementary wire in said track, at least every 1,000 ft.

We have heard of instances being cited where copper wire laid underground was more susceptible to electrolysis than that of galvanized iron or steel; but, after a thorough trial of upwards of three years, during which time we have used both, the conclusion reached is, that copper being not only a better conductor, but less liable to corrode and break, is, therefore, the best wire to use for underground work. Galvanized soft steel, or iron wire, used for this purpose, has not proved durable, and we have found the same to be entirely eaten away by electrolysis where it had come in contact with the cross tie, and in perfect condition elsewhere.

The only theory we can advance for this is, that a chemical action takes place between the gases of the earth, precipitated by the sap contained in the timber and salt water, the latter from the use of salt for the purpose of melting snow and ice; although such results have not been noticeable in the use of copper wire. In addition to cross wiring, as above mentioned, as a precautionary matter, to insure a complete circuit, it will he found advantageous to the economical operation of an electrical railway, to excavate or bore in the earth, to a sufficient depth, to secure continual moisture, and whilst iron is usually adopted, owing to its cheapness, yet we believe the use of copper will, in time, prove the most economical metal to adopt for this purpose—for we beg leave to repeat: "*The best is none too good.*"

Where such grounds are located, care should be taken to make the best possible connection to the supplementary wire and the track.

By a careful examination of the ampere meter at the power house, during dry weather, compared with that of rainy weather, it will be noticed that there is a marked decrease in the amount of current used. in favor of the latter; hence it follows that the more connections to the rail and the opposite poles of the generator, with the moist earth, the more economically is the system operated. It must also be remembered that the increased saving in wet weather, over that of dry weather, is not attributable to the increased moisture of the earth alone, but to the fact that the dust and dirt, which readily finds lodgment on the rail, is washed off, and many roads now in operation by electricity have found the use of a car equipped with a tank having one down spout, about five eighths of an inch in diameter, on each side, so arranged as to permit a stream to flow over the head of each rail, most advantageous. These down spouts should be located as near the wheel as possible, in order to insure the same being directly over the rail at all curves, as well as the straight track.

In conclusion, we have only to say, as to the construction of "A Model Electric Street Railway Roadbed and Underground Wiring," its successful accomplishment will involve the comparison and investigation of a wide range of personal experiences, coupled with the patient study of those engaged in the manufacture of rail and track supplies, who are constantly endeavoring at great expense to improve the material and method of construction.

Report on "A Perfect Overhead Electric Construction."

BY CHARLES H. SMITH, COMMITTEE.

Gentlemen:—The president has appointed me a committee on "A Perfect Overhead Electric Construction."

In thus selecting me to prepare a paper on this subject, he evidently intended to pay a passing compliment to my imaginative or inventive powers. He asks me to describe something that does not exist, something that I have never seen, although I have searched diligently for it. I can, therefore, give only my ideas of how an electric overhead line should be constructed, based upon facts and information derived from personal experience and observation.

Iron or steel poles have proved to be the most desirable. I would therefore recommend the following: The poles to be of tubular iron, thirty-two feet in length, and made in three sections, in the usual way. The lower section should be at least seven inches in diameter, and the other two sections six inches and five inches, respectively. The poles should be set in concrete, and at least six feet in the ground, and should not be more than 125 ft. apart. The top of the pole should have about 2 per cent. of rake away from the curb, and should be fitted with a suitable pole clamp, so that the span wire can be easily adjusted to the required height, which should be twenty-two feet above the track. On top of the pole should be a malleable iron cross arm to carry the feeder wires, and guard wire spans. This cross arm should be insulated from the pole by means of a wooden plug inserted in the top of the pole. The insertion of the joints of the pole should be at least eighteen inches, and the joints should be made solid throughout their entire length by means of shims, or other contrivances.

If these joints are not properly made, the poles will not stand the strain. For curves, or extra strain, there should be larger poles of the same make.

Span wires should be of No. 4 "B. W. G." silicon bronze wire, and should be fastened to pole clamps by means of insulated turnbuckles. Great care should be taken in insulating these turnbuckles from the poles.

All well built lines should be sectional, and the trolley wire should not be of too great a size, as it would then call for clumsy supports. As it is not the main current wire, it can be of a smaller size. I would, therefore, recommend No. 4 B. W. G. silicon bronze wire, which affords sufficient carrying capacity, and has great strength and durability.

Sections should not be of a greater length than two miles, and should be separated by trolley breakers, of which there are now a number of good ones in the market. In cities and villages, where there is great liability of fires, it would be advisable to put trolley breakers at shorter intervals. Trolley wire hangers and pull-off brackets should be of the lightest make possible, and still have the required strength and the very best insulation. There is a variety of such hangers and brackets now in the market.

As it is important to have as small a number of joints as possible in the trolley wire, it should be put up in mile lengths, and twisted splice joints should be made, and brass cone-shaped tubes slipped over the wire before the splice is made. After completing the splice, the larger ends of the tubes should be brought together over the splice and a little solder dropped through a small hole made in the tubes for that purpose, in order to keep the joint in place.

Overhead switches, or switch pans, should be avodied if possible, as they become a source of great annoyance. I would strongly recommend a double trolley wire for a single track road.

Great care should be taken in erecting the guard wire spans. They should be properly insulated from the cross arm by means of a strain insulator, or something equally good, and should be of at least No. 6 best galvanized iron wire. There should be two guard wires over each trolley wire, at least three feet apart and four feet above the trolley wire. This guard wire must be well insulated from the guard spans; in case of other wires falling, this would be of great importance.

Pull-off and anchor guy wires, or other wires for the same purpose, must be of the very best material, and of at least No. 8 galvanized iron wire.

Feed-in taps must not be more than five poles apart, and should take the place of the trolley span wire at that point. They should be of at least No. 0 insulated wire.

The trolley wire being sectional, it is necessary to run a feeder wire to each section. I would therefore recommend that the feeder wire be at least 30 per cent. larger than the occasion demands. It will be found that this is money well invested. The insulation on the feeder wire should be the best that can be procured, and I would advise using locust or iron pins with mica insulators or something equally good, for the purpose of fastening the feeder wire to each pole, and great care must be taken to protect it from trees and other obstructions.

A cut-out box should be located on the pole of each trolley breaker, and should not carry a fuse. It should have the same wire running through it as there is on the outside. The fuses should be at the station, with ampere meter and cut-out switch for each section; then, in case of trouble on any section, the location can be easily seen, and that section cut out, if necessary, until repaired.

Lightning arresters are of great importance on the line, and I would strongly recommend using them at least every 1,000 ft. They can easily be attached to the poles, and can be protected by means of a box.

In conclusion, I would say that no matter what expense is incurred for material, or care used in constructing, a good line cannot be insured without a thorough daily inspection.

It is to be hoped that in the near future a perfect overhead electric construction will be realized in some of our large cities, for the example or fact will be of much more value and interest than any paper on the subject.

Report on "Economy of Machine Shops for Electric Street Railways."

By J. H. BICKFORD, COMMITTEE.

Gentlemen:—It is with some hesitation that I present this paper. Everyone here is well aware that it is a subject on which only a very meagre amount of practical information can be gathered. The evolution of the electric motor has been so rapid that no definite methods have yet been established for its care and maintenance. There is great lack of uniformity in the operation of roads, and one can find hardly two which are following the same course as regards repairs and renewals to motor equipment.

Theoretically, it seems but a simple matter to prescribe rules by which this part of the work can be governed, but such will not find favor with the majority of the membership of this Association. *Practical information is what we want.* Street railway men are practical; they have gained their knowledge by long years of experience, and have come to believe that practice is the most reliable guide to follow, and that true theory becomes so only after having been verified by practice. As I have just said, there is a very small amount of practical data from which to deduce rules, therefore it becomes necessary, to a certain extent, to present the subject both ways; first, by looking at what seems to be reasonable, by means of which we will arrive at certain conclusions: second, by presenting such practical knowledge as I have been able to gather.

It would hardly be fair for me to give an account of only what we have done on the roads with which I am connected, and recommend only our methods, as a guide to others; therefore I have taken the means to gather from other roads as much data as possible, and this, together with my own experience, forms the basis of what is to follow.

The one thing to prove is, whether there is economy in maintaining a machine shop when there are so many manufacturing and supply companies which can furnish us with every conceivable thing we want (and many more we don't want) at short notice; and the local machinist stands ready to do our work at a price varying from fifty to seventy-five cents per hour for first class workmen (and double price for apprentices).

"Economy is wealth," so we are taught, but the expounder of this doctrine forgets to point out the particular method of economy which paves the way to fortune. Sometimes extravagance masquerades as economy. This is especially true when one buys cheap goods to place upon a street railway. Economy has two sides, with the transaction between. At first thought one believes that true economy consists in saving all you can at the beginning of the transaction. While this may be, and undoubtedly is, a good rule to pursue, yet in the majority of cases true economy consists in the elimination of all elements of weakness, and the providing of such apparatus as will give the best service with the least amount of repairs. Now, such apparatus cannot always be gotten cheaply, neither can it be well taken care of afterward without the proper means for so doing, which also should be considered as part and parcel of the transaction.

After having bought the best apparatus, we must provide means to take care of and repair it, and the first thing to do is to provide competent help. On this last point hangs the key to success. Heretofore on our horse lines, economy has been practised in its severest sense, and now when we change from animal to mechanical power, it is hard to break away from the old methods and broaden out to the extent which is necessary to properly conduct the affairs of a well equipped electric system.

Outside of conductors, drivers and subordinate officers, the help on a horse line can be of a class which does not command a high rate of wages. Stablemen and trackmen are, as a general thing, employed for their muscle; therefore, I am not far from the truth when I say that previous to the introduction of electricity, our street railroads were conducted with inexpensive help, and we have come to look upon this method as the only truly economical one. I do not present this as a criticism, only as a comparison. It was not necessary to employ high priced men; the class of work did not demand it; therefore, there is no censure due the management, nor can we say that this view of economy was not correct.

Let us look for a moment at the change which has taken place in the last five years, and, if possible, discern whether according to good reasoning it is wise to pursue the long established methods of which I have just spoken. We have equipped our cars with delicate machinery, and have put complicated mechanism in our power stations, and have obstructed (so the public say) our highways with a multiplicity of wires.

What shall we do now? Still employ the same class of help? Is it wise to place this apparatus in the hands of men who do not understand the first law of mechanics? No, emphatically, no; it would be the height of folly, yet I am sorry to say that such was the case with some of our roads in the early days of electrics. The laboring man is all right in his place, and is a necessary adjunct to a railroad, but until he educates himself to the level of the mechanic, he should not be allowed to handle, much less repair, the delicate mechanism of an electric motor. Heretofore, then, we have been dealing with muscle, now we must have brains; hence we must turn our attention to the mechanic and the engineer. Let us take one step more and look at the mechanic, and see if we should discriminate between men of this calling. We have two classes of mechanics; the thoroughly skilled class and the partially skilled class, the latter more commonly called handy men.

You have heard the old adage, "Jack of all trades and good at none," and do you not think that there is a grain of truth in it? However, there are exceptions in this class; some men are born mechanics, and could they have had the proper training, would have become even more skilled than their brethren of the other class. Such men are worth employing for some purposes, but the man who can, in his own estimation, do anything from the building of a motor to the framing of a house, seldom proves to be capable of doing either and the electric road is better off without him. He never gains in knowledge, because he is satisfied in his own mind that he knows it all now. Therefore, I say, we must look still higher for a class of men to care for and repair our electric machinery, and in doing so can only fall back upon the skilled mechanic. By the term "skilled mechanic" I do not necessarily mean a machinist. We have many kinds of mechanics; I mean a man who has learned a trade—has mastered some particular branch of the business, and applied himself to that exclusively. An armature winder is a skilled mechanic; so is a first class lineman; that is his trade, he has mastered it and knows every condition that enters into it; the same with the machinist and the carpenter. Hence, I say again, these are the men we must employ if we want to run our roads properly and economically, and right here we see, as stated a moment ago, that true economy does not consist on what we save at the start; it comes on the other end of the transaction; it is what we save in repairs and breakdowns, which can be very materially lessened by the employment of the right means.

Having thus arrived at the conclusion that skilled help is necessary to success, let us look still further into the subject and ascertain what else is needed to bring about true economy. Just here is where opinion will divide, and is what renders this subject difficult of elucidation. Whether it is economical to maintain an equipment of machinery will still remain a doubt in the minds of many, notwithstanding what I may say or what others, more experienced than myself, may write upon the subject. Nevertheless, we are all here to get information, and as this is brought about by discussion, perhaps what I am about to say will bear fruit later on.

There is no denying the fact that to do a piece of work of any kind properly we must have proper tools; a makeshift in such a case only leads to the abominable temporary hitch. We would be much better off if this word "temporary" and all its modifications were left out of the English language. To do a thing half way results in gross extravagance in the end. There is no denying this; we have examples of it already on the electric railway. If this be true, what conclusion follows, in view of our previous conclusion that we must employ the skilled mechanic. Simply that we must provide him with the requisite tools and machinery to do the work in a skilled manner.

Now that we have arrived at this latter conclusion, there is yet another step, the last, but by no means the least. It is this: How far shall we carry this equipment of the machine shop? Shall we make it a manufacturing establishment? There is surely a point here where we must draw the line. There is a distinction between repairs and renewals, but for all this the question arises whether, if we go so far as to establish a shop for repairs, is it best to go a little further and manufacture supply parts? It will be useless for me to attempt to prove by theoretical reasoning that it is economical to maintain a manufacturing establishment, or even an additional equipment to that required for repairs, therefore I am simply going to present to you a few facts.

In the first place, I wish to call your attention to the methods and practices of the steam railroads. It seems to me that we ought, to a certain extent, to be guided by these people. They have spent over

half a century in probing and sounding this matter of repairs and renewals, and even though we may not wish to follow their example in some things, it will surely be worth our while to consider what they are doing. We find here what we have arrived at through our conclusions, viz., complete repair shops equipped with all the necessary machinery for doing the work in a thorough and economical manner and manned by competent help; furthermore, a thoroughly competent master mechanic at the head of the whole. We find them manufacturing a great many supply parts, even complete cars and locomotives, and everything necessary for the maintenance of the road.

They have learned by experience that it is economical to manufacture in this way. This is shown by their still continuing to do so, and, so far as certain repairs are concerned, they know positively that such can be done in their own shops more satisfactorily than in a local machine shop. Their own men having become familiar with all the requirements of the work, they know every condition under which the apparatus has to work; consequently the successful and economical operation of the road, so far as this department is concerned, is assured. In some instances it may cost a trifle more to make the article than it could be bought for. Suppose it does. If it will give better service and wear longer, it is more economical. As I said at the beginning, economy does not always consist in buying a thing cheap. Happily, however, in the experience of the steam roads, they have found that it costs no more, and in many cases not so much, as to buy of supply companies, which is surely a conclusive proof that it is economical to maintain shops.

After viewing the experience of the steam roads, let us turn our attention to the substantial practical data which I have gathered from the more prominent electric roads. In attempting to write upon this subject, I found that in order to present unbiased information it would be necessary to gather as much practical knowledge as possible from roads other than those with which I am connected, therefore I prepared a list of questions covering the most important points of this branch of the business and sent them to over 250 of the more prominent electric street railways, asking them to co-operate with me in the preparation of this paper by answering as many of the questions as pertained to their respective methods of operation and maintenance of line and car equipment. I am sorry to say that I received answers from but sixty-six roads, notwithstanding I prepared the circular so that it was only necessary to write *yes* or *no* after many of the questions, besides enclosing stamp and envelope for return. It occurred to me that perhaps many thought that this information was for me personally, or else reasoned that if I was to present this subject I ought to know enough about it without their help. However, the sixty-six answers which I did receive gave me valuable data to substantiate my own experience and enable me to write much more intelligently, and I wish to extend my thanks to those who did interest themselves in the matter sufficiently to give me the information asked for.

Among these answers received I have found many things to strengthen my belief that it is economical to maintain a machine shop, not only for repairs but for the manufacture of supply parts. It turns out to be a fact that no less than twenty-four roads are maintaining machine shops, doing all their own repairs and manufacturing many supply parts. They say, unhesitatingly, that there is economy in so doing. They give as their reasons: First, that they can *make* better material than they can *buy*; that they are perfectly familiar with the requirements and conditions of the business; they are operating the roads and are in a position to know just what is needed, and are better able to judge of the strength and durability of the apparatus than those who have never been in a similar position. Is not this a natural consequence?

In presenting this I do not mean to cast a reflection on the earnest efforts of my good friends in the manufacturing business, but I must say from personal experience that there is much material on the market to-day that is not up to the standard. Why? Simply because the makers of it do not understand thoroughly the requirements of the business. Some may be unscrupulous enough to put goods upon the market just for what is in them for awhile, regardless of their stability; but I hope that is not the case, for surely we had much rather believe to the contrary.

A second reason given is, that there is a saving of from 25 to 50 per cent. by manufacturing the majority of parts.

What further, then, *can* we say? Is not this, coupled with the experience of the steam roads, sufficient to enable us to conclude that there must be economy in machine shops for electric street railways?

I have shown you then, first, by reasoning, and second, by actual fact, that this subject must be treated *affirmatively*; therefore, it will be wasting time to dwell longer upon it, except, perhaps, to give a few examples taken from information gathered, and add a few recommendations which naturally arise from a study of the whole.

I have made a sort of classification of the answers received, and the result is as follows:

10 CARS OR LESS.

Received answers from sixteen roads: Fourteen of these buy all supplies and repair parts, and have not a machine of any kind; the other two have a drill press, small lathe and blacksmithing outfit.

10 TO 20 CARS.

Received answers from thirteen roads: Seven of these have partially equipped machine shops, do all ordinary repairs, and manufacture many parts for renewals; the other six have not a machine of any kind.

20 TO 30 CARS.

Received answers from ten roads: Six of these have well equipped machine shops, do all repairs, and manufacture most parts for renewals; the other four have not a machine of any kind.

30 TO 50 CARS.

Received answers from six roads: Of these one has not a machine of any kind; one has only a wheel press; two have a drill press, lathe and blacksmithing outfit; the other two have fully equipped shops and do all repairs and make nearly all supply parts.

50 OR MORE CARS.

Received answers from twelve: Two of these have only a drill press, lathe and blacksmithing outfit; nine have complete shops equipped with machines of all kinds, and manufacture about everything necessary to maintain the equipment; one has a very extensive manufacturing establishment, outside of a complete repair shop, and also maintains a brass foundry.

The remaining roads from which I received answers had no definite information to give. One or two said that they were getting ready to establish shops, and others were undecided what they would do.

Out of the sixty-six roads heard from, thirty-six were winding their own motor armatures and field coils, and the cost of armatures varied from $17 the lowest, to $75 the highest; the average was about $35, including all material. Fifteen roads had wood working machinery, consisting principally of saw table, band saw, surface planer and mortising machine. Seven roads are cutting their gears, but some of them find it no cheaper than to buy. They think, however, that the work and material are better, and for that reason it pays them. Others make all gears and think there is a saving in cost. Eight roads are building their cars, while several are rebuilding old cars, but make no new ones.

I will give now a few of the prices for which supply parts are being made in the shops of the different roads. These figures are an average taken from eleven roads which are using Sprague, T-H. and Westinghouse, double reduction motors.

Refilling commutator (copper bars)	$18.50
Two halves armature bearing, T-H., $3.96, single Sprague.	1.85
Two halves axle bearing	3.50
Brush holder	1.35
Rocker arm, T-H., $1.00, Sprague	3.00
Int. shaft (steel), T-H., $10, Sprague	3.00
Int. pinion (steel)	4.20
Int. gear	3.88
Axle gear	5.66
Armature pinion (steel)	3.58
Trolley wheel (brass)	1.06
Line frog	1.90
Clips for line hangers (brass)	.15
To bore and press on thirty inch wheel	.95

The average price for which roads sell scrap car wheels is $13.65 per gross ton; the lowest being $8, and the highest $20.

Some roads have kept no account of cost of making repair parts, and therefore could give no prices. It is unnecessary to say that it would be wise to do so.

Being anxious to know, myself, and thinking it might be of benefit to many others, I asked the roads to give an opinion as to which of the different types of motors gave them the most trouble. With but two exceptions, the single reduction costs less to maintain.

Nineteen roads are employing an electrical engineer, and four have a superintendent and electrical engineer combined.

In regard to my own experience, I will say simply that it fully coincides with the information just presented to you. I have no doubt, whatever, that there is economy in maintaining repair shops, and even

manufacturing supply parts. Of course what will apply to some roads will not to others. Some roads are too small to think of its being profitable, but many others will find it to their advantage if they will look at the matter in all its parts.

I will not attempt to recommend the number and kind of machines a road ought to have, as it will depend largely on the number of cars they operate, but I have made up a list of machines which I find the majority of those having machine shops are using, and should judge that it covers those most necessary for the work.

One 20 in. swing, 10 ft. bed, engine lathe.
One 16 " " 6 " " " "
One 16 " " 6 " " speed lathe.
One 24 in. × 24 in. iron planer.
One No. 3 or No. 4 Universal milling machine.
One 45 in. upright boring mill.
One 24 " " drill press.
One 12 " " " "
One 100 ton hydraulic wheel press.
One open die bolt cutter and nut tapper.
One medium size shaper.
One tool grinder.
Two forges with power blower.
One set of emery grinders.
One grindstone.
Necessary bench tools and fittings for machines.
One 10 H. P. motor to run machinery.

Of course roads with a great number of cars would need to duplicate some of these machines, and add some others not mentioned.

After having considered this subject and shown you what conclusions have been arrived at, both theoretically and practically, I want to add that, in order to make a success of running a machine shop in connection with an electric road, it will be necessary to employ an electrical engineer. By this I do not mean a handy man, or a man who styles himself an electrician, just because he has had a few months' experience in the electrical business, but one who has a theoretical, as well as a practical, knowledge of mechanical and electrical engineering.

In conclusion, I wish to say that I have endeavored to be as impartial as possible in what I have said, and have tried to present the subject in a comprehensive manner. I hope that discussion will follow the reading of this paper, for although some of us are fully persuaded that machine shops are economical, yet, I think, none of us are so prejudiced that we could not be convinced, should it be proven to the contrary. Let us get at the truth, whatever it is.

Report on "Relative Cost of Operation of Horse, Cable and Electric Roads."

By WILLIAM M. RAMSEY, CHAIRMAN OF COMMITTEE.

Gentlemen:—"The comparative cost of operation of Horse, Cable and Electric Railways," is the title of the paper for which your consideration is solicited for the next few minutes.

The subject is, it is needless to say, a fruitful one, and one on which a wordy speaker might discourse by the hour and leave his hearers no wiser. Your committee desires to present to you the result of its efforts, with only such comments as shall be necessary to its clear understanding.

The work which the committee had to perform was to ascertain from leading horse roads, cable roads and electric roads, such information regarding the cost of operation of each, as the existing methods of accounting in each case made possible. They recognized in the early stages of their work that any attempt on their part to shape the accounts of the companies to suit the purpose of the committee would be fruitless, for reasons which must be obvious to all. A series of questions was framed comprehending the information desired, and with such subdivisions of operating expenses as it was thought would meet with most ready reply. Our experience has proved that the subdivisions were well selected, for many of the replies were as full and concise as could be desired.

As to the greatest difficulty encountered—the lack of uniformity in methods of keeping accounts—enough has been said at former conventions. The difficulty, however, still exists; and, it might be observed, another difficulty was brought prominently to the notice of the committee, that is, the woeful lack of acquaintance with facts, and the need of scientific study and research into the economics of one's own road.

Correspondence was opened with every cable road in the United States by Mr. Greene, and by myself with the representative electric and horse roads. It is with regret that the committee announces that the information received from horse roads, for various causes, is meagre and unsatisfactory. It was not the intention of the committee to pass superficially over the horse roads, as our report would seem to indicate.

Many of the replies sent to the committee were given for the personal consideration of the committee alone, and not for publication or public reference in any way. We have, however, chosen a few of the representative roads of each class, and have tabulated the replies in such a way that reference can be made to them by number if desired. Names, location, amount of stock and bonds, and other marks by which a road might be identified, are necessarily omitted.

A comparison of the reports from these roads does not reveal the characteristics which we should expect to find. We see results which are as varied as could be imagined. Why should cable road No. 1, earning only eighteen cents per car mile, have within eight cents per car mile as much to divide among its stockholders as road No. 3, having nearly twelve cents per car mile more receipts. Let us refer to the reports of these two roads and make a few comparisons.

The first noticeable difference in the conditions under which the two roads operate lies in the fact that road No. 1 operates daily an average of 298 trail or tow cars, while road No. 3 operates only grip cars. Road No. 1 operates 1.54 tow cars for every grip car operated, or a daily mileage of 203.2 for every train of one grip car and 1.54 tow cars to every 100 miles made by a train of one grip car only, which road No. 3 operates. Now if the expense of operating increased *directly* as the mileage, whether made by grip or by tow cars, a direct comparison of these two roads would be possible ; but such is not the case. Road No. 3 is evidently at a disadvantage. The same difficulty occurs in the comparison of certain electric roads with one another.

A very excellent method of correcting this error has been formulated by Dr. Cary T. Hutchinson, and is here presented by his kind permission. It is evident that what is wanted is a formula which will represent the ratio of cost per car mile, for any item of expense.

Dr. Hutchinson's method is as follows :

Let "t" = No. of miles a train of two cars runs per day.
" "m" = " " motor car alone runs "
" "a" = cost per train mile for any special item, *e. g.*, cost of fuel.
" "b" = cost per motor car mile—the same item.
" "N" = 2t + m equals "car miles" as ordinarily counted.
" "r" = a /b equals ratio of cost per train mile to cost per motor car mile for any given item.
" "c" = cost per car mile, counting trailers same as motor cars. This is the figure ordinarily given.
" "C N" = total cost of operating line per day for that item.

Then $a\,t + bm = C\,N$ for any item of expense.
but $a = br$
$\therefore b(tr+m) = C\,N$

$$b = \frac{C\,N}{t\,r + m}$$

$$b = \frac{C\ 1}{r\ \frac{t}{N} + \frac{m}{N}} \quad . \quad . \quad . \quad . \quad (1)$$

$$a = r\,b \quad . \quad . \quad . \quad . \quad . \quad (2)$$

Now $\frac{t}{N}$ and $\frac{m}{N}$, the ratios of train and motor to total mileage, are known.

Then r must be determined for each item of expense.

I take for "r" the following values :

First.—Maintenance of roadbed and track, r = 1.5 ; although there are two cars instead of one, yet the trail car is by no means as hard on the rails as is the motor car.

Second.—Maintenance of line, —r = 1. It is the same whether there is or is not a trail car.

Third.—Maintenance of power plant,— r = 1.4. Because I have found by experience that under average conditions a train requires about 1.4 times the power of a motor car, and maintenance should be assumed proportional to power developed.

TABLE NO. 1.

OPERATING EXPENSES, ETC., OF EIGHT CABLE ROADS.

No.	Average No. of Grip Cars operated daily.	Average No. of Trail Cars operated daily.	Daily Mileage of Grip and Trail Cars.		Receipts per Car Mile including Mileage of Trail Cars.	Fixed Charges per Car Mile.	Interest on Funded Debt.	Taxes, Tolls—State, County and Municipal Taxes, except Water Taxes.	Gross Operating Expenses per Car Mile, exclusive of fixed charges.	Maintenance of Road-bed and Track.	Maintenance of Cable Rope and Underground Machinery.
			Grip.	Trail.							
1	193	298	80	80	18.054	1.624	1.069	.555	8.810	.401	.686
2	30½	....	127	....	18.300	4.700	4.200	.500	13.700	.500	2.300
3	54	....	100	....	29.840	5.440	3.200	2.240	16.000	1.910	1.720
4	5	6	90	90	15.10	.....	.....	.....	41.000	.....	.....
5	7	7	70	70	19.80	.....	.659	1.210	.....	.....	.....
7	29	58	104	104	.....	1.230	.990	.....	6.750	.....	.....
6	8	5	90.40	105.65	.....	1.884	1.532	0.352	10.715	.448	.734
8	70	70	123.54	123.54	.....	6.610	5.700	0.910	20.050	.400	3.000

TABLE NO. 1.—*Continued.*

OPERATING EXPENSES, ETC., OF EIGHT CABLE ROADS.

Maintenance of Power Plant, including repairs to engines, boilers, etc.	Maintenance of Plant in general. Buildings, etc.	Maintenance of Rolling Stock.	Maintenance of Grips, including inspection and shop work.	Cost of Power—Fuel, water, oil, waste, and wages of employes.	Cost of Transportation—Conductors and Motormen, lighting and heating cars, etc.	General Expenses—Salaries, Legal, Accidents, etc.	Net Earnings per Car Mile.	Wages of Conductors and Gripmen per hour.	Kind of Fuel used.	Cost per ton.
.530	.132	.594	.084	.925	4.702	.756	7.620	28c.	Screenings	1.47
.100	.030	.300	.100	1.700	6.400	2.000	4.900	17c.	Slack & Nut	2.02
.190	.580	1.030	.570	1.070	7.450	1.480	8.400	18¾c.	Coal.	1.21½
....	....	....	....	.....	7.000	3.000	.....	17½c.	R. O. M.	2.00
....	....	....	....	.....	.....	.....	.....	.....	.....	....
....	....	....	....	.....	.....	.....	.....	19½ and 20½	.....	....
.055	....	.480	.263	2.530	4.984	1.221	.....	22½c.	Petroleum.	5½c. per gal.
.120	.100	.860	.540	3.240	9.890	1.900	.....	22c.	Soft Coal.	6.20 net ton.

TABLE NO. 2.

OPERATING EXPENSES, ETC., OF SEVEN ELECTRIC ROADS.

No.	Average No. of Motor Cars operated daily.	Average No. of Trail Cars operated daily.	Average Daily Mileage of Motor Cars.	Average Daily Mileage of Trail Cars.	Receipts per Car Mile, including Mileage of Trail Cars.	Fixed Charges per Car Mile.	Interest on Funded Debt.	Taxes, Tolls—State, County and Municipal, except Water Taxes.	Gross Operating Expenses per Car Mile, exclusive of Fixed Charges.	Maintenance of Roadbed and Track.	Maintenance of Line work, including Underground Wiring.
					Cents.	Cents.	Cents.	Cents.	Cents.	Cents.	Cents.
1...	39⅙	....	127	....	19.360	.....	.....	.....	9.690	.....	....
2...	17	....	89½	....	25.263	7.222	6.861	.361	17.974	.773	.203
3...	280	5	70	56	40.280	3.360	1.000	2.360	25.440	2.520	.720
4...	10	4	120	120	13.500	9.000	.....	.....	9.000	.....	....
5...	10	....	100	....	15.000	6.400	.....	.....	.....	.....	....
6...	5	....	96.6	....	.....	.....	.....	.....	16.000	.110	.070
7...	37	....	100	....	28.880	.....	2.560	.....	18.530	2.500	.520

TABLE NO. 2.—*Continued.*

OPERATING EXPENSES, ETC., OF SEVEN ELECTRIC ROADS.

Maintenance of Power Plant, repairs on engines, boilers, etc.	Maintenance of Plant in general, Buildings, etc.	Maintenance of Rolling Stock, Car Bodies, Trucks, etc.	Maintenance of Motors, inspection and shop work, electrical and Mechanical.	Cost of Power—Fuel, Oil, Waste, etc. Wages of employes.	Cost of Transportation—Wages of Conductors, Motormen, Dispatchers, etc.	General expenses—Salaries, Legal, Accidents, etc.	Net earnings per Car Mile.	Wages of Conductors and Motormen per hour.	Kind of Fuel Used.	Cost per ton.
Cents.	Cents.	Cents.	Cents.	Cents.	Cents.	Cents.	Cents.	Cents.		
....	....	....	....	....	....	....	9.670	15½	Slack at 1.90;	Lump 3.00,
.411	.040	3.405	3.405	3.301	8.750	1.091	.0067	24	Wood	by the year.
.360	.330	1.590	2.720	3.560	11.420	2.220	14.3400	22½	Lump Coal	3.92
....	....	....	....	....	1.500	....	4.0000	12½	Soft Coal	1.25
.420	....	1.230	2.360	3.200	....	....	3.4200	13	Soft Coal	1.32
....	....	.740	....	3.840	8.740	.620	5.2300	14	R. O. M.	3.00
....	....	2.360	2.380	2.840	6.900	2.210	6.6100	20½	Slack	1.21

Fourth.—Cost of power.

(a) and (b) fuel and supplies, r = 1.4, as above.

(c) and (d) attendants, r = 1. Because for a good sized plant no more men would have to be employed in the power house if all the cars hauled trailers; the force required is not proportional to the output, but is constant within pretty wide limits.

Fifth.—Maintenance of rolling stock.

(a) and (b) repairs to motors, r = 1.

(c) " " cars and trucks, r = 1.25.

Repairs to trail cars are very much less than to motor cars.

Sixth.—Transportation expenses.

(a) carmen, r = 1.5, three men on a train and two on a motor car.

(b), (c), (d), (e) and (f) may all be bunched at r = 1.25.

Seventh.—General Expenses.

r = 1.

Referring again to our table of statistics:

No. 1 road expends .925 cent per car mile for the item of cost of power, and No. 3 road expends for the same item 1.07 cent and this, notwithstanding the fact that road No. 3 only pays $1.21½ per ton for fuel, while road No. 1 pays $1.47 per ton.

TABLE SHOWING STATISTICS OF ONE CABLE AND SEVEN ELECTRIC ROADS.

By permission of DR. CARY HUTCHINSON.

OPERATING EXPENSES.	Mileage 4,750,000 No. 1.		Motor miles No. 2.		704,913. No. 3.		1,345,146 No. 4.		1,500,000		2,744,000 No. 6.		1,098,000 No. 7.		2,725,000 No. 8.	
	Cents	%	Cents	%	Cents	%	Cents	%	Cents	%	Cents	%	Cents	%	Cents	%
1. MAINTENANCE OF ROADBED AND TRACK	.....	.....	.....	.....	1.040	8.45	2.51	12.66	.....	.....	.....	.....	1.516	10.80	.505	4.60
2. MAINTENANCE OF LINE	.....	.....	.....	.....	.100	.81	.53	2.67	.145	.204	.....	.....	.515	3.82	.....	.....
Total	.159	.205	.200	2.10	1.140	9.76	.....	15.33	.....	.....	.300	2.80	.....	14.62	.....	.....
3. MAINTENANCE OF POWER PLANT:																
(a) Repairs of engines and boilers	.....	.....	.....	.....	.050	.40	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
(b) Repairs of dynamos	.....	.....	.....	.....	.007	.10	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
(c) Miscellaneous repairs	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Total	.....	.....	.....	.....	.057	.41	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
4. COST OF POWER:																
(a) Fuel	.....	.....	.....	.....	.830	6.75	.....	.....	.675	9.40	1.280	11.90	.....	.....	.....	.....
(b) Oil, waste, water and other supplies	.331	4.26	.391	4.12	.200	1.63	.....	.....	.412	5.64	.440	4.10	.....	.....	.....	.....
(c) Wages of engineers and firemen	.162	2.09	.223	2.35	.700	5.70	.....	.....	.168	2.35	.....	.....	.....	.....	.....	.....
(d) Wages of dynamo tenders, etc	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.500	4.65	.....	.....	.....	.....
Total	.493	6.35	.614	6.47	1.730	14.08	2.84	14.80	1.255	17.39	2.220	20.65	1.304	8.72	2.83	25.80
5. MAINTENANCE OF ROLLING STOCK:																
(a) Repairs on motors, except gearing	.....	.....	.....	.....	.905	7.35	.....	.....	.244	3.40	.....	.....	1.402	9.40	.....	.....
(b) Repairs on gearing and trolleys	1.040	13.40	1.430	15.10	.234	1.90	2.38	12.00	.....	.....	.....	.....	.....	.....	.....	.....
(c) Repairs on car bodies and trucks	.435	5.60	.542	5.70	.528	4.30	2.35	12.00	.315	4.40	.....	.....	.....	.....	.....	.....
Total	1.475	19.00	1.972	20.80	1.667	13.55	4.73	24.00	.559	7.80	1.800	16.80	.....	.....	.715	5.50
6. TRANSPORTATION EXPENSES (a) Wages of Conductors and motormen	.....	.....	.....	.....	4.560	37.14	6.98	35.30	4.678	65.50	4.650	43.29	4.815	32.00	4.00	36.40
(b) Wages of starters, switchmen, track sweepers, etc.	4.330	56.00	4.930	52.00	.485	3.95	.....	.....	.103	1.43	.515	4.80	.....	.....	.....	.....
(c) Cleaning and inspecting cars and motors	.....	.....	.....	.....	.290	2.35	.....	.....	.383	5.35	.....	.....	.....	.....	.....	.....
(d) Oil, waste and other supplies	.....	.....	.....	.....	.485	3.95	.....	.....	.036	.50	.....	.....	2.693	18.00	.....	.....
(e) Accidents to persons and property	.....	.....	.....	.....	.007	.01	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
(f) Miscellaneous	.172	2.05	.215	2.26	.477	3.90	.....	.....	.....	.....	.100	.93	.....	.....	.....	.....
Total	4.502	58.05	5.145	.....	6.304	51.30	.....	.....	5.200	9.29	5.265	.....	7.508	.....	5.62	51.30
7. GENERAL EXPENSES																
(a) Salaries of officers and clerks	.437	5.65	.600	6.34	.....	.....	.....	.....	.....	.....	.132	1.23	1.051	7.00	.....	.....
(b) Office expenses	.132	1.70	.182	1.92	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
(c) Advertising and printing	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.250	2.32	.....	.....	.....	.....
(d) Legal expenses and damages	.174	2.25	.240	2.54	.....	.....	.....	.....	.....	.....	.102	.95	.291	1.95	.....	.....
(e) Insurance and taxes	.384	4.96	.530	5.60	.....	.....	.....	.....	.....	.....	.153	1.43	.184	1.23	.....	.....
(f) Miscellaneous	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.523	4.90	1.090	7.30	.....	.....
Total	1.127	14.55	1.552	16.40	1.402	11.40	2.21	11.2	.....	.....	1.160	19.83	2.616	17.48	1.30	11.80
Grand total	7.756	100	9.483	100	12.30	100	19.60	100	7.159	100	10.75	100	14.915	100	11.00	100

APPENDED TO DR. HUTCHINSON'S TABLE.

Therefore, for

1. b=1.14 c, r=1.5.
2. b=1.36 c, r=1.
3. b=1.18 c, r=1.4.
4. (a) and (b), b=1.18 c, r=1.4.
   (c) and (d), b=1.38 c, r=1.
5. (a) and (b), b=1.38 c, r=1.
   (c) b=1.25 c, r=1.25.
6. (c) b=1.14 c, r=1.5.
   (b) (c) (d) (f) and (e), b=1.25 c, r=1.25.
7. b=1.38 c, r=1.

These are the figures used in computing cost per motor car mile in the case of the No. 2 railway. No other line used trailers.

Using for r the value assigned above for cost of power, 1.4, our equation reduces to b = 1.07 cent, or in other words .925 cent. should be multiplied by 1.07 to bring it on a basis of comparison with No. 3 road. This gives us .99 cent. for No. 1 road as against 1.07 cent for No. 3.

The difference which still exists may be accounted for either by reason of a possible difference in the efficiencies of the two power plants, or by the possibility that one road may operate more cars to do the same amount of business than the other road.

This method of comparison can be used satisfactorily for any roads, cable or electric, providing the necessary data have been obtained as to motor car miles and train miles, and providing experience and careful observation have enabled the investigator to assign approximately correct values for "r," which will differ in different cases. But there are yet many discrepancies to explain, for which we must seek other reasons. Why should the gross operating expenses of No. 3 electric road exceed the gross receipts per car mile of No. 4 electric road by nearly 100 per cent., and yet both roads still have a fair percentage of their receipts left for dividends? No. 4 road is a small road, and No. 3 is a large one, but we cannot argue that small electric roads have a better chance for profits than large ones. It is fair to assert that study of No. 3 report would lead to the conclusion that either there is more in the road than is brought out of it, or that the only thing that justifies the outlay of twenty-five and a half cents per car mile (trail car mileage included), is the receipt of over forty cents per car mile to do it with.

The quality of the management which any of our roads receives is an uncertain quantity, but must be assumed to be good, in our arguments. The management of roads Nos. 1 and 3 in the cable list are known to the writer to be excellent. The other conditions under which the two roads operate are nearly the same. Yet a "figure of merit," obtained by multiplying the total daily mileage by net earnings per car mile, and dividing by the amount of capital stock paid in, shows vastly in favor of No. 3 road, and this, notwithstanding the gross operating expenses of No. 3 road are about 50 per cent. higher than the operating expenses of No. 1 road—both being placed on an equal basis of grip car miles. We see, therefore, that still another method of comparison must be resorted to in order to give an intelligent idea of the comparative earning power of two roads, namely, the comparative earning power per day of each dollar invested in each road. This ratio, when stated, comprehends all of the conditions under which the two roads operate; it is the final result of a compound proportion of which the ingredients are the investment, the outlay and the income—"outlay" comprehending the management and efficiency of the road, and "income" comprehending, among other things, the comparative value of the territories through which the roads pass.

Operating expenses per motor car mile, or per grip car mile, afford a satisfactory basis on which to compare expense of operation, but net earnings per motor or grip car mile tell us nothing of the value of a road as an investment, unless we know also the total investment necessary to earn so much per car mile; and we take occasion to remark here that future committees on this important topic will find it discouraging work to follow the usual lines of investigation into receipts, cost of operation and net earnings of street railways, and may find it necessary to look to some method of comparison by arbitrary "figures of merit," as has been suggested by several of our thinking engineers.

For a comparison of an average cable road with an average electric road, let us take this same No. 3 cable road, and compare it with No. 7 electric road. The cable road has been shown to be something better than the average, and the electric road is known to the writer to be at least up to the average. These two roads afford us a better opportunity than any other two which we might select, for the following reasons:

1st. Both are located in the same city, where climatic and other local conditions are the same.

2d. Both roads are of the same magnitude.

3d. Fuel and labor cost the same in each case.

4th. Neither road operates trail cars.

The cable road has the advantage in route as to grades and curves; otherwise, the roads offer excellent opportunities for comparison. It might be added that the investment in each case is up to the average, that is, is not extravagantly large, and yet is ample for the business transacted. Each road may be regarded as typical of its class. We see, upon examination, that the cable road has the greater fixed charges by 1.7 cent. There is a difference of one cent in the gross receipts in favor of the cable road; one cent of which may be said to be due to the larger gross receipts; but resorting again to the comparison by "figure of merit," we find a ratio of .00015 to .00020, or nearly three to four in favor of the electric road. This simply means that each dollar invested in the cable road will earn .00015 in one day, whereas, each dollar invested in the electric road will earn .00020 in one day. The total investment in the case of the cable road in this case is two and one-eighth times the total investment in the case of the electric road. The capital stock alone, exclusive of bonds of the cable road, is two and four-tenth times the capital stock of the electric road. What is our conclusion from these facts, or can we draw a conclusion on which we can stand? We have not been conservative in our statements thus far, but are, of course, not infallible. "One swallow does not make a summer," nor do the examples we cite determine the whole matter once for all. The cable road has its place firmly established in the transportation business of the Pacific Slope, and we, who are acquainted with the conditions met with there, cannot presume to say that the electric railway would do the same work better and more efficiently. We are tempted to say so, but the interests concerned are too great to be trifled with in so dogmatic a manner. We recognize that the greatest value will be obtained from this report by members taking it home with them and studying the figures analytically. Another year may develop such improvement in methods of accounting that definite conclusions can be formed, but to do more than merely produce figures from typical roads, the committee is not prepared at this early stage of electric railroad practice. The cable roads have their methods pretty well digested, and their figures are, as a rule, reliable. The electric roads are as yet, with few exceptions published in this paper, in the dark as to what they are doing—except that they have enough left to satisfy stockholders—in fact, 89 per cent. of the electric roads heard from report dividends of from 5 to 12 per cent.

We believe that cable road practice has reached the stage where but little room is left for improvement. They have been developed, improved and operated by the best engineering skill which the country affords. Nearly all are on a good dividend paying basis; but whatever the past experience of the two systems has been, or whatever the present status of the two may be, we are only voicing the convictions of well informed engineers, when we say that electric systems will continue to increase in efficiency (by which is meant earning capacity) until all rivals are distanced, and only one method of rapid transit is recognized—the electric car.

Report on "Standards for Electric Street Railways."

By O. T. Crosby, Chairman of Committee.

Gentlemen:—The committee, of which as chairman I now desire to render the report, was named in the president's letter of January 4, 1892, and addressed to the undersigned. The scope of the committee's work as set forth in that letter and in the resolutions bearing on the subject adopted by the Association last October, is to report on the standardizing of rating, nomenclature, dimensions and accounts.

The committee, as first determined, consisted of the following members: O. T. Crosby, chairman; H. I. Bettis, who, as per your letter, was to give special attention to the matter of accounts; E. E. Higgins; Chas. W. Wason, named as mechanical member, and R. W. Rippetoe. The last named gentleman resigned from the committee work shortly after its inception, and Mr. J. E. Rugg, of Pittsburgh, was appointed in his stead.

The first meeting of the committee was called to take place in New York, February 9, 1892. The minutes of that meeting indicate quite clearly how the work was viewed by the members of the committee, and what subdivision of work was determined upon. I extract from these minutes the following statements:

Present: O. T. Crosby, chairman; Charles W. Wason, representing the East Cleveland Railway Co., and H. I. Bettis, representing the Atlanta Consolidated Street Railway Co.

The discussions in committee resulted in the following conclusions:

The things on which definite recommendations were to be made to the Association were as follows:

1.—Accounting methods. Concerning this the object of the committee will be to emphasize the three headings—transportation, maintenance and construction, under which expenditures are to be kept.

It was also concluded to present the car mile as the unit of operating expenses, especially in regard to the item of motive power. For the purpose of comparing motive power expenditures, double truck

cars shall be distinguished from single truck cars, while double truck cars shall be classed with trains of two cars.

It was also intended to urge the necessity of proper monthly returns. The whole matter of accounting methods was referred to Mr. Bettis, as sub-committee.

In regard to specific dimensions to be standardized, it was concluded that recommendation should be made concerning standard diameter of axles, of wheels, of trolley wheels, of trolley poles and trolley pole sockets; also the width of trolley wheels and the depth of their grooves, also key-ways for axle gears, and the distance between hubs of wheels measured along the axle. The report on their standard dimensions was referred to Mr. Wason, as sub-committee. It was concluded that the diameter of the trolley wire should be referred to Mr. Crosby, he to correspond with the various electrical manufacturing companies and other persons as he might deem suitable. The same conclusion was had in regard to the rating of motors for railway use, this being referred to Mr. Crosby.

The standardizing of the nomeclature of the various parts used in railway apparatus was referred to Mr. Higgins as sub-committee, with the suggestion that he correspond with the electrical companies and railway companies.

It was also determined that each member of the committee should report as soon as possible to the chairman of the committee, his views upon what plan should be recommended to the Association as adequate for carrying on in a permanent way the work of standardizing, which work can scarcely be more than begun by the present committee.

METHODS OF ACCOUNTING.

At the date of the preparation of this report, Mr. H. I. Bettis has made no special report on the subject of accounting, and, perhaps, indeed little remains to be said save to insist upon the importance of preserving the three separate headings, namely, transportation, maintenance and construction, while at the same time referring to the particular forms which were largely prepared by Mr. Bettis, and which appeared in the paper read by the undersigned last October, the discussion of which resulted in the appointment of your committee.

While awaiting any further special treatment of the subject from Mr. Bettis, I beg also to call special attention to the recommendation that a car mile be adopted as the unit of operation in regard to the item of motive power. The introduction of the double truck cars into street railway service makes this unit, however, somewhat inaccurate unless the distinction between the various kinds of cars be carried along with the use of this term. We have thought that the distinction should rest rather as between double truck cars and single truck cars than between cars of different specified lengths. Furthermore, and especially relating to the question of motive power, we recommend that it will be reasonably safe to class two standard sixteen foot cars with double truck cars, experience having shown that the consumption of power in the two cases is nearly equal under given conditions as to track, grade, etc.

One of the chief difficulties, heretofore, standing in the way of determining accurately the cost of one mile of service has been the inaccuracy in the determination of the amount of power consumed for such unit service. The perfection of recording wattmeters that has taken place during the past year will go far towards remedying this difficulty. This, like any other mechanical assistance, will, however, be of no avail if the books be not kept accurately with respect to all expenditures going to motive power. For such accuracy there must be paid a reasonable sum for clerical labor. The object of the blanks above referred to is to reduce that labor to a minimum for a given degree of accuracy. It will, of course, be possible to arrive at satisfactory results by means somewhat differing in detail, but it is strongly urged that the general lines indicated in the recommendation of this committee be followed so closely that it will at least be possible to feel sure in discussing reports of opening expenses from any two roads, that the same items of cost have gone into the headings of transportation, maintenance and construction. We do not feel it necessary to enlarge upon the importance of careful bookkeeping looking to the determination of these three headings. We assume that all intelligent railway men appreciate the importance of knowing what they are doing.

STANDARDIZING OF SPECIFIC DIMENSIONS.

In regard to this heading, I take pleasure in inserting herewith the report of Mr. C. W. Wason, sub-committee on this subject.

"In order to better determine the sizes of the several parts given me, as a member of the Standardizing Committee, I sent out circular letters to 200 of the leading electric roads, requesting them to give their opinion as to the sizes of the several dimensions.

"I would state right here that from the small number returned, namely, about 30 out of 200, that the street railroad companies do not realize the benefit to be derived from such a movement, else they would take the trouble of answering such questions of general information, thus enabling the committee to much better arrive at a satisfactory conclusion. I know, myself, as an officer of a street railroad company, my first inclination upon opening a letter containing questions is to throw it into the waste basket, but upon a second consideration, I conclude it best to send what little information I may be able to give to the party making the inquiry, thinking possibly that the general result therefrom obtained will be of benefit to the whole street railway fraternity.

"One of the objects, as I understand it, of the street railway convention is to enable the street railway men from different parts of the country to get together and exchange their views relative to varions matters, with the idea of the mutual benefit to be derived from the discussion, and which would be impossible for the individuals to obtain did they not come together in this manner. Members of a committee like the Standardizing Committee have much work attending the bringing together of the matter desired, and it surely seems to me that each individual company should do all in its power to assist the committee by answering, to the best of its ability, any inquiries put to it by the members of such a committee through the mail.

"In order to obtain the dimension of the car journals, such as this committee may think best to recommend, I corresponded with the several truck manufacturers, who kindly gave me blue prints and drawings of their journal boxes. If the electrical manufacturers continue to increase the weight of their motors, these dimensions should be increased. The data I have present have been gathered from railroads using possibly a lighter equipment than that which is now being put upon the market. It is absolutely impossible to standardize an appropriate size, considering the change of weight, but the following seems to be the best in the opinion of those from whom I had answers to my inquiries :

Diameter of axle, 3½ ins.
Diameter of car axle journal, 3 ins.
Diameter of axle wheel seat, 3⅛ ins.
Length of car axle journal, 8½ ins.
Diameter of car wheel, 33 ins.
Weight of car wheel, 350 lbs.
Diameter of trolley wheel, 4½ ins.
Width of trolley wheel 1½ ins.
Depth of groove in trolley wheel when new, 1½ ins.
Size of key way for axle gear ¾ in. by 6 ins.
Distance between hubs of wheels, measured along the axle, 48 ins.

"It is essential that the groove and depth of the trolley be the same if the cars run over the same style of switches, as it is almost impossible to put up an overhead construction that will carry all sorts of trolley wheels. This remark may at first look a little absurd, but when one has had much experience with several different sized trolley wheels he will at once appreciate the necessity of all being alike."

The dimensions above recommended as standard have been approved by the other members of the committee to whom they have been submitted, except that Mr. Rugg prefers a thirty inch wheel instead of a thirty-three inch to be considered as standard. It will be seen in studying the articles above referred to that those have been chosen which, if of varying dimensions, interfere most with the interchangeability parts in an electric railway equipment. The object held in view was so to standardize dimensions as to produce as little inconvenience as possible when apparatus such as trucks, trolleys, motors, etc., are obtained for use on the same railway from different manufacturers.

We have endeavored not to forget the principle referred to in the papers presented last year, namely, "that the standardization of parts should be so directed as not to interfere with the progress of invention." There must, of course, in the matters interesting to this Association, as in every other evolutionary development, be on the one hand a constant struggle to ossify into fixed forms, and on the other a tendency to restlessly change in the development of new forms. Complete ossification is justifiable only after the obtainment of perfection. Constant change in every detail is, on the other hand, justifiable only on the ground that nothing valuable has yet been reached. The adoption of any standard whatever constitutes a compromise between the two considerations named. We trust you will find those standards recommended by us to be a reasonable compromise.

Without in this report going at length into a discussion of the con-

siderations which have led to an adoption of each of the dimensions above given, it should be noted that besides the large correspondence carried on by Mr. Wason with various persons throughout the country, there has been a very considerable amount of private discussion on each dimension between Mr. Wason and other members of the committee, and various competent persons. The dimensions of wheels and trolleys above given are intended to be applicable alike to single truck and double truck cars.

Concerning another mechanical dimension, consideration of which was referred especially to the writer, I am able to report that a large majority of the numerous persons addressed by me upon the subject, recommended No. o B. & S. gauge as the best size for standard trolley wire. It is further understood that such trolley wire shall be of hard drawn copper; its conductivity to be 98 per cent. of the standard in the usual tables used; its tensile strength close to 55,000 lbs. per square inch.

Perhaps the desirability of standard dimensions can be as readily shown by referring to this trolley wire as well as in any other way, although at first it may seem to be of very small importance that there should be any agreement on such an article. If, however, it were shown throughout the country that No. o trolley wire was always in contemplation unless very plainly expressed to the contrary, there would be fewer mistakes than have occurred in the past in regard to the size of the channel in the overhead device to which the trolley wire is attached.

More than this, manufacturers of these devices could carry stocks more safely, and purchasers could correspondingly obtain more readily those articles which are especially desired to be shipped in a hurry.

NOMENCLATURE.

The list of names suggested by the writer in the paper last year, has been submitted to a number of railway officials, railway contractors and manufacturers of electrical goods. Some corrections of the list as presented last year have been recommended by various persons and are herewith incorporated. The name now recommended appears first, and after it, in parenthesis, is the one heretofore used for some articles.

Concerning this list of names, the following letter was received from the Westinghouse Electric & Manufacturing Co. :

PITTSBURGH, PA., September 17, 1892.

MR. O. T. CROSBY,
130 Summer Street, Boston, Mass.

DEAR SIR: Referring to your favor of the 6th inst., and to the copy of the extract from the last report of the Committee on Standards of the American Street Railway Association, would state that motors or parts as designated on the first sheet of the extract appear to us to be termed properly. We do not, however, with our motors, use standards for supports on bearings or side arms.

The second sheet of the extract pertains entirely to details required in the construction of the overhead work. As we do not make a specialty of this work, we prefer to refrain from expressing an opinion as to what terms should apply in this connection.

Yours truly,
(Signed) W. C. CLARK,
General Agent.

NOMENCLATURE OF ELECTRIC RAILWAY TERMS.

Generator (generator, dynamo) :—Machine in which the electric current is generated.

Motor (motor) :—Machine in which the electric current is transformed into mechanical power.

Frame (frame) :— Iron body of machine, including pole pieces and standards or side arms, if any, but not including base plates and bearings.

Standards (standard bracket) : — Supports of the bearings of generator.

Side arms (side arms, check pieces, armature bracket) : — Supports of bearings of railway motors.

Pole pieces (pole pieces) : — That part of the frame from whose surface lines of force may pass directly to the armature.

Field coil (field coil, spool) : — Coils of wires wound on frame in such a way that a current passing through these coils makes magnets of the frame and pole pieces.

Brush holder .—Device for holding the brushes in contact with the commutator, including the insulation used in its support.

Rocker arm (yoke, rocker arm) : — Device for holding brush holders in position on commutator while attaching it directly or indirectly to the frame.

Fuse (fuse, fusible plug) : — A metal device for opening circuit when the current becomes abnormally large, the soft metal being melted by a current of fixed quantity.

Switch : — A device for closing or opening a circuit at one or more points.

Rheostat (resistance box, rheostat) : — Wire or other material suitably protected and conveniently arranged to be introduced in more or less proportion into a circuit.

Trolley (trolley contact bar) : — A device used to transmit the electric current from the overhead wire to the cars, consisting usually of a

Trolley wheel : —A small metal wheel making rolling contact with the overhead wire.

Trolley fork :—Mechanically connecting trolley wheel to

Trolley pole :—Supporting the trolley fork and wheel and resting in a socket which is part of the

Trolley base frame.

Trolley wire :—Wire from which the trolley wheel directly receives current.

Standard trolley switch (trolley frog, frog overhead switch)—A device used to fasten or hold together the trolley wires at a point where the trolley wire branches, and to guide, ordinarily automatically, the trolley wheel along the wire over the track taken by the car.

Trolley switch :—A switch designed for use at a point where two branch lines make equal convergent angles with the main line.

Right hand trolley switch :—A trolley switch designed for use at a point where a branch trolley wire leaves the main line to the right in the going direction.

Left hand trolley switch :—A trolley switch designed for use at a point where a branch trolley wire leaves the main to the left in the going direction.

Three-way trolley switch :—A trolley switch for use at a point where the line branches in three directions.

Drawbridge crossover :—A device permitting the easy passage of a trolley wheel from one to the other of two adjacent wires in a continuous direction.

Trolley frog (trolley crossing, crossing frog, crossover) :—A device placed at the crossing of two trolley wires, by which the trolley wheel running on one wire may cross the other, the device also holding the two trolley wires together.

Insulated trolley frog (insulated trolley crossing) :—A device placed at the crossing of two trolley wires, by which the two wires are insulated from each other, and by which the trolley wheel running on one line may cross the other.

Hanger (line insulator, line suspension, trolley insulator) :—A device for supporting and insulating the trolley wire.

Straight line hanger :—The hanger used on a straight line and supported from a span wire, the strain on the same being essentially vertical.

Single curve pull off (single curve hanger) :—The hanger supported by a lateral strain in one direction and, ordinarily, on single track curves, except at ends and the inside curve of double track.

Double curve pull off (double curve hanger) :—The hanger supported by a lateral strain in opposite directions, used ordinarily at ends of both single and double curves, and at intermediate points and on double track curves.

Feeder clip (feeder clamp) :—Clamp with a device by which a feed wire may be connected to the trolley wire.

Feeder :—A wire usually insulated, used for transmitting current from the power station to the mains or the trolley wire direct.

Mains :—Wire usually insulated, serving for the distributing of current from the feeders to the trolley wire through tap wires.

Tap wires :—Wires to convey current from feeders or mains at the pole to a near point of the trolley wire.

Trolley wire section (trolley section) :—A length of one trolley wire with or without branches, but continuous electrically.

Line section :— A part of the overhead conducting system, so insulated from other parts as to permit the supply of power to be separately controlled.

Section box :—A box containing section switches and fuses used for control of a trolley section or line section.

This subject, which was referred at the first meeting to Mr. E. E. Higgins, has latterly been taken up by the chairman, Mr. Higgins having been for some months abroad.

RATING OF MOTORS.

This subject is one affording a wide range of discussion and opinion. In all the correspondence and conversation which the undersigned

has had concerning the matter, none have been found who did not agree that the present loosely used rating by horse power is objectionable, but it has been much more difficult to find agreement or any substitute. All feel the difficulty of putting into the mouths of the many who must refer to the capacity of motors any unfamiliar expression, yet no advance can be made without meeting that difficulty. At the risk of unduly lengthening this report, I desire to repeat in considerable part the considerations presented by me last year. I quote from the paper referred to as follows :

"It must be borne in mind that an electric motor, like any other machine, a man, for instance, is capable of performing work at widely varying rates and widely varying efficiencies, and with widely varying factors of safety with respect to indefinite continuance of such a rate of work. It should further be borne in mind that an electric motor in particular is known to do its maximum rate of work when its efficiency is only 50 per cent.; that is, if twenty horse power represents the maximum rate of work, then forty electric horse power will be required to perform this work. A series motor, such is commonly used for railway work, also must vary widely in its speed while varying the quantity of work it performs per second. Now, this maximum quantity of work, and the efficiency at which it is performed, and the speed of the car connected with it, are matters of importance when we endeavor to get a really serviceable idea of what the machine can do ; that is, of how nearly it can meet the conditions required by the particular service to which we wish to put it.

" Will it serve the purpose best if we rate the machine according to its maximum capacity when its efficiency is 50 per cent., or according to some lower capacity at high efficiency, and at some speed as nearly as possible that at which the motor must be run during the greater part of its time of service ? Should we use the maximum rating, we have the advantage of knowing at once very nearly what is the limit of service which the motor can perform ; but, on the other hand, we fail to be told by such rating what the capacity of the machine is when doing the average work of our service.

" There is at present no conventional uniformity controlling either the manufacturer or purchaser of electrical machinery in regard to these matters, which can be determined only by the custom of the trade, as it may grow up through years of uncertainty, or as it may be directed to more rapid maturity by the action of such an association as this."

The first condition, which, in my opinion, should be connected by implication with any rating whatever, is this: that the machine in question shall be able to perform its rated work indefinitely and under any condition of atmospheric temperature. There is, of course, room for honest differences of opinion in regard to this point. It is well known that the maximum demands for power in street railway service are not those which last for a considerable length of time. A certain manufacturer may thus argue to himself : " This machine which I am about to advertise is able to do twenty horse power of work for half an hour, when the atmospheric temperature is ninety degrees. In my opinion this rate and time and temperature will not be exceeded in the conditions of regular service. Why, then, may I not call this a twenty horse power motor? It is true, if I were building it for stationary work, in which generally the load to be carried is much more constant, I shall adopt a different rating."

It would be possible to express their condition thus : That whatever the rate, it should be possible to maintain that rate indefinitely under all conditions of atmospheric temperature, by stating that the windings of the armature shall never show more than a given excess of heat over atmospheric temperature.

There is again room for honest differences of opinion in regard to the efficiency with which a motor can do its rated work. Suppose the manufacturer has produced a machine which can do its maximum work for an indefinite time without undue rise of temperature. There is today no custom of the trade distinctly understood which would prevent him from rating the machine by this maximum capacity. And, again, in stating that the machine is of fifteen horse power capacity, even if there be agreement concerning efficiency and durability, there might be disagreement of much importance in regard to the speed at which work can be performed by the motor. If it has been so constructed that it can do fifteen horse power of work only at some armature speed corresponding to a linear speed of the car, either much above or much below the average speed of the car, then the information and motor may both be of little value for street railway service. Indeed, the use of the term " horse power" then has necessarily this uncertainty in it : The total number of foot pounds per minute, namely, 33,000, may be made up in an indefinite number of combinations of feet of travel and pounds of pull ; but for our service we should have some known relation between these two.

It seems to me that that which the purchaser has in mind to obtain is such horizontal effort exerted at such a speed and at such an efficiency as will do the work in view. Now, the work in view varies very widely, and we cannot, therefore, obtain a convenient rating which will express this relation throughout the range of the total capacity of the motor. We may, however, select some particular condition, say, that approaching as nearly as possible to the average, and tell by a method of rating, which I will propose, what the machine can do for such condition.

Let us first consider the speed at which it is desirable to know the capacity of the motor. I think ten miles per hour is not far from the speed at which cars will be found most frequently running. If, then, we state concerning a motor that it can develop so much horizontal effort at that speed, we at once have a pretty close approximation as to what load of a car and passengers it can handle at that speed, since we know that twenty-five pounds per ton is a fair approximation to the average traction co-efficient. Suppose, then, we are told that a motor can produce a horizontal effort of 500 lbs. at ten miles an hour ; it is, then, a quick inference that a car weighing twenty tons can be carried by such a motor at the rate of ten miles per hour on a level. We may then conscientiously call this motor a " 500×10."

It may, of course, at once be objected that such a method does not distinguish between efficiency of motor proper and the efficiency of its gearing. For a great many reasons this is not very objectionable. We buy the motor with its gearing, and I can see no particular reason why the manufacturer should not get the benefit or the blame of the good or bad gearing which he may use with his efficient or inefficient motor. Furthermore, in the single reduction motors, now so widely used for ordinary street railway work, the loss by gearing transmission is very small, and probably not widely variant as between the different manufacturers ; and again, in whatever high speed work which it may be feasible to do by gearless motors, the question of the efficiency or inefficiency of the gear is eliminated.

Again, it may be objected that such a method supposes uniform diameter of wheel which must be known to the manufacturer, in order that he may calculate what his motor is doing for a given car speed. Should there be no considerable variation from the thirty inch wheel now so largely used, such a diameter might be taken for granted as having entered the calculation ; and if a different wheel, say thirty-three inch, becomes general, then that diameter may be assumed in the rating.

It would, of course, in any such rating be assumed that the machine is working under a pressure of 450 volts, which is not far from that found on most of the lines throughout this country. In the necessary regulation to which these motors are subjected, a part of this pressure is practically applied to some resistance, external or internal, with respect to the motor ; but I can see no convenient way of taking this into account in determining upon a rating. Indeed, the action of a series motor in street railway service is very complex, and it is much more difficult than sometimes supposed to determine upon a rating which shall give the greatest amount of available information. The very difficulty, however, is warrant for approaching the subject seriously and industriously.

In spite of the fact that many objections may be urged against any suggested method of rating, that which is preferred by your committee and by many persons consulted in regard to the question is this : That a motor shall be known as to its capacity by the horizontal effort which it can apply to a car at a speed of ten miles per hour, the standard thirty-three inch wheels, above recommended, being used on the car, and whatever gearing may be preferred by the manufacturer. It is plain that the horizontal effort that may thus be produced from a given motor whose armature is running at a given speed, may be made to vary by this change of gearing, but for the reasons above stated it has been thought best to consider the motor and its gearing as one piece of mechanism. While this recommendation would at first involve the use of two terms in the name of a motor, namely, horizontal effort and speed, the term for speed would soon disappear after it had become generally understood to be ten miles per hour. Thus for the present, calling a given motor 600×10 ; this meaning that at a speed of ten miles per hour the motor in question will develop a horizontal effort of 600 lbs. Later, however, the same machine would be satisfactorily designated as a 600 lb. motor, the standard speed being taken for granted. At the same time as street railway men begin to go into suburban enterprises, in which higher speeds than those now familiar must be attempted, it will be easy to revive the expression for the

speed at which a motor is rated, and we may thus expect to see motors described as 600 × 20, 600 × 30, etc. This high speed extension of electrical motor work, and especially its extension in the same hands as those now directing ordinary street traffic, makes it especially important that some rating should be adopted which will take speed into account, as otherwise confusion will inevitably result. It goes without saying that much remains to be told concerning a motor after its horizontal effort at a given speed shall be expressed, and a part of the recommendation of your committee is that an implied part of the rating of a motor lies in this, that it shall be able to perform its rated work continuously without a rise of temperature exceeding seventy-five degrees C. over the atmospheric temperature.

In regard to the efficiency, desirable as it is to be informed on that point, it seems too difficult to be involved in any rating which shall be frequently and properly used.

Another method of rating motors, which is presented as the second choice of your committee, is as follows: That two terms should be used, one giving the horse power of the motor at which it can work continuously at a safe temperature, the other its maximum horse power. As has been explained, it is a feature of all electric motors that their maximum rate of work is done at a 50 per cent. efficiency. Nothing is more essential to be established, therefore, than the maximum work the motor will do. Following this method, which was suggested by Mr. Chas. A. Lieb, a given motor might be known as 15×33 or as 20×40, etc., concerning the first machine named, it being understood that it could do fifteen horse power of work all day long without undue heating, but under stress it could perform work at the rate of thirty-five horse power, the efficiency being at once known to be down to 50 per cent. It would also be understood, and go almost without saying, that the motor would be unable to do thirty-five horse power of work continuously; indeed it would be expected to perform such a rate of work safely for only a very short time, say from two to five minutes.

Uninviting as is the discussion of such a subject in a large assembly like this, your committee urges that serious consideration be given to this matter, and that one or the other of the methods here recommended be adopted.

In conclusion, while urging that all definite action possible shall be taken on the recommendations now made, we further urge most strongly that steps be taken to carry on permanently the work of standardizing, especially the work of standardizing the nomenclature and dimensions, since in regard to these there can never be any cessation of demand. To further this object, we recommend that this Association employ a salaried official to be known as the statistical secretary or clerk; that such employe shall give his whole time to the obtainment of data bearing on the work of the Association, direction to be given him in obtaining and collecting such data by the permanent executive officers of the Association at their discretion, and especially by the Standardizing Committee, which we further recommend shall be made one of the permanent committees of this Association. It is exceedingly difficult, as all who hear this will know, for men engaged laboriously in their private affairs to give such work, as that in question, the detailed attention it deserves. If, however, some competent person were at hand who could be asked to obtain the necessary information, then such men as would properly be chosen as officers of this Association, or as members of important committees, would certainly be able to digest the information and present it in useful form to the Association.

Another important work which could be assisted by such an official, and, by such a permanent committee as that which has been much before us ; namely, the furthering of the actual use of whatever standards this Association may adopt. Little has been gained in what we believe all recognize as a useful work, if we stop at a formal adoption of names and dimensions. A constant and well directed presentation of the Association standards by some proper official will do much to increase the value of whatever action you may take. Some presentation should be made, not only to members of the A sociation, but also to manufacturers interested in the standards that may be adopted. As a preliminary step to the extension of this work, we recommend that copies of this report and of your action upon it be sent broadly to manufacturers, contractors and dealers in electric railway supplies. We further suggest that in so far as you may adopt any of the standards herein recommended. that you should urge manufacturers and dealers to make their catalogues conform with your recommendations in the details touched upon ; and we further urge that the Association shall urge its members to keep before them the standards that may be thus adopted, and that they shall insist upon the obtainment of the use of these standards by the manufacturers in so far as possible.

As stated in the minutes of the first meeting of this committee, we consider that the work has been only begun by the presentation of this report To be of value it must be continuous. This report will be insufficient and faulty in many particulars, yet we feel that we have given, perhaps, as large a share of time and attention to this matter as it would have received at the hands of any other four or five men that you might have chosen. The cure for the insufficient report is, we feel, perhaps, to be had in the appointment of some official as above suggested, more than by any other means.

Standardizing of Accounts, Accounting Methods and Statistics.

Addendum to Report of Committee on Standards.

By H. I. Bettis, Sub-Committee.

Gentlemen :—The subject of formulating a standard system of accounting and forms for statistical information is of great importance to this Association, and I appreciate the weight and value of the undertaking as much as anyone, and perhaps more than the majority of the members of this Association, having given the subject considerable study.

The prodigious strides which the street railway business has made in the last few years now causes this business to come to the front. The meetings of this Association for the discussion of the knotty problems problems which are continually preplexing our managers, has also impressed upon us the necessity of more reliable statistics for comparative study.

The ultimate object of all accounting is to ascertain with accuracy the amount of net income after all operating expenses and fixed charges have been paid.

With this object in view, and no other, the art would be reduced to a very simple profit and loss account, debited with all expenses and credited with the entire income ; but the owners and managers of our street railway properties for many reasons desire some further information than this.

It is not sufficient for them to know that their road has a certain income, or that the expense has reached a certain amount.

They desire to know many things in addition to these ; what was the source of income ; how many miles of track they have ; how many cars ; how many trips those cars make ; how many passengers they carry ; what other sources of income there were ; what was the expense of operating the road ; what portion was simply for the transportation of the passengers ; how much was paid for motive power, for repair of cars, of apparatus, of track, buildings, etc., etc.; what has been expended in construction, improvements or betterment.

Having all this information well in hand, the owners and managers can determine more readily wherein the expenses have been too large, and have hereafter a basis upon which to calculate their future operations.

Moreover—what is of incalculable benefit—they can compare the cost of operating expenses of other lines throughout the country.

Heretofore, the great difference of opinion on the part of street railway officials as to the necessity or value of any reports or statistical information, has rendered it almost impossible to get any reliable information, and above all to make any comparisons, one road with another.

In order to get any beneficial results by comparison, it is necessary that we have statistics compiled from some standard basis.

We cannot compare wheat with potatoes, neither can we compare the cost of operation of one road with the operation of another, unless like expense accounts are included in each case, and the data compiled under the same rules.

In the case of the steam roads of the United States, the Interstate Commerce Commission has caused to be compiled a *Classification of Expenditures* and certain rules for their guidance in making the annual reports to the government.

Most of the railroad commissions of the several states have adopted this classification, and nearly all the railway companies use the same in their accounts.

It is quite probable that in the near future the Interstate Commission may extend its jurisdiction over the street railway companies, and in that case would compel them to adopt a uniform system of accounting as a basis.

Such a system of accounting, to be accepted by all the railroad

companies in this Association, can only be adopted after due consideration and the co-operative endeavors of our accounting officers.

This committee will not attempt to prescribe a set of rules and reports, but only to suggest certain distinctive lines which we believe should be followed in the future, when deciding upon a basis for accounting statistics.

DIVISION OF EXPENSES.

We are all agreed that it is essential for the expenses which add to the present or future value of a property to be separated from those which do not, and that the three great divisions should be

1. Transportation expenses.
2. Maintenance "
3. Construction "

This established, the various subdivisons may be few or carried to infinity, but the final results are necessarily the same.

The differences between these divisions are as follows:

1. *Transportation* expense is simply the expense of transporting the passengers, and includes nothing whatever expended upon the the property. Under this heading we should find wages of conductors, drivers, gripmen, motormen, (engineers and firemen on dummy lines), fuel, provender, lubricants, wrecking, etc., etc.

2. *Maintenance* expense is the expense of keeping the properties in their original condition, and consists of the amounts expended upon repairs of track, buildings, cars, power plant, engines, etc., etc.

3. *Construction* expense is such as adds to the value of the original plant, such as additional buildings and machinery, new tracks laid, less the value of old ones taken up, etc.. etc.

Improvements and betterments should also be included under the head of construction, that is, for such portion as the property is improved over the first cost.

One question deserving your consideration is that of taxes, and whether it should be included in the opening expenses or not. I have noticed that the majority of the roads do now include it, while a few deduct it from the net income after operating expenses.

In comparative statements this is an important item, and it would be well to decide this question. Our road deducts taxes after the operating expenses as one of the fixed charges, which I think is correct.

MATERIAL.

Another point we would suggest is to recommend the accounting for material as closely as possible. It is the practice upon many roads to keep no account of material purchased and kept in stock for future use, but to charge all material purchased to expense, whether used at once or not.

It must be perfectly clear to this Convention, that when material is purchased, there is no decrease in the assets of the company, and consequently no expense. There has been simply an exchange of cash for material. The expense does not occur until the material is used.

When we can impress upon our accounting officers the necessity of accounting for material as closely as for the paltry nickel, we shall have advanced one important step in the right direction; and until this is accomplished, our monthly returns will not show us what they are intended to show, *i. e.*, the business done and the expenses incurred during the month.

It is absurd to charge to the expenses of one month all the bills paid in that month, or the bills contracted in that month, when the material covered by the same may have been used long ago, or may be in stock for future use.

Material used represents from 30 to 40 per cent. of the expenses of operation, and yet on the majority of our roads it receives no attention whatever.

I would like to say something concerning the care of material, the method of handling supplies, method of keeping stock accounts, of the care of tools and old material, but fear to take too much of your valuable time upon subjects of minor importance.

UNIT FOR COMPARISON.

It has been suggested that we adopt as a unit for comparison *the car mile*, especially in regard to motive power, and consider the single truck with double motor car as the standard, double truck cars to be equal to two trains of two cars each.

It is difficult to say what should be the unit, whether it should be the car mile, the passenger or neither.

When we consider the vastly different conditions to be contended with on the various roads, in the shape of grades, distances from power house, amount of traffic, etc., we can hardly settle upon any factor for a unit.

It may be decided that the best results for comparison will be found by comparing the percentage which operation bears to gross income.

FUTURE WORK.

I would advise for the continuance of this work that a committee, selected from the accounting officers of roads in this Association, be appointed to prepare a Standard Classification of Expenditures, with blanks for Statistical Reports to be referred to the next annual Convention; the same to be previously circulated among the members of the Association, in order to obtain the fullest possible criticism and examination at the Convention.

Special Paper on "Experiments on the Expansion of Continuous Rails."

BY A. J. MOXHAM.

Gentlemen:—In the matter of track construction to-day, the question of paramount importance is that of the joint. For many years the question has been the rail. As this has received time and attention, one weak spot after another has been eliminated, and so great has been the pruning process that the one weak spot left, "the joint," is only the more glaring from the absence of many of its brothers in misfortune.

Known to be the weakest point in the structure, the question of the joint has had its full share of attention. It is not, perhaps, generally known, but is nevertheless a fact, that the joint of the formerly despised street railway has already distanced its heretofore leader, the steam railroad; certainly in its practical application, if not in its scientific development.

The question of the best joint is not entirely a scientific question. It is also a commercial question, and it ceases to be scientific when it ceases to be commercial; it then becomes "*non est.*" All evil is comparative:

> "The little girl who had a little curl
> Right in the middle of her forehead,
> Who, when she was good, was very, very good.
> And when she was bad was horrid,"

might have been either a little angel or a little devil according to whether the conditions were favorable to her easy control or not. So with the joint. The joint of the steam road can be controlled—it is exposed and therefore accessible; that of the street road cannot; it is practically inaccessible. It has been proposed to overcome this by making it accessible by means of boxes with removable covers. Apart from the objection that this adds to the amount of street taken up by the track, the cost, if properly done, is almost prohibitive. I have been informed by the manager of one of our largest and most progressive street railway systems that, after a careful trial, it was found to be cheaper to take up the paving and tighten the joints once every few months than to pay the interest on the investment of the boxes.

The question of a good joint is embodied in very few words, to wit, "absence of motion;" and it must be absence of motion of the cars as well as of the rails, particularly in the case of electric roads. If two rails be placed in perfect surface and alignment and closely abutted, and so held, the problem is solved. Not only must they be true to surface and line, but they must be abutted. It will not do to leave the usual expansion space. This can be quickly demonstrated by cutting a groove one-quarter of an inch wide in the head of the middle portion of a rail. The surface and alignment are here true, but not abutted. A slight jar can be felt from the first; in a short time it becomes worse, and after continued use, bad and rapid wear, accompanied by a low spot, results. In this case there is no motion of the rails; the evil is resultant from the motion of the cars. This, however, goes without saying, as, of course, the cars are the destructive agency, and it is only emphasized because it is a very prevalent opinion that if the rails as laid to-day could only be held rigidly level, the problem would be solved.

A few words as to the evolution of the joint: Ignoring the old stringer construction, the first leaf was taken from the steam road, at that time far in advance of street railway construction, at least in this country. The girder rail of to-day was in general use abroad some time before it was adopted here; but when adopted here, its advent at once permitted the use of the ordinary splice bars, in which the bevel of the plates fitting between similarly beveled portions of the rail and drawn into place by bolts, provided the joint. So amply strong was this joint considered, that at first it was deemed capable of economy;

the bars and bolts were made light and the bearing surface small. With the horse car it appeared satisfactory. The development of cable roads, however, at once indicated the weakness of the early practice, and the size of the bars and bolts was increased, and much larger bearing surfaces provided, in the shape of channel splice bars. Electricity now appearing showed even this improvement inadequate. It was found that the wear was concentrated at the rail juncture, and a bar that had become useless because of actual wear at this point, showed no wear at the extreme ends. In other words, the wear was indicated by motion at the rail ends, and did not extend to the whole bar. The problem was then attacked on the theory of stopping all motion. In this two points were essential:

First—To hold the rail against motion by means of the fastening bars; to which end it was necessary to

Second—Hold the fastening bars against motion by means of the bolts.

As to the first: Not only were the bars made of great rigidity both vertically and laterally (for both are essential), but they were made to *fit* the rail. If one of our hearers will carefully examine an ordinary splice bar after it is tightened up, he will be somewhat surprised at the result. Taking a thin piece of paper and trying to work it into the fit, he will probably come to the conclusion that he has not more than 50 per cent. of real bearing or fit, as compared with the apparent bearing. No matter whether the track comes from a careful or careless manufacturer, nor how rigid the inspection, the evil will be found; it is only a question of more or less. It is due to the absolute impossibility of making a fit of rolled surfaces when the structure is rigid. A good machinist will tell you that even with the lathe or planer this is a difficult achievement, let alone without. To avoid this, a spring or yield was introduced, and this under conditions demanding rigidity as a sequence. In other words, the springing or yielding portion was in itself of great rigidity, and only made to yield by excessive tightening power. Hence the bearings, while strong and rigid in themselves, were made to spring or yield to a fit when tightened home by bolts large in diameter and many in number; and to secure this, very deep bars of great structural stiffness, which permit of two rows of bolts of large diameter, were devoloped. It must be remembered that this must all be embodied in the joint itself; to make a poor joint and then merely support it, has been proved a total failure.

As to the second point, properly holding the bars: A large number of bolts was the first development, and increased size or diameter followed. A nutlock to prevent slackness has been experimented with. If without spring to take up, not only the slack of the nut, but also the stretch of the bolt, it is useless, and few, if any, exist with these desiderata. A bolt so large in diameter that it will not stretch, and threads well cut and tight fitting, so that the nut is not liable to turn, are to-day the best safeguards. Not only the size, but the location of the bolts, is an important factor. It is the jolt or impact of the car that loosens the nuts. The vibration passes along well defined lines. If the bolts are located in the line of greatest vibration. the nuts will tend to turn more quickly than if located elsewhere. A double row of bolts with the lower row staggered gives excellent results. A single row does not suffice.

Such is the joint of to-day, structurally stiff, heavy enough to take up the jar of the blow without transmitting it all to the nuts, a yielding fit that tends to counteract all motion, and large bolts, carefully located with a view to vibration; in itself good, and as it now stands, to a certain extent, capable of economical use, and far ahead of its brother on the steam road, even of the heaviest construction. But even so *it will not do.* If not, query, "What then?" There is but one answer. *No joint at all.* While apparently a bold suggestion, it is at least worthy of thought and discussion. That the rail can be made continuous by mechanical means we know, but what of expansion and contraction? *We will do without it*; and that we can do so, the sequel, I think, will show.

To the credit of Mr. Philip Noonan, I think, belongs the first practical idea of a continuous rail. His theory, in a nutshell, may be described as gripping the rail at one end and permitting the wave motion or flow induced by passing trains to be, so to speak, rolled out before the train wheels, into a tension device that within certain limits holds what it gets. He provides against danger of rupture by a spring device which limits the strain. He put his ideas to a test, built a considerable stretch of track (some three miles) on the Lynchburg & Durham railroad, at or near Gladys Station, Va., and it to-day is in successful use. Expert investigation and report indorse it in all essential particulars, though it is, perhaps, questionable whether the fastenings he used to make his rail continuous are strong and rigid enough to prohibit all yield. For details, those who care to investigate may be referred to a pamphlet on the subject, that can be obtained by addressing the inventor, at the above named place.

At a glance, the problem of a street railway differs from the steam road in that the former is surrounded by the roadbed, while the latter is, at least to a great extent, exposed. The effect of the surrounding roadbed is twofold:

First—By its great surface friction, it tends to hold the rail against change, stops all wave motion, and

Second—It to some extent modifies the temperature.

The problem was to find a measure of value for both. To this end the following experiment was made:

One rail in a section of track was so connected that it was in reality a continuous rail. One side of the track was taken instead of both, because it was thought the parallelism of the adjacent rail would at once indicate changes that were expected to occur, which, perhaps, other

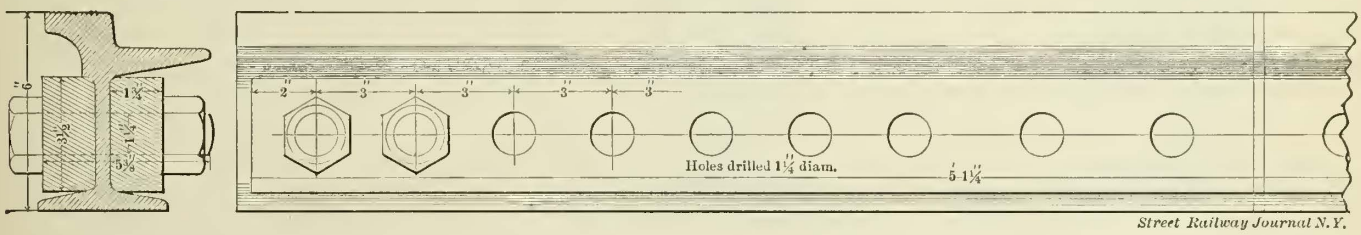

FIG. 1.—SECTION AND HALF SIDE ELEVATION OF JOINT.

measurements might fail to disclose. The length was 1,160 ft., and the profile one that embodied level track, up grade and down grade. As the track was laid and in use, it was determined that it was best to make the rail continuous by a joint rigid and stronger than the rail, so as not to have to remove the whole roadbed. This because the roadbed, which was macadam, had become solidly packed, and represented normal conditions hard to obtain if once disturbed. Remember that when the experiment was made it was thought questionable whether the rail, when prevented from expansion and contraction, could be at all restrained by the roadbed; hence all the restraining power offered was to be retained. At the end of each separate rail the usual one-fourth of an inch had been left for expansion. This was filled by a carefully measured dog, made of the same section as the rail, cut to fill the space tightly, and then driven into place.

Now for the joints: These were to be stronger than the rail itself, and for connection body-bound, machine-turned bolts were decided upon. The two side bars were of steel, 4 × 1¾ ins. thick and 5 ft 4½ ins. long. The body-bound bolts were eighteen in number and 1¼ ins. in diameter. (See Fig. 1.)

As is well known, one of the most difficult things in metal working is to secure a real fit between two surfaces. The usual work of a machine tool—be it lathe, planer or what not—is very far from accurate, as the introduction of template work into a shop soon shows. Out of an ordinary selection of average machinists, it is rare to find one in ten capable of making a real fit, sometimes less. To insure an absolute fit was deemed a necessity. It was done as follows: A number of jigs were made having a hardened steel guide for the drill. With this the bars were drilled in pairs, and as drilled each bar carefully tested by the standard. The holes were drilled one thirty-second of an inch smaller in diameter than ultimately needed. The roadbed surrounding a joint being removed, one bar was clamped to the rail, and the holes (also one thirty-second of an inch small) were drilled through the web, using the bar as a guide. After the temperature of the parts was equalized, the adjoining bar was then adjusted and a rose bit reamer carefully worked through the three holes. As quickly as one hole was completed the gauge was taken, and one of a series of machine bolts (previously turned to a standard slightly large) was accurately turned for

this special hole; and so to completion. The accuracy of the work may be shown by the fact that after reaming if anything interfered with the equalized temperature (as for instance one bar being removed and laid in the shade) during the work, the bolts could be put home. Each bolt was a driving fit. It took twenty-four hours to properly adjust each joint. The track was thus made continuous.

At five points along the line heavy stakes were firmly fixed in the ground, one on each side of the road, in the top of which were set small wire nails. A thin but small cord was tightly stretched from stake to stake, the tops of which were several inches above the top of the rail. Directly underneath this line a mark was made on the head of the rail with a cold chisel. Measurements were taken from the stake to the chisel mark, and from the top of the rail to the tightly stretched cord. Observations were taken at these five points, in the manner indicated, throughout the whole summer.

The work was started on March 19, and finished April 25, 1892. The average temperature during the work was 43.04 degs., the maximum eighty-one degrees and the minimum ten degrees.

The section of rail used in the track is of the girder type, six inches deep, weighing seventy-eight pounds to the yard, and shown in Fig. 1. The rail is fastened to the ties by means of tie plates, and the gauge is preserved by tie rods spaced ten feet apart. The ties are spaced eleven to each thirty feet, and the roadway is excellent macadam.

Anticipating the unknown, provision was made for a possible sudden stoppage of the line by means of portable connecting tracks kept in readiness. In order to further explain whatever might occur, careful preparations were made to read the temperature of the rail at different parts above and below ground during the experiment. As the rail was in use, this was done by a special rail in the adjoining roadbed, and in order that the scope of investigation should be fully complete, the temperature was continuously taken at the head of the rail, at the lower flange of a six inch rail, of a seven inch rail and of a ten inch rail, or its practical equivalent, a ten inch I beam. Simultaneously readings of the temperature were taken as follows:

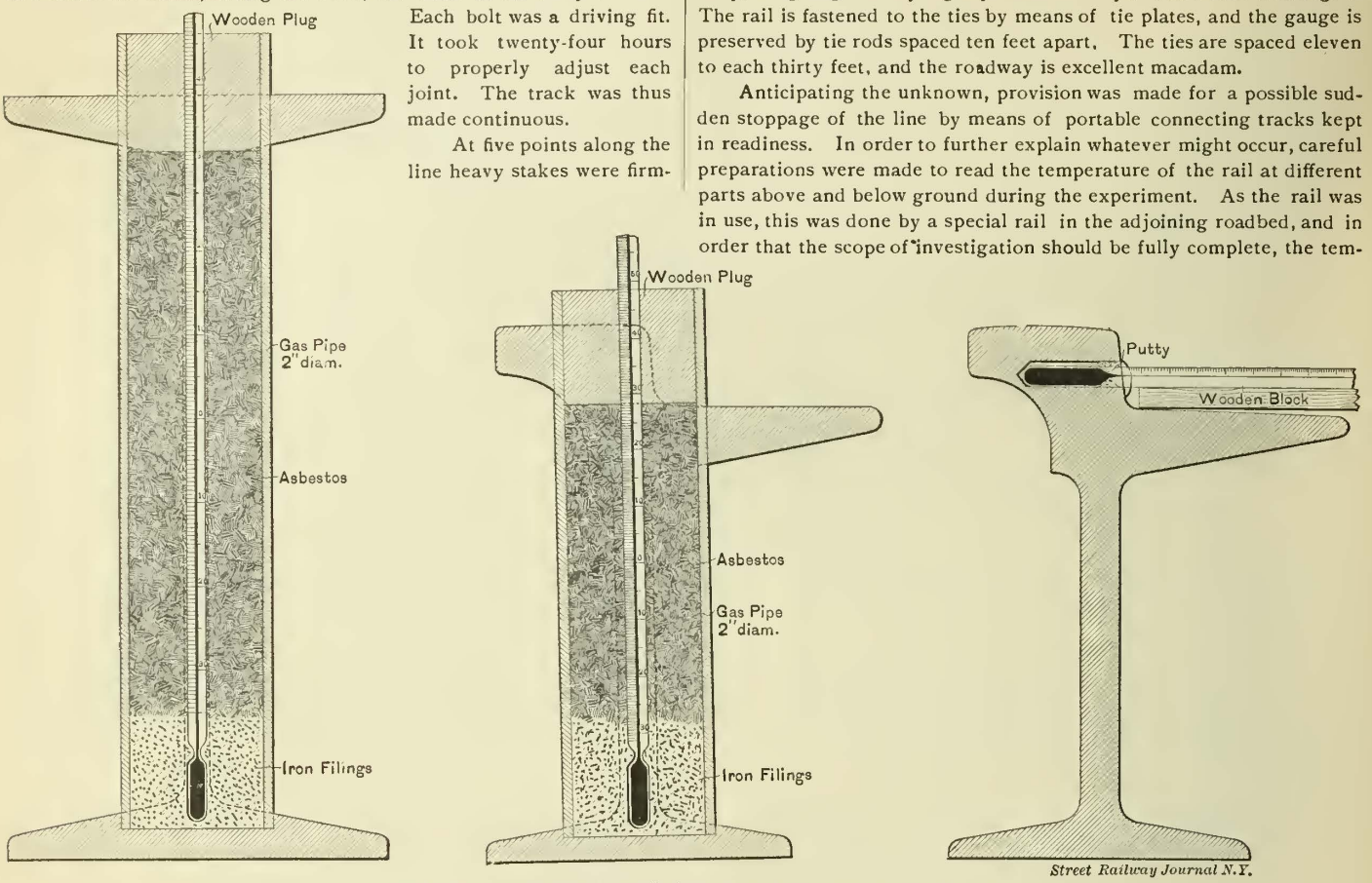

FIG. 2.—METHOD OF DETERMINING TEMPERATURE OF I BEAM AND RAILS.

Air in the shade.
" " " sun.
Roadbed at a depth of seven inches.
" " " " ten "

The apparatus used for the purpose of these readings is fully illustrated in Figs. 2 and 3. Before using the thermometers they were tested for comparative readings by immersing them all in the same bath, which was raised gradually from freezing point to the maximum limit of thermometers; simultaneous readings being taken at intervals of five degrees. It was not found necessary to make any comparative corrections, no difference greater than one-half degree being found. The correction for the stem exposed in the thermometers was in all cases so small, not amounting to more than one quarter degree, that it was neglected. The thermometers were obtained from Queen & Co., and are graduated to one-quarter degree. Fig. 2 shows the arrangement of thermometers for procuring temperature of top and bottom of rails, and explains itself. The rails were imbedded in macadam, and in such a manner as to most closely resemble the conditions found in an actual roadbed. The thermometers were enclosed by a box with sides of wire netting admitting the air freely, and intended only to protect the thermometers from accidental breakage.

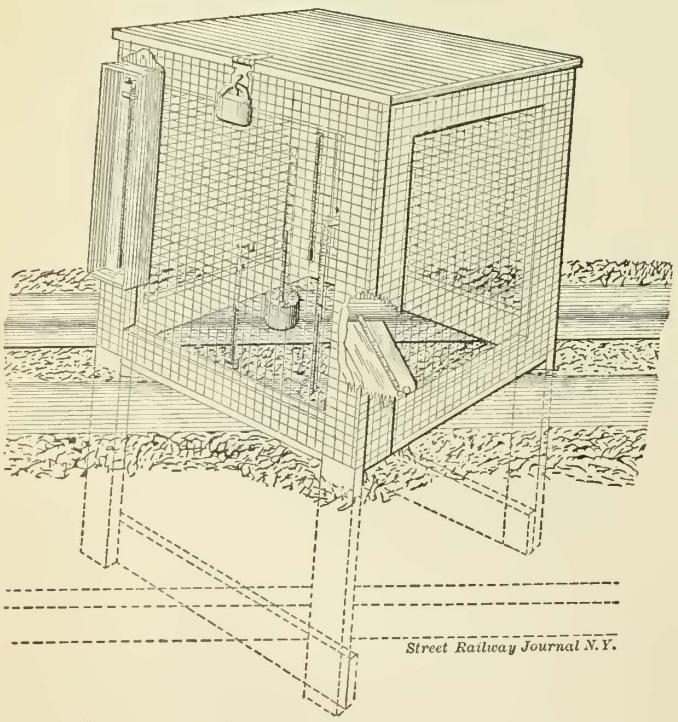

FIG. 3.—BOX FOR PROTECTING THERMOMETERS IN TEMPERATURE TESTS.

During the experiment many thousand readings were taken. Without wearying you with the dry, technical details of their repetition, the writer merely calls attention to the fact that a recapitulation of these readings, in the form of averages, is attached to this paper, and in such shape, that the engineering student to whom they will perhaps appeal, will find food for study. There are eight different comparisons. Speaking very briefly, it may be stated as the result of an analysis of some of these averages:

First—That the roadbed at ten inches depth averaged,

A.—During day readings

At 8 A. M. 1.25° less than air in the shade.
" 12 M. 5.52° " " " " " " "
" 6 P. M. 1.88° " " " " " " and

B.—During night readings

At 6 P. M. 1.93° less than air in the shade.
" 12 P. M. 8.30° more " " " " "
" 6 A. M. 8.09° " " " " " "

as was to be expected, the earth being colder than the air temperature during the day, and warmer during the night.

Second.—That the flange and head of rail, as laid in the roadbed, differed from the air temperature as follows:

A.—During day readings (see table No. 1).

At 8 A. M. Flange 2.36° less than air. Head 3.13° less than air.
" 12 M. " 3.63° " " " " 4.40° " " "
" 6 P. M. " 2.19° more " " " 5.61° more " "

B.—During night readings (see table No. 2).

At 12 P. M. Flange 5.93° more than air. Head 4.00° more than air.
" 6 P. M. " 3.94° " " " " 2.67° " " "

Comparison is always made with air in the shade, because the irregularity of the sun's rays introduces disturbing elements so great as to hide the law. As a factor of correction, if desired, the percentage of difference can be deducted from table No. 3.

This slight analysis of the tables will suffice to prove to the practical railroad man that for all ordinary purposes, the rail may be assumed to be subject to nearly full air temperature, and that the roadbed will not suffice, as has been believed, to keep the rail temperature virtually regular. Steel is a far better heat conductor than earth, and, as the tables show, the whole rail (flange as well as head) closely follows the air temperatures. Readings taken over a long period, night as well as day, every fifteen minutes. With this fact before us one element of doubt has been removed; but it also proves that the heating of the sun in the day, and the cooling of its absence at night, leaves the expansion and contraction most certainly there.

Now for its effects. The experiment has proved absolutely and beyond cavil, that it is restrained and held by the surface friction of the surrounding roadbed. From first to last, from a temperature of twenty-two degrees below freezing point (or ten degrees), to a temperature of eighty-nine degrees above freezing point (or 121 degs.), extending from March to August, there was *absolutely no movement of the track out of place.* Even at the ends was this true; proving that not only will the roadbed hold the track as a complete structure, but that it will do it consecutively. Once bedded, it will hold a rail ten feet or thirty feet, as well as one 1,100 ft. On this point there is no room for error. The expansion in 1,100 ft., if not neutralized, would equal five and one-fourth inches, under the conditions here stated, and five and one-fourth inches would throw the rail out of line fourteen feet, if it were held at the ends and permitted to bow in the center. An expansion of one rail would mean about six inches in thirty feet out of line. The query arises, "What has become of it?" It is existent, and, like all force, it would flow to the point of least resistance. In the case of a street rail, buried in the roadbed, it is reasonable to believe this point is in a minute enlargement and reduction of the sectional area of the rail.

As to its effect upon the steel: Experts teach us that a variation of seven degrees in temperature, if held, would subject the rail to a stress of 1,000 lbs. per square inch. Taking a track laid at the low

TABLE NO. 1.

DAY READINGS.

Variation between Flange, Head of Rail and Air (Thermometer shaded) for 8 A. M., 12 M. and 6 P. M.

Month.	No. of Readings.	Flange of Rail.	Head of Rail.	Air (Shade).
General Average:				
April	57	48.°40	49.°18	49.°97
May	70	62.°76	63.°98	65.°17
June	46	78.°00	78.°95	79.°43
July	72	77.°57	77.°91	79.°54
August	78	75.°17	75.°07	77.°68
September	36	65.°88	65.°38	67.°11
	359	69.°13	70.°09	71.°79
Average at 8 A. M.:				
April	19	42.°07	46.°50	41.°05
May	23	56,°97	52.°78	61.°91
June	17	71.°44	72.°26	74.°17
July	24	68.°07	65.°31	71.°50
August	26	68.°80	69.°38	71.°19
September	12	63.°25	59.°70	53.°33
	121	61.°21	60.°44	63.°57
Average at 12 M.:				
April	20	50.°00	50.°90	54.°20
May	23	64.°78	66.°71	69.°21
June	16	80.°59	82.°03	85.°53
July	24	79.°10	81.°27	83.°89
August	16	79.°44	76.°00	84.°71
September	12	71.°50	72.°25	73.°29
	121	71.°91	71.°14	75.°54
Average at 6 P. M.:				
April	20	52.°70	52.°28	53.°85
May	24	65.°85	65.°81	61.°10
June	14	84.°73	83.°88	78.°84
July	24	81.°79	81.°70	76.°68
August	26	78.°40	79.°57	73.°83
September	12	71.°75	70.°04	68.°04
	120	72.°26	73.°84	69.°45

TABLE NO. 2.

NIGHT READINGS.

Variation between Flange, Head of Rail and Air, for 6 P. M., 12 P. M. and 6 A. M.

Month.	No. of Readings.	Flange of Rail.	Head of Rail.	Air (Shade).
General Average:				
May	37	59.°88	58.°75	56.°07
June	48	73.°76	72.°37	68.°32
July	71	74.°40	72.°93	68.°54
August	75	74.°25	71.°70	68.°41
September	33	65.°76	63.°48	59.°63
	264	70.°74	68.°96	65.°60
Average at 6 A. M.:				
May	12	54.°25	53.°58	49.°79
June	17	67.°41	66.°66	63.°00
July	24	67.°22	66.°08	60.°66
August	25	67.°12	65.°99	62.°54
September	11	59.°27	58.°54	53.°13
	89	64.°50	63.°54	59.°23
Average at 12 P. M.:				
May	13	58.°11	56.°77	54.°88
June	17	71.°97	69.°50	65.°38
July	23	72.°96	71.°30	66.°17
August	25	71.°46	69.°90	66.°14
September	11	63.°86	62.°22	56.°90
	89	69.°15	67.°22	63.°22
Average at 6 P. M.:				
May	12	67.°12	66.°08	63.°62
June	14	83.°64	82.°53	78.°21
July	24	82.°96	81.°35	78.°68
August	25	80.°18	79.°26	76.°18
September	11	72.°31	70.°59	68.°86
	86	78.°69	77.°42	74.°75

TABLE NO. 3.

SIMULTANEOUS RECORDS

of Air Temperature Exposed to the Sun and in the shade.

Month.	No. of Readings.	Air (Shade).	Air (Sun).
General Average:			
August	60	77.°96	82.°00
September	30	65.°40	73.°38
	90	77.°11	79,°15
Average at 9 A. M.:			
August	20	69.°25	105.°45
September	10	59.°50	60.°55
	30	66.°00	90.°48
Average at 12 M.:			
August	20	82.°79	98.°87
September	10	73.°75	93.°85
	30	81.°10	97.°20
Average at 6 P. M.:			
August	20	80.°47	75.°70
September	10	69.°05	66.°30
	30	76.°66	72 °56

temperature of forty degrees and subject to a maximum of 120 degs., or a variation of eighty degrees, the stress is equal to less than 12,000 lbs. per square inch. Much less than the elastic limit, and less than the strain put upon an ordinary bridge, or similar structure. It would therefore appear that the effect on the steel would be harmless.

On the face of it, therefore, there is nothing to prevent us abutting our rails, and this is but the prelude to an absolutely continuous track —*one without joints*—the rails welded by electricity, or otherwise connected one to the other, up to such lengths as may be deemed best.

As to its practical application, many precautions suggest themselves. It must be remembered that a track so laid will be like a huge spring under tension, absolutely safe and harmless when restrained by the roadbed, but ready to spring like a shot from a cannon if, while in this condition, the roadbed be removed. The part of common sense would appear to be to limit the length of a continuous rail to, say, 500 or 1,000 ft., with specially devised expansion joints at these intervals; or, if desirable to take up the paving for repairs on a very short piece, the following would be effective: First remove only a foot of paving, then with a hack saw cut out, say, six inches of rail, thus removing the tension or compression, as may be. This done, the rest of the roadbed could be removed, starting from the cut part of the track, without danger. Be this as it may, it should be borne in mind that chained lightning is not a nice plaything, and therefore a lightning conductor is sometimes handy.

One important saving that would be effected by a "track without joints" would be in the weight of the rail. A rail of 100 lbs. per yard is to-day in use, and next year will be extensively used. Perhaps, without their knowledge, the cause of this has been the street railroad men's dearly bought and sad experience with joints. The joint being defective, the effort has been made to secure such stability of track as to relieve the joints by means of a heavy rail. In a 100 lb. rail there are but thirty pounds of wearing surface, of which not more than eighteen pounds can be used before the rail will have to be thrown out; therefore there will be eighty-two pounds unused. For mere stiffness and rigidity, a sixty-six pound rail, if supported by the proper number of cross ties, will answer every engineering demand, even of electric cars at high speed. Anything over this goes to the debt of "bad joints."

TABLE No. 4.

DAY RECORDS

Of Earth at 7 inches, Air (in shade), and Flange of Rail.

Month.	No. of Readings.	Earth 7′	Flange of Rail.	Air (Shade).
General Average:				
May	10	59.°80	62.°40	65.°40
June	74	73.°74	76.°71	78.°10
July	72	73.°95	77.°57	79.°55
August	18	73.°28	76.°05	76.°72
	174	76.°52	80 °88	82.°57
Average at 8 A. M.:				
May	3	55.°50	56.°50	63.°70
June	26	69.°35	69.°30	71.°67
July	24	69.°14	69.°29	70.°29
August	6	69.°50	67.°66	69.°50
	59	66.°75	68.°45	70.°49
Average at 12 M.:				
May	3	60.°33	65.°00	72.°66
June	25	73.°38	78.°90	84.°78
July	24	72.°79	80.°35	96.°35
August	6	71.°91	76.°83	82.°03
	58	70.°58	76.°84	92.°20
Average at 6 P. M.:				
May	4	62.°62	65.°00	61.°25
June	23	79.°13	83.°30	78.°21
July	24	82.°91	83.°49	79.°06
August	6	76.°66	84.°00	77.°83
	57	86.°50	82.°14	75.°57

TABLE No. 5.

DAY RECORDS

Of Earth at 10 inches, Air (in shade), and Flange of 10 inch I Beam.

Month.	No. of Readings.	Earth 10″	Air (Shade).	Flange of 10″ I Beam.
General Average:				
July	72	72.°59	79.°27	74.°90
August	78	71.°91	76.°42	72.°94
September	33	65.°12	66.°88	65.°12
	183	70.°94	75.°82	72.°84
Average at 9 A. M.:				
July	24	69.°80	76.°93	69.°37
August	26	65.°05	68.°64	69.°88
September	11	63.°18	58.°18	60.°25
	61	66.°57	67.°73	67.°73
Average at 12 M,:				
July	24	72.°04	88.°08	77.°50
August	26	70.°57	72.°74	73.°81
September	11	64.°04	72.°40	65.°37
	61	69.°95	78.°73	73.°92
Average at 6 P. M.:				
July	24	75.°91	78.°77	78.°20
August	26	74.°15	77.°36	80.°76
September	11	68.°13	69.°04	68.°91
	61	74.°08	76.°37	77.°62

Paper on "Is a Standard Rail Head Possible?"

BY JOHN F. OSTROM.

Gentlemen:—Perhaps an apology should be made for not submitting the contents of this paper to your committee on "Standards for Electric Street Railways." That this was not done is due to two causes. First, my attention was not called to the fact that such a committee was at work until within the past six weeks. Second, the last of the statistics to which I shall refer reached me less than a week ago, when I judged that the commitee's work was probably completed and its report made up.

For several years I have been deeply interested in the development of the modern American street railway track. I have seen rail weighfrom thirty to ninety-eight pounds per yard, and varying in height from three inches to nine inches, used for the same kind of traction, without, so far as I could see, any effort being made to standardize either weight or shape. On the same road I have seen eight different sections of girder rail in use, besides a stringer rail and four different sections of guard rail. Surely, I thought, if such statistics as are obtainable were presented to the American Street Railway Association the matter can be taken up and a standard rail, at least for electric traction, adopted. With such statistics it might be possible to submit to the Association a sketch of such a rail; and so, believing that "In a multitude of counsellors there is wisdom," I began by taking the car builders and truck and wheel manufacturers into my confidence. Twenty-two of them answered my letters. Eleven of them said, "Make your standard rail to carry the wheels we make the most of, two and a quarter inches tread and three-quarters inch flange." Six substitued two inches for two and a quarter inches, and said, "The majority of our wheels are made two inches tread and three-quarters inch flange." One truck manufacturer wrote last May; "The street railways generally in the large cities are using a wheel having a two inch tread and a flange not exceeding three-quarters of an inch. This width in tread I regard as altogether too narrow for electric purposes, and consider that it is used by the railway companies in deference to the fact that their horse car rails are not adapted, usually, to a wider tread. If you will permit a suggestion, the tendency of electric railroading, as you are doubtless aware, is to higher speeds than heretofore; and, also, there is a decided tendency to connect towns miles apart by the electric railways. This means, I think, that in the near future long distances will be traveled, largely in the country, and very high speeds will be attained. Consequently, the tendency will be to use broader treads and deeper flanges. I should recommend that your standard rails be adapted to a wheel having a minimum tread of from two and a quarter inches to two and three-eighths inches for city use, and an allowance should be made by which, at least, a seven-eighths inch flange must be used on the rails. We should prefer to put out a wheel having a tread full two and a quarter inches in width, and we put out two inches only because the two and a quarter inches are not suitable in all cases for the old rails which are sometimes used." After receipt of these letters I extended my inquiries and wrote to every street railway company in the United States and Canada, whose address I could learn, asking for particulars as to the kind of road operated, width of tread and depth of flange used, kind of paving in use or in contemplation, legislative or corporation enactment governing

type of rail to be used, and suggestions as to what would constitute a rail that could be used by the majority of the street railroads. When the answers to these letters began to come in both conditions and theories confronted me. Wheel treads vary from one and a half to five inches; flanges from seven-sixteenths to one and a half inches; rail from sixteen pound T to ninety-eight pound girder. One council unanimously requested the road to take up all girder rail and lay T rail instead. Another specified both form of rail and weight (groove girder, seventy-seven pounds), while others specify a rail of a particular manufacturer, a rail with a stated width of wagon tram, etc.

Suggestions as to standard vary as much as conditions. On one point only all seem to agree, and Ohio voices the general sentiment: "Tram rails no account for anything or anywhere."

One road writes: "There should no rail but a T rail be used where the city authorities will allow it." Another: "Plain T every time, under all circumstances of paving and traffic." Another: "There seems to be a popular projudice against T rail for street work, which is exercised wholly without reason; and, so far as the T rail for the very best service goes, there is no chance for argument."

Against these are suggestions for side bearing rail, with various widths of wagon flange and for center bearing and groove girder rails; eighty eight companies, operating 1,083 miles of track, suggest T rail; sixty companies, operating 1,101 miles of track, suggest girder rail; forty-five companies, operating 1,243 miles of track, suggest a section of girder rail deep enough to be spiked direct to tie in paved streets.

One correspondent sums up the subject of a standard rail as follows: "To my mind this would be utterly impossible. There are too many people who think they know more of such matters than any one else."

There was the last straw. I gave up the "search after the unattainable," but would call your attention to a most excellent article on "Rail Sections and Special Construction," by Geo. W. Mansfield, read before the Massachusetts Street Railway Association, and published in the October number of the STREET RAILWAY JOURNAL. It is by all means the best paper I have read on the subject, and except that I would make my lightest section of rail seven inches high, instead of six inches, I cordially endorse all he says as far as it relates to a solid rail. But if a standard rail is unattainable, it is not impossible to adopt such standards of measurements for the head of the rail as will make the six sections suggested by Mr. Mansfield possible.

There are at present, besides the various sections of the rail, over ninety sections of girder rail now on the market, with fifteen different widths of head between one and a half inches and two and a quarter inches. These rails have ten variations in flange room or dip, from seven-eighths to one and three sixteenths of an inch. Should each of these widths of head and depths of flange room be required in each of the four sections of girder rail, Mr. Mansfield suggests we would have 600, and with two widths of wagon flange, 900 girder rail sections to select from.

The adoption of one width for rail head and one depth for flange room would, in my judgment, be the nearest approach that can be made to a standard rail. With these measurements, specifications should be given as to the distance of gauge line from center of web of rail and radius of curve at gauge line. With these points decided, it would be comparatively easy for the railway companies to settle the question of a standard wheel tread and flange. Rails bought from one manufacturer would connect at gauge lines with those of another. The side bearing, groove and T rails suggested in Mr. Mansfield's paper, could be carried in stock by the various manufacturers, and many of the expensive delays incident to new construction during the past years could be thereby avoided.

The necessity for a standard recognized, is it possible to devise one that can be accepted as such? In response to inquiries already referred to, I received replies from 306 roads, operating cars on 4,347.8 miles of track.

Twenty of these roads operate with steam motors over 155 miles of track; twenty-nine with cable motors, over 328 miles; ninety-nine with horses, over 1,117 miles; 198 with electricity, over 2,748 miles; fifty-nine have 625 miles of stringer rail track; 197 have 1,532 miles of T rail track; 146 have 2,190 miles of girder track.

I think you will agree with me that this mileage will justify us in assuming that the above reports may be reasonably taken to represent the condition of the street railway situation of the country to-day.

Two hundred and sixty-four roads reported width of wheel tread on 3,937 miles of track. These varied from one and a half inches to five inches, in fourteen different widths, two inches, two and a quarter inches and two and a half inches being used in the majority of cases; 170 roads, operating 2,942 miles, use two and a quarter inch wheel tread or less; 56 roads, operating 568 miles, use two and a half inches tread.

If these could be combined, and a two and a quarter inch tread wheel substituted, we would have 226 roads, operating 3,510 miles, using one tread wheel, or about 84 per cent. of the reported trackage; 279 roads, operating 4,118 miles, reported twelve different depths of wheel flanges, varying from seven-sixteenths of an inch to one and a half inches, five eighths and three-quarters of an inch being most largely used; 223 roads use three-quarters inch flange or less on 3,581 miles of road; 26 roads use a seven-eighths inch flange on 298 miles of road.

If these could be combined, and a three quarters inch wheel flange adopted, we would have 249 roads using this wheel flange on 3,879 miles of track, or 94 per cent. of the reported trackage.

The adoption of such a wheel flange will be perfectly safe wherever the radius of curve at gauge line of rail is not over a quarter of an inch.

Leaving the general results, let us look for a moment at the statistics of the 198 electric roads, with their sometimes dangerously high speeds, and their 2,748 miles of track; 181 of them reported thirty one different wheels, varying from one and three-quarters inch tread and five-eighths inch flange to three and a half inch tread and one and a quarter inch flange on 2,640 miles of track; 109 of these use a wheel tread two and a quarter inches, or narrower, on 1,870 miles of track; 51 companies use a two and a half inch tread on 512 miles of track. If it were possible, as I believe it is, to combine these, we would have 160 companies using a two and a quarter inch tread on 2,382 miles, or 90 per cent. of the electric mileage reported.

One hundred and forty-six of the electric roads use a three-quarters inch wheel flange and under, on 2,244 miles of road, and 24 roads use a seven-eighths inch flange on 256 miles of track.

By combining these roads, increasing the depth of wheel flanges below three-quarters of an inch to that point, and cutting down the seven-eighths inch flange to three-quarters of an inch, we would have 2,500 miles of track using our standard, or 95 per cent. of reported electric track.

We find, then, that the wheel tread that most nearly approaches the necessities of the street railway world of to-day is a two and a quarter inch tread, and the wheel flange three-quarters of an inch deep. Recognize this fact, and the apparent need is for a rail designed to carry such a wheel. Such a rail should have, in my opinion, a head flat, or nearly so, two and five-sixteenths inches wide, with a curve not over a quarter of an inch on the gauge line corner, with a dip of one inch to the wagon flange in side bearing rails, and one and an eighth inches to the bottom of the groove in groove rails. The width of head and the gauge line curve can be made alike in both T and girder rails. Distance of center line of web to gauge line in the girder rail is five-sixteenths of an inch. My reason for making the groove deeper than the dip in the side bearing rail, is that in the latter both head and flange are subject to wear, while in the groove rail the wear is confined to the head of the rail until the wheel flange strikes the bottom of the groove.

Such a standard rail head I believe to be perfectly feasible. Its adoption by this Association would materially simplify both the track and wheel questions. It would give to manufacturers a clear idea of what street railway requirements are likely to be, and enable them to have such rails as may be desired, ready for next spring's business; and it would be of incalculable benefit in connection with such suggestions as those of Mr. Mansfield, already referred to, in enabling the many new companies to avoid the mistakes of inexperience, and to work with us toward a higher standard of excellence in street railway work.

Events Which Led Up to the Formation of the American Street Railway Association.

BY D. F. LONGSTREET.

Gentlemen:—Complying with a request from your Executive Committee, I have the honor to submit herewith a paper narrating the events which led up to the formation of this Association.

The October number (1891) of the STREET RAILWAY JOURNAL, a copy of which reached me in due course in Denver, contained an editorial under the heading "History of the American Street Railway Association," which contained these words: "Probably the credit of having first conceived the idea of an organization of street railway men belongs to Mr. D. F. Longstreet, while to H. H. Littell, Henry N. Watson, Walter A. Jones, Thomas Lowry and J. E. Rugg great credit is also due for the part they played in its organization."

It was because of reference to this article, in the office of your secretary, the following month, and of the conversation that followed, that I agreed to write up the inside history of the events which led up to, and the methods employed in forming, the Association. It was my intention to have written this for the secretary's files only, and simply that the future historian of the Association might be in possession of the facts, but your Executive Committee having requested me to prepare it in this form, I feel in duty bound to reply.

In order to give a clear idea of the matter, I shall have to go back to my first connection with street railroads, which was in July, 1865. I had then been back from the war about six weeks. I found on my return to Providence, R. I., (I had enlisted there in 1862) that street cars had been started on one route February 22, 1865, and other tracks were being laid by the Union Railroad Co. One of the routes then building was into the section of the city where my home was. I had become accustomed to long hours and exposure. It seemed to me that the life of a conductor would be an agreeable one, and I made the necessary application. On my nineteenth birthday I received notice of my appointment, and three days later commenced work. The pay was $2 per day, and the hours sixteen. I did not mind the hours, and the pay was ample for all my necessities.

I was impressed at once with the utter lack of system and accountability in the conduct of the business. The route was single track and turnouts. There was no system by which we knew when or where to meet cars, and no instructions which would give the right of way, or govern the movement of a car under unusual conditions, which latter it was demonstrated, were quite usual. The result was, that cars were frequently off time, would meet on single track, and after a season of wrangling as to who was right and who was wrong, one or the other would pull back or jump the track. The route upon which I was running was a double fare route; passengers riding beyond a single fare point were requested to pay more. There was no method of telling which had paid through. There was no system of accounting for money received. It was the custom to keep tally with pennies, and at the end of the day to turn in as many fares as you could find tallies. It was said that some of the boys would spend the "tallies" (by mistake) for beer, sandwiches or cigars, and in that way unconsciously reduce their living expenses. Whether this was true or not, they certainly had the credit of being dishonest. I had just passed three years under circumstances which demanded the strictest sort of discipline and accountability, and these things were very annoying to me. I figured out a time table for the boys on the route upon which I was running, in which the passing points were given, and established an understanding as to what each should do under certain circumstances. During that summer we carried, at times, large crowds to a resort which was located beyond the half fare line. As there had been no system provided by which those who had paid through could be distinguished from those who had not, the results were disastrous. It was the custom to use two-penny pieces in tallying for such passengers.

When a car would arrive at the line with seventy-five passengers, for instance, you might find only twenty-five two-penny pieces, and it would puzzle you to pick out those who had not paid.

To remedy this, I cut some little strips of writing paper, and bought me a punch of peculiar design. I punched two clippings out of these strips, and, as fares were collected, would hand one of my crude checks to passengers paying through, and when the line was reached such passengers as did not have these evidences were required to pay again. One thing annoyed me so much that I decided to leave the business as soon as an opportunity should present. It was a common occurrence for a passenger to remark: "How much do you give the company out of this trip?" It was no use "getting mad," it would only make matters worse; there was no way of proving your honesty.

I fully recognized that a young man like myself, with ambition and no capital, was out of place. I would willingly have worked for my board in any business which held out inducements in return for honest and earnest efforts. I did not think this did, and after six months' service made up my mind to leave the business, and had made application for a clerkship in a large establishment in the city. Just at this time I learned that the superintendent was about to appoint a clerk in his office, and I at once made application. I had the advantage of being familiar with the details of the business, and my record at the receiving office and elsewhere was good, and I got the place. This was in February, 1866, and I had been on the road seven months. I had to work long hours in my new position. The road had been in operation a full year, and nothing had been done towards systematizing the office work. It was the construction period, and the superintendent was of necessity on the street much of the time, and false economy had prevented giving him any clerical assistance. I found everything in a state of chaos. It was slow work to go back a year and pick up all the ends and establish a system of reports and accounts which would be useful, but it was suited to my tastes. Things were reduced to a system. Gradually, as the business grew, I got the hours down to twelve for a day's work without reduction of wages, believing we would get more efficient service and better results. The one matter which bothered me most, was how to get a check on the fares collected, not only for financial but for moral reasons. I resorted to such means as changing the runs every week. The conductor who had turned in the most money during the week was put upon the run of the conductor who had turned in the least, and so on. By careful observation of conditions and comparison of results, I would some time determine if a man was dishonest or incompetent, and let him go.

While this and other methods resorted to, was a check which undouhtedly benefited the company, in a degree, yet it did not touch the vital thing, which was, to my mind, a system which would enable the conductor to maintain his honesty before the public.

I believed that, until we got such a system, we should not be able to get honest and competent men, to remain long in our service. I gave a great deal of thought to this matter, and talked to inventors and mechanics whom I happened to know, and, as early as 1869, I presented to the board of directors, with a great deal of pride and satisfaction, a machine which had been designed by a Providence mechanic, by the use of which a record of fares collected could be kept. It was a small, light affair, carried in the hand, and the pressing of a button by the passenger recorded the fare. It was crude, of course, as are all new inventions, but it was on the right track. To my great surprise and astonishment, it met with violent opposition in our board, one member remarking that he would as soon order a placard, "This is a thief," to be placed on a conductor, as to require him to "carry such a thing as that." My reasons and explanations were scouted and frowned upon, and I was not quite certain when I finally got out from the meeting, that I had not fully lost caste with the board for having made such a heinous proposal. However, before leaving I fired this parting shot, "I don't think any member of this board would care to place himself in a position where he could appropriate thousand dollar bills as easily as a conductor can six cents." I was disgusted and dishearted in a degree, but I knew I was right, and in the end it would be shown to be so.

It will be necessary for me to refer to the fact that the Union Railroad Co. was a Sprague corporation (so called), the house of A. & W. Sprague owing a control of the stock. Col. Amasa Sprague was president, and his brother, the Governor, was also a director. Colonel Sprague was largely interested in the breeding and training of trotting stock, and (in 1867) had constructed the finest trotting track in the country. It was located in Cranston, R. I., just outside of the corporate limits of Providence. Something like seventy acres of ground were enclosed, and the grand stand and stables, probably cost to exceed $100,000. Large purses were offered, and it was Colonel Sprague's intention to have all contests over that track conducted "on the square."

Col. Geo. H. Smith of Providence, who was superintendent of the railroad, and whose clerk I was, was appointed by Colonel Sprague as secretary and treasurer of the "Narragansett Park Association." Colonel Smith had been a conductor on a steam railroad all his life, and derived his military title from his connection with the state troops. Neither he nor I knew much of anything about trotting contests. The matter of providing suitable record books, and of reducing the business to a system, was entrusted to me. I collected all the rules to be found, and made a study of the matter, in order that I might know the requirements. For the first year everything moved along very nicely, but at the October meeting (1868) a fraud was perpetrated in the painting and otherwise disguising of a horse, and entering him in a class in which he did not belong. The case was followed up, the guilty parties ascertained, and punished by being ruled off our grounds for all time.

We reasoned, however, that as the country was large, these people could wear out their natural lives in similar frauds before they had exhausted the opportunities which the multitude of courses provided.

A copy of the evidence in the case, and the finding of our association, was forwarded to the turf papers, and to a few of the principal associations in the east. The latter took the matter up and expelled the guilty parties from their grounds.

This suggested unity of action, and I began to talk about an association, national in its scope, in which all members should be governed

by the same rules, and with a governing board which should hear all appeals and render final judgment.

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In due time, February 3, 1870, at New York, an association was formed under the name of "The National Association for the Promotion of the Interests of the American Trotting Turf." By-laws, rules and regulations were adopted. Colonel Sprague was elected president, and Colonel Smith, secretary and treasurer, and the work of organization and systematizing this new business fell to me.

Three months later (May, 1870) I was elected secretary and treasurer of the Union Railroad Co., and treasurer of the Narragansett Association, and when Colonel Smith went to London, Eng., in 1872, as general manager of the Metropolitan Railroad system there, I was elected to all the positions he had filled, in addition to those I already held.

From the formation of these associations up to July, 1874, at which time I resigned from the Narragansett and National Associations, I was remarkably busy. My office in the National Association had taken me frequently to other cities, but I had little or no opportunity to observe matters connected with railroading.

Early in the year 1872, a friend returning from Buffalo, told me of a registering punch he had seen in use by conductors on the street cars there. I had some correspondence, and then went on to Buffalo to inspect its working, and to arrange the terms of a contract. Our board of directors had somewhat changed since the time when the device I had presented to their attention three years before had been so summarily rejected. Upon my return I advised a contract for the punch, and at the same time an increase in the pay of the men, and putting them in full uniform.

All this was agreed to. If I am not mistaken, the Atlantic Avenue, East New York & Greenwood Railroad, now a part of the Richardson system of the roads of Brooklyn, was the first to contract for the punches, and the contract which I signed was the second one, The punches were put on in a small way both at Syracuse and at Albany before they were in Brooklyn, but that was because we agreed it should be so. I was in Albany a few days, and was also in Brooklyn when the punches were first put on, for the purpose of watching results. It was at that time I first met the elder Mr. Richardson who was in charge as lessee, and I have very pleasant recollections of his courteous treatment of me while I was closely watching the developments in Brooklyn.

In October, 1872, just twenty years ago, I got it into my head that "horses had got to go," This was because of experiments I had witnessed with an engine running on naphtha gas and air. A contract was made in January, 1873, with Mr. Geo. B. Brayton, the inventor, in which he agreed to build, and we agreed to pay for, an engine of suitable size and shape for the propelling of a car. An amendment to our charter was obtained by the terms of which, towns and cities were enabled to grant us permission to use any motive power. We had previously been confined to the use of horse power. By numerous experiments, Mr. Brayton convinced me that naphtha was not dangerous if handled under proper conditions; that settled, it seemed to me the rest was easy. We talked of the size and shape of the engine, and finally decided upon an upright four horse power machine. It occupied precisely the same location and space that are commonly taken up for stoves in street cars. There was a water jacket around the cylinder which was cased with hard wood. A condensing coil was put out on the roof, a five gallon can of naphtha was under the seat with an air pump near it which pumped into a tank under the floor of the car. The power was transmitted by gears, and controlled by a lever at each dasher rail, so graduated that a speed from a crawl to fifteen miles an hour was possible. We were very confident, Mr. Brayton and I, that the problem had been solved, and I had already in my mind disposed of all our horses upon favorable terms. When everything was ready we found to our dismay, that four horse power was not sufficient. It would hardly "take up the slack," so to speak. Mr. Brayton thought, after this experiment, that six horse power would do, but I said "if six will do, make it twelve or fifteen and that will surely be enough." The new machine was twelve horse power because we found that was as big a machine as we could get into the space. Again I was confident, and I must say that the early experiments gave very gratifying results. To make a long story short (for the experiments extended over a period of eighteen months), we concluded that in order to get traction for ordinary grades, and to meet the usual and unusual conditions of the track, that the car would have to be very much increased in weight, and that nothing less than forty horse power to a car would give assurance of success. That settled the matter, to my mind if not to my satisfaction. It was not feasible from a commercial standpoint.

There were things which five cents would buy, but this was not one of them. Ten years later, when this same question of self propelled street cars came up, and it was proclaimed that a five horse power electric motor was going to revolutionize the street car business (Bentley-Knight system, Cleveland), I ridiculed the idea.

It is well known that I opposed all electrical schemes. It was not because I knew less, but because I knew more about the practical requirements than those who were promoting these schemes. We all know how the motors have been increased from five horse power to fifty horse power, and it is generally admitted to-day that forty horse power to a car is none too much; and then all these machines can be pushed to nearly double their rated power for a short period. The early teachings about electricity were that, if it took twenty horse power to run one car it would take more than forty horse power to run two cars, and so on in increasing ratio; but that has been shown to be false. The manner in which the power is made and distributed makes the system feasible. As soon as this was demonstrated, I became an enthusiastic believer in electrical propulsion, and two years ago built a road in Denver, and equipped it with cars thirty-eight feet long, which climb along grades of 5 per cent., carrying loads of 40,000 lbs.

But I am getting away ahead of time; I must go back to 1874.

The Sprague failure was in 1873 and the control of the Union Railroad stock fell to the trustee. A radical change in the *personnel* of the board was made, and it was proposed to use the scalping knife in every direction. At one of the first meetings of the new board, it was voted unanimously to reduce the pay of employes to the old standard of $2.00 per day, and it was seriously proposed to abandon the punches.

There had been no discussion of this resolution; it seemed to have been talked by the members before they came to the meeting and I was taken by surprise. It seemed to me to be undoing in a minute what we had been years in accomplishing. I was not then a member of the board, but was its secretary. I hastily drew up a resolution, and asked that it be substituted for the one just passed, and after some discussion it was so voted. The resolution was as follows:

"*Resolved:* In order that we may intelligently consider the expediency of reducing the daily compensation of conductors and drivers, the treasurer be, and he is hereby directed to furnish this board, at its next meeting, a statement of all the facts which should properly enter into the consideration of the matter, together with such notes and remarks as are necessary to an understanding of the subject in all in bearings."

At the next meeting I presented the report called for by the above resolution, and will quote from the concluding portion:

"In connection with this subject, I deem it proper to call your attention to a few facts in connection with the operation of the road, that you may readily discover how important it is to secure faithful and efficient service from conductors, and from that you will also be able to estimate the amount you can afford to pay, to make the position so desirable, and the means of detection so ready and complete, as to stop both the inducement and the opportunity for peculation.

"It is undoubtedly essential to remove both, for, if the inducement exists, the opportunity will offer in a greater or less degree under any system, and if the opportunities are large, the inducements will exist in a majority of cases. Each car transports on an average 130,000 passengers per year and is driven in that time about 19,500 miles. The safe conduct of these passengers, and their good will as well as valuable property of the company, is entrusted to these men. It is therefore of vital importance that the driver should be careful and considerate, and that the conductor should, in addition, be intelligent, gentlemanly, active and attentive. That we do not always secure men possessing these qualifications in the highest degree, is true; but it is also true that we can make a much better selection where the pay is adequate to the service required. The number of passages made over our road last year was 285,000, and, to illustrate the vital importance of honesty, it is only necessary to say that one fare appropriated by each conductor on each passage would amount to the sum of $17,100. The registering punch, which establishes a system of accountability, the need of which was long felt in the business, is of almost incalculable benefit not only to the company, but to the men who use it. Its cost to us does not exceed one and a half cents per passage, and is an insurance, in my judgment, of many times that amount. It furthermore secures to the conductor the means of preserving his character for honesty before the public, without which he might be falsely accused and unduly influenced."

This was written nearly twenty years ago. Figured on the lines of to-day's methods of railroading the results would be much more favorable to the company than are here shown. A full discussion of the matter followed the reading of this report, and it was voted unanimously that it was inexpedient to reduce the compensation. This was a decided victory for the right. These directors were all able business men. Their first impression was that the pay was too much, but when a full statement of the facts was placed before them they saw in a different light. The great obstacle I had to contend with, always, was

that other roads did not pay as much wages, or did not keep up their roadbed and equipment as we did. My argument was that we got the equivalent in a better service which was bringing to us a relatively better business.

I remember that during this and other struggles for good service, even at the expense of dividends for the time being, I many times wished there was a way to get at the whole railway interest of the country, just as I could get at our own board of directors, believing that the entire service of the county could be built up, greatly to the credit and advantage of the companies if they would pursue a liberal policy with employes and the public.

My early experiments were not confined to any branch of the business, but included everything that came along. I could tell of many amusing experiments with car starters, sand boxes, snow scrapers, brakes, boxes, loose wheels, roller bearings and dozens of things. They all cost money. I would gladly have told all my experience to any one interested in the business, and would have been glad to learn the experiences of others.

It may seem strange to you that under all these circumstances I did not make an effort earlier to form this Association. I did make a start for it once. Let me tell you about it. Just at this time when my mind was full of the idea of a national organization, a man by the name of Sayles, representing the Tanner patent brake, made a claim against our company for $30,000, for past use and also an extravagant demand for the right to continue its use. Inasmuch as his claim covered the brake which was in use practically, upon all street cars, it was something which interested every one in the business. Mr. Sayles named over to me many roads which he said settled his claim. I took his papers and promised to look into the matter. Soon after this I heard of an injunction suit which Sayles had brought against a small road in Brooklyn, the "Grand Street & Newtown Railroad Co." I remember that "Tracy, Catlin and Van Cott" were attorneys for the road. General Tracy was counsel. As soon as I heard of this suit, I went to Brooklyn and had an interview with General Tracy. In substance he said he did not think the claim was valid. They had made a good *prima facie* case, but he believed it could be successfully contested. It was a question of expense. It would cost any small company much more to fight than to settle. It seemed to me that here was the golden opportunity for a union of interests, and I undertook to see what could be done to that end. I ascertained that Mr. White, president of the Dry Dock road in New York City, knew much about this case, and I first called upon him. I found out that he had settled the claim so far as his road was concerned, but upon terms which made it cheaper to settle than fight. Mr. White gave me all the information he could, and evinced a spirit of cordiality and fraternity exactly harmonizing with my own feelings. I wish I could say as much of any other New York City railroad man I met, but I can't. I did not call on them all, however; I got very tired. I went to Boston and called upon the president of one of the roads there to see what he thought of forming a combination to pay the expense of making a test case of the Brooklyn injunction suit; suggesting at the same time that it might lead to a permanent organization which would be of great advantage in many ways. This president was a "very busy man." I had never seen him before, but the moment I put my eye on him I could see he was "very busy." He settled my business at the "drop of the hat," and this was about the way he did it:

"Young man, go back to your country hamlet; but first learn that this company will take care of its own affairs, and attend to its own business, and if it shall have any lawsuits on hand it will not call upon you for contributions." The matter was dropped.

This experience taught me that the fraternal spirit was not strong in either New York City or Boston, and I had other experiences which were quite discouraging.

I was personally acquainted (brought about and continued by other than railroad interests) with two gentlemen who were presidents of street railway companies in their respective cities. "Philadelphia," said one of the gentlemen, "is a peculiar city. We operate under different conditions, perhaps, from any other city; our business is governed largely by our 'Board of Presidents.' That is carrying out your idea of association, but is local, and it seems to me it must be so, and that no real good can come from a national organization, as there is not much in common."

The Baltimore gentleman held quite similar views. Even when the convention was called, ten years later, you will notice that not a single company in New York City or Philadelphia was represented, and only two companies out of a possible three dozen or so took any notice whatever of the call, and had the convention been held anywhere else, I know of at least one other city where the apathy would have been nearly as great.

But all this is now over. Everybody now sees the advantages of this organization, and it has been supplemented, strengthened and supported by numerous state organizations all formed on the same lines. The incidents I have mentioned are interesting as a matter of history, and show what little encouragement there was, and why a little diplomacy was finally necessary to bring about the desired result.

In the fall of 1878 I had a very severe sickness, from the effects of which I did not readily rally, and the following summer (1879) by the advice of physicians and friends, dropped all business thoughts and cares, and started for the Northwest, my first and only vacation in fourteen years. My objective point was Duluth, and we went straight there without delay. A month later, leaving the ladies in Duluth, I took a trip to St. Paul and Minneapolis, and then out to the wheat fields of Dakota, the Dalrymple Farms. The only street railways I saw on that trip were at St. Paul and Minneapolis, and I confess I did not seek to become acquainted with the people who were responsible for such an outfit. The cars were bobtails, the drivers went on duty with pants tucked in boots, minus coats, hats ranging from the derby to the sombrero. I thought them, taken as a whole, to be about the toughest lot of humanity I had ever seen bunched together. I learned that they were boarded at the company's expense, and paid about $40 per month. There was an evident lack of any sort of discipline or system. The horses, mules and cars, matched the men. I don't know now when it was that our friend Thomas Lowry took possession of these properties, but I do know that to-day they are among the best equipped and best managed systems in the country.

I first met Mr. Lowry at the Boston convention. I was impressed by his personality more. perhaps, than by any other one man. His energy was inexhaustible, and I could see that, on general principles, which should govern the conduct of the business, there was no difference of opinion between us. On my way back East I stopped in Chicago to see the city and its system of roads. Remembering some of my experiences in cities nearer home, I wondered what my fate would be if I should call upon one of the superintendents. However, as there is something of the spirit of adventure in my makeup, I concluded to try it. The city directory told me where I could find the office of the Superintendent of the West Division road, and, boarding a car, I was soon there. I advanced timidly, and asked if the superintendent was in. Being answered not unkindly in the affirmative, I had the courage to send in my card, upon which was engraved my name and address and a modest reference to my official position. I was received with open arms, as it were, and soon made to "feel at home." I found Mr. Lake to be quite willing to impart any knowledge he had, and ready and quick to pick up and digest anything which was good in the experience of others. I spent the day with him very pleasantly, and to our mutual advantage, so we both agreed. The next day I received the same sort of treatment from Mr. Holmes, of the South Side road.

The fraternal spirit shown by these men was in such strong contrast with the narrow-minded views of Eastern railroad men that I determined to revive the idea of a national organization. I was satisfied that it must apparently originate in the West, where the fraternal spirit was strong. The question was how to draw the East into the scheme, and I did not see at once any feasible way of doing it. "Western ideas" were not at the time popular in the East. It was evident to my mind that the convention must be held in the East. I turned plan after plan over in my mind, certain that I would eventually hit upon the proper one. While this Western trip did me a lot of good, my health was not completely restored, and in the spring of 1881 I went away again, this time to the South. The street railroad business in that section of the country was not then developed, and I saw nothing to indicate that the "South" could be drawn into any organization.

One day during the Summer of 1881 a very pleasant and affable gentleman walked into my office in Providence and introduced himself as H. H. Littell, of Louisville, Ky. He had been spending a season on the Rhode Island shore, as I recollect it, and was on his way home. He could not stop to look about, as he was in a hurry to get away, but said he liked to make the acquaintance of street railway men, and so had run in. The idea of a national association was then firmly fixed in my mind, and I talked with Mr. Littell about it in a general way. He agreed with me that it would be a good thing for every one connected with the business, and I promised to let him know more about it.

Mr. Walter A. Jones, than whom there was no more genial,

earnest and active member of the fraternity, was a close friend of Mr. Rugg, of Boston, and of myself. My affiliations with Boston railroad men at that time were confined to the "Highland" outfit, including Merrill, Rugg, Littell, etc. I mentioned the matter to Jones and Rugg, and they were both enthusiastic over it, especially Mr. Jones, who was quick to see the advantage from the view of a supply man, as well as a railroad man. He urged me to carry the plan out that fall (1882). I was inclined to wait until the Spring of '83. His persistence carried the day. The plan was this: The convention was to be held in Boston. Mr. H. H. Littell was to issue the call from his home in Louisville. The reasons for this were: 1st. Because the location was right, it being about the geographical centre of the region I supposed would send delegates. 2d. I felt we could depend upon Western enthusiasm and support. 3d. Because in my interview with him in Providence Mr. Littell had agreed to co-operate in any plan I would get up.

The whole thing was to be done quickly. No time was to be given to discuss the matter until the convention was reached. It would have been very awkward, and I am afraid very disastrous, to have explained that out of the many roads in Boston, only one could be relied upon to take any part in any plan for such a convention. I agreed to prepare a draft of by-laws and constitution, as a basis for the convention to act upon, and this I did. In order to carry the plan out successfully, some missionary work was necessary, and I suggested that we three, (Jones, Rugg and myself) take a trip West, and talk the matter up. This was done. I wrote the letter calling the convention, before I left Providence on this trip (Mr. Littell has the original now, so he told me six months ago) so that I could show and explain it as we went along. The following is the text of the letter, and a copy was mailed to all street railroad companies throughout the United States and Canada.

LOUISVILLE CITY RAILWAY COMPANY,

Louisville, Ky., November 8, 1882,

Dear Sir:—Permit me to call your attention to a matter which has for some time been considered by a number of street railroad men, viz.: The formation of an association based upon well established principles governing similar organizations, the object of which shall be the promotion and advancement of knowledge, scientific and practibal, in all matters relating to the construction, equipment and management of street railways; the establishment and maintenance of a spirit of fraternity among the members of the association, by social intercourse and fricndly interchange of information and ideas, to the end that the best service may be obtained at the least possible cost.

With this object in view, I have been requested by a number of street railway officials, both in the East and West, to issue this circular, and urge that your company send a representative to a convention to be held in the city of Bostion, on the twelfth day of December, 1882, for the purpose of organizing and adopting a constitution for the government of such an association.

It is expected that most of the prominent street railroad companies in the United States will be represented. Will you be kind enough to notify Mr. J. E. Rugg, supterintendent Highland Street Railway Co., Boston, Mass., at once whether your company will send delegates, in order that adequate accommodations for the convention may be made in advance? As soon as replies are received arrangements will be made, and you will be notified of the location and the hour the convention will meet.

Very respectfully, H. H. Littell,
Supt. Louisville City Railway Co.

The whole plan was an innocent conspiracy, as it were, to get a lot of railroad men together with only a crude idea of what they were coming for, relying upon the combined wisdom of delegates to bring good out of it.

It must not be understood that I wanted to control the convention. My advance work was simply to furnish a form to be afterwards moulded to suit the ideas of the majority. The Boston roads were not at the time a unit. There had been a free fight among the different companies, long continued. The hatchet had been buried, but with the handle up. President Merrill of the Highlands road, agreed to the plan, and to stand behind the invitation to meet in Boston, even if no other Boston road came in. I knew they would be obliged to come in when we tumbled in upon them delegates from all over the country. Mr. Merrill urged Mr. Richards, of the Metropolitan road, to preside at the convention and welcome the delegates, but this he declined to do as late as the Saturday prior to the meeting which was on Tuesday. Mr. Merrill then prepared the statistics for his speech at the opening of the convention.

The plan being fully decided upon, we (Jones, Rugg and myself) started West. Our first stop was at Buffalo, where Messrs. H. M. Watson Spaulding, and Edwards were met. They all heartily approved of the plan.

Next stop was at Cleveland, where Dr. Everett, Robison, Hathaway and others were seen. Then to Chicago, where Lake, Holmes and Wright were posted. From there we went to Louisville and pounced in upon Mr. Littell one fine morning. He was informed of the plan, and presented with the letter he was to sign and issue. He modestly objected to taking the responsibility of issuing such a call, but we assured him it was the only way, that the whole subject had been explained and was understood, and that any delay or consultation would open up the whole subject to talk and explanations which would not be profitable and would consume valuable time, as the season was already far advanced. Every one we saw agreed to do as much missionary work as possible. Mr. Jones agreed to look after New York City, Brooklyn, Albany, Troy, etc., and we came East.

Mr. Littell's letter was issued November 8. Twenty days later Mr. Rugg sent out his letter, and the convention assembled on the 12th of December. In just five weeks from the time the first gun was fired, the national organization had been perfected. I doubt if this speed will be equaled by any similar organization.

One word more and I am done. No one, who was prominent in forming the Association desired anything personal out of it. Mr. Merrill was chairman of the convention simply because Mr. Richards could not be coaxed to become interested in the matter. Mr. Littell was naturally the nominee for president, his name having been attached to the call, but as he was not primarily responsible for that, he cannot be said to have benefited from his own efforts. Personally, I did my full share of work on the organization committee, and would then gladly have let go the helm I had practically held up to this time, feeling sure that a crew would be put on board which would steer the Association away from all shoals and breakers. I reluctantly consented to take a position on the executive committee at the urgent request of many friends who thought I ought to be on board the ship on its first voyage. Not that I was not proud to be associated with such men as comprised the official list, but because I was willing others should reap the honors and credit so long as the Association I had looked forward to for so many years, and which I could see would elevate and benefit the business so much, was now an accomplished fact.

Among the names which should be recorded in this connection, in addition to those hereinbefore referred to, are those of Mr. Cleminshaw, chairman of the Committee on Constitution and By Laws, Mr. Richardson, secretary, and Messrs. Walsh, Goodell, Johnson and Robillard, who together with Messrs. Littell, Lowry, Jones, Merrill, Watson and myself, formed the original Committee on Constitution and By Laws.

Who can compute the value of this organization for the past ten years?

How much money has it saved to individual members?

How much has it contributed in advancing the material interests of the communities which are served by its members?

How much has it benefited the supply companies?

How much the employes?

What an educator it has been!

The street railroad business of to-day is conducted upon lines thought out by intelligent and progressive men, and not, as ten years ago, in the main, by narrow minded, selfish men, who guarded with zealous care as so much individual capital stock anything for good or evil which they had met with in their experience. The question now is, how can the Association be made more useful and beneficial to its members?

PROCEEDINGS

OF THE

ELEVENTH ANNUAL CONVENTION.

Wednesday Morning Session.

The Eleventh Annual Meeting of the American Street Railway Association was convened in the Hall of the Young Men's Christian Association, Cleveland, O., October 19, 1892.

President John G. Holmes, of Pittsburgh, Pa., called for order at 11 o'clock, and introduced Hon. William C. Rose, Mayor of Cleveland.

The Mayor made an interesting address of welcome, which was as follows:

Address of Welcome.

BY MAYOR WM. G. ROSE.

This is one of the most important conventions that ever assembled in this or any other city. You represent all kinds of surface street railways, steam dummies, horse cars, cable and electric. There is no question of a practical nature that more nearly concerns the denizens of large cities than that of rapid transit to and from their places of business or occupation.

You have come together in a friendly spirit of enterprise to exhibit and adopt all the most modern and practical improvements in the various methods of surface transportation.

Cleveland is highly honored by your presence, and in behalf of her citizens, it affords me pleasure to extend to you a cordial greeting, a hearty welcome and the liberties of the city. Being strangers in our city, I deem it my duty to admonish you of the dangers and pitfalls that may beset your paths while here. In all cities the size of Cleveland, there are certain streets that are considered more or less dangerous, especially after nightfall. But we are indebted to a New York paper for the information that danger lurks in some of our most beautiful streets at all hours, both of the day and night. This is a verification of the old saying that a man must go away from home to learn the news.

In the New York *World* of August 15, there is a communication written from this city, two and a half columns in length, which opens with these startling head lines:

"A TROLLEY RIDDEN CITY,"

"CLEVELAND, OHIO, IN THE THRALL OF DEADLY, HIDEOUS WIRES."

"WHERE NEW YORKERS SHOULD GO FOR AN OBJECT LESSON."

"THE SECOND MOST BEAUTIFUL STREET IN THE CITY PRACTICALLY ABANDONED TO THE ELECTRIC JUGGERNAUTS."

"EXTRAORDINARY RULING OF THE COURT AGAINST THE PEOPLE."

"HUMAN LIFE AND VALUABLE PROPERTY SACRIFICED."

I have only time to read one or two extracts. The writer says:

"Prospect, from one of the finest residence streets in the country, had been transformed into a street where life was almost a burden. The electric cars, with their horrible uproar, were tearing up and down it at all hours of the day and night and at intervals of less than a minute. The charged rail was continually knocking horses high into the air and sending them sprawling to the ground. Driven mad by the electric shock and terrified by the electric motor with its indescribably horrible uproar, the crazed animals tore through the streets strewing the roadway with wrecks of carriages and with thrown riders. Women, children and men were constantly knocked down by the cars. Many of these accidents were fatal."

The mind shrinks back appalled at the contemplation of such a scene. Beautiful and peaceful Prospect Street, strewn with dead and mangled bodies, like the path of the noble six hundred at the charge of Balaklava! Think of it! Vehicles, frenzied horses, gentle women, tender children and stalwart men, all involved in the common ruin! Horses knocked high in the air! You may search in vain for a man, woman or child who ever saw one of these horses, that was knocked so high in the air, come down again. Where have they gone? Perhaps beyond the reach of the earth's attraction and they may be still soaring through space, their red nostrils widely distended, their flaming tails steaming in the blue ether, like Encke's comet. What a picture Prospect Street, as portrayed by this writer, would be for the brush of a Raphael, a Reubens or a Michael Angelo! It must be stopped. Such a state of affairs, if allowed to continue, would soon enrich the undertakers and drive every accident insurance company into bankruptcy.

Let us read a little further: "The East Cleveland company, three of whose four branch lines concentrate in Prospect Street between Case Avenue and Erie Street, has just got its charter so widened as to permit the carrying of freight as well as passengers. It is the plan of the company to extend its lines eastward to Painesville, a distance of thirty miles. When this is done the company will run regular freight trains bringing into the City country produce and even heavier wares. With the passenger cars already running at intervals of less than a minute each way it can be faintly imagined what the once beautiful Prospect Street will be when to this traffic are added numerous heavy rumbling freight trains."

Now, throwing aside all jokes, this correspondent is a clever writer and the greater portion of his article is well written and truthful; but his statements, as to the carnage and devastation on Prospect Street, and as to the rumbling freight trains that are soon to appear on the East Cleveland company's lines, are unwarranted exaggerations. The writer must either be gifted with an imagination that would rob Munchausen of his laurels, or he has been imposed upon by some disgruntled old moss back who is opposed to all modern improvements. No grant has been given to the East Cleveland company to run freight trains on any of its lines within the City limits, and I have ridden on the trolley cars of that company on Prospect Street three or four times, nearly every day for a year and a half, and I have not yet seen a man, woman, child or horse killed or injured by the trolley wires. I have heard of several horses being killed, in various parts of the city, by the breaking of the trolley feed wires, and I have also heard of a number of persons who have been killed or injured by the electric light wires, traceable in every case to faulty construction, but I do not now remember a single instance where a human life has been lost by reason of the trolley wires.

It is true that accidents often happen and a good many persons have been killed or injured by the rapid running of the motors, but not more, perhaps, in proportion to the amount of travel, than occur by the steam railroads or by any other method of rapid transit. Many of these accidents could be prevented by placing proper guards over the wheels and by proper care on the part of the motormen, by slowing up and ringing bells at all crossings. Another fruitful source of accidents is the employment by the company of "green" men to run motors. No man should be placed in charge of a motor until he has passed an examination by an experienced electric motor engineer and has been licensed the same as locomotive and stationary engineers. Laws should be passed compelling the companies to adopt such regulations.

I am opposed on general principles to overhead wires; they are often an obstruction to the effective working of the fire department; they are unsightly and more or less dangerous, and as soon as possible they should all be placed in conduits underground. But no practical method has yet been devised for running motors by underground wires, and until that time arrives I would rather bear the ills we have than to go back to the barbarous system of horse cars. If it were put to a vote to-day in the city of Cleveland, there would be twenty to one in favor of the electric or cable system. The noise of electric cars on residence streets is a great annoyance, but it can be overcome in a great measure by improved methods of gearing.

The use of electricity as a motive power is yet in its infancy, and it is only a question of time when all these desirable improvements will be accomplished. It is less than five years since the first electric street railway was put in operation in the United States. You will find in the *Forum* of September, 1891, a very able article on this subject from the pen of Frank J. Sprague.

He says, that "there were, then in operation and under contract, in the United States, Europe, Australia and Japan, not less than 350 electric street railways, using more than 4,000 cars and 7,000 motors with 2,600 miles of track and a daily mileage of nearly 500,000 miles and carrying nearly a billion passengers annually."

This was over one year ago, and the tabulated statement contained in the *Electrical Industries* of October, 1892, shows that on the 15th of September last, just one year later, there were in the United States alone 469 electric roads with 5,446 miles of track, using 7,769 motor cars and 3,790 trail cars. If these statements are both correct, wonderful progress has been made in the construction of electric railways during the past year.

There are now in operation in Cleveland about fifty miles of double track electric street railways and sixteen miles more of double track in process of construction, which, when completed, will make a total of 132 miles of track using the trolley system. We have also one of the best constructed cable roads in the country operating eleven miles of double track. This road is splendidly equipped with all the most modern improvements known to the cable system. Including horse car lines, there are altogether about 175 miles of street car tracks in Cleveland.

It is gratifying for me to know that I am not addressing a convention of fossils. No fossil ever succeeded in anything except to leave the marks of its lineage on the rocks or in the crust of the earth. I doubt if it would be possible to get together a body of men more representative of the "push" and "pull" of American life than those I see before me. Coming from the different cities of the country, you embody in your collective capacity, a system which has evoluted from small and crude beginnings into 1,500 street railway companies. You are fast taking harness off horses and putting it on lightning and steam. The words "grip" and "wire pulling" have received from you a new and enlarged meaning. You propose to divide the use of the streets with the people, but you take your half out of the center. You ask a right of way through the principal thoroughfares, and when it is granted, the right to keep out of your way is the only valuable right that remains. Knowing your tendency to absorb everything in sight, rails are laid down to keep you where you belong.

The longing for a future life has always been regarded as a strong proof of the immortality of the human soul; but corporations have no souls, and therefore their strong desire for continued existence would seem to disprove this theory. Eternity itself seems too short for some of them. There was a time when a shrewd man was spoken of as being "as sharp as a Philadelphia lawyer," but now they say "as sharp as a street railway grabber." You often obtain franchises, as in this city, worth millions of dollars, without paying for them one penny into the cities' coffers. But who is most to blame for it? The municipal legislature. And who is to blame for the municipal legislature? The people who elected it.

In Ohio you have appealed to Cæsar. A bill is now pending in the legislature of this state to extend, for a mere nominal percentage of the gross receipts, all street railway franchises for a period of ninety-nine years. Gentlemen, this is a mistake. You are asking too much. The legislature that will enact such a law will be doomed to eternal infamy. If you persist in such demands, the time will soon come when municipalties will own and operate all street railways the same as they now own and operate water works, and in some places gas plants.

Nothing could be more appropriate than your selection of Cleveland as the place for holding this national convention. It is another evidence of your shrewdness, because while here you can leave your orders for everything necessary for the equipment of your various roads and possibly they may be filled before you reach home. In speaking of the prosperity of Cleveland, I will make no invidious comparisons between this and other cities. We should all rejoice at the growth and prosperity of any and every city in this broad land, whether East or West, North or South. I take no stock in a man who is jealous of the growth of any city that is protected by the Stars and Stripes. We are one country with one flag and one destiny, and what-

ever benefits one section or one city adds to the general prosperity of the whole. A man who is so small that he can see nothing good outside of his own city or his own folks is not big enough to be called an American citizen. The marvelous growth and prosperity of American cities, along the sea coast, the great lakes and rivers and in the interior is without a parallel in the history of the world, and every man who loves our free institutions should be proud of every one of them. Cleveland is a growing city and the growth is solid and substantial. The true way to judge of the prosperity of a city is by the growth of its industries, the increasing volume of its business and the number of its buildings and permanent improvements.

The books of our building inspector will show that in the past four years there were erected in this city 11,000 new buildings and 5,000 new additions at a total estimated cost of over $21,000,000. This would be an average of about 2,700 new buildings every year. The Census of 1890 will show that during the decade between 1880 and 1890, we increased over 100,000 in population. During the same decade we added 1,010 new manufacturing establishments to the number we had in 1880, so that we now have 2,065. In 1890 these factories gave employment to 47.000 adult males, and 5,000 adult females, making a total of 52,000 hands. There was paid to them in 1890, over $30,000,000 in wages alone. The cost of the raw material necessary to run these factories in 1890, was over $56,000,000, and the value of the manufactured products in the same year amounted to nearly $100,000,000. These facts and figures as to our industrial growth are official. You will find them in the address of General Porter, superintendent of Census, recently delivered in this city. It was published in pamphlet form for free distribution by the Board of Industry, and I hope each one of you will receive a copy before leaving our city,

In that address he sums up the growth of Cleveland in the following language :

"In ten years you have doubled the number of your establishments and the value of the products. You have nearly trebled the capital invested in manufactures, multiplied the total number employed two and a half times, and you are paying out annually in wages more than three times as much as you did in 1880."

He also says "that Cleveland is the largest ship building port in the United States, and the largest in the world, except Clyde, in Scotland." He also adds : "These are cold, clear, official statements of facts."

Few, if any, cities in the world can present such a record of growth and prosperity. The manufactories in Cleveland are, perhaps, more diversified than those of any other city in the world. These 2,065 industrial establishments manufacture nearly every kind and variety of articles in the shape of iron, steel, brass, copper, wood and rubber that can be found anywhere in the markets of the world, or of which the mind of man can conceive.

This brief review must suffice. We might exhaust ourselves in trying to exhaust this subject. I will now commit you to the tender mercies and generous hospitalities of the street railway magnates of Cleveland. I need not tender them the liberties of the city; they have taken them already, and will share them with you. Like yourselves, they are great "hustlers." They will doubtless keep you on the move and afford you every opportunity to enjoy the varied social and business life of Cleveland. If anything should be wanting to make your stay pleasant and agreeable, they know how to appropriate it. I trust that your convention will be of profit to yourselves and to the public in whose service you are enlisted.

The address of welcome of the Mayor was received with applause, and was followed by the address of President John G. Holmes, given on page 635.

The next business was the report of the Executive Committee.

Report of the Executive Committee.

Your Executive Committee respectfully submits the following report :

MEMBERSHIP.

At the opening of the meeting in the city of Pittsburgh the membership numbered 184 companies.

At that meeting, and during the year, the following companies have become members, being arranged in alphabetical order :

Akron, O.—Akron Street Railway Co.
Allentown, Pa.—Allentown & Bethlehem Rapid Transit Co.
Amsterdam, N. Y.—Amsterdam Street Railroad Co.
Birmingham, Ala.—Birmingham Electric Street Railway Co.
Boston, Mass.—Boston & Revere Electric Street Railway Co.
Bristol, Tenn.—Bristol Belt Line Railway Co.
Carbondale, Pa.—Carbondale Traction Co.
Colorado Springs, Colo.—Colorado Springs Rapid Transit Railway Co.
Denver, Colo.—West End Street Railroad Co.
Detroit, Mich.—Wyandotte & Detroit River Railway Co.
Fort Wayne, Ind.—Fort Wayne Street Railway Co.
Haverhill, Mass.—Haverhill & Groveland Street Railway Co.
Hazleton, Pa.—Lehigh Traction Co.
Johnstown, Pa.—Johnstown Passenger Railway Co.
Mansfield, O.—Citizens' Electric Railway, Light & Power Co.
McKeesport, Pa.—McKeesport & Reynoldton Passenger Railway Co.
Nashua, N. H.—Nashua Street Railway Co.
Newark, N. J.—Newark & South Orange Horse Railroad Co.
Norwich, Conn.—Norwich Street Railway Co.
Oil City, Pa.—Oil City Street Railway Co.
Paterson, N. J.—Paterson Central Electric Railway Co.
Pawtucket, R. I.—Pawtucket Street Railway Co.
Petersburg, Va.—Petersburg & Asylum Railroad Co.
Portland, Ore.—Metropolitan Electric Railway Co.
Pottsville, Pa.—Schuylkill Electric Railway Co.
Scranton, Pa.—Scranton Street Railway Co.
Springfield, O.—Springfield Electric Railway Co.
Steelton, Pa.—Middletown, Highspire & Steelton Street Railway Co.
Syracuse, N. Y.—Syracuse Consolidated Street Railway Co.
Vincennes, Ind.—Vincennes Citizens' Street Railway Co.
Yonkers, N. Y.—Yonkers Street Railroad Co.
Youngstown, O.—Youngstown Street Railway Co.

The following change by consolidation has taken place :

Portland, Ore.—The City & Suburban Railway Co., in place of the Willamette Bridge Railway Co. and the Transcontinental Street Railway Co., the former company having been a member.

The following companies, now being controlled and operated by member companies, have withdrawn :

Passaic, N. J.—Passaic, Garfield & Clifton Street Railway Co.
Philadelphia, Pa.—The Thirteenth & Fifteenth Streets Passenger Railway Co.
Port Huron, Mich.—City Electric Railway Co.

The following changes of names of members have taken place :

Baltimore, Md.—City & Suburban Railway Co. in place of the Baltimore Union Passenger Railway Co.
Davenport, Ia.—Davenport & Rock Island Railway Co. in place of the Davenport Central Railway Co.
Detroit, Mich.—The Fort Wayne & Belle Isle Railway Co. in place of the Fort Wayne & Elmwood Railway Co.
Easton, Pa.—Easton Transit Co. in place of the Easton, South Easton & West End Passenger Co.
Little Rock, Ark.—The City Electric Railway Co. in place of the Capital Street Railway Co.
Lowell, Mass.—The Lowell & Suburban Railway Co. in place of the Lowell Horse Railroad Co.
New York City.—Union Railway Co. in place of the Harlem Bridge, Morrisania & Fordham Railway Co.
West Superior, Wis.—Superior Rapid Transit Co. in place of the Douglas County Street Railway Co.
Wilkes-Barre, Pa.—Wilkes-Barre & Wyoming Valley Traction Co. in place of Wilkes-Barre & Kingston Passenger Railway Co.

The following members have withdrawn :

Cedar Rapids, Ia.—Cedar Rapids & Marion Railway Co,
Galesburg, Ill.—College City Street Railway Co.
Harrisburgh, Pa.—Harrisburgh City Passenger Railway Co.
LaFayette, Ind.—LaFayette Street Railway Co.
Newton, Mass.—Newton Street Railway Co.
Sioux City, Ia.—Riverside Park Railway Co.

As a result of these changes, the membership is now 206 companies, being a net increase of twenty-two companies since the opening of the session of 1891.

MINUTES OF EXECUTIVE COMMITTEE.

Inasmuch as it was impossible for the Executive Committee to meet directly following the last meeting of the Association, it was decided to hold a meeting of the Committee in the city of Cleveland. This was arranged for, and the minutes of that meeting form a part of this report, as follows :

Minutes of special meeting of the Executive Committee, held at the Hotel Hollenden, Cleveland, O., on Wednesday, February 10, 1892. at twelve o'clock, noon.

There were present, the president, Mr. John G. Holmes, and Messrs. McLean, Lang, Watson, Perrine, Bean, Penington and the secretary.

The president announced that he had made the following appointments in accordance with the authority conferred on him by the Association at the annual meeting at Pittsburgh :

Standards for electric street railways : Thomson-Houston, O. T. Crosby, president Union Belt Line Railway Co., Utica, N. Y.; accountant, H. I. Bettis, assistant treasurer Atlanta Consolidated Street Railroad Co., Atlanta, Ga.; Electrician and Short, E. E. Higgins, general manager Short Electric Railway Co., Cleveland, O.; Mechanic and Short, C. W. Wason, general manager East Cleveland Railroad Co., Cleveland, O.; Westinghouse, R. W. Rippetoe, president Terre Haute Street Railway Co., Terre Haute, Ind.

Power house engines : T. W. Wrenne, president United Electric Railway, Nashville, Tenn.; L. H. McIntire, engineer Union Railway, New York ; F. S. Pearson, chief engineer West End Street Railway Co., Boston, Mass.

Relative cost of operation of horse, cable and electric roads : Wm. McC. Ramsey, electrical superintendent Federal Street & Pleasant Valley Passenger Railway Co., Pittsburgh, Pa.; F. R. Greene, secretary Chicago City Railway Co., Chicago, Ill.; John L. Heins, superintendent Brooklyn City & Newtown Railroad Co., Brooklyn, N. Y.

The question of subjects for reports of special committees was next considered.

On motion of Mr. Watson, the following subject was designated : "A Perfect Overhead Electric Construction."

On motion of Mr. McLean, the following subject was named : "Indemnity Insurance for Street Railways."

On motion of Mr. Bean, the following subject was selected : "A Model Electric Street Railway Roadbed and Underground Wiring."

On motion of Mr. Watson, the following subject was named ; "Economy of Machine Shops for Electric Railways."

The Committee then took a recess until six o'clock.

The Committee reconvened at six o'clock.

The secretary stated that Mr. Allen R. Foote, special United States census agent for the investigation of the electrical industry, had been in correspondence with him as to the formulation of a schedule for obtaining a uniform system of accounts, in accordance with resolutions which were adopted at the last annual meeting.

Mr. Perrine moved that a special committee, consisting of Messrs. McLean, Watson, Bettis and Warren be appointed to prepare a form for obtaining electrical statistics from the street railway companies of the United States for the Census Bureau, and that they submit the same to the Executive Committee. Carried.

The letter of Mr. J. H. Bickford, chief engineer of the Naumkeag Street Railway Co., of Salem, Mass., in regard to the formation of an engineers' auxiliary of the American Street Railway Association, and referred to the Executive Committee, was read.

Mr. Lang moved that it is the judgment of the Committee, after having duly considered the question of the formation of an auxiliary association of engineers, that it would be unwise to form such an association at present. Carried.

A recess was taken until ten o'clock Thursday morning.

Thursday: The Committee met at the time named.

The question of the selection of a place for the twelfth annnal meeting was considered.

Mr. Penington moved that Mr. H. C. Payne, vice-president of the Milwaukee Street Railway Co., be corresponded with by the secretary in regard to the selection of Milwaukee as the place for holding the twelfth annual meeting, and that the correspondence be submitted to the Executive Committee.

A personal letter from Mr. D. F. Longstreet, of Denver, Colo., to the secretary, sketching the ante-natal history of the Association, was read.

Mr. Watson moved that Mr. Longstreet be requested to prepare a history of the events which led up to the formation of the American Street Railway Association, and present the same at the next annual meeting. Carried.

On motion, adjourned.

WM. J. RICHARDSON, Secretary.

SPECIAL REPORTS.

It will be seen that it was the judgment of your committee that electricity, having come to stay, should be considered carefully and largely at this meeting; and we, therefore, provided for the preparation of reports on a number of subjects of vital interest to the members of the Association in regard to electrical construction, equipment and operation.

The subjects were selected with great care, and assigned to gentlemen in every way competent to treat them understandingly and profitably. It is the desire of the committee that all the subjects shall be thoroughly discussed in order that the fullest and best information relating to the operation of street railways by electrical power may be obtained by all present.

The special papers noticed to be read will also be found to be of unusual interest, and will, doubtless, receive their well merited share of discussion.

ADVANCE COPIES.

The decision of the Association, at its last meeting, authorized the printing of advanced copies of special committee reports, and the distribution of the same among the member companies. Only two reports were received in time to be printed and distributed before this meeting. Since then four reports have been received in time to be printed and distributed at the outset of the meeting; but not in time, of course, to be carefully read and digested before being read to the Convention.

This being the first time in the history of the Association that advance copies have been prepared, it was thought that it would be almost impossible to have all the reports distributed in advance of the meeting. We trust that hereafter all the reports will be received in time to be sent out in advance of the annual meetings.

STREET RAILWAY LAW.

The following judicial decisions have been issued during the past year, and constitute parts of Volumes VIII and IX of "Street Railway Law."

1891.

November—Fenton *vs.* Second Avenue Railroad Co.

December—O'Connell *vs.* St. Louis Cable & Western Railway Co.

1892.

January—O'Neill *vs.* Dry Dock, East Broadway & Battery Railroad Co.

February—Wynne *vs.* Central Park, North & East River Railroad Co.

March—Alexander *vs.* Rochester City & Brighton Railroad Co.

April—The People, *ex rel.*, the Union Trust Co. *vs.* Michael Coleman *et al.*

May—The Mayor of the City of New York, *et al.*, *vs.* Dry Dock, East Broadway & Battery Railroad Co.

June—De Lesdernier *vs.* Houston City Street Railway Co.

July—Keller *vs.* Hestonville, Mantua & Fairmount Passenger Railroad Co.

August—Sheets *vs.* Connolly Street Railway Co.

September—Heffron *vs.* Detroit City Railway Co.

October—Ehrisman *vs.* East Harrisburgh City Passenger Railway Co.

AMERICAN STREET RAILWAY DECISIONS.

The editors of the work entitled "American Street Railway Decisions" have nearly finished the preparation of their manuscript for the work, and promise the speedy completion of the entire publication. Copy is in the hands of the printers, two volumes are promised to be issued by the close of the year, and the remaining volumes as soon as practicable thereafter.

THE TECHNICAL PRESS.

We take occasion to express our earnest appreciation of the hearty expressions of good will and manifest interest in the welfare of the Association that have been made from time to time during the year by the street railway and electrical press of the country.

THE NEXT REGULAR MEETING.

In conformity with the action of the Association at its last annual meeting, which empowered the Executive Committee to select the place for the next annual session, the Association having been very cordially invited by the city of Milwaukee, and satisfactory arrangements having been made through Mr. H. C. Payne, general manager of the Milwaukee Street Railway Co., your Committee has selected that city as the place for holding the meeting of the Association in 1893. Its nearness to Chicago makes Milwaukee an especially desirable city in which to hold our convention, because of the advantage it offers to delegates by making it possible for them to attend both the World's Fair and the meeting of the Association on the same trip.

PROPOSED AMENDMENTS TO BY-LAWS.

Based upon a motion adopted at the last annual meeting, referring the selection of the place of meeting to the Executive Committee, the following resolution relative to the amendment of Article VII of the by- laws is submitted:

Resolved: That Article VIII of the by-laws be amended by the insertion of the words "by the Executive Committee," immediately following the word "designated" on the third line as printed.

When the third week in the month of October was chosen as the time for holding the annual meeting of the Association, we believe those who made the choice of that time of the year builded better than they knew; for during the ten meetings already held in all parts of the country, covering usually three days, the weather, both as to temperature and humidity, has been delightful with but two exceptions; one being when the weather was rather too cool for comfort, and the other when rain disturbed the convention for one session only.

This year, by reason of the inaugural exercises of the World's Fair in the city of Chicago occurring during the same week of the meeting of this Association, the question of changing the time of meeting was seriously considered by the Executive Committee. It was decided, however, after careful consideration, that it would be unwise to change the date of meeting, a prominent reason being that it would require a special meeting of the Association for the purpose. In order that the Executive Committee may hereafter have power to change the date of meeting, in case sufficient reason should in its judgment arise, the following resolution is offered for adoption:

Resolved: That Article VII. of the by-laws be amended by the addition to the first sentence of the following words "unless otherwise ordered by the Executive Committee."

OBITUARY.

Your Committee is called upon to record the death of the presidents of two member companies during the Associational year.

Lewis Lyon died in the city of New York, October 29, 1891, of heart failure, after a short confinement to his home. He was the president of the Third Avenue Railroad Co., of New York City, for the last thirteen years, and was known as the pioneer cable railway man in that city, having been instrumental in introducing cable traction there. He was faithful to the great business interests devolving upon him, and his friends were warmly attached to him.

John H. Bonn was president of the North Hudson County Railway Co., of Hoboken, New Jersey, at the time of his death from apoplexy, November 16, 1891. He conceived the idea of developing the street railway traffic of Hoboken, and was for many years president of the company organized by him. He left the property in a most flourishing condition. His was a genial nature. He was beloved by all who knew him intimately, and highly esteemed in the community in which he lived so long.

Again we are called upon to mourn the loss of an ex-president of the Association. Calvin A. Richards departed this life February 15, 1892, after a brief illness, the result of an attack of the grip. He was for many years president of the Metropolitan Railroad Co., of Boston, and for a short time general manager of the West End Street Railway Co. He was president of this Association for the year 1884-'85. We shall miss his joyous presence at our annual gatherings which he was always anxious to attend.

OUR BUSINESS FUTURE.

The outlook for business was never better. With scarcely an exception, the pleasant and harmonious relations between the employes and the managers in the street railway business in America have been undisturbed. The community of interest of both parties has been fully appreciated; and with the desire to work together harmoniously, with the purpose of furthering the best interests of the companies with which we are connected but little friction has developed. May this state of affairs long continue! The financial outlook is the best. With peace at home and abroad, the people prosperous and happy, with the best country in the world, we look forward to the future with the brightest hope. Respectfully submitted,

JOHN. G. HOLMES,
THOMAS H. MCLEAN,
ALBION E. LANG,
H. M. WATSON
LEWIS PERRINE, JR.
W. WORTH BEAN,
W. J. RICHARDSON, Secretary.

The treasurer's report was then read, a summary of which is as follows :

SUMMARY OF TREASURER'S REPORT.

RECEIPTS.

Balance	$1,742.06
33 admissions	825.00
1 anuual dues, 1888–89	25.00
1 annual dues, 1889–90	25.00
8 annual dues, 1890–91	200.00
166 annual dues, 1891–92	4,149.75
8 annual dues, 1892–93	200.00
Tenth annual banquet	280.00
"American Street Railway Decisions"	105.00
Miscellaneous reports	22.50
	$7,574.31

EXPENSES.

Secretary's salary	$1,749.97
Tenth annual banquet	1,600.00
Publishing tenth annual report	1,001.68
Miscellaneous printing	276.25
Compensation, special committee reports	250.00
Special Executive Committee meeting at Cleveland	244.96
Postage	230.00
Expenses incident to tenth and eleventh annual meetings	219.10
Printing legal opinions, "Street Railway Law"	198.00
"American Street Railway Decisions"	162.00
Printing "Public and State Treatment of Corporations," No. 3	60.00
Return of annual dues, second payment, by error	25.00
Insurance, telegrams, stationery, etc	17.68
Expressage	14.90
	$6,049.54
Balance in bank	1,524.77
	$7,574.31

The World's Fair committee reported as follows:

Report of the World's Fair Committee.

CLEVELAND, O., October 19, 1892.

Gentlemen:—The World's Columbian Exposition Committee respectfully reports :

That under date of May 25, 1892, a circular letter, of which the following is a copy, was sent to every dealer in street railway supplies, whose address was obtainable, as well as to every member company :

OFFICE OF
THE STREET RAILWAY ASSOCIATION,
CORNER ATLANTIC AND THIRD AVENUES.

BROOKLYN, N. Y., May 25, 1892.

Gentlemen:—The special committee appointed by the American Street Railway Association for the purpose of securing as commendable an exhibit as possible of all that pertains to the street railway business at the forthcoming Columbian Exposition at Chicago, desires to urge upon you the importance and necessity for making application at once for such space as you will need to make a proper exhibit of your manufactures.

This Association has secured 50,000 sq. ft., and the allotments of space as to desirability will be made in the order in which applications are received. Unlike any other World's Fair, the management of the Columbian Exposition will arrange the exhibits regardless of nationality, in departments, each comprising all that relates to any particular industry or subject. All, therefore, that relates to transportation will be in one building, and that devoted to street railways will all be gathered together in one section of the building.

The Exposition will make no charge whatever for space. It will be necessary in estimating the amount of space required, to state just the number of square feet needed for the exhibit, independent of aisle room. A limited amount of power will be supplied without charge. Exhibits will begin to be received as early as November 1, 1892, and no article will be admitted after April 10, 1893. Complete rules covering the entire subject will be sent on application to Mr. Willard A. Smith, chief of the department of transportation of the World's Columbian Exposition, Chicago, Ill.

Mr. John B. Parsons, vice-president and general manager of the West Chicago Street Railroad Co. has kindly consented to serve the Association as its sub-committee, to advise with Mr. Smith in reference to the exhibit under the auspices of this Association. All applications for space and information in regard to the exhibit should be made to Mr. Willard A. Smith, chief of the department, for which purpose an envelope, duly addressed, is enclosed.

The committee desires especially, as stated in the outset of this letter, to impress upon you the necessity for immediate action as hereinbefore set forth, should you desire to be represented by an exhibit at the World's Columbian Exposition.

Very respectfully yours,

GEO. W. PEARSON, Washington, D. C.
G. HILTON SCRIBNER, New York, N. Y.
JNO. B. PARSONS, Chicago, Ill.
E. B. EDWARDS, Philadelphia, Pa.
AMOS F. BREED, Boston, Mass.
THOMAS LOWRY, Minneapolis, Minn.
CHRS. GREEN, St. Louis, Mo.
E. LUSHER, Montreal, Can.
J. L. WILLCUTT, San Francisco, Cal.
JNO. G. HOLMES, Pittsburgh, Pa.
WM. J. RICHARDSON, Brooklyn, N. Y.
Columbian Exposition Committee.

Our committee has been advised by Mr. Willard A. Smith, chief of the department of transportation exhibits, that the circular met with a hearty response, and that the exhibit of manufactures and inventions, under the auspices of this Association, at the World's Columbian Expositon, to be held in Chicago in the year 1893, will be altogether creditable to the street railway industry.

We earnestly request all intending exhibitors, who have not yet attended to the preliminary arrangements necessary to secure admission of their novelties and products at the Exposition, to do so forthwith, in order that the exhibit shall be systematically arranged, as well as perfect in the ground covered. Respectfully submitted,

GEO. W. PEARSON, Chairman.

The first paper read was by by Mr. D. F. Longstreet, of Denver, Colo., in which he traced the successive steps which were taken to create an organization among the street railway men, and which culminated in the formation of the American Street Railway Association in Boston, Mass, December 12th, 1882. (See page 655.)

On motion of Mr. Cleminshaw, of Troy, a vote of thanks was passed to Mr. Longstreet for his interesting sketch.

The next paper was that of Mr. George W. Baumhoff, of St. Louis, Mo., entitled "A Model Electric Street Railway Roadbed and Underground Wiring." (See page 635.)

On motion of Mr. McLean, of New York, a vote of thanks was passed to Mr. Baumhoff; and it was ordered that three copies of the report be distributed to every company a member of the Association, and one copy to every street railway company of America.

The hour for taking a recess having arrived, the discussion of Mr. Baumhoff's paper was deferred until the evening session.

The secretary then read a letter of invitation from the Short Electric Railway Co., inviting all in attendance to visit the works of the company and take luncheon on Wednesday afternoon. A letter was also read from the Walker Manufacturing Co., of Cleveland, inviting the delegates and others to visit their works on Friday, and take luncheon as the guests of the company.

On motion of Mr. Cleminshaw these invitations were accepted.

The meeting then took a recess.

In the afternoon all in attendance at the Convention were taken in special cars to the works of the Short Electric Railway Co., and entertained in a very agreeable manner. Souvenirs were distributed by this company and also by the Swan Electric Lamp Co. The weather was perfect and the affair was one of the most pleasing features of the Convention. A full account of this excursion will be found on another page of this issue.

Wednesday Evening Session.

The meeting opened at eight o'clock.

The following companies applied for membership.:

Roanoke, Va.—Roanoke Street Railway Co.

Washington, D. C.—Washington, Alexandria & Mt. Vernon Railway Co.

Wilmington, N. C.—Wilmington City Railway Co.

The discussion of Mr. Baumhoff's paper was then taken up.

MR. EPPLEY, of Orange : I would like to hear the experience of some of the gentlemen in reference to the merits and demerits of the railway track chair, as compared with the recent form of girder rail, nine or ten

inches high. I should like to hear from some of the gentlemen who have been laying the new rail, and who have also used the chair which has been in use for the past six or seven years.

MR. PAYNE, of Milwaukee: Up to within a year ago we used the girder rail on chairs—we had twenty miles of road of that construction—and about a year ago we commenced to lay the eight inch rail spiked directly to the ties. It is laid twenty inches apart, centers. The rail on the chairs has not proven satisfactory, and we are replacing it in some places. The other rail is very satisfactory indeed; you can hardly tell where the joints are. We think we have the best track in the world.

MR. RICHARDSON: What weight?

MR. PAYNE: Eighty pounds to the yard.

MR. RICHARDSON: The chair?

MR. PAYNE: I cannot give you any particulars about the chair; I only know that it was not satisfactory. Our present construction is the one in which we use the eighty-eight pound rail. It is eight inches high, and it has taken the place of the other rail which was only down two years and had to be discarded.

MR. LITTELL, of Buffalo: The road I am connected with has lately contracted for twenty miles of track, with the privilege of increasing it ten more, and we are going to use a nine inch girder rail without chairs. Splice bars three-quarters of an inch thick and thirty-two inches long; twelve one-inch bolts; tie rods every five feet; eight foot ties, three and a half feet apart, 5×7. We use yellow pine or oak. The rail is ninety-three pounds to the yard.

MR. RICHARDSON, of Brooklyn: The company of which I am president recently obtained about twelve miles of seventy pound rail, six inches in depth, and four and a half inches wide at the base, laid on chairs. The substructure is made up of long leaf, untapped Florida pine, free from sap or defect of any kind, 5×9, seven feet long. The ties were laid two feet six inches apart from center to center, and under each joint we laid a special joint support of about thirty-six inches in length, of forty pound T rail reversed, properly supported by chairs. We have not yet operated this track with electric motors, but we thought when we laid it we would have a perfect track. I think, however, we have decided on something better, and we are now laying a ninety pound rail, nine inches in depth, five inches across the base, and we lay this on the same kind of ties. In addition, at each rail joint, we put in a 6×12 ins. seven feet long tie, thoroughly tamped and laid as well as it can be. At each joint of the rail we have plates twenty-six inches long, three-quarters inch thick, supported by two rows of bolts, four in each row; I think the size is an inch and a quarter. One thing referred to in Mr. Baumhoff's report I am doubtful about. The gentleman said in hot weather the joints may be laid close together; if not in warm weather there must be a space.

MR. LITTELL: There is nothing in that.

MR. RICHARDSON: That is my opinion; and that the best plan is to make a perfectly close and tight joint, with smooth ends to your rail, and bring it up as close as possible, and make it as nearly a continuous rail as possible.

MR. PAYNE: I want to ask if in the use of these deep rails you would not be governed somewhat by the question of paving?

MR. RICHARDSON: I have investigated that subject and find that paving with Belgian block, or granite paving, eight, nine or ten inches deep, is equally satisfactory to the people in New York and Brooklyn.

MR. HURT, of Atlanta: My experience has been that it is not the size or strength of the rail that you use; it is entirely the strength of the joint. In the construction I adopt, I endeavor to have no variation in the joints; I object to the difference of a thirty-second of an inch in the elevation of the ends of the rail. I think if you have weak joint in a rail, to magnify that weakness you should use a large rail; the stronger you make the rail, the weaker is the joint, because it throws the whole strain on the weak point. I lay track with seven inch deep rail, on stone bearings, and there is no weak point about the track, except where we break grade, and then we have a little difficulty about weak joints.

MR. LITTELL: My experience is that the best rail to lay is a deep rail, an eight inch rail without any chairs. Chairs are a delusion. We tamp with broken stone or gravel, as the case may be. If we are laying the track where there is gravel, we tamp with gravel; if there is no gravel there we use broken stone.

MR. PEARSON, of Boston: I think we have tried nearly every joint. Up to this time we have not found a joint which is perfectly satisfactory. The Johnson standard girder joint is the one which gives the most promise. We have not laid any of the deep rail, and consequently have not had any experience with it. We have, however, detected a fault which we think will be inherent in any girder rail laid on ties. The ties are cut into very rapidly by the rail. You will notice on steam roads in the winter, when the ground is too hard to admit of tamping, that they place wedges under the rails to hold them up till Spring, when they can be tamped. It seems to me that in the deep girder rail that same fault will arise by the constant pounding on the tie. The width of the flange on the rail has not sufficient surface on the tie to prevent that; and unless you put a broad plate, ten or twelve inches long, and six or eight inches wide on each tie, it seems to me that the deep girder construction will go to pieces the same as all the lighter rails. On the steam road you can get at the tie, but in the street railroad you cannot. I think that with the six inch girder rail, laid on a stringer with proper joint construction, Johnson joint or something similar, you get a good construction. In the stringer construction we get a large bearing surface; the rail bears its whole weight on the stringer, and there is not that cutting into the rail that we will find with the use of a nine inch rail. If you are going to use ten inch girder rail, you will want long fish plates, thirty-six inches long, two rows of bolts, say twelve bolts to a joint. Another fault in rails, which I do not think is looked into carefully in laying track, is the importance of a slight difference in the height of two rails abutting together. You get a sixteenth or even a thirty-second of an inch difference in the height of the two rails, and you will have a bad joint, no matter how good the fishplate may be.

MR. LITTELL: Especially with an eight wheel car.

MR. PEARSON: It does not seem to me that an eight wheel car will wear on the track more than a twenty foot car.

MR. HENRY, of Pittsburgh: I think that we have most of us been in error as to the construction of our trucks. I think that has nearly as much to do with the breaking down of our joints as anything else. I think we are all of us operating nearly the same kind of trucks. They are rigid on the axle boxes. Half of the weight of the motor and the whole weight of the truck goes down on the rail like a sledge hammer when an obstruction is met. We have got to find something that will take off that compression, that impact. It is like taking a weight of four or five tons and hammering it down on the rail. Every time you hit it, it goes lower. The sooner we come to understand this, the less trouble we will have. We are putting an elliptical spring on top of the axle box, and suspending the whole weight by this spring, so that the wheel box will work up and down as you come to a depression or elevation on the track. It allows the wheel to go up and down. I believe that the tracks have something to do with the rail joint.

MR. LAWLESS, of Paterson: I think the deep rail is what we require for electric cars. We have heard a good deal of discussion in reference to joints. I have found that a great deal of the trouble with the joints is due to the defective tamping of the joint tie. That is one of the main troubles with the joint. If you will use a good wide tie under your joint, put on your splice bars and tighten up your bolts with a wrench, tighten them as well as can be, you will find that the trouble with the joints will be considerably overcome.

MR. WHARTON, of Philadelphia: I wish to pay tribute to the complete and exhaustive paper which has been presented to us on this subject. As to the matter of rails,

we all know that if it were possible to use a T rail, nobody would use anything else; unfortunately, the railway companies are obliged to do what the local authorities direct. In regard to the joints, I think one point has been overlooked, and that is in the proper tightening up of the bolts, in forcing them home. After they have been once tightened up they should be removed, and the oxide or other matter which may have come there should be cleaned off, and the bolt put back and tightened up again. They should be again screwed up in about two or three months after, and the track would remain fairly permanent. On the steam roads they are continually tightening up their joints, and they have track walkers whose business it is to look after weak points and especially to tighten up the nuts. This is quite an easy matter with steam roads, but not so simple with street railroads.

Mr. A. L. Johnson, of Cleveland: My recommendation to any man laying a street railroad track is to put down at the joints extra large ties and ballast them in the best manner. The ballasting is what tells. The man who puts in an engine puts in a solid foundation. You can use all the heavy rails and heavy ties and heavy joint plates, and if the track is not properly ballasted, it will not stand. There is a road in St. Louis, which my brother is interested in, and which is managed by Mr. Minary, where the rail is seventy-eight pounds, laid on rock ballast. It has stood up for the past two years and is as good a track as any I have ever seen. In straight track I put the joints opposite each other; you can take better care of your track in that way. With curve rails it is better to divide the joints. The thing I think the most important of all for street railroad people to do is to ballast the track thoroughly; it will last longer.

Mr. Beckley, of Rochester: Three years ago last spring, the company with which I am connected commenced the construction of an electric road in Rochester. It was the first electric road in Rochester. It was a suburban road and constructed of forty pound T rail. That rail is in use to-day upon that road, and I venture to say that no gentleman who has occasion to ride upon the cars can count the joints. The T rail is the best where it can be used under the ordinances of the local authorities. We have heard a great deal about girder rails of eight, nine and ten inches in depth. I do not believe in that kind of construction at all. Our company in the past three years has constructed about 130 miles of track, on which we have been operating for nearly two years with electric cars. The reason why a T rail has been found to be the most satisfactory where it is in use is that it does not have a great depth. Take the T rail now being laid by the New York Central & Hudson River Railroad, and you will find that it has little depth. It has thickness; it has stability. My own judgment is that the best track which can be laid for electric traction is a track consisting of a rail weighing fifty-two to sixty pounds to the yard, say four and a half or five inches in depth, and where you have paved streets, giving the necessary space for your paving blocks. I would put them on stringers, vulcanized preferably, upon cross ties two and a half feet apart. The stringer, it seems to me, should be six inches in width. giving you an opportunity to place the paving stone without interfering in any way with the track construction. I have had a track constructed in this manner recently, and I am satisfied that that track will be standing up, doing its work, when a great deal of the track which has been spoken of to-night will be in process of repair. My own judgment is that a rail which is five and a half inches in depth is the proper rail to be laid where you have very heavy and frequent travel.

Mr. Ramsey, of Pittsburgh: I have not had the years of experience that some of you have had. I heard a civil engineer once say that if he was building an electric railway, or any kind of street railway, he would put under each joint tie two feet of concrete and surround it with stone, and he would have a permanent construction. He said he would recommend a better ballasting and a better foundation under the joint plate than under the rest of the track. A perfect joint is, of course, a joint that will not be noticeable when the cars pass over it and remain permanent. The plan of our company is to put exactly as good construction under the whole length of the rail as we put under each joint.

Mr. Baumhoff, of St. Louis: I believe it is customary in submitting a report of this kind for the committee to be put on the defensive—that is to say, to reply to the discussion. I am pleased to note, however, that after all the discussion that has taken place there have been only two exceptions taken to the report. The principal one seems to be on the question of what space should be allowed at the joint. I desire to say that, in submitting a report of this character, embracing as it does a territory with such wide variations in climate, it was my desire to be on the safe side. In St. Louis, where we laid upwards of two miles of rail of the seventy-eight pound pattern, we laid the ends of the rail as closely together as it was possible to get them. If I had the same rail to lay in that climate to-day I would do the same thing. I would not advocate that for a rail of less weight, or of shallower depth. To be on the safe side, I have suggested that rail, when laid in cold weather, should be laid with a joint to allow for expansion. In regard to the ballasting for the roadbed, I advocate that, before the tie is laid, as you will notice by the report, that not only should the soil be well rolled, but the ballast, after it has been placed, should also be well rolled. The character of the soil must be considered, and the method adapted to it. In a sandy soil I should not provide drainage; but in a yellow clay or more solid soil would do so. I am pleased with the reception the report received, and wherever a recommendation is made, I know you will consider that it is made with a view to perfect construction and not the haphazard.

Mr. Janney, of Philadelphia: In regard to bad joints, I think the trouble has principally been that you gentlemen trust too much to the fishplate. Some times the holes in the rails have been drilled a trifle larger than the bolts, and the bolts cut through. I have seen a half inch bolt cut half way through. This in many cases will account for bad joints. I do not see, nor can I believe, a ten inch rail is any better than a six inch rail. The nearer you get the head of your rail to the tie, the better track you have; that is conceded. If you get a seventy-eight or a sixty-six pound rail on a good chair, that would carry the weight of the rail and the car, you have just as good a track as with the use of a ten inch rail. We are to-day running a ten ton dummy over a sixty-six pound rail, and have been doing it for eighteen months in a street not paved, and subject to all conditions of weather.

Mr. Richardson: How often does the dummy pass over the track?

Mr Janney: About every five or seven minutes, and carries a trail car, with 100 to 150 people.

Mr. Payne, of Milwaukee: Of course, every city is governed by individual conditions, and the action of the Common Council. In our city we got special permit from the Council, and in streets not paved put down a rail five and a half inches high, weighing about fifty-six pounds. We have about twenty miles of that track, and it gives us exactly as good service, and we use it as frequently as where the street is paved and we have an eight inch rail weighing eighty-eight pounds to the yard. We run over some parts of it every two minutes with electric motors and it gives us just as good service in every respect.

Mr. Wason, of Cleveland: In order to get as nearly as possible a continuous rail, we made an experiment in the early part of the present year and put down about 1,000 ft. of track riveting the joints with red hot rivets and put in by boiler makers. The rails were placed end to end as close as we could get them, fifty-six pound rail spiked to the tie, and six red hot rivets put into each joint. The joints were first put together with bolts and then pulled home, and then one by one the bolts were taken out and replaced with red hot rivets. That was on one of our suburban lines. It is true that it does not have a large amount of traffic, but it was principally done to see whether the summer would have any effect in twisting it or throwing it out of line. It was put down in March, and it is just as straight now as when first put down.

The joints are absolutely imperceptible; and in my opinion, so long as you depend upon bolts, which are bound to work loose in time, the track will be in trouble. What the results will be with this track in the winter I do not know. The hot weather had no effect whatever on it.

MR. RICHARDSON: I do not think it is expected that there will be trouble with red hot rivets in hot weather; they are not likely to shrink then. I think, however, it is the experience on the elevated railroads and elsewhere, where they have done their riveting with red hot rivets, that when it comes to cold weather the rivets will get loose.

MR. PEARSON: It always seemed to me that in this way you might possibly get a good joint. I do not think we need fear anything from expansion. It is true that in certain elevated railroad work, where the joints were not proportioned properly, and the rivets have been pressed into place, when the structure had expanded they began to get loose. Another method of looking after joints, is by having joint boxes. We have tried joint boxes, not a great many of them, and we have some on hand; but we do not think we shall use them. Our experience has been that while you can take off the cover and get at the joint, as a rule when the bolt needs to be tightened up the tie needs to be retamped. In consequence of this, the joint box is of no particular use. We think it is easier to take up the pavement and tamp the tie and tighten up the joint plate.

The following gentlemen were appointed a committee to consider the question of a permanent industrial institute for the exhibition of all inventions and supplies relating to the street railway business: H. C. Payne, of Milwaukee; D. F. Longstreet, of Denver; O. T. Crosby, of Boston; Wm. Wharton, Jr., of Philadelphia; H. A. Everett, of Cleveland.

The report on "A Perfect Overhead Electric Construction" was then read, as printed on page 639.

On motion of Mr. Payne, the report was received and ordered to be spread upon the minutes.

Thursday Morning Session.

The president, John G. Holmes, having been called away by the receipt of a telegram, announcing the sudden illness of a relative, the first vice-president, Mr. Thomas H. McLean, of New York, presided.

The secretary announced the Committee on Nominations, as follows: W. W. Bean, St. Joseph, Mich.; Charles Cleminshaw, Troy; W. A. House, Baltimore; A. L. Johnson, Cleveland; J. E. Rugg, Pittsburgh; G. W. Baumhoff, St. Louis; and V. Cronyn, London.

The report of the Committee on "Economy of Electric Street Railway Machine Shops," was then received. (See page 640.)

MR. PAYNE: I hope this report will not go upon the records without discussion. I think every street railroad man recognizes the fact that in his machine shop lies the secret of the successful operation of the road, so far as producing results to the stockholders is concerned. There are a good many points that we are undecided about, I have no doubt, the question whether all repairs of the machine in all its details, the manufacture of parts, ought to be under the control of a master mechanic, with or without electrical knowledge. I know there is a difference of opinion on these points, and it is a matter that could be discussed with profit to the members. There is no doubt that practical results in the operation of an electric road come from economy in the machine shop.

MR. WARDWELL, of Duluth: The repair shop, if it is not properly cared for, will be the largest institution about your place. The repair shop may contain four times as much material and tools as are necessary. In a number of cities I have noticed that the motors are running without any covers, your gear cases are not on, your pinions exposed to the dust, and in some places where you have sharp sand flying about, and I warrant you your gears will last about half as long as in the cities where they have a soft soil. If you do not take care of your motors on the street, you can take the machine shop and make a fine organization out of it.

MR. LAWLESS, of Paterson: There is no question that a machine shop on a proper scale is desirable for a cable or an electric road. The trouble is that when it is once started it keeps growing. It is astonishing when you get a good mechanic or machinist how he likes to get in expensive tools and other equipment, and unless you watch him carefully, in a short time you will have a shop that will supply half a dozen roads. There are a good many things it is cheaper to buy than to make yourself. If you have a machine shop do not have it too expensive or elaborate; have it in accordance with the size of the road.

MR. RAMSEY: I agree with the gentleman as to drawing a line at certain points in making parts in your own shop. The results of our observation for the past three years confirm the views of the committee on this subject. We had nearly all the raw material finished for us for the first three months of our operation, but found that the cost was beyond our reach. This compelled us to put in planers and lathes and other machinery for finishing it completely, and we now get the raw material and finish it ourselves. There is a point where we draw the line, and that is a point where you will differ with me, and that is in the matter of gear cutting. We could not figure that there was any economy for us to do this for ourselves. A machine shop, such as may be found all over the country, where a number of men are employed, with a dozen or fifteen gear cutters, side by side, can do this work much cheaper than you can, with one man, to whom you pay good wages, with not more than half enough work. We cannot manufacture gear wheels as cheaply as we can buy them. The commutators used to cost us seventy-six dollars three years ago; we produce exactly the same commutator now for nineteen dollars. This relative reduction in the cost of parts applies to nearly everything in connection with our motors. I suppose, however, that this experience is familiar to most of you gentlemen.

MR. WASON: I think there is one point outside of the machine shop that should be taken into consideration in the repairs of motors, namely, the pits in which you do your work, the manner of handling the motors to facilitate putting them on and taking them off. The number and length of the pits should, of course, be in proportion to the number of cars you operate. There is such a thing as having a pit too long; for it will generally be found that the car which requires only simple repairs, and which is first needed, is invariably the last one on the line, and the others must be first moved. In our shops the pits are so arranged that you can put four cars over them, but three are all we take over each pit. We have a hydraulic lift underneath the car, running on the track, which we have found very serviceable; and when I tell you that we have taken off two motors and put on two, and had the car running out in thirty minutes, you will be sure it is a handy pit. We have taken an armature out and put one in, and had the car running on the road, in five minutes. The facility of handling your cars in your pit will greatly help the men, and I think it as essential as a complete machine shop.

I think our machine shop comprises about the number of tools that the report suggested. We have ninety motor cars, and I do not think we have any superfluous machines. I am sure that we have more than paid for all our machinery, in the saving over what we would have had to pay to have the work done, especially taking into consideration the saving in the matter of cartage. I am confident that taking the motors from underneath the car rather than raising the car bodies up is preferable. We have found this system very advantageous and complete. We have a thirty-five horse power, Sprague stationary motor for generating the power that we put in three years ago, and have not had any trouble with it. We are not doing more than ten or twelve horse power work with it, but we start it and stop it, and put a little oil on it once a month, and that is all it requires. It is run from the street railroad circuit. I think it will run very many years without any trouble.

MR. BAUMHOFF, of St. Louis: Several years ago I

made an inspection of the various machine shops and other departments of electric railroads; and among others visited the shops of Mr. Wason's company, and I advise you all to take this opportunity of going there. We do a great deal of manufacturing, but we sometimes find it more profitable to buy of the numerous supply dealers. When we first started in about three years ago we found the prices for the various materials connected with electric railways so high, that for our own protection we were compelled to inaugurate a machine shop system. In doing so we found it profitable to press on our own wheels. We also found it profitable to manufacture our commutators and to cut our pinions and gears, and in the matter of gears it is not so much a question of the cost of the cutting as the quality of metal used. Our shops are operated by the same style of motor as Mr. Wason described

Mr. McCulloch, of St. Louis: My remarks apply more to cable road machine shops. Some years ago we began to establish a machine shop in a small way, and in a little time we had all the implements and tools for doing our own repair work. It worked very well, until, being very much engrossed in other matters, I personally neglected the machine shop for some little time. It began to grow to such proportions that it was about the biggest part of the establishment. There were very expensive men in it, and they seemed to be turning out very little work. I remonstrated with the master mechanic, but it did very little good. I finally discharged the master mechanic, and closed up the shop, and re-opened it on a new basis, and since then it has operated very well. It has been very profitable and very satisfactory; but you must watch it closely. Without this watchfulness, it will become a great burden.

On motion of Mr. Wm. Richardson, a resolution was passed condoling with President Holmes, in the bereavement he had sustained in the death of his father-in-law.

The report of the Committee on the "Relative Cost of Operating Horse, Cable and Electric Roads," as printed on page 642, was then read.

Mr. Baldwin, of Cincinnati, presented the following letter, giving the comparative cost of operating cable and electric roads in Cincinnati:

Cincinnati, October 17, 1892.

The American Street Railway Association.

Gentlemen:—There have been a great many statements made at various times, which give a detailed account of the "actual" (?) cost of operating a large electric railway, the statements being made with a view to show "how much cheaper it is to operate an electric road over the cost of operating a cable or horse system."

The experience of our company (The Cincinnati Street Railway Co.) leads us to think that there is a "screw loose" somewhere, and just where, we don't know. Our "operating expenses" do not agree with those published, nor does the cost of repairs, attention, etc., correspond. In making up these statements for "publication," much must have been "forgotten," or "overlooked," or else other cities are being favored with "skilled labor," supplies, etc., at much lower figures than we find it possible to obtain them, or else the surrounding conditions are such that they do not have the number of breakdowns, burnouts, wear, etc. that we have.

Agents from various "supply companies" have called upon us and agreed to furnish material that will do "thus and so," but upon trial it does not come up to the guarantees. Where is the trouble? Is our company the only one that finds the expense of operating an "electric road" so much more than it was "calculated" to be, taking the published statements, or the agents' word as a basis of calculation?

Take for example our cable road with about sixty cars in service; it requires only six men in the repair shop to keep these in first class order. Then look at the number of expensive men that are necessary to keep up the repairs in our electric road repair shops. Armature and field winders, lathe hands, vise hands, planer hands, men to operate drill presses, gear cutters, presses, etc., which number as high as eighteen men to keep up the same number of cars. Then the attention and care of the motor cars. It requires more than double the number of men to clean motors and make the usual repairs to electrical apparatus; most of these men are "high" priced men in place of being ordinary laborers, so that when "cost of this labor" is taken into account it is found to be fully three times that necessary to keep the cable cars in good order. In operating an electric road, especially in heavy rain or snow storms, it is impossible to maintain the same regular service that is possible upon a cable system. As to "actual cost per car mile," we find that operating the cable road is far cheaper than operating electric cars over a similar route.

We think that it would be a great assistance and of great value to every Member of the American Street Railway Association to have the question of *cost* sifted down to what is actually the case, the "actual cost" of operating various roads all over the country. The items can be reduced to such terms that it will be an easy task, for the different members to fill in the items of cost for operating, repairs, etc., per day, and the number of miles run per day, also number of passengers carried per day, so that all can be reduced to cost per car mile; in this manner we would have a table, "generated" by a large number of roads, from all parts of the country, showing cost per car mile, as follows:

Cost per mile to carry a passenger.
Cost per car mile, for repairs.
Cost per car mile, generating station expense.
Cost per car mile, attendance and cleaning.
Cost per car mile, line repairs.
Life of gear in car miles, etc., etc.

Also length of road, average grades, speed of cars and other data by which the various "costs" can be compared.

In view of the foregoing, we would suggest that a committee be appointed with power to act, who will have such printed forms prepared, that will be sent to each member of the Association, asking them to fill in the "blanks," as accurately as possible, and return the same to the committee, who will embody the results in a report, which can be one of the "special subjects" for our next annual meeting.

Cincinnati Street Railway Co., and
Mt. Adams & Eden Park Inclined Railway.
Bert. L. Baldwin, M. E.

SUGGESTED FORM OF BLANK FOR COMPANY OPERATING AN ELECTRIC ROAD.

(similar blank would be required for cable roads.)

Name of Company.....
City of.....
State of.....

Total length of road in miles.....

Total amount and average per cent of grades.....

Name of System in use.....

Number and arrangement of trolley wires { Double trolley..... / Single trolley..... / or Underground.....

System of return wiring.....
Make and type of motors.....
No. motors to each car.....
Length of cars used.....
No. cars run singly..... No. cars run in train.....
Style running gear used.....
.....

Power House:

Number, size and make of engines.....
.....
Number, size and make of boilers.....
.....
Style of furnaces used.....
.....
Kind, quality and cost per ton of coal burned.....
.....

Number of men at power plant:

Engineers.... Firemen.... Dynamomen....
Switchboardmen.... Cleaners.... Helpers....

"A" Cost per car mile for all station expenses, including wages, fuel, oil, waste, water, repairs on machinery, interest, insurance, taxes, etc.....

Repair Work:

Do you perform the following class of work at your own repair shop?

General Repairs. { Wind armatures..... Wind field coils..... / Repair rheostats..... Controllers..... / Motor switches..... Lightning arresters..... / Trolley poles..... Wheels..... Details..... / Cut pinions..... Gear wheels..... / Make motor brasses..... Shafts..... Axles.....

What material do you find best for your gears?

Material in Gears.	Armature pinions	
	Intermediate pinions	
	Intermediate gear	
	Axle gear	
Life of Gears.	Armature pinion,	in car miles
	Intermediate pinion,	" "
	Intermediate gear,	" "
	Axle gear,	" "
Cost of Gears.	Armature pinion,	cost per car mile
	Intermediate pinion,	" " "
	Intermediate gear,	" " "
	Axle gear,	" " "
Cost of Repairs to Electrical Apparatus on Cars.	Armatures	cost per car mile
	Fields	" " "
	Rheostats	" " "
	Controllers	" " "
	Motor and reverse switches	" " "
	Lamps and wiring of car	" " "
	Trolley poles, wheel, bases, etc.,	" " "
Life of Running Gears.	Average life of: Car wheels	in car miles
	Brake shoes	" "
	Axles	" "
	Brasses	" "
	Pedestals and springs,	" "

"B" Cost per car mile for repairs upon electric cars, including all labor connected with the cleaning and repairing of same, and material used.....

"C" Cost per car mile for all other expenses not named in the foregoing: Office expenses, salaries to officers, receivers, conductors, motormen, linemen, barnmen, trackmen, switchboys, taxes, insurance and interest upon property and equipment, legal expenses, etc., etc.....

"D" Average number of passengers carried per car mile.....

Then by adding together all station expenses "A," cost of repairs "B," and office and miscellaneous expenses "C," we would have cost to operate an electric car, one car mile, which equals .....

And cost to carry a passenger one car mile, which equals.....

The recommendation was referred to the Executive Committee.

MR. RAMSEY, of Pittsburgh: I would say, in answer to the gentleman who has just spoken, that he is in line with our committee in the position which he takes. The committee, in their investigation, came across several cases similar to his own. Outside of a personal investigation of the subject, there is no better way to get at the matter than by the appointment of a committee such as he has suggested. I might argue in support of the report presented this morning for a long time, but I will spare you. The report was presented to the second largest cable railroad in this country for a preliminary reading, and it was returned with the statement that "our views on this important subject are fully expressed in the attitude which our board has taken in regard to further extensions of some thirty miles of electric railroad, which we are about to build."

MR. LAWLESS, of Paterson: I had the honor to be connected with one of the first cable lines built in this country, and have been connected with the construction of a number. I was always a strong advocate of the cable and still am, in its proper sphere. The cable railroad sphere is limited; but in that sphere it holds its own. There are some districts where, I claim, cable railroads can be operated more economically than any electric railroad.

As regards car mileage, I find that some roads have made wonderful results in the operating expenses per car mile. In those districts where the electric cars are run into sparsely settled sections the results are better than cars run in thickly populated portions. Where you can run at the rate of about twenty miles an hour you can make about 130 miles per day; but in the heart of the city you can only make from eighty-five to ninety. If you pay the same wages per day, the results are better in the former case, so that it is pretty hard to get at accurate figures in that respect. The results were rather in favor of cable lines three or four years ago; but since the single reduction motors have come in, and the cost of repairs has come down, in thickly populated sections, even, the electric line is going to press the cable pretty hard. We have no reason to expect that we have come to the end of improvements in the motors, and as these progress, the conditions will be increasingly in favor of electric traction.

The Committee on Formulating Standard System of Accounting Forms for Statistical Information reported that the work had been too considerable for them to accomplish it, and recommended the employment by the Association of a statistical clerk to compile such information as might be necessary.

On motion of Mr. Lang, of Toledo, the question of appointing this clerk was referred to the Executive Committee.

An invitation from the Walker Manufacturing Co., of Cleveland, to visit their works at ten o'clock Friday morning, and partake luncheon, the guests to be conveyed in carriages to the works, was read and on motion accepted.

The Convention then took a recess.

Thursday Afternoon Session.

It was announced that the Worcester, Leceister & Spencer Street Railway Co., of Worcester, Mass., had joined the Association.

The first business was announced to be the report of the Committee on Standards.

Mr. Crosby, the chairman of the committee, said that it was scarcely expected that the report would be discussed. It was important, however, that some attention should be given to the subject of the rating of the motors. As stated in the report, it was the most difficult, and at the same time one of the most important, matters to be determined. He hoped that some expression would be given concerning the two methods proposed in the report. He was exceedingly anxious to have the matter determined, and hoped the Association would give expression in favor of one of the methods.

The report was then read. (See page 645).

MR. HOLMES, of New York: I desire to thank Mr. Crosby for the persistent manner in which he has been hammering this matter of standardising motors into us. This matter of rating motors is in my opinion a very important one. The manufacturers of dynamos for electric light stations have been accustomed to rate them according to the number of lamps they will burn in candle power. One company will say, here is a machine that will develop 400 incandescent candle power lights; another company says, here is a machine which will also develop 400 incandescent lights; but the difference between the two machines is the difference between six and five. Now, gentlemen, if we can standardize our motors as dynamos ought to have been, we shall not be subjected to confusion by overheating generators by subjecting them to greater duty than they are supposed to perform. I, therefore, offer the following resolution:

Resolved: That it is the sense of this Convention that the standard rating of railway motors shall be the horizontal pull which the motor can exert when running the car at ten (10) miles per hour with thirty-three (33) inch wheels, and that when so running the temperature of the motor shall not be raised more than sixty-five (65) degrees Centigrade above surrounding atmosphere after a ten (10) hour run.

The resolution was adopted.

The recommendation in the report of the employment of a statistical clerk was referred to the Executive Committee.

On motion, the Executive Committee was empowered to appoint another Committee on Standards.

The Committee on Nominations then reported the following names of gentlemen nominated for the officers of the Association for the ensuing year: President, D. F. Longstreet, Denver, Colo.; first vice-president, A. Everett, Cleveland, O.; second vice-president, Joel Hurt, Atlanta, Ga.; third vice-president, W. Worth Bean, St.

Joseph, Mich.; secretary and treasurer, W. J. Richardson, Brooklyn, N. Y. Executive Committee, John G. Holmes, Pittsburg, Pa.; J. D. Crimmins, New York City; T. J. Minary, Louisville, Ky.; J. R. Chapman, Grand Rapids, Mich.; B. E. Charlton, Hamilton, Ont.

These officers were elected.

Messrs. Watson, of Buffalo, and Martin, of Cincinnati, were appointed a committee to escort the newly elected president to the chair. Mr. Longstreet fittingly acknowledged the compliment paid him in his election, and expressed the hope that he would meet all in attendance at this meeting at the convention to be held in Milwaukee next year, and the year following in Denver.

Mr. F. M. Eppley, of Orange, called the attention of the delegates to the merits of a new fender and ground brake as a safety device, a model of which he presented. This device was illustrated in our last number.

The secretary reported that the Executive Committee had considered the matter of the formation of a supply dealers' association in connection with the American Street Railway Association; and that in the judgment of the committee they could see no necessity for the formation of such an association at this time.

A communication was presented from the Massachusetts Street Railway Association relative to the subject of the provision of proper interacting signals at crossings of steam and electric railroads, as follows:

Boston, Mass., October 17, 1892.

To the American Street Railway Association.

Gentlemen:—At a recent meeting of the Massachusetts Street Railway Association, the subject of crossings at grade by street and steam railroads was discussed with considerable fullness. It was decided to present the matter for the consideration of your body, it being deemed of sufficient importance to warrant a broader and more comprehensive discussion. The undersigned, therefore, a special committee appointed by the Massachusetts Association for the purpose, beg with your kind attention to submit the following remarks:

Among the most serious of the cares and anxieties which surround the establishment and management of an electric road, the grade crossing must be named. As law and custom now stand, there is an entirely unjust discrimination against the electric line. We have passed the stage where the necessity of electric roads is questioned by the community; it is now universally recognized; and yet there remains this relic of the struggling experimental era, the favoring of the steam, to the detriment of the electric railway.

From various reliable sources it has been computed that the street railroads of the United States carry many more passengers than the steam roads. In the state of Massachusetts, for example, the Railroad Commissioner's Report for 1892, shows that 107,271,842 passengers were carried on the latter as against 176,090,189 conveyed by the street roads. And yet, despite this showing, there remains among the Public Statutes of Massachusetts, the following:

Chap. cxii. Sec. 40. A street railway company whose tracks cross the tracks of a steam railroad shall make the crossing in such a manner as to injure as little as possible such tracks; and shall not insert frogs therein, or make incisions into the rails thereof, without the consent of the directors of such road.

As custom goes, the steam road possesses a right of way superior to that of the highway. Their cars travel at very high rates of speed, and absolutely no notice of the highway traffic is taken, save to block it by a slender gate at such times as they wish to exercise their autocratic privilege. But it must be borne in mind that it is the public who are traveling on the highway as well as on the train; that that public, whether as passengers in street cars, drivers of other vehicles, or simple pedestrians, may properly demand that their safety and convenience be consulted with as great solicitude under those circumstances as when they use the steam road; they have a right to demand, and they do demand, that grade crossings, where the interests of the two classes conflict, should be rendered as safe and convenient *for both* as human ingenuity can devise means for doing.

Recognizing these facts, it seems eminently proper that the law should establish a uniform regulation for grade crossings which shall be fair to both parties. The points of conflict are not so numerous nor so deep as might be imagined, but unfortunately it has become the attitude of steam railroad companies to stand aloof from negotiation; upholding their strict and technical rights under the laws, they refuse even such adjustment of difficulties as could be made without cost or inconvenience to themselves; and by this course they imperil the lives, not only of the passengers upon street railroad cars, but of highway travelers in general.

To show how closely this subject concerns the electric railway industries of the United States, we have estimated that fully 75 per cent. of the electric roads in this country have one or more grade crossings with a steam road on their lines. These are a menace not only to the safety of their passengers, but in many cases to the road's financial success. Investors often regard the possibility of accidents at these crossings (entailing the payment of ruinously large sums as damages) as so great that no reliability can be placed on the net earnings; and, declining to lend their funds to the promotion of such a road, an otherwise promising enterprise fails. In view of these considerations, it has seemed good to the Massachusetts Association, to suggest to your body the following action, namely:

That a circular letter be sent, not only to every electric railway company in the United States, but to the Board of Railroad Commissioners in each state, or to that authority under whose jurisdiction the operation of railway comes, recommending the passage by each state legislature of regulations upon this important subject, on the following lines:

First, that whenever a grade crossing is necessary, between a steam railroad and an electric or other street railway, the details of construction at such crossing be arranged, if possible, by agreement between the respective parties. In case such arrangement cannot be reached, the matter to be referred to, and decided by, the railroad commissioners of the state, or other proper authority after due hearing.

Second, that in general, the treads of the respective rails be at the same level; that the rails of *both* lines be grooved or notched, in such a manner as to be suitable for the passage of the flanges of the wheels of each kind of car, and as not to afford a smoother crossing to one than to the other.

Third, that the cost of such crossing be apportioned between respective companies, and the cost of maintenance and repair be borne by both companies, in proportion to the number of tracks which each has laid at said crossing. There is ample reason for making the steam road pay a part of the expense of the crossing even when the steam road pre-exists. The establishing of the crossing is for the purpose of perfecting the use of the street and making it better adapted for the purpose for which it was constructed, namely, for public travel, in all ways, whether such travel is by foot passengers, persons in carriages, or people in street cars.

Fourth, that the railroad commissioners, or other proper authority, be empowered to approve or condemn any construction at such crossings, and to require that the same be made to subserve the safety and convenience of both lines equally; also to require from both lines the adoption and installation of whatever protecting devices they decide to be appropriate, including some form of automatic signaling device to be operated in connection with the gates as at present maintained, so as to show, at least 1,000 ft. distant upon the steam railroad tracks, a danger signal when and so long as the crossing is open for the passage of vehicles upon the highway. That at crossings embracing a large number of tracks, or where dangerous conditions are otherwise multiplied, automatic interacting signals between the two roads be required, so that the presence at the cros ing of either class of cars shall be shown in advance to the other. All of which is respectfully submitted. Yours very truly,

Geo. W. Mansfield,
Chas. S. Sergeant,
E. P. Shaw,
Committee.

On motion, the matter was referred to the Executive Committee.

A letter was read from Mr. E. G. Connette, of Nashville, Tenn., chairman of the Committee on Power House Engines, stating that owing to the slowness with which replies had been received to the circular letter of the committee requesting information, their report was not ready; but it would be put in shape and circulated among the members later.

The convention then took a recess until Friday morning.

Friday Morning Session.

On motion of Mr. McLean, the paper on "Experiments on the Expansion of Continuous Rails," as printed on page 650, was read by its title only.

On motion of Mr. Watson, the paper on "Is a Standard Rail Head Possible?" was read by its title only. See page 654.

Mr. Cronyn, of London, Can., offered the following:

Resolved: That the American Street Railway Association sends greeting to the tramway managers and officers of European and foreign countries, and most cordially invites them to attend the 12th annual meeting of this Association, to be held in Milwaukee, Wis., U. S. A., in 1893, during the World's Columbian Exposition.

Resolved: That the secretary take such measures as in his judgment may seem necessary to carry out the above.

The resolution was adopted.

Mr. McLean moved that the secretary be authorized to express to the Short Electric Railway Co. the appreciation of the Association of the courtesies shown by that company to the delegates in attendance at the meeting.

A vote of thanks was passed to the different traffic associations for their courtesy in granting reduced rates to the gentlemen in attendance at the meeting.

The Association then adjourned to meet in Milwaukee, Wis., the third Wednesday in October, 1893.

The Banquet.

This was the crowning event of the meeting, and was served in the large dining hall of the Hollenden, the occasion being enlivened by some music from an orchestra stationed in the balcony. Four tables were arranged parallel, extending the long way of the room, and were profusely decorated with cut flowers and growing plants, but there was only one floral piece, and this represented a fully equipped electrical car. There were no wall decorations, for the reason that the elegant finish of the room could not be improved by floral decorations.

The 300 and more guests being in place, grace was said by the Rev. Dr. Sprecher, when all were seated and partook of an elaborate and generous banquet as per the the following menu :

MENU.

BLUE POINTS.

Celery.

CLEAR GREEN TURTLE, VICTORIA.

Sherry. Olives. Salted Almonds.

LOBSTER, A LA NEWBURG.

Sauterne. BOILED SALMON, SAUCE VERTE.

Cucumbers. Dauphine Potatoes.

FILET OF BEEF, A LA MONTGLAS.

Pontet Canet. Sweet Potato Croquettes.

SWEETBREADS GLACE, JARDINIERE,

French Peas.

Cigarettes. FROZEN EGG NOGG.

Moet & Chandon. "Brut Imperial." BREAST OF PRAIRIE CHICKEN WITH TRUFFLES.

Saratoga Chips.

DRESSED LETTUCE.

NEAPOLITAN ICE CREAM. CAKE.

ASSORTED FRUIT.

WATER CRACKERS. EDAM CHEESE.

Brandy. Cigars. COFFEE.

MUSICAL PROGRAM.

1.—MARCH, "Welcome to All, ... *Zimmermann.*

2.—OVERTURE, "Raymond," . . . . *Amb. Thomas.*

3.—SELECTIONS from "Bohemian Girl," . . . . *Balfe.*

4.—WALTZ MOVEMENT, "Loin du Bal," . . . *Gillet.*

5.—PATROL, "American," . . . . . *Meacham.*

6.—POLKA, "Bei Kroll," . . . . . *Fink.*

7.—OVERTURE, "Martha," . . . . . *Flotow.*

8.—SPANISH FANTASIA . . . . . *Miund.*

9.—SELECTIONS from "Wang," . . . . . *Boethger.*

10.—CAPRICE, "The First Heart Throbs," . . . *Eilenberg.*

11.—SELECTIONS from "Erminie," . . . . *Jakobowsky.*

12.—MEDLEY—"Plantation Echoes," . . . . . *Ross.*

Thomas H. McLean, first vice-president, presided and acted as toastmaster in the place of President Holmes who had been called home by a sudden bereavement, and about eleven o'clock introduced the intellectual part of the evening, first calling upon the audience to rise and sing the national hymn, when the toasts and speakers were announced in the following order :

"SOME PHASES OF THE LEGAL LIABILITIES OF STREET RAILROAD COMPANIES."

BY HON. ANDREW SQUIRE.

Mr. Toastmaster, Ladies and Gentlemen :—I am sorry in some regards that the order of toasts has been changed. However, I can assure you that General Meyer is here and will respond in a few minutes to his toast, "The City of Cleveland." It is needless for me to say that I am pleased to meet with you to-night, and to say to you that I realize that in an association of this character there is gathered together at this time in the city of Cleveland as representative a body of busy, active, intelligent business men as this country affords. Of all the revolutions of this decade, I know of none that is attracting to it more attention, more brains, more capital, more activity, and more usefulness than the evolution in the street railroad system of the country. (Applause.) The putting on of cable cars ; the adoption of electricity ; the laying of solid, substantial track ; the introduction of cars of the latest and most approved patterns, convenient for the people ; the amount of capital it is taking to do this, and the rapidity with which it is being done, is something in itself astonishing. You, gentlemen, are all of you familiar with it. It is to you an every day occurence ; but to the man outside of the street railway business, if he will stop to consider it, it is something wonderful.

You gather here in this city in the interest of this progress ; you gather here to discuss how you can make the most of it, how you can make the greatest success of what you are undertaking ; to compare notes, to look forward to the future of your properties, each realizing that anything that the other company has that is better, that is more convenient, that is less expensive, that is a greater commercial success, may be worthy your attention and, perhaps, your adoption. I understand such to be, in a measure, the object of your Association. Now, having had some connection, for the past two years, with street railroads in this city, I approach the subject from a different angle, and I ask of you to pause in this construction, to pause in this development, and give heed, and give thought, along with all of the other things that are engrossing your attention, to the legal liabilities of street railroad companies. They are growing, as you are adopting more rapid locomotion, as you are crowding into the densely populated streets of the city, with instrumentalities which are dangerous. You are imposing upon the public greater duties, upon the private citizen greater care and greater caution, and at the same time you are imposing upon yourselves conditions which require the exercise of greater caution on your part ; and it behooves you, while considering the commercial phases, to consider also your legal liabilities.

I know there are the chronic grumblers ; I know you come in contact every day with thousands of people hard to please ; I know you are condemned for doing this and for not doing that. I believe I know something of the trials of a street railroad manager ; at the same time it is a sort of burden that you have taken upon yourselves. You must meet it patiently, considerately, and be thoroughly careful of your employes and of the public, providing the best possible equipment that you can, and the greatest possible safeguards to protect the lives of the passengers that you carry and the people upon the street, and even of the boys, no matter how annoying they may be, who seek to steal rides on your trains. I know they may be trespassers, but human life is dear to every one of us. I know they may have few rights, but caution on the part of motormen, on the part of gripmen, on the part of drivers, on the part of conductors, is one of the first lessons to be instilled. Accidents will happen, enough of them ; but that does not take from you the duty of being as careful, as painstaking, as thoroughgoing as you can. I know that steam railroads have their claim agents that meet every year of late, and discuss from their standpoint how accidents can best be avoided. I know that while you are discussing what you will do to make your companies commercially a success, that you will soon, and you cannot too soon, find it one of your duties to discuss how to make the roads safest, how to inflict the least injury upon the public and your passengers. It all comes back to the pecuniary standpoint in the end, because, unless you are safe, unless you do this, the public will make itself felt by reaching for the pocket of the street railroad company ; so from a commercial standpoint, as well as from a humane standpoint, it is a duty, it is an obligation, to be forgotten at no time.

Within the past few years, comparatively few, insurance societies, that are successful in many respects, are undertaking to insure street railroad companies against their liabilities. I will not stop to discuss whether this is likely to succeed or not to succeed. In this I am sure you will bear me out, that your observation will run along with mine, that they started in to do it too cheaply. No man can afford to have an article, no matter what it is, at less than cost, and you who are paying attention to this matter already know that in the last year, and especially in the last six months, many of these societies have realized

that they are doing it too cheaply, and are putting up the rates. It may be arranged on a basis profitable to the street railroad companies, in a pecuniary sense ; but one thing is certain, it will never be successful if it undertakes to relieve you, in a sense, of your responsibility. It must go hand in hand with the railroad company. The public must never come to feel that an insurance company stands between the railroad company and the public in such a way as to relieve the railroad company from its responsibility. Whenever the insurance company lends its aid, and inspects your machinery, inspects everything, and helps, and is an assistant, in caring for the public and the employe, in caring for the passenger, then it will be welcome, but not before that. It should simply be an assistant ; and the employers or the owners of street railroad companies, those who have invested their capital, must never feel in any sense relieved from their responsibility. They must use all caution and all care , and in doing this, they may reach out for any and every assistance that they can.

I have mentioned these matters, because I am compelled to look at these things from the legal side ; and I believe, understand them, perhaps, better than the man who is actively engaged in the commercial success of the railroad company. I can feel the public pulse and understand what it is. I know the matter has only to be drawn to your attention; perhaps it is unnecessary even to do that, to insure its careful consideration at your hands. I hope, and am satisfied it will be received in the sense and in the way in which it is intended ; and being thus received I am satisfied that it cannot result in harm, but that it will do good to call your attention to these things as subjects worthy of your discussion, that are worthy of your united action.

"THE CITY OF CLEVELAND."

By Gen. Edward S. Meyer.

Ladies and Gentlemen :—I esteem it a great pleasure, indeed, and no less an honor, to look into the faces of this representative body of men and women—men who are to-day transforming the methods of intercommunication almost to the point of a revolution. I stand in awe of the men to whose efforts, to whose intelligence, is due the exhibition that it was my pleasure to witness to-day. Be not deceived, the American people appreciate what you are doing (applause), and no community more so than this goodly city of Cleveland.

In this era of rapidly developing great cities, it is no light task to present, in an interesting manner, the merits of any one of them ; and yet we who live here, and have witnessed the growth and development of our city, are proud to be citizens of it. Cleveland was incorporated as a city in 1835, with less than twelve hundred inhabitants, a struggling, straggling community, but made up of great men and noble women. In the few years that have elapsed—it seems but a very few years since that time—its population has increased to nearly three hundred thousand souls. Situated as it is, midway between the exhaustless fields of ore to the north and magnificent and only partially developed tracts of coal, such as no other nation possesses, to the south, with fourteen railroads centering here, four of them parts of as many transcontinental systems, which, in their turn, bring into our markets not only the coal and the ores, but the wealth of one of the greatest agricultural States as well, whose magnificent harvests roll into the lap of this city, to make up its grandeur and its wealth. So in this short time all this has happened ; and as you look about, as you hear the hum of its thousands of industrial establishments, as you see mast upon mast in its harbor, as you see the puffing and steaming of the many railroad trains that are moving continuously, and you witness all the progress, all the business development, and view the endless stretch of magnificent homes, bear in mind that all this is the product of a single generation. We have two thousand and sixty-five manufacturing establishments, employing nearly sixty thousand mechanics and laborers, giving out over thirty-three million dollars in pay per annum, sending over these magnificent waters a home fleet of over three hundred vessels, with a tonnage of one hundred and seventy-one thousand tons, and our magnificent ship-yards, second to none on earth, turning out in the year 1889-90 no less of a tonnage than seventy-one thousand tons, thus wresting from proud Philadelphia the crowning glory of her prominence as the first ship city in America. Not only that, but, in addition thereto, our city, standing like a young giant amid the forests of her own masts, boldly confronts Clyde across the sea in a no longer unequal contest for the supremacy of the modern world. This is the great glory of our goodly city.

We hear now and then a croaker who sees in all this development a tendency of going toward damnation ; but they are 'most all dead, and the rest of them are erecting monuments to their own memory. So rapid has been the march of this progress here in Cleveland, that even to-day we find it necessary to put a tight board fence around the statues of departed heroes, lest they should leave their pedestals and join the procession as we march along. (Laughter and applause.) Do not be mistaken ; that enclosure on the square is not, as the New York *World* intimates, a cemetery for the victims of this "deadly trolley."

But that is not all. We have here a set of master minds at the head of the railroad interests. They have kept abreast with the rapid strides made in the development of our greatest interests, until they have to-day equipped and in operation — and I say it without a moment's hesitation—the best line of street railways in America. Notwithstanding this, we growl at them ; we find fault because they lengthen our right arms entirely out of proportion to our left, by compelling us to hang on to a strap in their cars. Of course, we know that we can manage their roads much better than they can ; but, nevertheless, we get along reasonably well with them. They have not only a local mileage of one hundred and thirty-three miles of roadway, but beyond the city limits a mileage so great that one of their master minds, unequalled in the street railroad business in America, has ridden upon his own line clear into a seat in Congress. There, strange as it may seem, the chosen representative of this goodly community, he boldly advocates, as fearlessly as he does everything else, free trade and the single tax, as the representative of sixty-four million dollars invested in protected industries here. (Applause.) In the meantime he leaves his jolly, genial, big brother at home, at the old stand, marketing the municipal chestnuts at five cents apiece. Be assured, ladies and gentlemen, that only through a profound regard for his innate and well known modesty, I hesitate to mention the name of our genial Tom.

We have another master mind in the street railroad business, who is a master of hospitality as well, and who, adding to the responsibilities of the presidency of a great line, the duties of a bank president and the director of a score of railroad and manufacturing establishments, occasionally finds time to turn to politics as a matter of diversion and recreation, making, and occasionally unmaking, legislatures, governors and senators ; and having achieved such great influence and power that every member of the Common Council makes obeisance, with his hat under his arm, whenever he passes him on the street ; and shrewd politicians, basking in the sunshine of his favor, do not hesitate to make genuflexion of the knee, that thrift may follow him. Keep your glasses upon current events, for you will find that his latest gubernatorial protégé, and the most able and honorable of them all, will be landed by this gentleman in the White House four years hence.

Again, the young men of your fraternity are not behind in this spirit of enterprise. They have occasionally, for matter of recreation, slipped across the border, and singularly enough have seized the choicest tree in all the Canadian garden, gathering the luscious, seedless fruit, while our English cousins are discussing their breakfast chop. Give the boys a chance. They will not only land that tree itself over here, but in due time they will shift the border; and carry with it as well the tricolor of our fathers.

But one would think, from what I have said to night, that grandeur and fame had only been acquired by street railroad men ; that is not the case. We have other interests, but I cannot enumerate them to night. There are other gentlemen to follow me, and to whom you will pay due deference when they make their appearance; but in all the industries everywhere, from the peanut stand to the great transportation lines, you will find master men doing master service. Why, our chewing gum itself is renowned the country over. Its proprietors have ornamented the highways and byways of the country with all the colors of the rainbow, in setting forth its merits. It has given jaws of iron and stomachs of brass to the rising generation. It is the champion of muscular development; and not content with this it now boldly marches up the Capitol steps of the nation demanding admission as the herald of a new era in American statesmanship. All this has come from Cleveland. It rides in magnificent yachts, it has a double mile race course, and dispenses an hospitality heretofore almost unknown.

But I must not tire you. Leaving merriment, let me say to you, that Cleveland to-day is trying, at least in a crude and, perhaps, unsatisfactory manner, to assist in solving the greatest problem that has yet confronted the American people ; that is, the proper government of these great cities. For the first time in the history of America, the epoch of great cities is upon us, and the future of this Republic—its future progress, its advance to the highest and grandest civilization—depends more largely upon the proper solution of this problem than anything else we have ever had to deal with. Ours is a cosmopolitan nation, and each city is in itself cosmopolitan, made up of a population gathered from every quarter of the earth, from the vine clad hills of Germany, from the steppes of Russia, from the vales and sunny valleys of France and Italy, from beyond the Andes, have come to us to help build up our institutions, if we wisely dissipate, absorb and assimilate them. If not, they become a menace to our institutions. Let us not in this or any other city, shove them apart into communities and clans by themselves, but make the best of it ; extend to them a warm helping hand and point out to them the beauties of our country, the glory of our institutions, and the great immunities and prerogatives of American citizenship. If we do this, we have nothing to fear in the future. When we who are here to-day shall have laid bown the burden and the armor, let us feel that

> Here on Erie's shores, from age to age,
> Our city shall lift its spires ;
> And gem with stars its history's page,
> And kindle still its altar fires.

"THE IDEAL STREET RAILWAY: A PROPHECY."

By Hon. L. A. Russell.

Ladies and Gentlemen of the American Street Railway Association and your guests :—It is your misfortune, and not my fault, that some busy member of your committee has discovered the fact that I am possessed of the prophetic gift; but I am, and I have a monopoly of it, and it isn't patented, either. I am not afraid to tell you about it, because it pertains to me, and is altogether unique. I have the real and truly infallible gift of accurate prophecy. Whenever the inspiration is sufficient, and amidst good cheer and good company, such as I find here this evening, I can, without the shadow of a doubt, or the possibility of error, foretell with precision the exact condition of the street railroad system of the United States, and especially of the city of Cleveland, to any indefinite time in the future that any member of this assemblage may suggest ; and the reason why I have it is because I have also the gift of prophecy in regard to the result of elections. Many men have heretofore made great money by backing the opposite of my predictions. (Laughter.) But all I have to do to be precise and accurate in regard to the street railroad business, as against the

matter of elections, is to run the same machine backward. In regard to elections, I always prophesy that the thing will be as I want it, but it never is. In regard to street railroads I am going to prophesy that they will be as I don't want them, and then I know the thing will be all right.

I would have the tracks solid and smooth ; I would have the cars swift and certain, and the intervals between them short. I would have the tracks on each alternate street, and I would live on the other street. (Laughter and applause.) I would have the motors exactly controllable, and always controlled. I would do no harm, and I would have no legal liability. By the way, that puts me in mind of the remarks that General Meyer made. He said that he stood in awe of street railroad men. He only said that because most of you are strangers. (Applause.) Every street railroad man in Cleveland who ever went to the municipal government to apply for more franchises, found that General Meyer did not stand in awe of him. Why, General Meyer would not let you repair a crossing frog in the city of Cleveland unless you gave up ten or fifteen years of your last renewal of franchise. (Applause.) Mr. Herrick, who sits over there, would not let you turn a car around on a turntable unless you vacated half a dozen streets and paved four blocks somewhere else with the best paving blocks. There are many things about street railroad men that are worthy of respect (laughter), but in the future there will not be, for after we have the ideal system completed, I understand that we are to turn it over bodily to the public, and make the blessed public a present of it. After that the fare will not be five cents.

I imagine, when my prophetic gift comes upon me strongly, that I can see a great future for street railways of this country. Some of you may have observed, or your attention may have been called to the fact, that man, among his other peculiar and interesting characteristics, is a moving animal ; and since the time whereunto the memory of man runneth not to the contrary, has been in the habit of having ways for his motion, and thus we have come to speak of highways. But after all, the way is not the great thing, although some times, in moments of enthuaiasm I have called the road the hol(e)y road ; that is, the middle of the road. But the fact of it is that the great thing to be considered at last is the man. The way is only the convenience for the man, and the railway or railroad is not the great thing of the street railway business after all. The road is only the appurtenance of the car ; you have not been in the habit of thinking so, but it is a fact. The road is only the mere appendage and appurtenance and convenience of the car, and the car itself, whether short or long, whether for smokers or for ladies only, it is only the appurtenance and the convenience of the man. It is an instrumentality of man's devising for his use and convenience. What, then, of necessity, must be the ideal street railroad of the future ? Not necessarily a street railroad in every street, but a perfect street railroad operated by perfect cars and a perfect system upon enough of all the streets and highways of the land to serve the convenience of the people of the land ; and that will never be until between all centers of men, all centers of population, all thoroughfare highways, there be rapid, swift, sure, controlled, safe, convenient locomotion for men by means of street cars. If you will but for one moment stop and consider the past growth of the ways of men, and consider what in its nature a street railroad is, you will then know that the best street railroad convenience is just as certain to exist in the main highways and thoroughfares of the people, and between the great centers of population, as it has been certain that the pike road has succeeded the corduroy cut road through the forest, that the plank road has succeeded the pike, that the paved street has succeeded the plank ; and just so sure will the street railroad succeed and follow on in the development of the ways of mankind ; and that that day is nearer to us than we can imagine, is shown by the great extent and stupendous rapidity with which the street railroad system has developed and improved in this country in the past few years. And it is a proud thing to me, as a citizen of our good city of Cleveland, that the development has been more rapid and more thorough and wider in the city of Cleveland, and done in less time, than any other city of the nation, Boston not excepted.

I trust that being entirely satisfied, as I take it you all are, of the absolute accuracy of my prophecy, you will be willing to let me give way to more entertaining speakers.

"THE CARRIER, FROM THE STANDPOINT OF THE CARRIED."

By James H. Hoyt.

Mr. Toastmaster and Gentlemen :—If I had been asked to respond to this toast some months since, I should have come here as the representative of the passenger class, bubbling over with bile, and eager to pour out upon the devoted heads of you street railroad men, not the "vials" merely, but the barrels, of my wrath ; for, at that time, I was simply one of the "carried" myself and had no interest whatever with the "carrier." But lately I acquired a few shares of stock in a street railroad company, and it is perfectly marvelous what a humanizing, liberalizing agent a certificate of stock in a street railroad company is ; how it softens asperities, and mellows criticism, and enlightens the understanding, and warms the cockles of the heart. For instance, this toast itself, selected as it has been by street railroad men, and which, a few months ago, would have aroused all my animosities and inflamed my passions as a red rag inflames the passions or a bull, now seems to my enlightened and stimulated understanding to be a statement of magnificent candor and absolute fairness,—"The Street Railway Carrier, from the *Standpoint* of the Carried."

In any argument, the man of liberal mind and broad ideas always admits the truth ; and this toast itself, gentlemen, contains a frank and refreshing admission on the part of the street railroad men, when you come to analyze it, that the contention made by the passenger, that he is not furnished with adequate seating facilities, is entirely correct ; indeed, it goes further and, with an unexampled fairness, boldly announces in effect that the standing room, even, of the passenger is restricted to a single point.

But let me illustrate this change of heart, which has come over me, in another way. The tracks of a street railroad company run in front of my door, and, prior to the making of the investment I have mentioned, the whirring and buzzing of the electric current, the soughing of the trolley wire, the banging and bouncing of the trucks, and the grinding and groaning of the improved, patented, noiseless, gearless motors were, to say the least, annoying. But now I am quite able to agree with my little daughter (five years of age), who remarked this fall, after her return from a three months' trip to the seashore, that it was very sweet to be at home again, where she could hear the pleasant electric cars go by. I never fully appreciated the truth of the Scripture before, which tells us that many things are hidden from the wise and prudent and are revealed unto babes.

I remember a story of an Irishman, who, after earnest solicitation, was finally persuaded to sign the pledge and become a total abstainer. He kept this arid obligation for about three days, and then, Nature proving too strong for him, he became gloriously drunk. A member of the Father Murphy Temperance Society, who had induced him to don the blue ribbon, met him and, with a voice full of reproach, said : "Why, Patrick, how is this? I thought you were a total abstinence man." To which Pat replied : "So I am a total abstinence man, sor ; but, be jabers, I am not a bigoted one."

Now, I come here this evening as the representative of the carried ; but, for the reasons I have stated, I am not a bigoted one, and I desire to acknowledge a few of the more significant benefits which the street railroads of this country have conferred upon the passenger class.

In the first place, gentlemen, owing to your unselfish efforts, it is no longer necessary for the ambitious spirit to go abroad in search of peril or adventure. The dense jungles of Africa and the slippery slopes of the mountains of Switzerland, thanks to you, no longer monopolize the excitements of danger. You have brought the deadliest peril and the most thrilling adventure within the reach of the humblest citizen, and all for a single cash fare of five cents. There is no need now for a Stanley to explore the Dark Continent or for a Tyndall to climb the Matterhorn in order that, by deeds of signal courage, they may challenge the admiration of the world. The average American citizen must be possessed of a more indomitable spirit, of a more heroic fortitude, every time he goes from his house to his office or crosses a street over which the lines of your railways run. If, when he goes through the usual, but entirely unnecessary, form of signaling one of your cars to stop, he avoids being paralyzed by an electric shock, he is sure that only the agility of a goat will enable him to reach the interior of the car without sacrifice of life or limb, and when, at length, he has gotten there (if, indeed, he ever does), and, at the risk of his life, has possessed himself of the standpoint which is named in the toast, and which you generously permit him to occupy, for a consideration, why there is the usual altercation, with the conductor still before him to sharpen his wits, and the pleasurable certainty in prospect that, unless he has courage for a flying leap, he will be carried beyond his point of destination. Why, gentlemen, I consider the street railroads of the present day, both cable and electric, as valuable educational agents. They exercise a man's muscles and stimulate his courage, sharpen his reasoning faculties, and last, but not least, induce a solemn and profound belief in the protecting care of Providence, since a single trip on one of your lines anywhere will convince even a scoffing sceptic that he could not have been preserved were it not for the aid of Omnipotence. I am informed that it is due to the street railroads alone that the Triennial Convention of Episcopalians, now in session in Baltimore, has decided to amend the noble litany of that church, so as to make it conform to modern needs, by adding this pregnant sentence : "From motor and cable cars, from overhead wires and sudden shocks, good Lord, deliver us."

But not only are you street railroad men aiding the physical, mental and religious development of the race; you are also, as I have been credibly informed, relieving us from some of the most onerous of our pecuniary burdens. Were it not for your generous and unsolicited donations of money, the salaries which members of City Councils would demand would largely increase the taxes of the people who elect them. These benevolences of yours, too, deserve the highest praise, because they are so unostentatious. In the language of the poet, you uniformly

"Give by stealth and blush to find it fame."

But there is yet another incalculable benefit which you have conferred and are conferring upon the "plain people." You have done much and, indeed, are still doing much to enrich and enlarge the vocabulary of the race. Where can more vigorous or forceful English be heard, I should like to know, than on one of your crowded cars about the hour of 6 P. M., especially if the night happens to be rainy? Why the daily impromptu dialogues between your motormen and conductors and the general public are shining, nay, lurid, examples of the vituperative art. I have heard some of your most efficient servants indulge in profanity which rivaled the electric flash itself in color and intensity. The motorman is not, indeed, like Chaucer, a

"Well of English undefyled ;

but, like Nature,

"Speaks a various language."

He is a sort of storage battery of *epithets*, and a storage battery that does not wear out or become exhausted by frequent use, and so is a commercial success, like the Ford-Washburn storage battery, in which I have an interest. I remember that a conductor once came into the car where I was swinging from a strap and accused me, in the presence of a large and interested audience, of having passed a plugged quarter on him. Now, of course, my first inclination was to prepare

his remains for instant burial; but, after listening to him for a few moments, I cheerfully handed him a sound quarter. I do not think, even after the lapse of years, that the plugged quarter was mine; but I cheerfully gave him the other as a slight testimonial of my appreciation of his perfect style.

But, gentlemen, let me speak seriously for the few moments left me. The street railroad has been and is one of the mightiest agents in the unparalleled development of this country. No city is without street railroads, for the simple reason that, but for them, it could never have become a city. They are the arteries running from its throbbing heart center and carrying life and nourishment to its extremities. Because of them, pleasant homes, pure air, the meadow's sweet expanse and blooming flowers are within the reach of every honest and industrious man. Wherever their rails extend, houses spring up, lands are reclaimed and the value of property is enhanced. The street car is the poor man's carriage and it is always at his beck and call, and yet it is curious that the very people that are most benefited by street railroads are usually the most eager to set up obstacles in the way of this great agent of human progress. Humanity has a strange characteristic—you have very often to help it in spite of itself. The problem of rapid transit is one of the most important which confront us, and the prosperity of our great centers of manufacture and trade depends largely upon the successful solution of this problem. We look to you and men like you to solve it. You have already done much and will yet do more. The cable or electric car of to-day is far ahead of the bobtail car of yesterday drawn by a single, flea bitten mule, but will be far behind the street car to-morrow. In spite of grumbling passengers and stupid and venal councils and ignorant and unjust criticism you are doing your work well and deserve the thanks and appreciation of every intelligent American. The public might as well try to dim the brilliance of the sun with a rush light or bring a herdic in competition with a street car, as to prevent your certain progress. Air and light are blessings so common that we fail to appreciate them until the eye is blinded or the lungs are clogged. It only needs a strike such as we had last winter, which paralyzed some of the great street railroad lines of this city, to convince the most captious critic that the street car has become a prime necessity. Every man, gentlemen, who lays an additional rail, runs an additional street car, or invents or adopts a useful appliance is a credit to the carrier and a benefactor of the carried.

"THE PRESS."

By W. W. Armstrong.

In a very modest way for many years, on various occasions, political, historical and social, I have responded to the toast of "The Press," but not now being actively connected with it, I approach the subject to-night with some trepidation and awe, for I find myself in the presence of the masters of a subtle and mysterious power, who may, if ancient chestnuts are fired at them, touch a button of some of their various systems and send me sailing up amid the little stars.

* * * * * * * * *

While the 400th anniversary of the discovery of this country is being celebrated, you people are only celebrating a science that has become a fact and a necessity within a quarter of a century. If equal progress is made in the next fifty years with what has been made in twenty-five years, what may not be expected from electrical science? There is nothing too daring to escape the mind of the American inventor and American scientist. It is, perhaps, safe to say that electrical science is in its infancy, but when I look over the wonderful display of American ingenuity in the Army and Navy Hall; witness the countless inventions that make electricity so direct a factor in our business and domestic life, which make it an employe in our shops in the city, in our mines under the earth, which make it light our vessels that plough the land and sea, which light up our mercantile palaces, our places of amusement, our palatial and humble homes, and is the means of our comfortable and swift conveyance in summer's heat and winter's cold, I cannot help but call to mind the first formal telegram that ever passed over the wires, from Professor Morse to a Washington lady, "What hath God wrought?"

In conclusion let me say that the press of Cleveland, which is not dilatory in its reports, entertains for you gentlemen from abroad, connected with the business for whose interests your convention has been called, the highest respect and only reflects the kind feelings our whole people entertain for the strangers within their gates, and it will do you full justice in its reports and give that prominence to your objects, that electrical science and electrical scientists deserve.

We of Ohio are proud of our state, the record of its statesmen, and its soldiers, but we hold in proud remembrance the attainments, the ingenuity, the talent and the masterful minds of such Buckeye lads as Charles F. Brush and Thomas A. Edison.

Hon. Tom L. Johnson, of Cleveland, was called upon, and among other things said:

I was at the street railroad convention in Boston at the birth of this Association. I have watched it with interest ever since, and it gives me great pleasure to night to be here and witness what has taken place since that time. Many familiar faces are here, and I see many gentlemen who were at Boston and took an active part in the formation of the Association, Coeval with the organization began the great progress in the street railway business which we have witnessed during the past ten years. One subject has not been touched upon to-night, the old subject that used to interest us in the early days—the collection of fares, and what was the best method of collection, and the best devices for registration, to insure us the necessary revenue that should come from the operation of our cars. We discovered in Johnstown, just after the flood, the best system in the world to secure all that was taken in on the cars—we ran them free.

The president-elect, Mr. D. F. Longstreet, was called upon, and after referring to the speeches that had preceded, and noting the lateness of the hour, expressed the hope that he should meet in Milwaukee all who were present at the meeting, and in two years hoped to have them all cross the plains to the most beautiful city on the face of the continent—Denver.

Mr. Wm. Richardson, of Brooklyn, on behalf of the Association, fittingly thanked the ladies and gentlemen of Cleveland for their very hospitable entertainment of the ladies and gentlemen of the Association.

All the speeches were presented in a happy manner, and were listened to with satisfaction. The banquet then closed by the singing of Auld Lang Syne.

Summary of the Convention.

The proceedings of the eleventh annual convention of the American Street Railway Association have passed into history and will mark it in some respects as the most remarkable, profitable and most enjoyable meeting yet held.

Although the attendance was not as large as we had anticipated, owing to the fact that many Western delegates were compelled to be in attendance at the Columbus fêtes at Chicago, yet the number of delegates (about 400) was larger than at any former meeting, and there were fully as many more representatives of allied interests and visitors.

THE PAPERS

read were of unusual interest, and reflect great credit on the committees, and will form a volume of valuable street railway literature, but the discussions following the reading of the papers were rambling and not up to the standard of the papers.

The advantages of having the papers printed and distributed previous to the meeting were not fully realized, from the fact that they were not handed to the secretary for distribution in time before the meeting to allow of careful study. The printed copies, however, proved of great assistance in following the reading and for ready reference. The hesitancy manifest on the part of the delegates to engage promptly in the discussion, and the tendency to ramble away from the subject in hand, show that it is as necessary to have certain parties selected beforehand, whose duty it is to open the discussion following the reading of particular papers, as it is to designate the committees who shall prepare papers, and also that the presiding officer hold the meeting well in hand and check any tendency to lug in side issues.

THE OFFICERS AND EXECUTIVE COMMITTEE

performed their duties in an admirable manner and received the grateful appreciation of the members.

THE EXPOSITION OF APPLIANCES

surpassed that at any former meeting, as will be noted from the report in another column, and received the attention and praise of every delegate, while it evidences in a striking manner the enterprise of the various dealers and shows their interest in the welfare of the Association. The advantages of having the exhibits in one locality was strikingly shown, but the necessity of providing a much larger space for these exhibits at future meetings was not less marked. This difficulty must be met, for the overcrowding during the evening hours when the whole city seemed to be besieging the doors was dangerous and disagreeable both to exhibitors and visitors.

In case sufficient space is not available, there should be a small entrance fee imposed upon the public, or they should be admitted only during the business sessions, when the delegates are otherwise engaged. No reflection, however, is cast upon the local committee in this case, for the hall and the temporary building adjoining were supposed to be ample for all purposes.

THE HOTEL ACCOMMODATIONS

were ample, the attendance and entertainment satisfactory and rates reasonable. We heard no complaints, and we think every guest left the city with pleasant memories of his stay in Cleveland. The Hollenden proved to be a model "headquarters," and the new rule of excluding all exhibits and posters from the rooms, lobbies and halls was appreciated by all.

EXCURSION TO THE SHORT ELECTRIC RAILWAY CO.'S WORKS.

Following the adjournment of the first session, the delegates, ladies and visitors accepted an invitation from the Short Electric Railway Co. to visit its works, and boarded a train of ten electric cars that were in waiting on a temporary siding that had been laid with the overhead construction the night before on Bond Street in front of the Hollenden Hotel.

A pleasant ride over the Prospect Street line of the East Cleveland Railroad Co. brought the guests to the works, and the cars were run into a siding extending through the company's grounds, Mr. Short himself having acted as motorman on one of the cars which was equipped with gearless motors and truck of his own invention. Having alighted, the company were escorted first, through the business offices, Mr. Short and President Potter welcoming all in their private apartment. The halls, lobbies, private offices, furniture and railings were decorated with a lavish profusion of palms, flowering plants, cut flowers and festoons of smilax, while a string band, concealed behind a bank of huge palms, enlivened the scene with strains of enchanting music, reminding one the pictured scenes of fairy land. In answer to a question, we were informed that this was the ordinary every day furnishing of the offices.

Leaving the office building, each guest was handed a boutonnière, and the company was conducted across the street to the works and first made a tour through the cathedral building where was an endless variety of motors and parts in various stages of completion, the workmen being engaged at their ordinary tasks, making the contrast between the æsthetic and the practical as violent as can be imagined.

Passing on through the testing room where the great throbbing engine was performing its accustomed labor, unmindful of the presence of the admiring guests, to the rear room of the cathedral building, another surprising but agreeable contrast was met. Occupying a cleared space down the center of the room were long tables, loaded with the choicest viands, while the white linen, shining silver, glistening glass, delicate china and floral decorations were in marked contrast to the electrical material that was strewed all about. Never did dining room have such a setting, and never was a lunch more enjoyed or partaken with a keener relish; "And aft they ca'd it guid."

Mrs. Short graced the occasion with her presence and gave special attention to see that the ladies of the company were properly served. Among the table decorations was a large floral electric open car with the name of the company in purple flowers spelled out on the side sill. The cream was frozen in the form of a ring armature, showing the winding of the bobbins and other characteristics of the armature employed in the Short system.

After lunch a run was taken through the different departments of the works, when all were assembled in front of the machine shop and photographed in a group.

Again the cars were boarded, when a run was taken over the lines past the Garfield Monument and other interesting localities, when all were returned safely to the hotel, being profuse in their praises of the company's kindness and hospitality.

Any description of the excursion will be incomplete without reference to the cars in which the trip to the works was made.

One of these was the well known Accelerator, manufactured by the Brownell Car Co., of St. Louis, mounted on their improved non-teetering truck and equipped with two thirty horse power, single reduction, Short motor.

Another car, painted white, was manufactured by the Lamokin Car Co., of Philadelphia, which was mounted on the Robinson all-steel truck, and equipped with one twenty horse power, single reduction, Short motor.

The General Electric Co.'s system was represented by two cars, one an eight wheel car, manufactured by the J. G. Brill Co., the other a handsome closed car, manufactured by the Gilbert Manufacturing Co., and mounted on a McGuire truck.

The Sperry system which employs a single motor geared to both axles was illustrated on a highly finished car, built by the Pullman Co., mounted on the new No. 19 F., McGuire truck.

A handsome car, built by the St. Louis Car Co., served to demonstrate the advantage of the new gearless motor, and as noted above, was run by Mr. Short.

The officers of the Association were carried on the gorgeous private car of Mr. Short, which has recently been re-equipped, now having the new Short gearless motors and the Anger truck. This car, it will be remembered, was built by the Gilbert Manufacturing Co.

A car, manufactured by the East Cleveland Railroad Co., and mounted on the Fulton Foundry Co.'s truck, was propelled by two Short single reduction motors.

Four ordinary open cars, of the East Cleveland Co., equipped with Edison motors, completed the train.

Another interesting feature of the occasion was the construction of the siding on Bond Street from which the start was made.

This temporary track, which was laid on tiers above the pavement, was composed of the Johnson girder rail with electrically welded chairs.

A SPECIAL EXCURSION

which proved very enjoyable, was tendered the ladies who were present at the convention by Mrs. S. H. Short on the afternoon of the second day. The trip was made in the elegant private cars, above described, and the route was out Euclid Avenue to Lake View and return by way of Cedar Avenue to the Union Club where a bountiful luncheon was served by Mrs. Short. The floral decorations of the table were tasteful, and all the appointments were in keeping with the generous hospitality of the hostess. The guests were: Mrs. W. J. Stephenson, Washington, D. C.; Mrs. T. E. White, Washington, D. C.; Mrs. Church, Washington, D. C.; Mrs. T. E. Loyd, Washington, D. C.; Mrs. W. Worth Bean, St. Joseph, Mich.; Mrs. G. H. Bush, St. Joseph, Mich.; Mrs. A. De Bevoise, Hoboken, N. J.; Mrs. A. E. Lang, Toledo, O.; Mrs. Smallman, London, Ont.; Miss Richardson, Brooklyn, N. Y.; Mrs. Wm. Richardson, Brooklyn, N. Y.; Mrs. Wm. J. Richardson, Brooklyn, N. Y.; Mrs. J. S. Minary, St. Louis, Mo.; Mrs. G. H. Bunch, Memphis, Tenn.; Mrs. Wm. Hazleton, Cleveland, O.; Mrs. Lewis Perrine, Trenton, N. J.; Mrs T. H. McLean, New York; Mrs. E. P. Morris, Boston, Mass.; Mrs. Charles Cleminshaw, Troy, N. Y.; Mrs. W. Kemp, Troy, N. Y.; Mrs. Maxcy, Troy, N. Y.; Mrs. J. A. Hanna, Chicago, Ill.; Mrs. Clark Rude, Mansfield, O.; Mrs. Graham, Norwalk, O.; Mrs. B. Owen, Reading, Pa.; Mrs. Smith, McKeesport, Pa.; Mrs. Chapman, Grand Rapids, Mich.; Mrs. Longstreet, Denver, Colo.; Mrs. Ferguson, Denver, Colo.; Miss Ferguson, Denver, Colo.; Mrs. I. Burgess, Cleveland, O.

THE LOCAL COMMITTEE

of arrangements performed their arduous duties in an admirable manner and won the hearts of every member. The JOURNAL staff are especially indebted to them for courtesies shown. The generous hospitality shown by the local companies in providing for the guests, has placed the Association under many obligations. May they continue to prosper, we know, is the wish of every member.

THE LOCAL DAILY PAPERS

had representatives present and devoted considerable space to Association matters, and seemed to do all in their power to make the delegates feel at home. It is gratifying to find the press of so large a city in sympathy with street railway interests.

EXCURSION TO THE WALKER MANUFACTURING CO.'S WORKS.

A fitting close to the three days' session was the excursion and banquet tendered by the Walker Manufacturing Co. to all in attendance, of which over 250 accepted.

Carriages were in waiting at the Hollenden at 10 o'clock Friday morning, and after a delightful drive of half an hour the extensive works of the company, beautifully located on the shore of Lake Erie, were reached.

Although it was a legal holiday, the works were in full blast, the men having sacrificed their vacation in order to exhibit the resources and magnificent equipment of the works. These we will not stop to describe, as they were fully illustrated in our Souvenir edition.

After a pleasant visit through the foundry and machine shops, the guests repaired to the draughting room over the main office, where lunch was served. The room and tables were profusely decorated with flags, streamers, plants and flowers, making it indeed a "fairy land." Seats were arranged on each side of four long tables, and everybody was made to feel at home. The lunch was bountiful, and was partaken of with the keenest relish, Mr. Walker himself doing the honors of the occasion. The splendid tool equipment of the shops, and the great quantity of completed cable machinery awaiting shipment, was a revelation to many, and was the admiration of all.

A full description of the exhibits made at the Convention, as well as a list of many of the attendants, will be found on another page.

Storage Battery Cars in New York.

Two railway companies in New York are preparing to test storage battery cars in actual practice. One of these companies is the Second Avenue Railway Co., which will soon have ten cars in operation on the Waddell-Entz system, on Second Avenue between their main depot on Ninety-sixth Street and the Harlem River. The Ninth Avenue Railway Co. officials are trying an Acme storage car.

The Brooklyn Bridge Traffic During Columbus Week.

During the "Columbus Festival" in New York, the various lines of transportation leading to the metropolitan district, as well as those within its boundaries, were obliged to carry a largely increased number of passengers, as compared with their ordinary traffic, and at times within quite limited periods.

What was successfully done on the New York & Brooklyn Bridge Cable Railway in moving the congested masses of humanity is shown in the following summary of operations on the week which included the festival:

On this railway trains of from two to four cars each are run on headways of from fifteen to one and one-half minutes, each varying at the time so as to best accommodate the fluctuations of travel. Usually the cable runs from five o'clock A. M. to one o'clock A. M. following, or twenty hours, and the last train during this interval hauled by cable is dispatched from Brooklyn station at 12:39 o'clock A. M. During the remaining four hours and twenty-one minutes of the day of twenty-four hours the trains are hauled by locomotives.

To carry the crowds offering on Wednesday and Thursday, October 12 and 13, the cable was run continuously for forty-four hours, and trains of from two to four cars each, averaging 3.87 cars, were run on headways from four to one and a half minutes, averaging two and one-fifteenth minutes. During the twenty-four hours beginning at 8:45 o'clock, Wednesday, 770 trains were run, on an average headway of one and five-sixths minutes, and 258,953 passengers were carried, or nearly one-fourth as many as were carried on the day of the greatest travel over the five elevated railroads in New York, constituting the Manhattan railway system.

For comparison, the numbers of passengers carried on the days of the preceding week, October 2 to 8, are written in the table, showing what is the ordinary traffic, at this time. Each day during the two weeks was fair. From this it will be seen that the increase in travel due to the Festival, began on Saturday, October 8, and continued for one week. The greatest increase was on Wednesday, October 12, when 223,625 passengers were carried; more than twice as many as on the same day the week before, and over 40 per cent. more than had ever before been carried in one day on the railway.

NEW YORK & BROOKLYN BRIDGE CABLE RAILWAY.

Summary of Operations during the Week including the Columbus Festival.

DAY.—1892.	Length of Time the Trains ran.	Average Headway.	Total Number of Trains.	No. of Single Car Round Trips.	Average No. of Cars per Trip.	Passengers Carried.		Passengers Carried the same day of the prec'd'g week.	
						No.	Av. per Car.	No.	Ratio.
	H. M.	M. S.							
Sunday..Oct. 9.	24.00	3.12	453	1652	3.65	99309	30.0	81918	1.21
Monday. " 10.	22.32 *a*	2.28	549	2096	3.82	188677	45.0	167122	1.13
Tuesday. " 11.	22.45 *a*	2.27	558	2114	3.81	158085	37.4	120204	1.32
Wedn's'y " 12.	24.00	2.04	697	2622	3.76	223625	42.6	109790	2.04
Thursday " 13.	24.00	2.18	624	2383	3.82	144842	30.4	112464	1.29
Friday... " 14.	24.00	2.44	526	1931	3.67	123413	32.0	116479	1.06
Saturday. " 15.	24.00	2.45	524	1943	3.71	153588	39.5	162006	0.95
For the Week...	165.17	2.31	3931	14741	3.75	1091539	37.0	869983	1.25
b. From 8:15 A.M. Wednesday, Oct. 12 to 8:15 A. M. Thursday, Oct. 13	24.00	1.50	770	3032	3.94	*c.* 258593	42.6	.....	....
b. From 5:00 A.M. Wednesday, Oct. 12 to 12:39 A. M. Friday, Oct. 14.	43.39	2.04	1266	4895	3.87	*c.* 358913	36.6	.....	....

a.—To permit displays of fireworks, trains did not run one hour, and twenty-eight minutes Monday evening, and one hour and fifteen minutes Tuesday evening.

b.—The trains usually are sent out from Brooklyn by cable, from 5 A. M. to 12:39 A. M., that is, nineteen hours and thirty-nine minutes, and by locomotive the remaining four hours and twenty-one minutes. In this instance the trains were hauled continuously by cable forty-three hours and thirty-nine minutes.

c.—Estimated.

The operations here recorded illustrate the extreme flexibility of a cable railway system. During the period covered there was no halt or failure of the driving mechanism, and the increase in demand for hauling power was much less, comparatively, than the increase in traffic handled. The reliability of the driving mechanism employed was, however, but one element contributing to the success of the work done; the discipline, vigilance and efficiency of the employes operating the railway constituted another element fully as important; a few served twenty-six hours continuously, more twenty-four hours, and most of the others nineteen hours, all with entire willingness and a strong personal desire each to perform faithful and effective service.

"WE would recommend for small towns the construction of narrow gauge roads, and feel confident they would give greater satisfaction. The width of a narrow gauge road, being three, three and a half and four feet, prevents other vehicles from traveling on the track, thus preserving the roadbed and preventing it from being cut up. It has been found by experience that on a narrow gauge track a lighter car can be used. A car on a three feet gauge track requires 33 per cent. less power to pull it than does a car on the regular standard."—*Chicago Street Railway Convention*, 1883.

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

Address all communications to

Street Railway Publishing Co.,
World Building, New York.

The Souvenir which we issued in honor of the Convention, was well received, and we are grateful for the many pleasant things said for it and for the STREET RAILWAY JOURNAL.

That Averages are a Delusion and a Snare is strikingly illustrated in the paper on the "Relative Cost of Operating the Different Systems" and emphasizes what we have often said in regard to employing the car mile as a standard of comparison. The paper was carefully prepared and shows a prodigious amount of work, but thorough analysis of it must be deferred to a later number.

President Holmes' Address was ably conceived and admirably delivered, and received the hearty applause of the delegates. His prophetic allusion to the future of electric traction, were it not that still more fabulous predictions have already been fulfilled, would seem to be too extravagant to be entertained for a moment, but everyone realizes that the statement "that we are yet only on the threshold of electric traction" is true.

"A Perfect Overhead Electric Construction" was the title of a brief but excellent paper prepared by Mr Charles H. Smith and seemed to coincide so fully with the views of the delegates that no discussion followed. The concluding statement, however, is one that every manager would do well to ponder and practice: "I would say that no matter what expense is incurred, material or care used in constructing a good line cannot be ensured without a thorough daily inspection."

Valuable Recommendations and such as should receive careful attention at the hands of the committees and officers to which they were assigned, were contained in the able paper on "Standards." Mr. O. T. Crosby, chairman of the committee presenting the report, deserves a great deal of credit for the persistent efforts he has put forth at this and other conventions, to attain the desired end. The need of standardizing many parts is plain to all; especially is this true for rails and wheels, as is shown in another paper treating on rail heads. We shall have occasion to refer to this matter of standards in future issues.

The Character of the Metal from which rails are made has much to do with their life and efficiency, according to the able paper read by Mr. Baumhoff, and his suggestion that an order for rails be accompanied by specifications as to the chemical composition of the steel is a good one, and is already the practice of some lines. No paper read at the convention attracted more attention than Mr. Baumhoff's on a "Model Roadbed" and no other was so thoroughly discussed. Only one or two exceptions were taken to the recommendations of the committee, and we are pleased to know that the types of construction recommended coincide very closely with our own views on the subject.

The Mayor's Address of Welcome to the delegates at the Cleveland Convention was one of the most able and interesting speeches ever delivered before the association by a public functionary. Street railway men should not only read it, but should see that a copy, as printed in this issue of the STREET RAILWAY JOURNAL, is put into the hands of the mayor of every important city. It also contains some suggestions that railroad men would do well to ponder, especially those relating to long grants and the importance of employing skillful and well trained (licensed) motormen as a provision against accidents. Grip and wire pulling have indeed come to have a new meaning, as the mayor says, and coupled with the proverbial "push and pull" for which street railway men are noted, may be turned to the very best good of both community and operating companies.

It is Possible and Probable that a standard rail head will soon be adopted, the advantages of which are fully set forth in the carefully prepared paper presented by Mr. J. F. Ostrom. Not only can we have a standard head, but this will lead to a standard wheel, so that a great burden will be lifted from the shoulders of the wheel makers, and also from the users. The universal need for standards in these directions is evidenced by the numerous replies received from street railway companies to a circular letter sent out asking in regard to present practice; and where such a want is felt it will sooner or later be gratified. It is evident that a great amount of labor and study has been bestowed upon the paper, and the volume of statistics collected bearing on the subject will be of great value in solving other perplexing questions. As this work has been voluntary on the part of the writer, the Association is greatly indebted to him.

The paper presented by Mr. A. J. Moxham at the Cleveland Convention was a most valuable one in that it outlines the importance of definite experiments, investigation and tests to determine how far natural laws are affected by certain conditions. According to some of the experiments given, the laws governing the contraction and expansion of metals may, under certain circumstances, be ignored in the construction of street railway track. This would seem to be a bold theory, but it is confirmed by the practice cited; but other experiments in the line of a continuous rail on steam roads have not given satisfactory results. One of the conclusions of the

paper in regard to the joint, which is no doubt true, is that it is the space between the ends of the rails, and not the weakness of the joint, that causes the trouble. The paper showed most careful investigation, and contained much that is valuable and of the greatest interest to the street railway manager.

A Pioneer in many things relating to street railway practice, is a title well merited by Mr. D. F. Longstreet, as is shown in his paper on the causes that led up to the formation of the American Street Railway Association. Not only did he discover the need of system in the operation of the affairs of a company, and feel the need of the advice and assistance of others engaged in the same line of business, but, being of an inquiring disposition, he sought some device for assisting conductors to keep their accounts correctly, and in answer came the bell punch and register. We know of no publication in which the marvelous growth of the business is so strikingly illustrated as in this paper, and it was a happy thought which led to its publication. Judging by the past, it is reasonable to expect that the Association, which had its origin in the brain of its new president, will yet become a great power in influencing the growth and character of the street railway business throughout the world.

So Long as Grade Crossings Exist, experience has shown that accidents from collisions between steam railway trains and the occupants of streets are extremely liable to occur. Three serious cases of this kind, in which street railway passengers were the sufferers, were reported extensively during the first week of last month, and emphasize the fact, which we have always maintained, that the greatest care should be taken to guard such points. Two of these accidents took place on October 4. In one, a horse car in Orange, N. J., was struck on a crossing of the Delaware, Lackawanna & Western Railroad, and one person was killed and two injured. The second accident occurred in Cincinnati, where a switch engine ran into a loaded street car, killing two persons and injuring four others. The third was on October 6, when a Belt Line car in New York City was overturned by a freight train on Tenth Avenue, and three passengers and the driver were hurt. In each case the crossing was guarded by flagmen or gatemen who, however, seemed incapable of preventing the accidents. All grade crossings are, undeniably, points of danger, and should be protected by some system of automatic block signals or safety switches, by which the chance of such collisions would be greatly reduced, if not eliminated. Negligence and incapacity are qualities which, unfortunately, are liable to exist in guards and flagmen, and the sooner such crossings are supplied with automatic protecting devices the better.

Conventions of political, educational and religious bodies, of trades and professions, are characteristic of this age of combination and organization. In nearly every case, however, the membership of such organizations consists of those employed directly in a common trade or calling, the chief exception being political and religious bodies; but in this respect the American Street Railway Association is unique, as it embraces in its direct membership nearly every profession and trade, including men prominent in leading and financial circles, managing directors (men who have made street railroads and those whom railroads have made), executive officers, accountants and others composing the executive staff. There are also civil, mechanical and electrical engineers, veterinaries, workers in metal and wood of every class; while among the non-members are those composing the great body of visitors, manufacturers of and dealers in numerous appliances embracing every commercial industry, and last, but not least, the representatives of the daily and technical press. Notwithstanding these diversified employments, all are interested in the development, extension and improvement of street railways, and all seem to be actuated by the same laudable desire to give, receive and take home whatever will make for the common good and which may have come to the knowledge of each in his individual calling. It is not essential, however, that such knowledge must accumulate and be made available only once a year, for the STREET RAILWAY JOURNAL in its way, is a perpetual convention, and may be made the medium through which every man may give or gain that which will add to his own power or that of others for doing useful work. In any event the value of the conventions, or of this paper to the individual, depends largely upon his desire to know, and the consideration he has for the good of others.

All Industries are Waiting for More Skill, but with none is this fact more apparent than with street railway business, and those interested should be willing to pay a reasonable price for it in order to hasten its coming. This subject was incidentally treated in a paper on the "Economy of Machine Shops" read by Mr. J. H. Bickford at the Cleveland Convention, and deserves the careful attention of street railway managers. The men controlling this industry should not, if they could, compete in making labor come down, nor encourage any movement tending to this end. There are plenty of men controlling other industries who can easily beat in such a contest, but street railway men should be above it and never think that a downward competition is open to them. On the other hand, there should be a concentrated movement to raise the intelligence and skill of employes, so that this industry shall be above all competition. "What do you mix with your colors?" was asked of a painter; "brains," said the master, "brains." Labor tells just in proportion as it is mixed with brains, and for such a mixture managers can afford to pay a reasonable price.

* * * * *

The paper referred to above, besides being convincing, beyond question, that a well equipped repair shop is an essential and economical feature of an electric line, was in its method of preparation a model, the writer having supplemented his own experience by that of a number of other managers which he obtained by directly communicating with them. He complains, however, that from over 200 letters of inquiry sent out only sixty-six replies were received. From our experience in such matters we think he was extremely fortunate in receiving even so many. This raises a question which we have never been able to answer satisfactorily, why it is, in investigations of this kind, which are instituted wholly for the benefit of of the business at large, so many managers neglect or refuse to answer a set of simple questions relating to their ordinary practice. It argues at least that there is a large number of persons controlling street railway interests who have not yet caught the spirit of progress that marks the development of this business, and were it dependent upon them,

"No greatness ever had been dreamed or done."

Correspondence.

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

The $350,000 Cable Road and the $46,000 Electric Road.

III.

(*Continued from* STREET RAILWAY JOURNAL *for August.*)

Drawing his inspiration from Census Bulletin No. 55, that admirable treatise on "*The Relative Economy of Cable, Electric and Animal Motive Power for Street Railways*," the writer in *Engineering Magazine* for May, 1892, whom I have before quoted, says: "No one would think for a moment of building a cable road if a franchise could be obtained for a trolley road, as they cannot carry any more people, route for route, than the electric road, and cost nearly ten times as much to build." This article is, throughout, so excellent a specimen of the current literature of this subject that I shall quote it frequently.

My July letter said, "for the small business now done by the cheap, half-built electric road with its occasional car, the cable system cannot compete; for a cable railway business the cost of a cable road is not ten times, or five times, or two times, or one and a half times the cost of an electric road."

The statement that a cable road cannot carry any more people than an electric road "route for route" is obscure. But our magazine writer—not content with making ten bills out of the seven he found wrapped up in his copy of the Bulletin—seems to imply that the cable road equipped with nineteen cars, of which about 30 per cent. are eight-wheel cars, "cannot carry any more people" than the electric road with 2.93 four-wheel cars, per mile of line.

It is safe, however, to say that a given business requires fully as many electric as cable cars.

And when we compare the $46,000 electric with the $350,000 cable road (which cost less than $217,000) it is well to remember that *the cost of an electric road bears a rather close relation to the number of its cars.*

Mr. F. L. Pope says in the STREET RAILWAY JOURNAL for February, 1891, "The whole outfit, *exclusive of roadbed, track and buildings*, for either system [overhead or storage] will aggregate perhaps $10,000 *per car.*"

The president of the West End Street Railway, addressing the Commercial Club of Providence, in May last, said, "* * * to provide this means of transportation it is necessary for some one to put in $10,000 for every *car.*"

In my July letter I said, "If we add fifteen or eighteen cars to the three [of the $46,000 electric road] an added investment of $150,000 per mile is necessary; not for the cars alone, but for the cars and what is necessary to run them."

The last two statements probably fall short of the truth in the premises, but neglecting the dollars for a while, and bearing in mind the principle, it is well to get a clear idea now of what the electric road of to-day really is as to its equipment and its capacity for business; and I want to emphasize the fact that the road everywhere compared with the cable railways so fearfully and wonderfully misrepresented in Census Bulletin No. 55, is a thing of three cars or less per mile of line.

Here are figures picked up at random:

THE ELECTRIC RAILROAD—ITS CARS PER MILE.

	Miles.	Cars.	Cars per Mile.
In 1888, *The Car*, Dec., 1891	48	95	2.00
" 1889, 26 Cities, *Railroad & Engineering Journal*, Oct., '89	380	538	1.40
" 1889, *Street Railway Gazette*, June, '89	592	966	1.62
" 1890, *New York Times*, April, '90	1,260	2,000	1.59
" 1891, *The Car*, Dec., '91	3,000	4,513	1.50
" 1891, New Mileage, *Street Railway Journal*, April, '92	1,538	3,300	2.15
" 1892, *Philadelphia Pamphlet*, March, '92	4,062	7,181	1.77
" 1892, *Street Railway Journal*, April, '92	4,061	8,892	2.19

It matters little whether the "miles" above are miles of line or miles of track; the difference in the case of the electric road, on large averages is probably less than 15 per cent. Wherever you find it the electric road is equipped for a very light business.

And moreover it is always this attenuated thing in the minds of those connected with the electric interest.

Mr. C. J. Field, in an estimate given in the STREET RAILWAY JOURNAL for October, 1891, proposes to take a street railway in a city of 100,000 inhabitants, and to equip it electrically "with forty miles of single track and sixty-five electric cars."

From the examination of a prominent electric railway man, before a committee in Philadelphia last March, I extract this:

Q. How many miles under this contract are to be covered in Brooklyn, and how many cars?

A. I do not know the number of miles, but six hundred cars.

Q. How many miles approximately?

A. *They run, say, three cars to the mile, and that, roughly, would be two hundred miles.*

Illustrations might be multiplied; this general impression is well supported by the facts.

Further than this, it may be said, there is probably *no where in existence* an electric road, the steam plant, electrical equipment, wiring and rolling stock of which are equal to *one-third* of the 1,242 "standard car"-miles of the average cable road of the Bulletin; while among cable roads we find such business as 2,000, 2,200 and 2,500 car miles per mile of line per day, not for exceptional days, but for yearly averages.

If there is as heavy an electric business anywhere else as that of the West End, of Boston, I do not know of it, and from such imperfect data as I can find I *estimate* the average West End business for the year ending September 30th, 1891, at about 300 car miles per mile of line (electrically equipped) per day, or allowing for long cars in use (and counting four wheels to the "standard car"), at about 375 "standard car"-miles.

It may be said, incidentally, that the West End Street Railway is not one of the "$46,000" electric roads. When finished, it will probably be found in a class by itself; and I doubt not that it will illustrate this truth: *The cost of an electric road bears a close relation to the number of its cars.*

Let us now add this: "*The cost of a cable road is better measured by its length.*"

Though these assumptions are not strictly true, they are so far consistent with the facts that a little study of the subject shows the electric to have a decided advantage on one end of the scale of business, and the cable road on the other.

It is admitted again that because of the cost, a cable road should not be built for 177 car miles per mile of line per day, or for a traffic that may be handled by single four-wheel cars on thirteen minutes' headway. Don't build a steam hammer to crack nuts; there are better ways of cracking nuts.

But I venture to predict that by the time *any* trolley road has reached *half* the business done by the *average* cable railway of this country, the writer quoted at the head of this letter will have had it forced upon him that, for a cable railway business, the cost of a cable road is not even one and a half times the cost of an electric road.

A glance towards Boston, or Brooklyn, ought to suggest this to observant people. The president of the great Boston system said, in May last, "The West End Railway has expended $9,000,000 and it is not quite finished yet [very truly]. * * * The company will have 1,000 cars [it had perhaps 550 of them at this time, electrically equipped]. * * It will cost the company upwards of $3,000,000 to get the power to drive the cars around," and so on. And the STREET RAILWAY JOURNAL, for June, tells us that the power house at Harrison Street and Albany Avenue will contain engines of 26,000 H. P., and the one now building at Cambridge 5,000 H. P. more; and these together be 31,000 H. P. The same Journal of Education informs us, by the by, that the total amount of copper purchased by the West End Company "*during the last three months* of 1891, in the shape of feed wire, trolley

wire, bonds, etc., aggregated a million and a quarter pounds." (Worth about fifteen cents a pound; but whether this is Information or Misinformation I cannot guess). An occasional glance at Boston or at Brooklyn, will dispel this popular $46,000 electric delusion.

From auditors' books I get details of the cost of sixteen miles of the cable railways included in Census Bulletin No. 55—parts of the systems of two companies. The figures were taken when the lines had been in operation about six months. From this sixteen miles of road an average mile is made, which is given below for the cable side of the table. In a parallel column is exhibited the *estimated* cost of corresponding details for an electric road, *similarly equipped, in the same place, at the same prices.*

On the cable side I have omitted only the estimated value of the old Horse Railroad property; but as the auditors' *distribution* of the disbursements was sometimes most *unprincipled*, from our point of view, I have to some extent reformed the records, leaving marks, generally, of the operation in the round numbers which will be noticed in the column on the left. This process I have carried far enough, perhaps (and not too far, I hope), for present purposes. Not a dollar of the *total* has "got away," which is an important thing.

In the electric side I admit a lack of entire confidence in details and total. Some critic will, perhaps, show us how to reduce the latter by 90, or 80, or 50, or 33 per cent. without a corresponding reduction of the cable side.

Of the sixteen and one-half miles of double track cable road, from which the average mile below was obtained, these details will be of interest:

Curvature in tracks, 111 degs. of double track curvature per mile of double track.

Length of curved track, about 133 ft. per mile of line.

Power houses, four, or one to four miles.

Cables, eight, of an average length of about 22,600 ft.

In their steam plant these cable roads are equipped for an *average* of 2,000 car miles per mile of line per day; and by this I mean that with 50 per cent. of their engines and 33 per cent. of their boilers in reserve, the engines using steam at eighty pounds, cut off at one-fifth of the stroke, have a nominal horse power equal to the *average* power required on these roads for this car mileage, made in twenty hours at an average car speed of eight miles per hour, including stops. (When we consider the possibilities of such a steam plant, with steam run up to, say, 125 lbs., it is obvious that these roads were heavily overloaded in this respect for the business and the car equipment with which they started out. This is the rule rather than the exception on cable roads, but who ever yet has seen an electric road with any such provision for future growth, with anything whatever in reserve for an extraordinary demand?)

I have endeavored to similarly equip the electric road, as to its steam plant, its electric plant and its wiring, with, however, a smaller reserve in the power plant.

Our two roads being now near enough alike for comparison, we find them to be, in cost, about 5 per cent. apart; and if we bring the rolling stock in each case up to the capacity of the power plant for an *average* day's work of 2,000 car miles (bearing in mind, what seems to be often overlooked, that the "average" can never equal the maximum), we shall not yet be equipped for the business of, let us say, the Olive Street line of St. Louis, but the difference in the cost of the two systems will have entirely disappeared.

In my next letter some concessions will be made in connection with this exhibit, which will impress the reader with my liberality; and taking up the *financial* aspect of the case, I expect to show how easy it is to be liberal when you stand on a cable railway business.

Incidentally, I would note that the $5,000,000 worth of

COMPARATIVE ESTIMATE, ONE MILE OF DOUBLE TRACK.

The Cable Road. [From Auditors' Books.]		The Electric Road. [An estimate for a road of like capacity.]	
Ground for Buildings, and Right of Way	$13,343	Ground for Buildings, and Right of Way	$13,343
Buildings, exclusive of machinery foundations and of Main Vault	20,552	Buildings, exclusive of machinery foundations	20,552
Foundations for Steam Plant and Winding Machinery.	2,400	Foundations for Steam Plant and Generators	2,400
Engines, erected, exclusive of foundations	4,396	Engines, erected, exclusive of foundations	16,000
Boilers and Appurtenances, exclusive of foundations	3,794	Boilers and Appurtenances, exclusive of foundations	
Winding Machinery	6,511	Electrical Equipment of Power House	13,000
Tension Carriages	595		
Other Machinery	422	Other Machinery	422
Electric Light Plant	209	Electric Light Plant	100
Shop Tools and Supplies	1,191	Shop Tools and Supplies	4,000
Main Vault	1,200		
Excavation	6,568	Excavation, 20 inches deep	3,500
Concrete and Brickwork	31,148	Broken Stone Ballast, 12 inches deep	4,200
Wheel Rail (Mostly 58 to 60 lbs. Girder, at $50 to $55),	9,350	Wheel Rails	9,350
Slot Rail and Paving Plates	10,892	Tie Rods (5 ft. apart)	1,300
Curved Rails	1,600	Curved Rails?	800
Switches, Crossings, etc.	1,610	Switches, Crossings, etc. (track)	500
Yokes	15,276	Ties (2 ft. apart)	2,500
Manhole Castings	1,600	Chairs	4,000
Bolts and Fastenings	4,150	Spikes, Joints and Brackets (on curves)	1,000
Line Machinery	3,739	Bonding, Materials and Labor	1,500
Track Laying	5,062	Track Laying	2,000
Paving	18,729	Paving	20,000
Drains	2,410	Subsoil Drains, connected with sewers	200
Cables	3,410	Poles	3,200
Gas and Water Changes	3,381	Trolley, Feed and Guard Wires (trolley switches, etc.)	4,000
Bridges and Viaducts	11,122	Bridges and Viaducts	15,000
Patent Licenses	1,318		
Engineering	4,922	Engineering	4,000
Rolling Stock (cars, grips, sweepers, etc.)	15,101	Rolling Stock (9 motor cars, 7 trailers, sweepers, etc.)	43,000
Legal	524	Legal	524
General Expense	1,996	General Expense	1,996
Miscellaneous Expense	900	Miscellaneous Expense	900
Insurance	23	Insurance	23
Damages	368	Damages	368
Taxes	47	Taxes	47
Discount, Interest and Commission on Bonds	12,659	Discount, Interest and Commission on Bonds	12,659
Cost of Securing Franchise	1,246	Cost of Securing Franchise	1,246
Grading Streets	1,722	Grading Streets	1,722
Total, so far	$225,486	Total so far	$209,352
Old Horse R. R., *say*	124,838.60	Old Horse R. R., *say*	124,838.60
Grand Total	$350,324.60	Grand Total	$334,190.60

"new stock" of a certain street railway, quoted at $194 per share in my last letter, is now selling at $255. "It is," indeed, "a healthy sort of a system," etc.

CABLE RAILWAYS.

(*To be continued.*)

Fare Taking in Europe.

The system of proportioning street car fares to the distance traveled by passengers is very popular abroad, and has been adopted on the street railway lines in practically all of the large European cities except Paris. Most of the lines also provide first and second class accommodations for passengers, with corresponding rates of fare, and this is done by the Paris lines, so that on a comparatively short road in Europe there may be five or six different rates in vogue depending on the distance traveled and the style in which each passenger wishes transportation. This practice is due largely to the rigid economy in regard to small expenditures practiced by many classes abroad, which would induce many of the short distance passengers to walk in preference to spending the amount required if a uniform fare of, say, five cents were in vogue. But while the lowest charges on European street lines are less than five cents, the charges for long distances are generally considerably in excess of the American standard fare, so that a fair return is given for the capital invested in nearly every case in spite of the arduous conditions often imposed and the antiquated methods of operation. Indeed, under the conditions, it is doubtful whether many of the lines which now show a good profit over operating expenses would be able to exist with the system of a uniform charge for transportation.

Waehrend der Fahrt aufzubewahren!

1. Nollendf. Pl. Leipziger Pl.	H **FAHRSCHEIN**	9. Lehrterstr. Gesundbrunn
2. Potsd.-St. E. Luetzowstr. Franzoesischst E. Charl. Str.	02462	8. Stromstr. E. Thurmstr. Wedding-Pl.
3. Leipziger Pl. Werdersch. M.	und bescheinigung ueber gezahlte 10 Pfennige Fahrgeld, als Ausweis fuer diejenige Person und Fahrt, fuer welche geloest, auf der duren Lochung bezeichneten Strecke und vor den in den Wagen aushaengenden Fahrbedingungen. **Dir. d. Gr. Berl. Pferde-E.** Friedrich-Strasse 218.	7. Beusselstr. Lehrter Str.
4. Mauerstr. Ozigerstr. Fischm.		6. Charlottenb Stromstr. E. Thurmstr.
5. Bahnhof.		

FIG. 1.

Various methods are employed in the collection of fares, and this item has not proved so difficult as at first thought might seem. The street railway line is first divided into sections or zones of from three-quarters of a mile to two miles in length, and the minimum fare is for transportation within one section, the next higher rate for travelers through two sections, and the third or maximum, if three rates only are charged, through three or more sections.

A passenger upon boarding a car informs the conductor of the distance which he wishes to travel, and then upon payment of his fare receives a fare receipt upon which is indicated the amount paid and the point at which he got on. The form of fare receipt adopted by the Great Berlin Horse Railway Co. is shown in Fig. 1. The O under section four indicates that the ticket was punched by the conductor and thereby the point of departure was recorded. Fig. 2 shows that employed by the Naples Tramway Co. The conductors on this line, however, tear the receipt or ticket at the proper point, instead of punching it. The receipt used by the Dublin Tramways Co. for 3d fares is shown in Fig. 3.

Reclusorio	TRAMWAYS NAPOLETANI	San Ferdinando
Porta Capuana	Il biglietto deve presentarsi ad ogni richiesta	Vittoria
Carmine	04750	Torretta
Principessa Margherita	Percorso di quattro Sezioni 1. CLASSE 25	Controllo

FIG. 2.

These receipts must be retained by the passengers and shown upon demand to any inspector of the railway company who may board the car. As these inspectors are not stationed at special points, but may get on a car at any time, the ticket must be always ready as evidence that the fare has been properly paid. Different classes of tickets are often distinguished by being printed on different colored paper.

Each receipt is numbered, and each has also the private mark of the railway company, so that old receipts cannot be secured by the conductors or saved by passengers for use a second time. As an additional precaution against fraud, the tickets are printed on long strips, or are pasted in blocks so that a ticket must be torn off in presence of the passenger. As the number assigned to each conductor upon starting out is recorded in the office of the company, the proper amount of receipts can be determined by the number of unused tickets turned in at the end of the day.

Dublin United Tramways Co.

Bu 0215

DONNYBROOK LINE.

TO OR FROM Donnybrook & City | 3d | 3d

This Ticket is available for a SINGLE journey only—on the Car where issued. It must be produced for inspection on demand of the Conductor or other official of the Company. Any passenger attempting to use this Ticket for a SECOND journey, or otherwise defrauding the Company, will be liable to Prosecution, and a fine of *Forty Shillings*. (See Bye-laws.)

FIG. 3.

8795 London Road Car Co. Ltd.

Car No. 108

Every passenger must have a Ticket, to be produced or given up on demand. 1d

Issued subject to regulations

FIG. 4.

Upon the reverse side of the tickets is sometimes printed some local advertisement, and the income from this source, not only often defrays the cost of printing, but is of itself sometimes an item of considerable income.

The system of fare receipts is not only used for lines on which different rates of fare are charged, but it is also in force on many omnibus lines and short street railway lines which have a uniform fare. The form used by the London Road Car Co. is shown in Fig. 4.

A Street Railway for Sale.

The Fidelity Trust and Safety Vault Co., of Louisville, Ky., trustee for the mortgage bondholders of the Mobile (Ala.) Street Railway Co., has offered the rights, franchises and property of that company for sale under the deed of trust. The property includes a total mileage equivalent to twenty and five-eighths miles of single track, with switches turnouts, etc., and the right of equipping the line with electric power. The sale will occur in front of the Court House at Mobile on November 14.

Electric Traction Abroad.

The Corporation Tramways Committee of Glasgow, Scotland, has invited estimates for the equipment of certain of the street railway routes in that city on the overhead wire system. Communications should be addressed to the general manager of the committee, John Young, City Chambers, Glasgow.

Meeting of the Ohio Street Railway Association.

The next annual meeting of the Ohio State Street Railway Association occurs this month at Zanesville, O. The date is Nov. 9, and a large attendance is expected.

IN conversation with Mr. J. W. McNamara, of Albany, we learn that the Lewis & Fowler girder rail, which was laid on State Street two years ago, is standing up remarkably well under the electric car traffic.

Philadelphia Electric Railway System.

As already stated in the STREET RAILWAY JOURNAL, the plans of the electric railway system of the Philadelphia Traction Co., in that city, have been decided upon, and the work of installation is now being carried forward by the Field Engineering Co., of New York.

The first station to be built will be located at the corner of Kansas Street and Sutherland Avenue (see Figs. 1 and 2). The steam plant here will consist of six horizontal, return tubular, steel boilers, seventy-two inches in diameter and twenty feet long. These boilers are designed for 100 lbs. steam pressure, and are fitted with domes and set in two batteries of three boilers each. The longitudinal seams are triple riveted and the joints double butt strapped. Each battery is furnished with full cast fronts, and the boilers are so set that the gases are returned over their tops, the setting being arranged with covering bars forming a flue over the top of the shell for this purpose. The brick flue for carrying gases from the boilers to the stack is placed at the rear of the boilers, and adjacent to the cross wall between the engine and boiler rooms. The boilers are fed by means of two No. 10 Monitor injectors and two Snow duplex feed pumps, 8×6×10 ins.

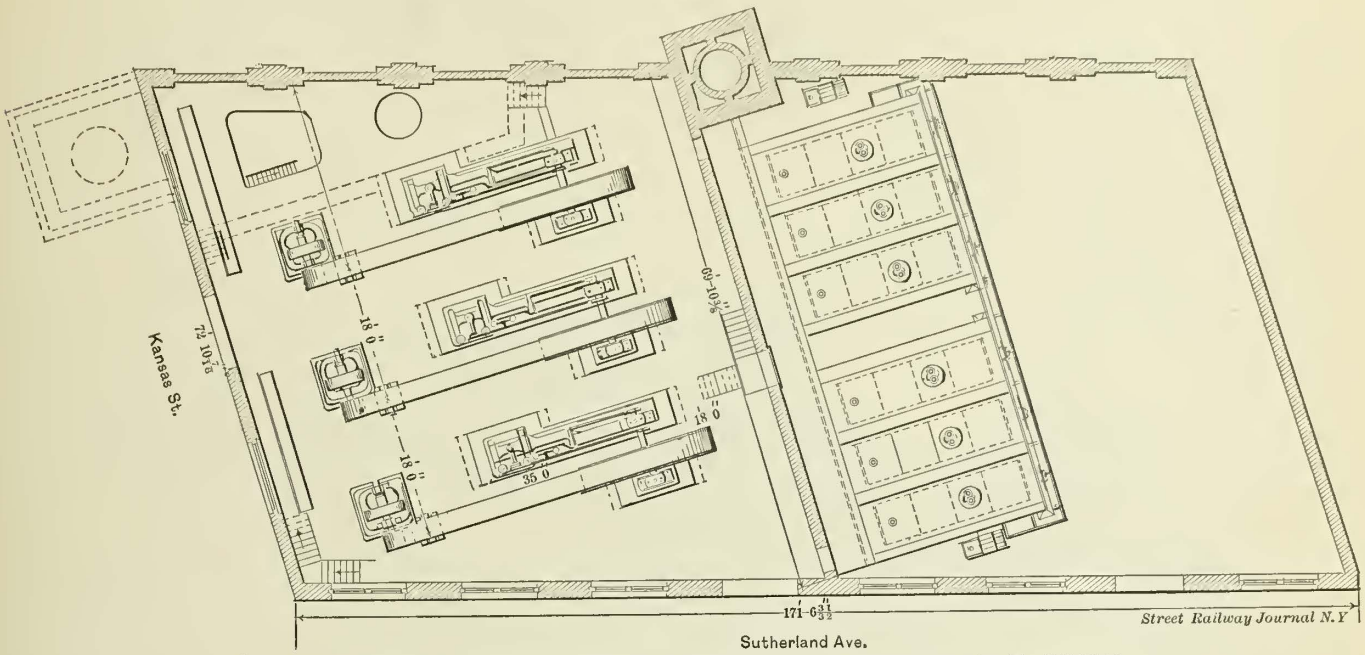


FIG. 1.—PLAN OF POWER STATION FOR PHILADELPHIA TRACTION CO.'S SYSTEM.

The engines are three in number, of 250 H. P. each, and of the horizontal, single cylinder, Corliss type, with all the latest improvements. The plan is to operate the engines at present non-condensing, but all arrangements have been made to enable the plant to be run condensing at any future date. The engine cylinders are twenty-two inches in diameter by forty-eight inches stroke. The flywheels are eighteen feet in diameter by thirty-four inches face, are made in eight segments, and have a total weight of 29,000 lbs. The crank shafts are hammered wrought iron, and provided with babbited main bearings. Both engines and boilers were furnished by Robert Wetherill & Co., of Chester, Pa., who are also the manufacturers of the feed water heater, which is of the water tube type.

The stack has an internal diameter of six feet, is 125 ft. high, and is made of wrought iron, lined with brick work for a distance of about forty feet from the base. The iron work of the chimney is supported on cast iron plates securely bolted to the brick base of the chimney, which latter also forms a portion of the side walls of the building by means of foundation bolts. The stack is made self supporting by means of wrought iron tie rods, which are secured at the base directly to the foundation bolts.

The steam piping is so arranged that any boiler may be connected with any engine, or *vice versa*, so that the liability of a shut down from repairs to the steam pipe system is avoided. The piping consists of one twelve inch main, which is carried under the engine room floor and has connecting branches to both engines and boilers, the branch pipes being connected to the main by means of two twelve inch valves. All piping made of wrought iron pipe is screwed into cast iron flanges, and is thoroughly caulked on the inside. All valves have steam metal seats with extra heavy shells, and were furnished by the Chapman Valve Co. The exhaust piping is so arranged that the heater can be cut out if necessary, without inconveniencing the operation of the plant. Coal can be delivered direct to the boiler room by means of teams.

The generating plant consists of three four-pole Westinghouse railway generators, of 186 K. W. capacity, and running at 525 revolutions. Power is transmitted from the engine by means of a thirty-two inch belt running over a stationary idler as shown in Fig. 2. The generators have each four brushes which rest on a commutator of ninety-five sections and seventeen inches diameter. The diameter of the shaft is four and a half inches. The series winding of the field magnets is arranged four in parallel and the shunt fields are connected in series. The commutator bars are all made of Eureka copper.

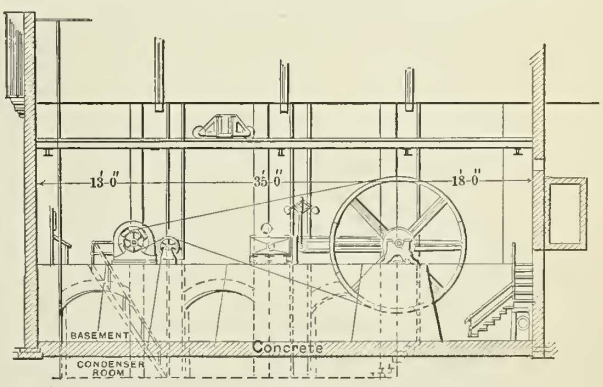


FIG. 2.—ARRANGEMENT OF ENGINES AND GENERATORS—PHILADELPHIA.

The generators are connected to a vertical switchboard built up of angle iron, to which are attached all the necessary ampere meters, automatic cut-outs, controlling switches, rheostats, etc., mounted on marble bases. This construction makes the board fireproof and very substantial. The feeder wires running from the board are conducted to a vault under the street, where connections are made with the underground feeder system.

The underground system adopted is the well known cement lined pipe set in concrete. The duct from the

station consists of eight pipes of three inches internal diameter, laid two feet deep and intended each to carry

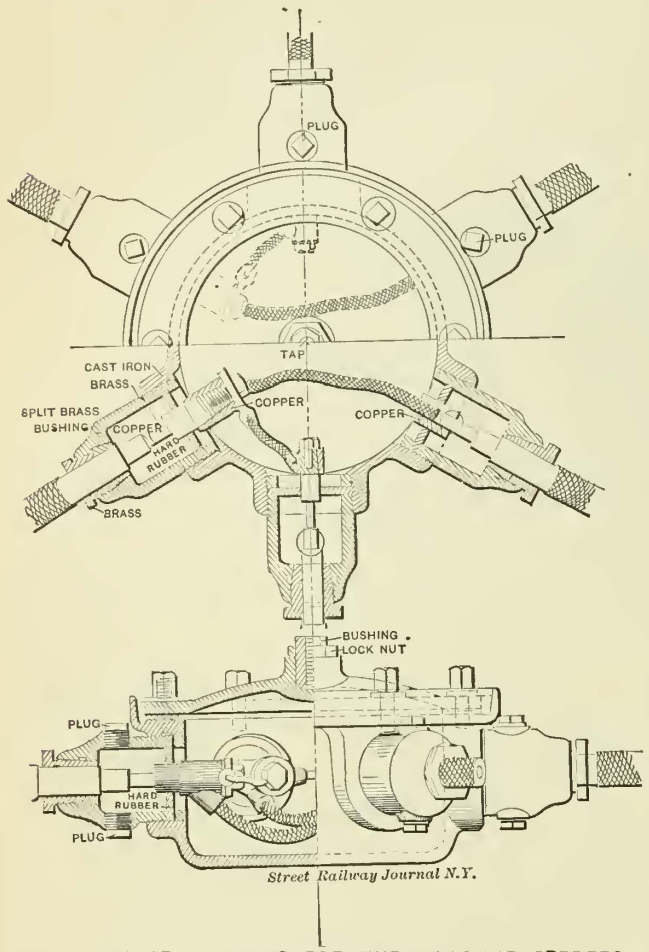


FIG. 3.—JUNCTION BOXES FOR UNDERGROUND FEEDERS—PHILADELPHIA.

two No. 0000 lead covered cables. Manholes are placed at suitable distances to enable careful and efficient handling of the wires, and also for dividing the line into sections for testing and disconnecting any defective part. The manholes are equipped with cast iron covers and water tight plates.

The junction box adopted is shown in Fig. 3 and has proved very efficient under severe service in other places. Connection is made to the line from the manhole through the inside of the nearest side pole, a special pole top being designed for necessary connections to the insulated span wire at this point.

The overhead construction is single track span wire with iron side poles. The side poles are twenty-eight feet in length, of six inch, five inch and four inch sections, extra heavy pipe, built up with telescope joints eighteen inches long. These poles are set in five and a half feet of concrete made up of the best Portland cement, sand and broken stone.

The span wire is No. 3 B. & S. silicon bronze wire, and attached to poles by means of the "Brooklyn" insulated turnbuckle. Double insulation is secured by the use of this insulator, and also by a round top bell insulator of moulded mica.

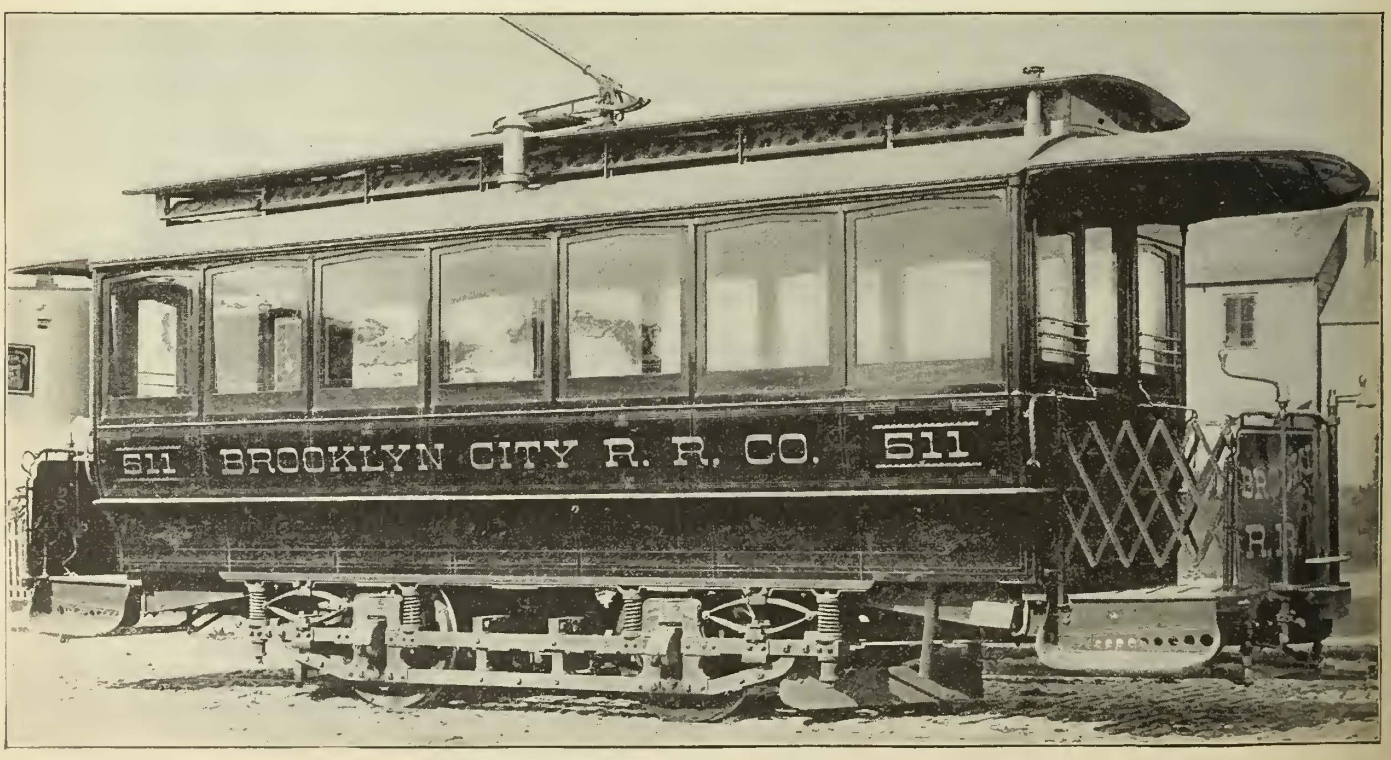
The trolley wire is No. 0 B. & S. hard drawn copper attached to insulator by soldered clips. To protect the trolley wire from other lines, two No. 6 B. & S. silicon bronze guard wires about three feet apart are used. All feed wires and mains are underground, the only wire overhead being those mentioned. The trolley line is divided into sections, each section being under direct control from station, and the wiring is so arranged that should should one feeder require overhauling, another can be placed in service.

This line is now supplied with current from the temporary power station of the Brooklyn City Railway, at the foot of 52d Street.

Car and Truck, Brooklyn City Railway.

The accompany engraving shows one of the new electric cars built for the Brooklyn City Railway Co. of Brooklyn, N. Y., and in use on the Hamilton Avenue division of that railway. The car body has a length of twenty feet, while the length over all of the car is thirty feet five inches.

The truck shown is one built by the Peckham Motor Truck & Wheel Co., of Kingston, N. Y., and entitled by the manufacturers the "5 A" type. An extended description of this truck was given in our last issue. The manufacturers of the car body were the Lewis & Fowler Manufacturing Co., of Brooklyn, N. Y.



ELECTRIC CAR—BROOKLYN CITY RAILWAY.

The Milwaukee Street Railway System.

Of the cities on the edge of the great West, Milwaukee may justly be said to be one of the foremost. Its progress may not have been so rocket-like as has been that of some other Western cities, but, built on a firm foundation and peopled with a slowly but surely progressive population, it has attained to a solidity and opulence which entitle it to rank as a shining gem in the eastern fringe of the West. With a speed relatively slow when compared with that which has marked the growth of Chicago, Milwaukee has spread out its streets and thoroughfares to meet the ever increasing demands of a growing population, and already has quite a respectable congregation of suburbs, as befits a city metropolitan in its territory. The German immigration to Milwaukee has been of the better kind, and it counts among its naturalized children many a philosopher and many sturdy merchant, who, weary of kingly and imperial exactions and procedures in the Fatherland, have come hither, bringing their knowledge and business instincts and desires to the development of the Cream City. This element, joined to the go-aheadiveness and adaptability of the modern American, working together, have given to Milwaukee a pre-eminence of which she is worthy and in which she takes justifiable pride.

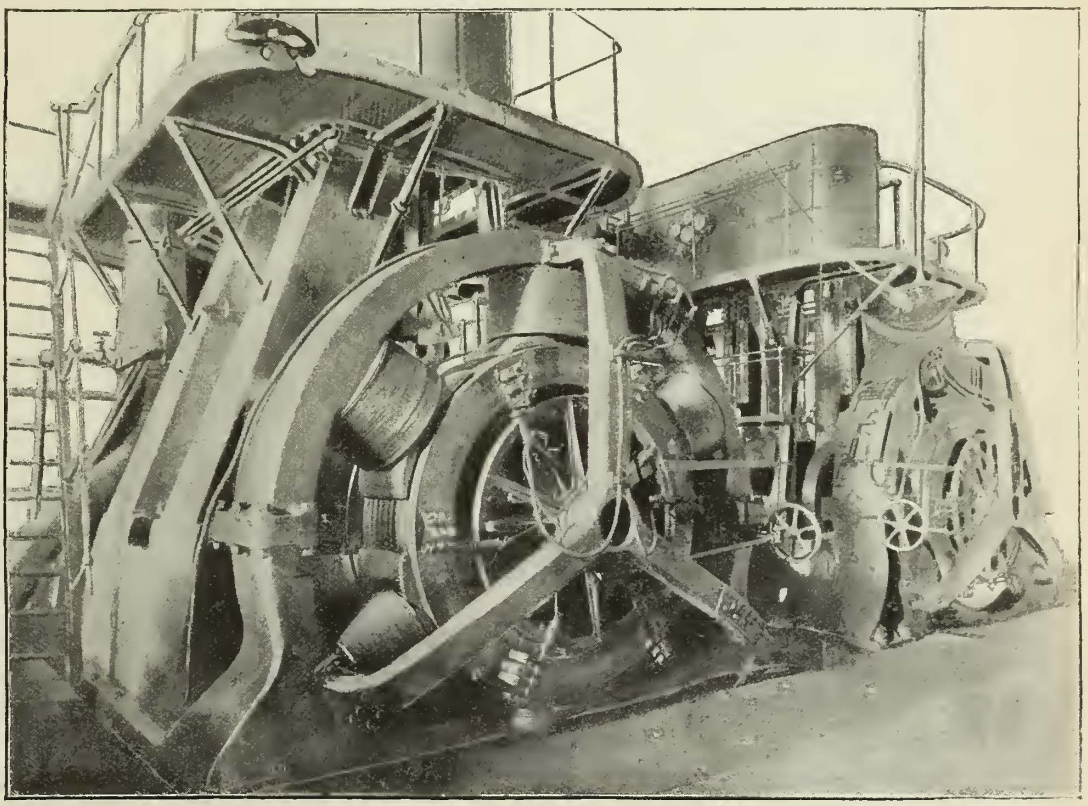


FIG. 1.—MULTIPOLAR ELECTRIC RAILWAY GENERATORS—CENTRAL STATION, MILWAUKEE.

Such a city could not long refuse to itself the blessings of rapid transit which New York City is still reluctant to adopt. The various horse car systems soon became far too antiquated for this Western city. Having tolerated them for many years, owing to the lack of alternative, it has suddenly set aside all objections, and, having chosen the trolley system, has now reason to bless it for the many benefits which its adoption has already conferred and is still conferring. The electrical installation there comprises all the latest known expedients for utilizing electrical power most advantageously, and is a monument to the progress made in the science of electricity as applied to commercial uses.

A short history of the early efforts of the Milwaukeans towards a satisfactory solution of the problem of the transportation of the city's inhabitants shows that they followed the usual beaten track, and that each new extension has been the work of private initiative prompted by the sharp commercial instinctive desire for more of the almighty dollar.

In 1859 the River & Lake Shore Co. was formed, with a capital stock of $50,000, to operate horse cars in the streets of Milwaukee. This line was opened in May, 1860, its extent being a track about two miles long, and was the first street railway company in that city. Its rolling stock consisted of four bobtail cars. This road was taken over after about ten years by the Milwaukee City Railroad Co., organized with a capital of $100,000, and a number of extensions were made. In 1869 the road changed hands again, and this step was followed by still further improvements and extensions, and in 1881 Peter McGeogh became owner. Under his management the line rapidly developed, and in 1888 he sold out to New York capitalists for $1,500,000, who in turn made it over to the present syndicate in August, 1890. It operated fifty-four cars regularly of the 103 owned, and owned 650 horses and sixty mules, with nineteen miles of double track.

1874 saw the creation of two other roads—the Cream City road and the West Side road. The former began operation in 1875 and was sold to a Pittsburgh syndicate in April, 1890, which, in August of the same year, yielded possession to the present owners for a consideration of $850,000, netting about $75,000 profit by the deal. Of its eighty-four cars it operated forty-four daily. Its ten and a half miles of double track was in a deplorable condition, in some parts being unfit even for horse service.

The West Side road was formed to operate cars in the west side of the city. It secured further valuable franchises in 1876, 1879 and 1880, and ran its course for another ten years when, in August, 1890, it was also absorbed. Electricity has since been its motive power. In 1888 Milwaukee began to tire of its horse cars. Two enterprising citizens, Messrs. Hinsey and Hinckley, saw that a cable line might be a valuable substitute, and secured a municipal authorization to lay cable lines over the whole city. This plan was, however, abandoned before it was put into execution, and, in 1890, authority was granted by the City Council to use electricity. Electricity was put in, but the road nearly failed, the question of finance proving one over which the partners could not agree. Matters were settled by selling out, and the streets allotted to the Hinsey company, but not occupied, were now taken in hand by the White Fish Bay Co. This line was consolidated with the Hinsey line in 1890, and in the same year, with the various other roads, was consolidated by the Villard syndicate into the Milwaukee Consolidated Street Railway Co.

The Villard people did not take hold of the transit system of Milwaukee with any intention of mincing matters. They boldly avowed their intention of using electricity, and started at once to make the installation. To the Edison General Electric Co., which has been merged into the General Electric Co., the electrical installation was confided, and it is not too much to say that it has skillfully performed the task entrusted to it. The task undertaken was one not entirely devoid of difficulties,

both from an electrical and constructural standpoint. The paving of the streets left much to be desired, and despite the appeals of residents, streets badly paved were

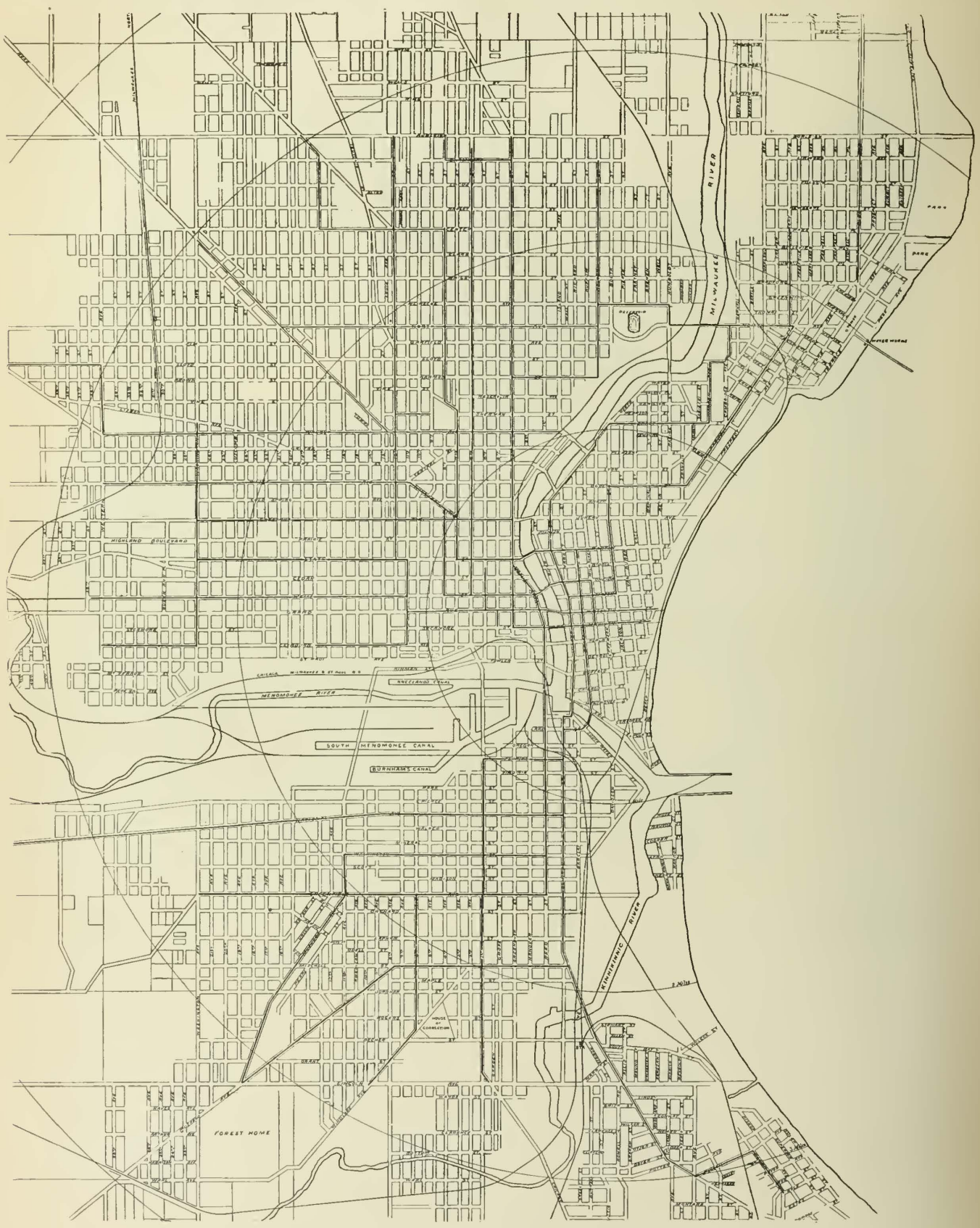


FIG. 2.—MAP OF MILWAUKEE, SHOWING STREET RAILWAY SYSTEM.

left so by the city authorities. The track had also to be entirely relayed and several drawbridges crossed.

The power house is situated on the west side of the Milwaukee River between Oneida and Biddle Streets and fronts on River Street. It is a two story, fireproof, brick building, having a frontage of 100 ft. and a depth of about 115 ft. From this, two stacks, both 125 ft. high, shoot upward, one in the front and one in the rear. Through the center of the ground floor runs a substantial wall, thirty feet high, dividing the engine room from the boiler room. This boiler room (Fig. 6) has space for two tiers of boilers, the second tier at the present time being installed. The battery now consists of nine, internally fired, Galloway boilers, built by the Edgemoor Iron Works of Wilmington, Del. They are each twenty feet long and seven feet in diameter, and have a horse power of 350 each under 160 lbs. pressure. Space is left for a second tier of

nine boilers. These will be set as occasion arises. The steam from these boilers is fed into the two main headers, running along the wall of the engine room. These are sixty feet long and have a diameter of sixteen inches. The subheaders of twelve inch pipe run from these along the ceiling of the engine room, and the steam is fed from there by five inch steam pipes to the engines.

The engines (Fig. 1) for supplying power to the street railway of which five are at present in place, are of the standard triple expansion, vertical type, were designed by the Edison General Electric Co., and built by J. Morton Pool, of Wilmington, Del., and each runs two 200 K. W., multipolar generators. They have satisfactorily answered the purpose for which they were designed, and seem to prove correct the General Electric Co.'s surmise that the compact steamship type of engine was especially adaptable to electric power or light work. The cylinders are 16½, 23⅞ and 38½ ins. in diameter, and have a stroke of 30 ins. under a steam pressure of 160 lbs. They stand twenty-one feet high.

The engines for the electrical light work (Fig. 3) are situated on the second floor. These will consist of sixteen triple expansion engines,each running two 100 K. W., multipolar dynamos. One of these, having cylinders 11⅞, 17½ and 28¼ in. bore with a 21 in. stroke at 160 lbs., is already in place. It is at present supplemented by a temporary plant of two fifty kilo-watt, multipolar generators, two No. 20 and four No. 60 standard General Electric Co 's bipolar machines. Five surface Wheeler condensers, and four Blake combined air and circulating pumps, are comprised in the condensing plant under the main engine floor, for railway work only. The four feed pumps supply the engines from the hot wells. One condenser of 1,000 H. P., two air pumps and two circulating pumps comprise the condensing plant for the electric light work.

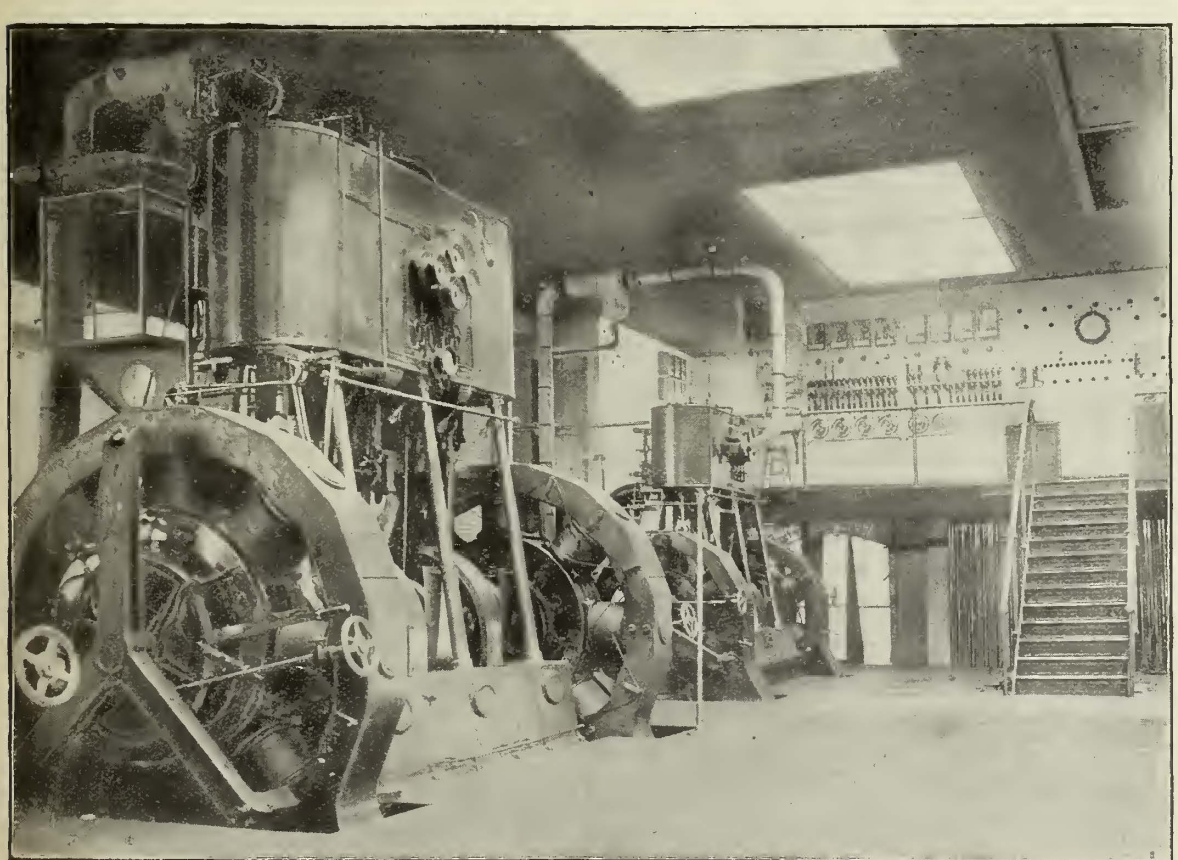
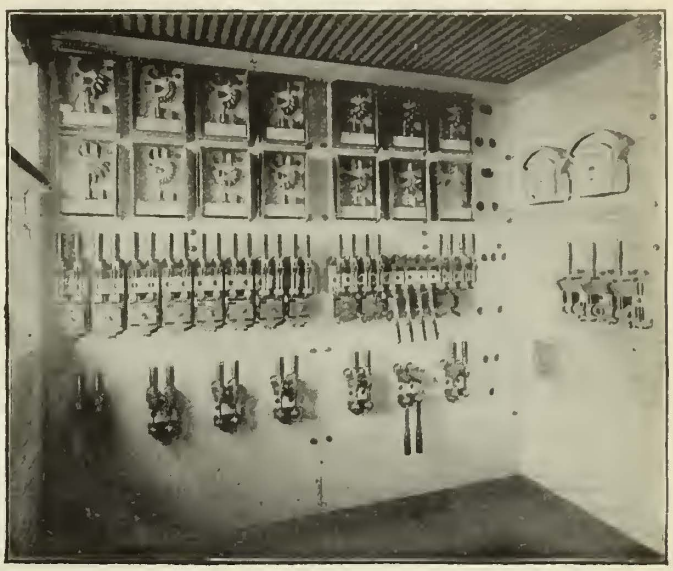


FIG. 3.—MULTIPOLAR ELECTRIC LIGHT GENERATOR AND SECTION OF SWITCHBOARD—CENTRAL STATION, MILWAUKEE.

Between the boiler and feed pumps are the necessary grease extractors of Wass type; and the exhaust and steam pipe of each engine is furnished with grease extractors and separators of the De Ryke make.

In the multipolar generators for the railway work are embodied all the latest improvements. It is the first time that generators of this type have been used for street railway work, and the fact that they have been adopted as against other types is worthy of record. The wound spools of the magnet fields are bolted inside the exterior polygonal frame, the interior surface of each core being



FI . 4.—ELECTRIC RAILWAY SWITCHBOARD—MILWAUKEE.

turned true, so as to present a perfectly true face to the armature. The latter is of the Gramme ring type. The winding consists of a series of U shaped copper bars slipped over a brass spider frame, and having their exterior ends connected by a second bar. Each of these is properly insulated, and when everything in the armature is in place the exterior surface is planed to a perfect level. The brushes rest on this surface which thus forms a perfect commutator.

A cast iron spider carries the brush holders. These are so arranged that by the manipulation of a small hand wheel on a shaft of a worm gear, a simultaneous adjustment of the brushes can be secured. Iron centers are double keyed directly to the shaft of the engine. The normal speed is 120 revolutions per minute for the 2 × 200 K. W. generators and 170 revolutions per minute for the 2 × 100 K. W. generators.

The feeder system as applied under the patents of the General Electric Co. has been adopted throughout for the distribution of the electric current from the station to the main lines of the street railway. These feeders are composed of the Edison tubing laid underground throughout the system as needed, and through junction boxes, and connected to the overhead mains by flexible cables.

The railway switchboard, shown in Fig. 4 in the station, is forty-two feet long, and is a remarkable piece of work. It consists of an iron frame, upon which are

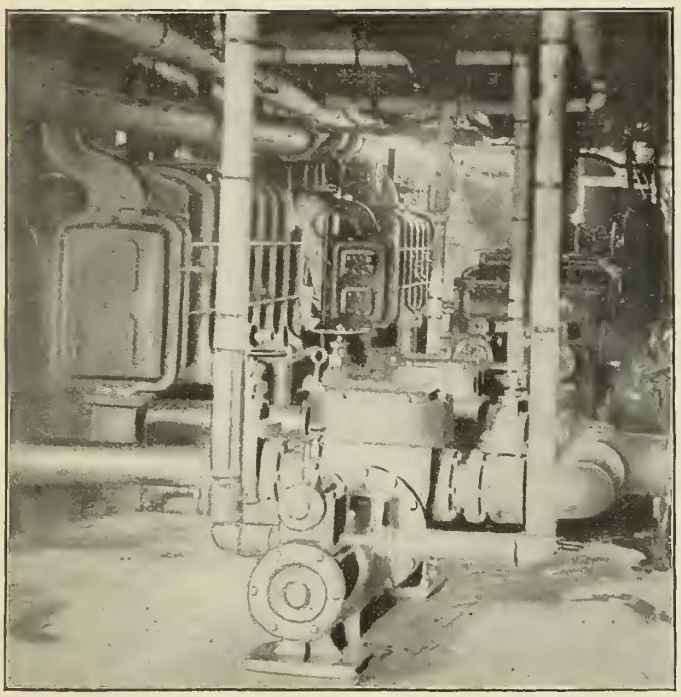


FIG. 5.—SURFACE CONDENSERS IN BASEMENT—CENTRAL STATION, MILWAUKEE.

mounted Italian white marble slabs. The ampere meters are mounted directly to the marble and have covers of polished brass and bevel glass. The switches of polished copper are on separate bases, bolted to the board. The bus bars run along the back of the marble slabs, and from these the feeders run in the usual manner, connection being made by heavy, flexible cables. The switchboard is thus perfectly incombustible, and danger of fire in the station is reduced to a minimum by the further employment of safety devices of the latest improved type. The steam gauges are also mounted on this board.

The larger electric light switchboard has been erected in a gallery above the floor of the dynamo room, and is of the same handsome type as that for the power work. Connections between the machines and switchboards are made through incombustible tubing laid in the concrete of the floor.

The overhead system is as perfect in detail as the station. The poles are of latticed iron of a special type, are double armed and are set midway between the double tracks in the city. Wooden side poles are used in the suburban work. In setting these poles much difficulty was encountered. In certain cases they had to be fixed on flat bases and concreted in the earth a few inches only from the surface. In other cases they had to be specially made so as to ride astraddle of iron gas pipes before they could be properly concreted in their settings. The trolley wire is of standard gauge silicon bronze, and the overhead line appliances of the most improved pattern. The loss of pressure between the station and the car is about 10 per cent. only.

The track construction was described in the June issue of the STREET RAILWAY JOURNAL. A side bearing, seventy-nine pound rail, rolled by the Illinois Steel Co., spiked to the ties, is employed within the city. Elsewhere a fifty-eight pound rail is used. There are several grades in the city, some of from 6 to 9 per cent.

The rolling stock of the company consists of 130 cars of various makes, representing nearly all the large car builders in the country. Some are furnished each with two motors of the No. 8 Edison type, and others with the single reduction No. 14. The car switches are the latest barrel type with indurated fibre covers. The cars are all handsome, are well lighted, easy of control and extremely comfortable. The company also own a private vestibuled car, illustrated in our March issue.

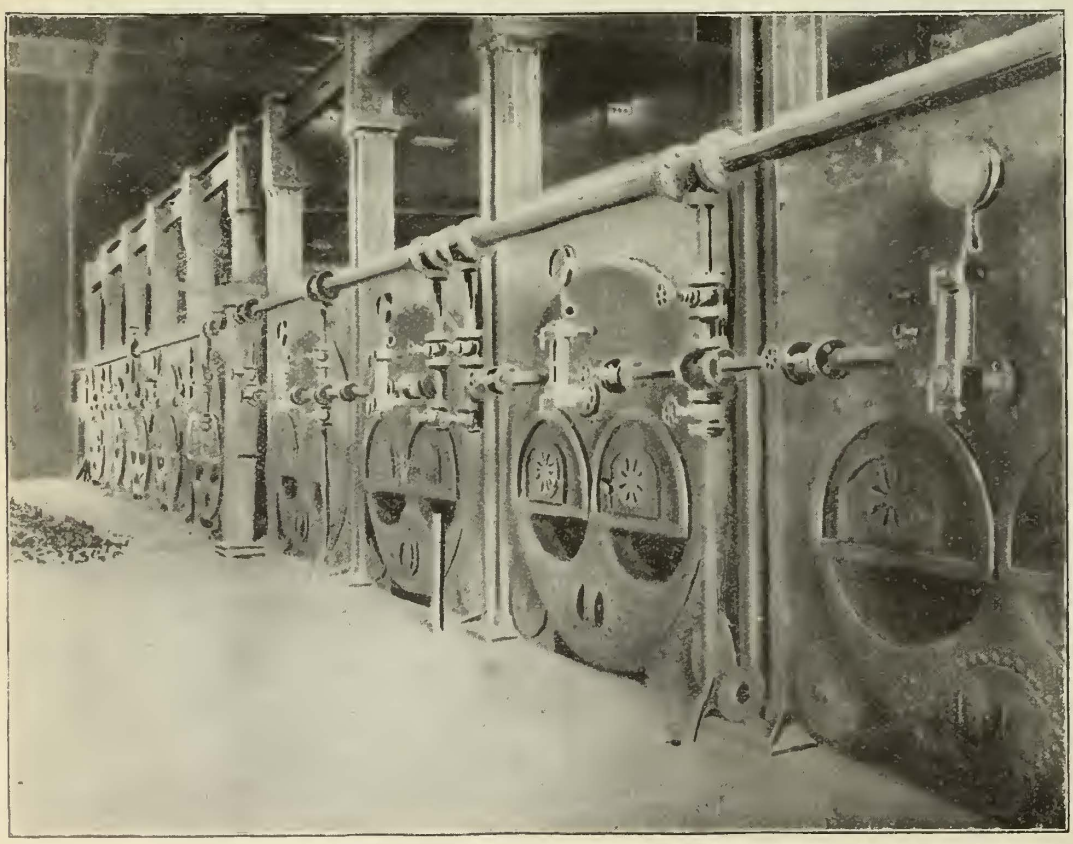


FIG. 6.—BOILER ROOM—CENTRAL STATION, MILWAUKEE.

The management of the company is in the hands of Mr. H. C. Payne, general manager, who is also vice-president. The credit for placing the road in such admirable condition is certainly his proper meed. The engineer in chief of the whole system is Mr. J. C. Henderson, already well known to all our readers. The construction of the road under his direction is only one more good point added to his already excellent record.

The superintendence of the company is divided into two separate organizations. Mr. Geo. W. Hummel attends to the West Side district from the Milwaukee River to about five miles out. Mr. A.W. Lynn is superintendent of the remainder of the system and has charge of a considerably larger territory than Mr. Hummel. To his untiring energy may largely be ascribed the present perfection of the Milwaukee Street Railway system. The main offices are at the corner of Mason and Milwaukee Streets on the second floor of the Colby & Abbott Building Here is the accounting department, as well as the vice-president's, secretary's and treasurer's offices. In this building, too, Mr. Stikeman, the chief engineer, and Mr. O. M. Rau, the electrician, have their offices. No expense, pains or ingenuity has been spared to give to the Milwaukee system that degree of

perfection to which the promoters and managers of the company aspired, and to them and to the railway and engineering departments of the General Electric Co. must be given the praise which is strictly their right.

"The objects of the Association are to be cultivated, and the benefits are to come. All will agree with me that

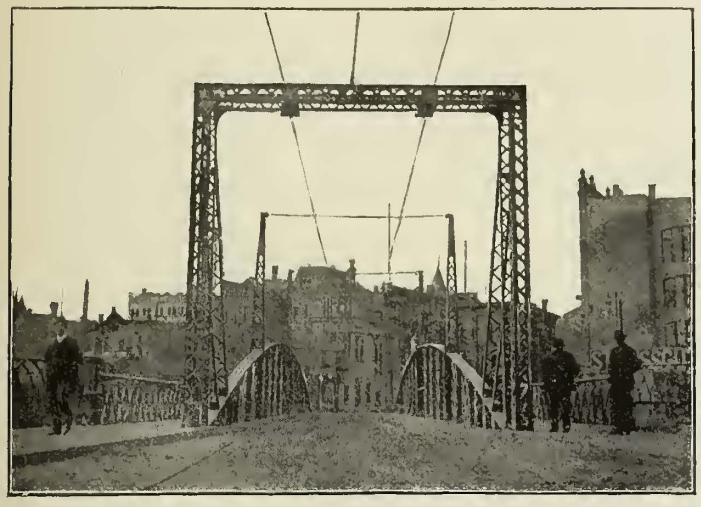


FIG. 7.—SWING BRIDGE—MILWAUKEE STREET RAILWAY SYSTEM.

what experience we have gained will greatly inure to our benefit. The position of the horse railroad president is not to be described. It is an onerous position. It calls for labor and attention, and all the strength of mind inherent to fully discharge the great duties set before him. The position calls for indomitable perseverance, because it supplies the demands of the public. The public will put up with everything in steam cars, but the least thing out of the way in horse cars will cause complaint. This is a peculiar freak of human nature. In Boston we have great difficulties to surmount. Owing to the great competition in this city between railway companies, the public has been educated to expect everything, and I should not be surprised if we were obliged eventually to back our cars up to the very doors of dwellings. There should be an exact understanding of what we have to do. We should consider the best way of feeding horses and caring for them; the best pattern and manufacture of cars, and how to make conductors honest. Above everything else,

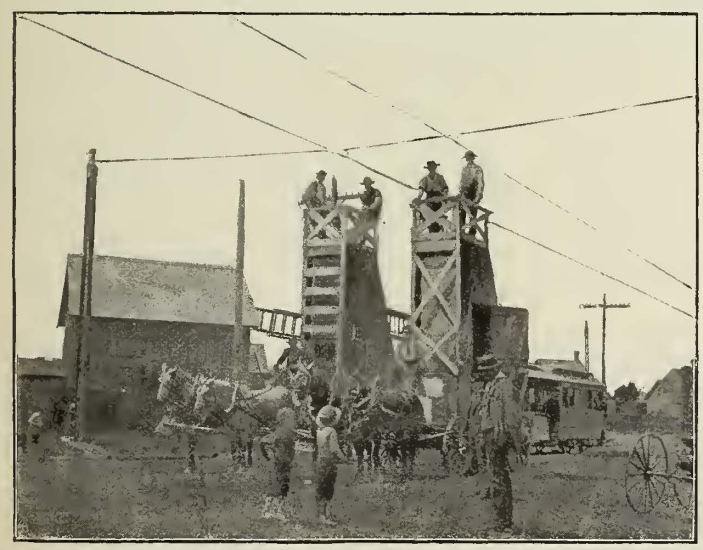
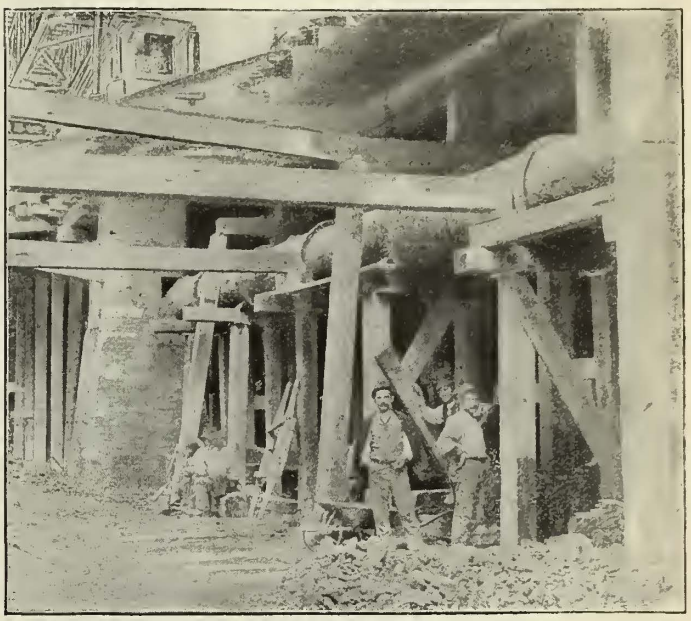


FIG. 8.—TOWER WAGONS—MILWAUKEE STREET RAILWAY SYSTEM.

let the members of this Association foster a brotherly regard for each other, so that, when we meet in strange cities, we shall be as brothers. That is what we should be. There should be no North, South, East or West with us. We welcome you here from every quarter, and only hope that you have found warm hearts, just as well as you would have in Ohio."—*Boston Street Railway Convention*, 1882.

Cable Construction on Third Avenue, New York.

The work of the track and conduit construction for the Third Avenue cable railway has been almost entirely completed between the upper terminus at 129th Street and Grand Street; and of the work below Grand Street the greater part has been finished. The power stations now present scenes of great activity. The foundations for machinery at the main station on 65th and 66th Streets have been practically completed. The walls of the boiler room, which will be 200 × 78 ft., have been carried up a distance of about thirty feet, to the height of the room, and are ready for the floor beams. The work of installing the boilers will probably have begun by the time this reaches our readers. The walls of the engine room have been carried up rather farther than those of the boiler room, and on the north side have reached such a point that the appearance of the interior finish, which will be of buff brick, can be observed. All the machinery in this room will probably be in place in about two months, and the road will be ready for operation, in the opinion of the



PRESENT APPEARANCE OF PULLEY VAULT AT 65TH STREET—THIRD AVENUE CABLE RAILWAY, NEW YORK.

engineers, by April 1. The contractors for the machinery at both stations are the Pennsylvania Iron Works, of Philadelphia, Pa.

The accompanying engraving is from a photograph taken at the foot of the main pulley vault, which is 146 × 61 ft. by 20 ft. deep, and extends for nearly the entire block from 65th Street to 66th Street, on Third Avenue. As will be seen, the elevated railway structure is directly over the pit. To supprt the pillars of the elevated railway, which rested on piers eight feet in height, sub-piers had to be built of brick supported on a layer of concrete. The total height of these foundations, from the surface of the street to the bottom of the concrete, is twenty-one feet six inches. Nine elevated railway piers had to be cared for in this way.

Another engineering problem was the disposition of the pipes, including a thirty inch water main, shown in the engraving as extending through one of the elevated railway piers and supported on timbers. It was decided to support the small pipes from the roof of the vault, but to carry the main entirely below the floor, where it will rest on a concrete foundation. A secondary vault between 66th and 67th Streets is 37 × 27 ft., horizontal dimensions, by 19 ft. in depth; the deflection vault for the down cables, near the center of 66th Street, is 24 × 12 ft., horizontal dimensions, by 17 ft. in depth, and the vault for the elevating sheave, between 65th and 64th Streets, is 10 × 6 ft., horizontal dimensions, by 17 ft. in depth.

Another especially difficult and interesting part of the work is the Post Office loop at the lower terminus of

the road. As stated in a former issue, three cables are run from the lower station at Bayard Street for service between Bayard Street and the Post Office. Two of these are high speed cables, and are for use by the cars until near the entrance of the loop, or to about opposite the *Times* Building on Park Row. Here will be located a rope transfer, and from this point the high speed cables on the down track are carried through a blind conduit around an end sheave fifteen feet in diameter, returning by a second conduit to the rope transfer, where they are picked up by the cars. The Post Office loop, which is operated by the slow speed cable, has a radius of forty-one feet, the entrance curve being of fifty feet, and the exit curve forty-one feet radius, respectively. The diameter of the curve pulleys is thirty-three and five-eighths inches, and there are thirteen on the entrance curve, forty-two on the main loop, and seven on the exit curve. All the wheels in the loop have gimbal bearings.

A point of curvature on the line is at Chatham Square, and the arrangement adopted here is most interesting. The curve is compound, 500 ft. long, and with radii varying from 280 to 500 ft. A special disposition is made at this point of the slow speed rope which is not used, of course, for operating the cars here. On the down track side, which is on the inside of the curve, the slow speed rope is carried through a blind conduit in three chords. The third rope on the up track is carried outside the high speed ropes and has a curve sheave at points twenty feet apart. In the conduit the high speed ropes are carried on curve pulleys placed four feet three inches between centers as in the main loop. To facilitate inspection, etc., of the curve pulleys, a passageway has been constructed on the inside of each conduit. This passageway has a section of four feet in width by five feet feet eleven inches in height, and is covered with six-inch I beams, reinforced on top with T irons, above which is the paving. Access is provided by manholes located at convenient points.

FIG. 1.—MAIN POWER STATION—BROADWAY CABLE RAILWAY, NEW YORK.

THE Detroit City Street Railway Co. has let the contract for the electric equipment of the Woodward Avenue line. The successful bidder was the Detroit Electrical Works, which equipped the Jefferson Avenue line of the same company, and not the least consideration which entered into the letting of the contract was the satisfactory manner in which the Jefferson Avenue line was equipped.

The Detroit company is to furnish the motors overhead construction, station equipment and all other adjuncts necessary for the line, and is to do all the work of putting them in place. The motors will be of 40 H. P. each twenty in number, and the cars will be supplied by the Pullman Car Co. The rails will be extra heavy and the ties will be imbedded in concrete.

The contract calls for the completion of the road in forty-five days.

Broadway, N. Y., Cable Construction.

All of the track and road construction of the Broadway Cable Railway, from 59th Street to Bowling Green, has been finished for some time, the only section of the road yet uncompleted is part of the short loop between Bowling Green and South Ferry, work upon which is now being carried on. Of the two power stations, the upper, at Sixth Avenue, 50th and 51st Streets, is the farthest advanced. This station is contained in a portion of the general building belonging to the Broadway & Seventh Avenue Railway Co., extending from Seventh Avenue to Sixth Avenue, and occupying most of the block bounded by these avenues, 51st and 50th streets. The cars will be stored in the western end of the building, which is the portion now occupied as a car house, and the cable will be carried from the Sixth Avenue, or eastern end, of the building through a blind conduit to Seventh Avenue upon which the roadway line extends between 46th and 59th Streets.

The interior of the upper station now presents a busy appearance. The machinery is being installed by the Pennsylvania Iron Works, of Philadelphia, who are the contractors of the entire plant, and the greater part of it is already in place. The power will be supplied by two Dickinson-Corliss engines, with cylinders thirty-six inches in diameter by sixty-inch stroke, and having a capacity each of about 1,000 H. P. The flywheels are twenty-four feet in diameter. Each of these engines is connected at one end by friction clutches to a common shaft which carries four driving drums ten feet in diameter, for operating the main driving drums. By means of the friction clutches, already mentioned, and two additional ones at the center of the shaft, either engine can operate the entire shaft, and so drive either cable of the duplex system or both engines can be disconnected, and the shaft, or either half of it, can be turned slowly by a small auxiliary engine placed in the center when the power of the larger engines is not available for this purpose. Each of the cable drum shafts is driven independently from the engine shaft by means of thirty-two foot drums connected with the ten foot drums on the engine shaft, the power in each case being transmitted by thirteen two-inch cotton ropes. The cable drivers are twelve feet in diameter, four in number and designed for five wraps.

The engine room also contains two traveling cranes, one of ten tons, the other of six tons capacity, furnished by the Yale & Towne Manufacturing Co., of Stamford, Conn.

The boiler room, which adjoins the engine room, at present contains six Heine safety boilers of 250 H. P. each. Further details in regard to the equipment were given in the issue of the STREET RAILWAY JOURNAL for May, 1892.

The work on the main power station at Houston Street, which will have a capacity of more than twice

that of the upper station, is being carried on rapidly, and by the time this reaches our readers the iron work will be nearly, if not quite, completed, and walls carried up to the second story. As will be seen upon examination of Fig. 1, which shows the appearance of the building when completed, the claim of the company that this power station will be the handsomest in the country, is well founded. The building will be eight stories in height, and constructed in the Rennaissance style. The lower part is of granite, and in the upper part buff brick with terra cotta trimmings will be used. As stated in previous issues, the driving machinery will be entirely below the ground floor, and on special foundations, so that any vibration of the machinery will not affect the building proper. Twelve boilers and part of the driving machinery are already in place. The upper stories will be leased for offices, stores, and light power purposes.

The location of the small power station for operating the loop between Bowling Green and South Ferry is on Front Street. Fig. 2, shows the method of placing the yokes at the loop of the main line at Bowling Green. The yokes rest on piers, and a passageway is left on the inside of the curve, by which access is easily had to the

FIG. 2.—BOWLING GREEN LOOP DURING CONSTRUCTION—BROADWAY CABLE RAILWAY.

curve pulleys for the purpose of inspection, repairs, etc. The managers of the railway company expect to have the main line in operation by January 1, 1893.

Adaptation of the Cable System to Swing Bridges.

Navigable rivers have always proved a great obstacle in the construction of cable railways, and a device has long been needed which would avoid the necessity of tunneling, and hence save the large item which such a method adds to the cost of construction.

By the plan shown in Figs 1 and 2, the cars cross the river on a swing bridge, a special cable being employed to operate them while on the bridge. The main cable passes over an angle wheel, which guides it from the surface conduit downwardly into a vault formed in one of the abutments, whence it is carried on sheave or carrier wheels through a conduit of suitable dimensions, to a vault located within the center pier. Here it is lapped around a double grooved wheel carried on a vertical shaft within the center piece of the bridge, after which it is returned to the first abutment, and to the power station,

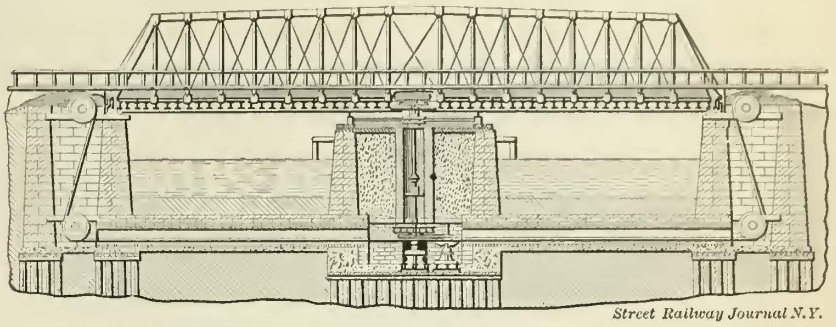


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FIG. 1.—ADAPTATION OF THE CABLE SYSTEM TO SWING BRIDGES.

or else is carried entirely across the river to a vault provided in the opposite abutment, thence to the surface conduit and terminus of the route, to return through the same channel to the power house. The auxiliary cable on the bridge is driven by being lapped around a grooved wheel carried on the upper end of the vertical shaft, and then is carried around an adjacent idler and other idlers located at the ends of the bridge.

By a system of gearing from the shaft of the idler located near to the auxiliary cable driver, the bridge may be opened and closed at will by means of the main cable,

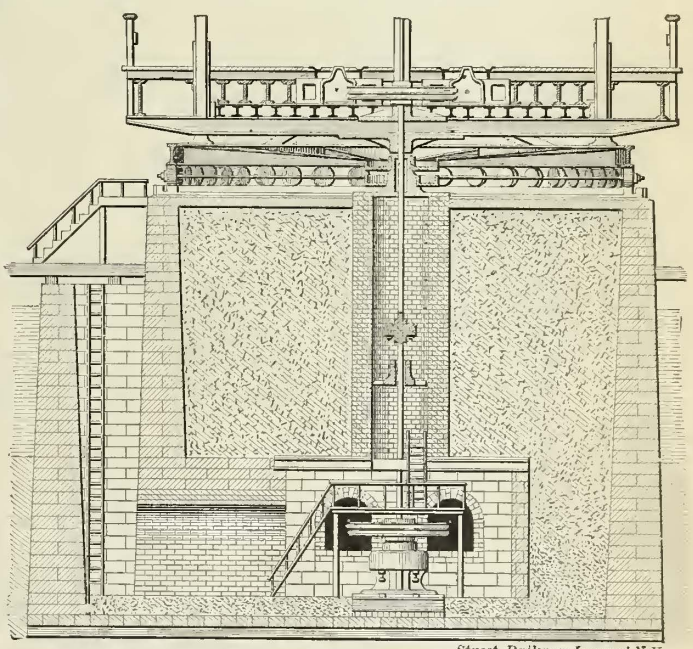

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FIG. 2.—ARRANGEMENT OF CENTRAL PIER—ADAPTATION OF THE CABLE SYSTEM TO SWING BRIDGES.

being capable of swinging either to the right or left. Access to the vault in the center pier is had by means of a vertical opening formed in the pier, close to the vertical shaft. (See Fig. 2.)

When the bridge is closed trains are enabled to pass to and fro without interruption, the gripman letting go his main cable at the abutment, taking hold of the auxiliary cable as his grip passes to the bridge, letting go at the opposite abutment, and again taking hold when reaching the surface conduit. Safety appliances are used as adjuncts to the system, whereby it is rendered impossible for accident to happen to a train in case the bridge should be open. The details of construction and operative arrangements are simple and effective.

The system is the invention of William C. Metzner, of Chicago, and G. E. Buschick, who has long been connected with the West Chicago Street Railway Co., and has had an extended experience in cable railway engineering.

The New Cable Station of the West Chicago Street Railroad Co.

The West Chicago Street Railroad Co. are now erecting two new cable power stations whose equipment combines many features of interest. These improvements, together with the new tunnel under the Chicago River at Van Buren Street, will involve a total outlay of $2,000,000. Both of the stations are well under way. One of them will, in all probability, be in operation by January 1; the date when the second plant will be started is contingent upon the completion of the tunnel, the construction of which has been already delayed to such an extent by litigation that no one dares to commit himself to a prediction.

The larger of the power stations is located at the corner of Blue Island Avenue and Twelfth Street. The ground is irregular in shape, but the form is nearly triangular. As a reference to the drawing (Fig. 1) of the elevation on Blue Island Avenue shows, a six story building is to be erected adjoining the station. It will be a handsome structure, and will be divided for offices which the railway company will let for general and business purposes. It will be lighted by electric light, provided with elevators, and the tower will contain a clock with six four foot dials. The structure, which will cost $50,000 exclusive of the site, will be the most pretentious building in the neighborhood.

FIG. 1.—BLUE ISLAND AVENUE ELEVATION, NEW CABLE POWER STATION—WEST CHICAGO STREET RAILWAY.

From the same drawing an idea of the general appearance of the exterior of the power station may be gained. The station, like the adjoining office building, is to be built of brick with cut stone trimmings, and will be covered by a truss roof, 100 ft. span, with corrugated iron inside and outside. Louvres are provided for furnishing light and air. The stack will rise to a height of 165 ft. Fig. 2 shows the Twelfth Street elevation of the building.

The sub-construction for the station was very expensive. When the excavations were in progress a slough was struck. To make proper foundations for machinery it was necessary to excavate thirty-eight feet below the street level and to use an enormous amount of concrete. The cost of this portion of the work was not less than $65,000. The West Chicago Street Railroad Co. constructed the building, and the entire equipment was contracted for by the Pennsylvania Iron Works Co. The cost of the building and its equipment will be about $500,000.

The boiler room is built with steel girders and brick arches. There are eight Otis steel boilers, the dimensions of which are 72 ins. × 20 ft., made by John Mohr & Co., of Chicago, and provided with furnaces for burning oil. Dodge injectors will be used, capable of furnishing the supply of water for all the boilers, and a large duplex Snow pump, with dimensions 14 ins. and 8 × 12 ins. will be available. Two Berryman heaters, each of 1,000 H. P., will be installed. Under the sidewalk will be located a cistern of sufficient capacity to hold a twenty-four hours' supply. This is an extremely important provision, as it has more than once happened in Chicago that the city supply has failed, and steam users have been subjected to extreme inconvenience for several hours. Oil will be burned as fuel, and two tanks, each of a capacity of 20,000 gals., will be built under the sidewalk.

Power will be supplied by two high pressure Allis engines of 1,800 H. P. each, with flywheels twenty-four feet in diameter and weighing 100,000 lbs. each. All cylinders will take steam from the under side beneath the floor, so that no steam pipes will be seen in the engine room. The cylinders are provided with hand reversing gear consisting of a bronze rack on the wrist plate, and a pinion which is secured to a cast iron stand bolted to the floor, the starting bar being removable. A fourteen inch separator with steam loop arrangement is provided for each engine. The eighteen inch exhaust pipe is fitted with a Warren Acme A exhaust head. An electric light plant will be located in the engine room.

Power will be transmitted from the main line shaft, which is eighteen inches in diameter, by means of cut steel gear and 1,000 H. P. friction clutches operated by hydraulic cylinders. By this arrangement any of the four cables may be started or stopped by turning a small valve.

Four sets of winding machinery, consisting of Walker differential drums, will be installed, of which one will be kept in reserve. This provision is regarded as a wise one as it guards against prolonged delay in case of an accident to one of the drums. The vault sheaves are so arranged that any one of the cables may be transferred to the reserve drum in an hour and a half. For winding up the old cables two sets of the Pennsylvania Iron Works

Co's patent reels have been located between the tension runs which extend under the boiler room floor, the carriages being of the Root design.

From the plant will be operated three cables, two for the Blue Island Avenue line, and one for the Halsted Street line. The latter passes through a subway on Twelfth Street for half a mile before reaching the Halsted Street conduit. This cable will have a speed of ten miles per hour; of the two ropes on Blue Island Avenue, one will move at the rate of ten miles, and the other at twelve miles per hour.

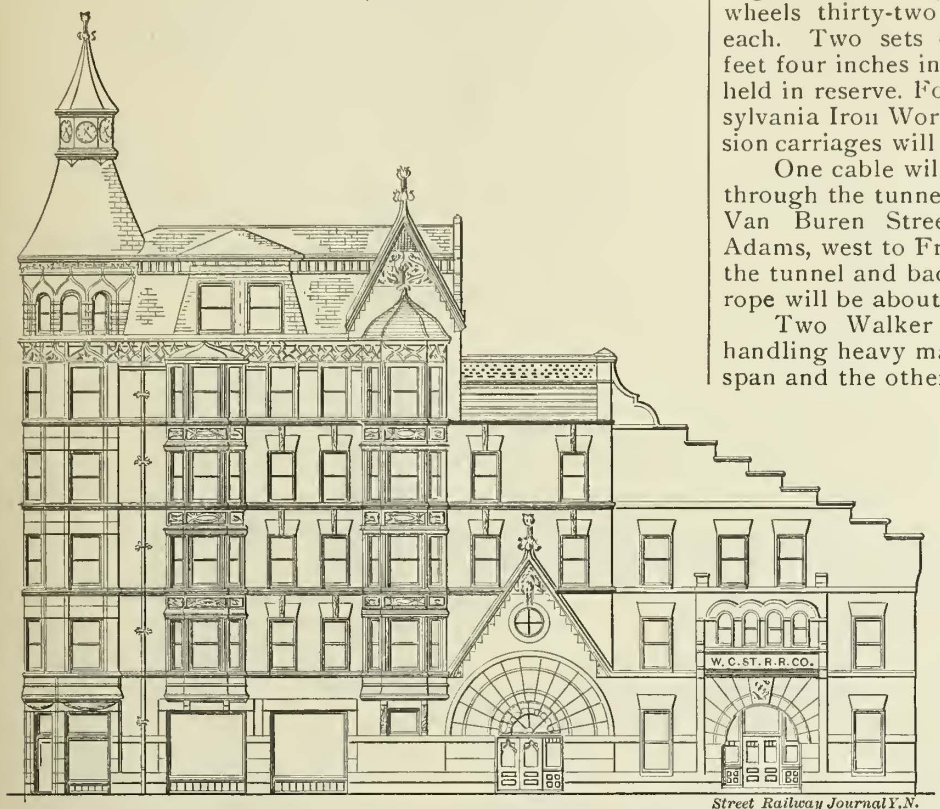


FIG. 2.—TWELFTH STREET ELEVATION, NEW CABLE STATION—WEST CHICAGO STREET RAILWAY.

It has been stated that the engine room is free from steam pipes, which have been kept below the floor. This plan was followed in order that the room might be clear for the operation of traveling cranes. It is doubtless true, as the engineers of the West Side Street Railroad Co. assert, that an equipment of cranes in a cable station conduces to the economy of the plant. When the inevitable accident comes, repairs can be made quickly, and an enormous saving in time is effected; and at the same time when these appliances are available it is no longer necessary to keep on hand the "rigging" for handling heavy parts, which in the aggregate involves the outlay of considerable money. The two cranes in the station were manufactured by the Walker Manufacturing Co. They are each of fifty-six foot span, and each has a capacity of twenty-five tons.

VAN BUREN STREET POWER STATION.

From the station located at the corner of Van Buren and Jefferson Streets, the cable for the new downtown loop will be operated. The building is L-shaped, with a frontage of 175 ft. on the latter street and fifty feet on Van Buren Street. The structure will be brick with cut stone trimmings. The stack will be 150 ft. in height with eight foot core. As in the case of the other station, the building is erected by the railroad company and the entire equipment is furnished by the Pennsylvania Iron Works Co.

With one or two important exceptions, the station has been planned on the same lines as the Blue Island Avenue station, and the description may, therefore, be materially abridged. Steam is generated in two Otis steel boilers, 72 ins. × 18 ft. under which oil will be burned. Dodge injectors and a Snow duplex pump will be used.

The two engines will be of 1,500 H. P. of the Allis make, with flywheels twenty feet in diameter, each weighing 100,000 lbs. In this station power will be transmitted by twenty-six three inch cotton ropes, the pinions on the engine shaft being eight feet in diameter, and the rope wheels thirty-two feet in diameter, weighing sixty tons each. Two sets of Walker differential drums, thirteen feet four inches in diameter will be installed, one being held in reserve. For winding old cables, reels of the Pennsylvania Iron Works Co.'s patent type will be used. Tension carriages will be of the Root design.

One cable will be operated from the station, passing through the tunnel and around the loop as follows: On Van Buren Street east to Dearborn Street, north to Adams, west to Franklin Street, south to the entrance of the tunnel and back to the station. The length of the rope will be about 12,000 ft., and its diameter 1⅜ ins.

Two Walker traveling cranes will be available for handling heavy machinery; one will be of forty six foot span and the other fifty-four foot span.

The electric light plant for lighting the tunnel will be located in the station. Seventy-five arc lights will be necessary for this purpose, and the current will be generated by a dynamo operated by a sixty horse power engine. A similar engine and generator will be held in reserve.

Both the stations will be complete in every respect, and every detail has been carefully worked out. They were both designed by S. Potes, chief engineer of the West Chicago Street Railroad Co., with whom was associated in designing the buildings H. B. Prudden of Kansas City. The work has been prosecuted under Mr. Potes' personal supervision, and when finished they will embody the very latest ideas in the design and equipment of cable power stations.

Street Car Fenders in Boston.

The committee appointed by President Whitney, of the West End Street Railway Co., of Boston, to examine into the merits of fenders for use on the electric cars of that company, and consisting of Thomas C. Clark, C. E. A Bartlett and George F. Swain, has rendered a most interesting report. The experiments made by the committee in its investigations extended over a period of more than eight months, and in all 211 types of fenders were examined. Of this number fifty fenders were selected for trial under actual service, and the tests made upon them consisted of equipping a car with the fender, and then experimenting upon three dummies made as nearly as possible of the size, shape and weight of a man, woman and child.

The committee reports that upon examination it found that all fenders brought to its attention could be divided into three classes, viz.:

Class A. Buffers which soften the blow given by the car to the person, and pick him up in a net.

Class B. Platforms which project beyond the dashboard of the car, and upon which a person could leap, or, standing up, could be caught and carried along.

Class C. Fenders which are placed below the car platform, and whose object it is to push along a body lying down upon the tracks, and prevent it from getting under the wheels.

There are three methods of operating the fenders, the committee finds, included in Class C, viz.:

First. Where they are supposed to be always ready to catch the body of the person.

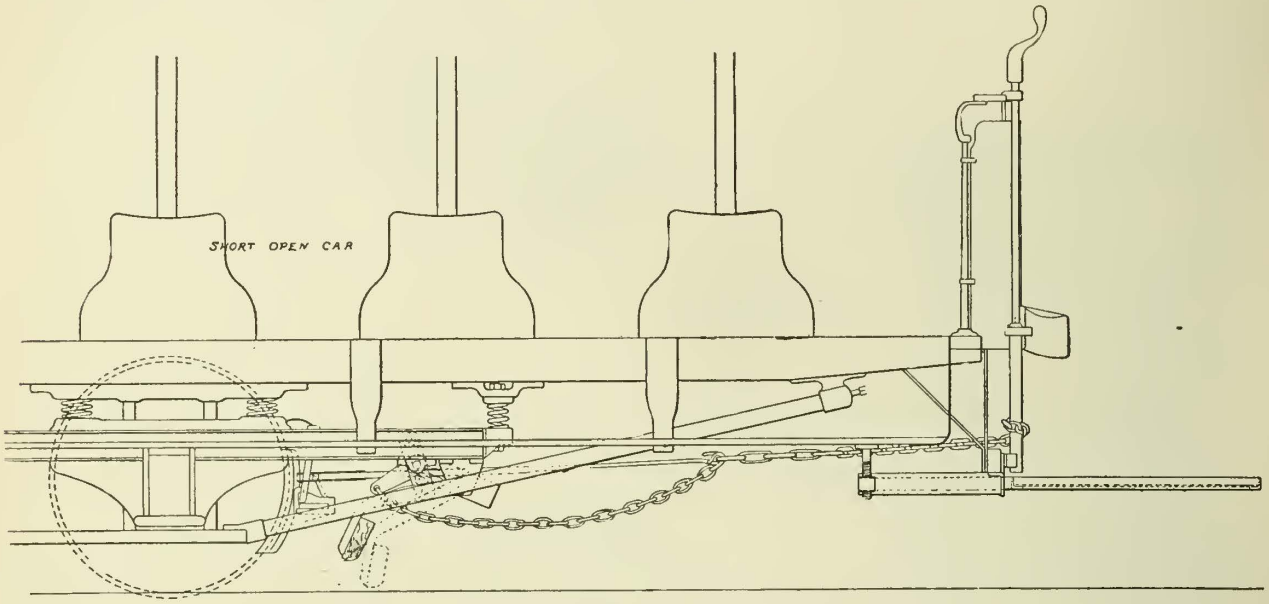
Second. Where they require the action of springs, levers, or some other device which is operated by the force of the blow struck against the body of the person.

Third. Where they require the direct action of the motormen to put them in operation.

The conclusion of the committee is that while it is

manifestly impossible to secure absolute prevention of injury to a person who has been struck by a car moving even at a slow speed after the brakes have been applied, the safety of the public can be increased by the adoption of two devices brought to its attention.

The first device recommended is included in Class B, and consists of a platform projecting in front of the car platform, known as the Cleveland Platform (see figure),



FENDER ADOPTED BY WEST END STREET RAILWAY, BOSTON.

and invented by T. L. Johnson, of Cleveland. This platform has been modified by the officers of the West End Street Railway Co., to enable it to be slid under the cars, or under the rear of any car, when it is not in use.

In addition to this platform, the committee considers there should be an elastic buffer, made of stout wire or metal strips, and curved so as to project from the front dashboard and receive, on a yielding surface, the blow of a person's head and shoulders. This buffer could, if desired, be easily detached and changed from one end of the car to the other. The meshes of the buffer should be large enough to enable a person to seize it with his hands.

In connection with this platform and buffer, the committee recommend the use of a fender as described in Class C and shown in the figure. This fender is normally held at a distance of three and one-half inches from the track, but is capable of being lowered, so as to prevent a person who has fallen down, and is lying on the track, from being run over by the wheels.

The three different methods of fender operation mentioned were carefully considered, and the first two modes were rejected as u idesirable. That finally selected was one submitted by L. J. Hirt, master mechanic of the West End Street Railway Co., and was that the fender should be lowered by means of the ordinary brake handle. The turning of the brake handle first applies the brake, and then lowers the fender down to the track; but the action may be made so quick that the two movements appear nearly simultaneous.

Sectional Condenser.

The condenser shown herewith has been recently patented by Elihu Nelson especially for marine use, and possesses the advantage of occupying considerably less space than the condenser now in use on seagoing and other steamers, while at the same time there is no diminution in the amount of condensing surface, nor is there any reduction of the vacuum. Incidentally, other advantages are obtained by reason of various details in the construction. It will be seen by reference to the cut that one or more of the sections of the condenser can be cut out by operating certain valves and passing the steam through the by-pass. This permits a damaged section or sections to be repaired while the engine is in operation. It will be seen, also, that one of the sections, namely, the first, can be used either as a heating or a condensing section. Beyond the last section is a receiver, R, for taking up the water of condensation and a safety branch or overflow pipe connected with the pipe that passes the water of condensation, from the heating section into the receiver. By these means several important improvements are effected, among which is that of relieving the air which has been drawn by the air pump from the condensing sections along with the water of condensation.

The peculiar shape of the hoods will be noticed, one side of each hood being flat and the two flat sides being located horizontally and facing each other, so that they can be connected by a straight vertical pipe, and thus cause the water of condensation to flow of its own gravity from one hood to the next. The center tubes W, of the first three sections are made somewhat larger than that of the last section, X, and a little smaller than the

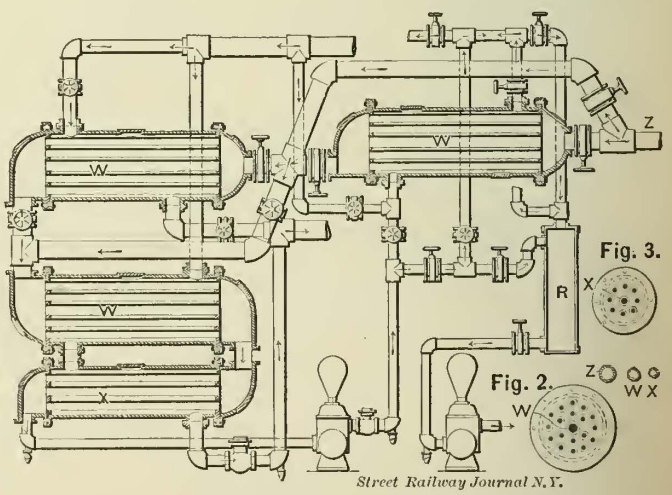


Fig. 1.
SECTIONAL CONDENSER.

steam exhaust pipe, Z. The relative sizes of these tubes are shown in Fig. 4. All the center tubes are surrounded by smaller tubes, that in the last section being surrounded by a smaller number of tubes than those in the other sections. (See Figs. 2 and 3.)

Altogether, the Nelson condenser recommends itself to those who are contemplating the use of such an apparatus for marine or similar work.

A NEW electric railway company is being organized at Carlisle, Pa., by M. L. Funkhouser, to build an electric railway four miles in length.

Types of European Steam Locomotives for Suburban Lines.

Steam railway service on street and suburban lines in the cities of Europe has assumed far greater proportions than in America. These lines, though rarely extending into the business centers, are sometimes laid on important streets, and the speed maintained equal to, or in excess of that on electric lines in America. The locomotives and cars employed in this service differ, of course, from those for trunk line service, and also from those employed in this country for similar work.

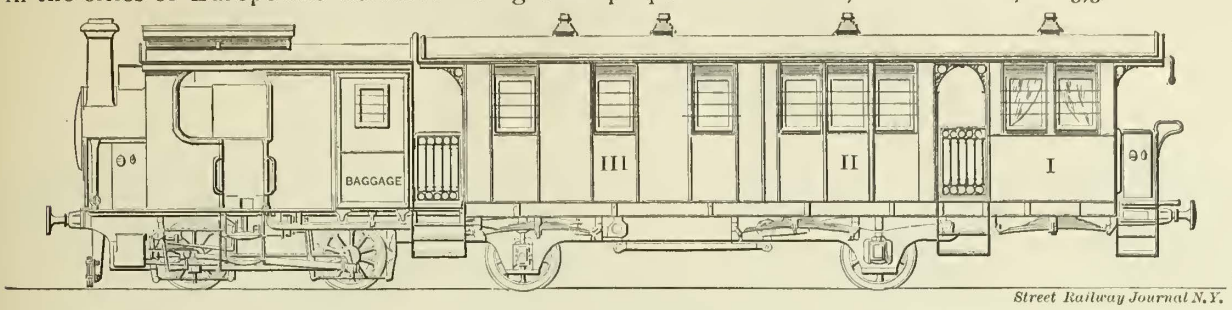


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FIG. 1.—NOVEL STEAM MOTOR AND CAR—EUROPEAN STREET RAILWAYS.

Some recent types of locomotives and cars used extensively for city and suburban traffic in Switzerland and France and manufactured at the works of La Société Métallurgique, Brussels, Belgium, are shown herewith. Fig. 2 shows a locomotive built for a thirty-nine inch gauge and mounted on six wheels, all of which are driven. The principal dimensions of this locomotive are: Length 20 ft. 4 ins., height 11 ft. 8½ ins., width 6 ft. 10½ ins., gauge 39.37 ins., weight (empty) 33,660 lbs., weight (with coal, etc.) 42,900 lbs., diameter of cylinder 11.8 ins., stroke 14.2 ins., diameter of drivers 2 ft. 8¾ ins., number of tubes 160, total heating surface 345.4 sq. ft., steam pressure 180 lbs, traction (theoretical) 10,437 lbs., traction (effective) 6,785 lbs.

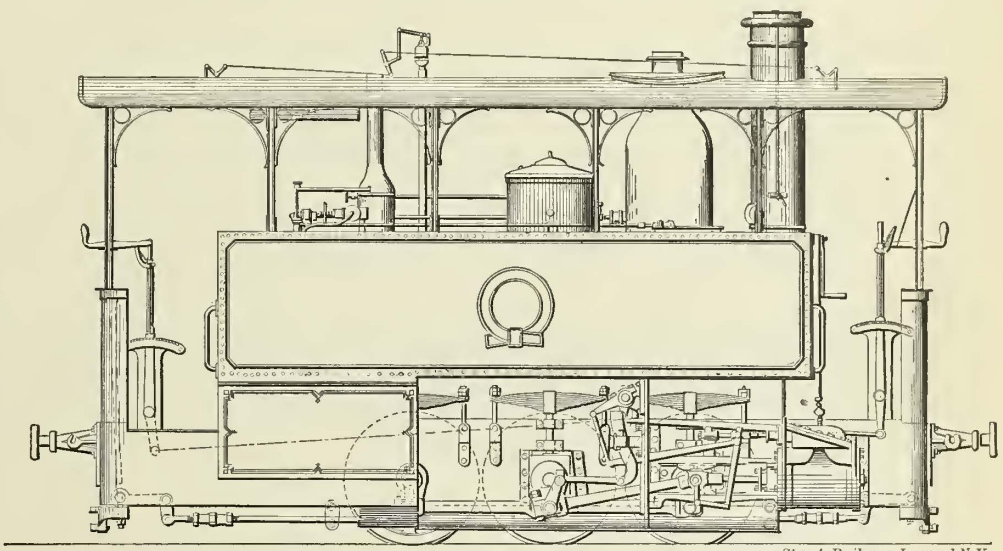

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FIG. 2.—STEAM MOTOR FOR EUROPEAN STREET RAILWAYS.

Fig. 1 shows a novel type of steam motor and car built by the same manufacturers for a standard gauge. The vehicle complete has a total length of 49 ft. 7 ins. The wheel base of the locomotive is 7 ft. 3 ins., that of the car 16 ft. 7 ins. The cylinders have dimensions 8½ ins. diameter by a 13¾ in. stroke. The boiler is of the ordinary tubular type and has 150 tubes, 13⅓ ins. in length and 1⅓ ins. in diameter and with a heating surface of 239.3 sq. ft. The steam is supplied to the cylinders under a pressure of 180 lbs. The car has compartments for first, second and third class passengers, and three sets of steps. The compartments have seating capacity, respectively, of eight, fifteen and thirty passengers. The maximum speed is twenty-five miles an hour. The car is fitted with a Westinghouse brake. The total weight of the car and motor, without load, is 63,382 lbs. Fig. 3, shows a car built for dummy lines, having a gauge of thirty-nine inches, and provided with two compartments, one for smokers, and the other for general passengers, with open platform between the two about six and a half feet in length. Each of the end compartments has a length of about seven and a half feet. The smoking compartment is fitted up in old oak, the floor is covered with linoleum, and the seats and backs are covered with leather. The other compartment is upholstered in cloth, and seats and backs covered with plush. Each compartment is lighted with two oil lamps.

The frame upon which the body of the car rests is of iron; the wheels are of iron with steel tires.

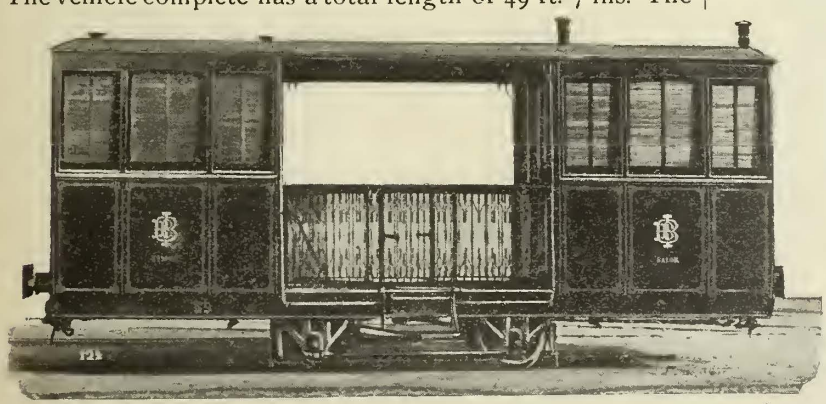


FIG. 3.—COMBINATION PASSENGER AND SMOKING CAR—EUROPEAN STREET RAILWAYS.

The Buffalo, North Main Street & Tonawanda Electric Railway has been put in operation. The road is five and three-quarters miles in length, and the track is laid on cedar ties, with sixty-five to ninety pound T rails. The road is rock ballasted all the way, and was built by the Field Engineering Co.

The reproduction of Columbus' caravel, the "Santa Maria," is being built by the Spanish government at the Carraca yard at Cadiz. The keel was laid on March 1. Great care is being taken with details, and the instruments and appliances of the time of Columbus will be in their places aboard the caravel. The "Pinta" and "Nina," it is announced, are being reproduced by American capital, so visitors to the Exposition, will be able to see the "Columbus fleet" complete The Spanish government will provide crews for the three caravels, dressed as were Columbus' sailors, and the trip across the Atlantic will be made under escort of a Spanish man-of-war. After participating in the naval review in New York harbor the caravels will proceed to Chicago. After the Fair closes they will remain the property of the United States.

A New Maximum Traction Truck.

The truck herewith presented is the invention of Otto Schmid, mechanic in the employ of the Lindell Railway Co., St. Louis, and is being put on the market by the Laclede Car Co., of the same city. It will be seen at a glance that simplicity of construction, fewness of parts and shapeliness are the distinguishing features. The bolster is of channel iron, and rests on two heavy bars which are supported by two latitudinal bars, one behind the driving wheels, and the other between the latter and trailing wheels. The latitudinal bars each rest on two heavy spiral springs. The latter are supported by the steel trussing of the truck in the ordinary manner. Objections might be raised against the bolster being in the way when the motors are to be removed or repaired. This is obviated by its being spare in construction, but trussed, and being placed a good distance from the driving wheels. The side elevation of the truck shows its crowning feature—the placing of 75 per cent. of the weight of the car on the driving wheels. Practical tests have shown that this can be guaranteed. The brake work is simple but very effective, and is placed very low so as not to come in contact with any of the mechanical parts.

The truck may be run with either the driving wheels or the small wheels foremost, or so placed under the car that the driving wheels of the front truck are foremost and those of the rear truck trailing, or *vice versa*, and in any of these cases the small wheels will not climb the rails.

The Laclede Car Co's. patent dustproof box is used in connection with the truck, Jones & McLaughlin's three and a quarter inch cold rolled steel axles, and Missouri Car & Foundry Co's. wheels. The Lindell Railway Co. are at present using ninety of these trucks on forty-five of their combination cars. S. L.

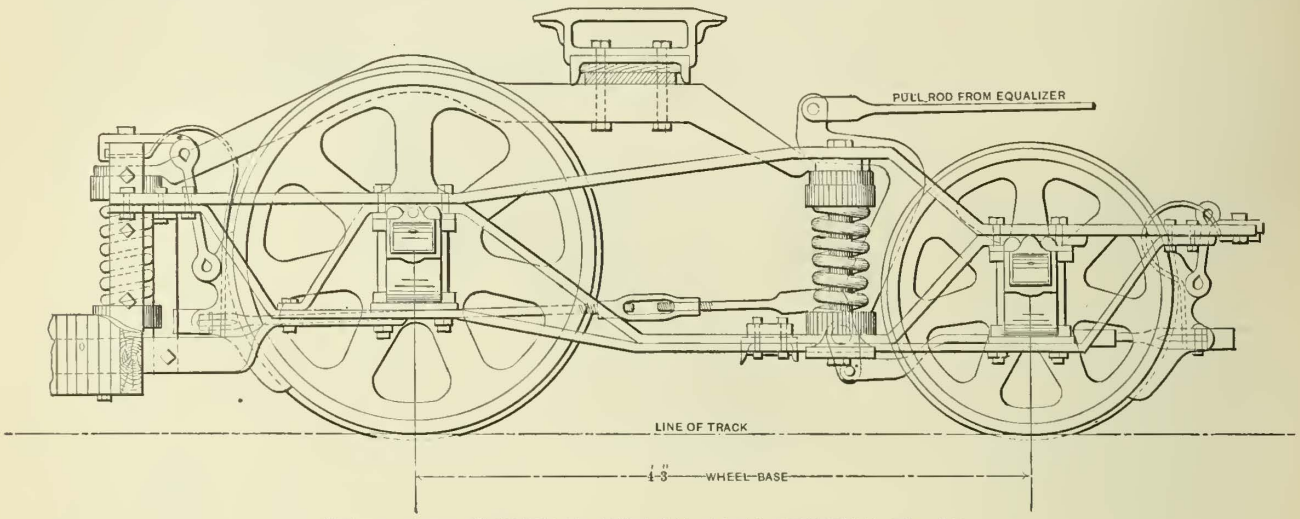


FIG. 1.—SIDE ELEVATION—NEW MAXIMUM TRACTION TRUCK.

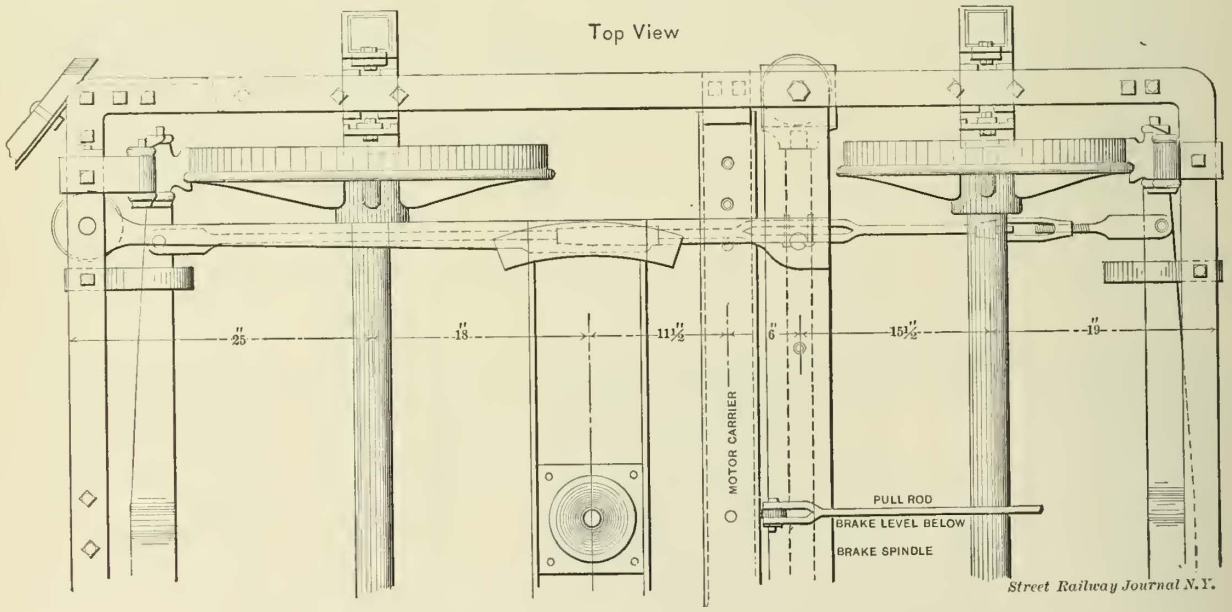


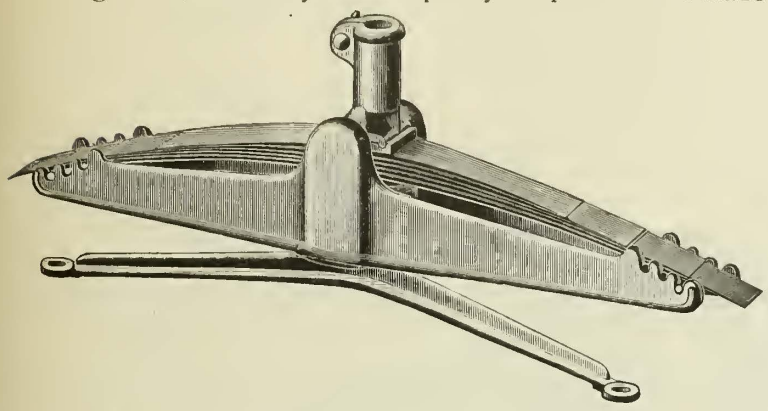
FIG. 2.—HALF PLAN—NEW MAXIMUM TRACTION TRUCK.

THE total number of passengers carried on street railways in Massachusetts for the year ending June 30, 1891, was 176,090,189. During the same period the number of passengers carried on the steam railroads of the state was 107,271,842.

AN extensive scheme on the part of conductors to defraud the Cincinnati & Covington Street Railway Co. was discovered during the early part of last month. It was the custom of that road to burn in the furnace of the power station all the punched tickets turned in at the office of the company, and the plan of theft adopted was for the fireman of the furnace to rescue the bag containing the tickets before they were consumed, and to sell the tickets to the conductors for two cents each. The conductors would then turn in these tickets in place of cash fares received. The truth was discovered through the efforts of a detective in the employ of the company. It is stated that the amount lost by the company in this way was considerable.

The Philadelphia Trolley.

The trolley whose stand is shown below is manufactured by the Technic Electrical Works, Philadelphia, and embodies substantial mechanical design with lightness, durability and simplicity of parts. It is made



STAND OF PHILADELPHIA TROLLEY.

up of only nine pieces, can be dismantled in seven seconds and assembled in twenty-two seconds, all without a wrench. No nuts, bolts, screws or washers are used in its construction, and there are no chains, coil springs or small parts to rust or break. All parts are interlocking also and interchangeable.

The spring used, as will be seen, is of the leaf or wagon type, and is not liable to get out of order, while the design of the cam against the spring gives equal tension against the trolley wire, in all positions of the trolley pole from vertical to horizontal.

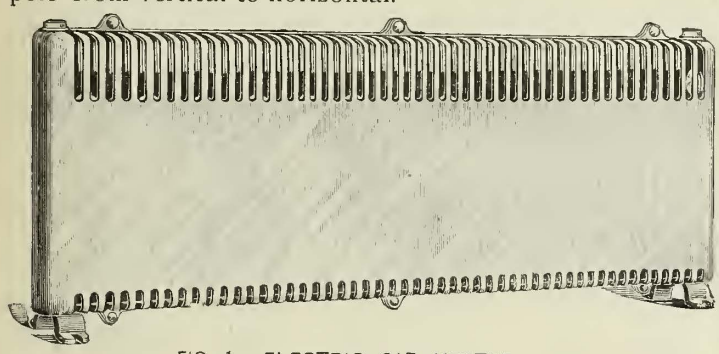


FIG 1.—ELECTRIC CAR HEATER.

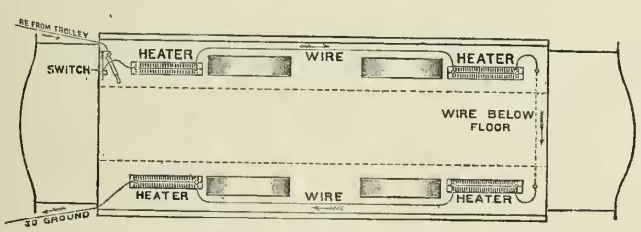


FIG. 2.—DIAGRAM SHOWING ARRANGEMENT OF ELECTRIC HEATERS.

The trolley has side motion, besides being pivoted and free to turn, and the degree of tension may be adjusted through a wide range.

ACCORDING to the *Louisiana Planter*, molasses has been recently used for fuel in Cuba with seeming success. It is either poured or sprayed on to the bagasse as the latter enters the furnace, and in the judgment of those intreested, its efficiency as fuel when used in this way is considerable. The present price of molasses on the Louisiana plantations is at the rate of about $3.33 per ton, which is rather less per ton than current prices for coal delivered there.

Car Heating by Electricity.

For electric cars the electric heater possesses many advantages. It is light, durable and can be easily controlled. Moreover, it occupies no valuable space in the car, being generally carried under the seats, and can be turned on and off so easily by a switch that only a moment is required to throw the heater in and out of circuit. Electric heaters are perfectly safe, and as the electricity used is generated from cheap coal at the station, are also economical. Again, the heaters do not require close attention, thereby allowing conductors to attend to their other duties closely.

Electric heaters for an ordinary sized car are claimed to cost no more than a coal stove, and take but three amperes of current on a 500 volt circuit. One watt will heat nearly one cubic foot of air space in a car.

In the electric heater manufactured by the Dewey Electric Heating Co. of Syracuse, types of which are shown herewith, the entire surface of the heating conductor is exposed to the air. The conductor is supported and held firmly by non-combustible or fireproof material, and yet all except a very small percentage of its surface area is exposed to the air. There is no chance of getting a shock, as all current carrying parts are shielded and protected. The Dewey standard car heater is shown in Fig. 1. These heaters are located under the seats, and from four to eight are necessary to heat a car, depending upon the size of the latter. The heater case is of cast iron finished with a black japan, twenty-six inches long, two inches wide and less than eleven inches high, and can be secured firmly to the floor. The weight is about twenty-five pounds each. The heaters are generally connected in series on the car as shown in the diagram (Fig. 2). But

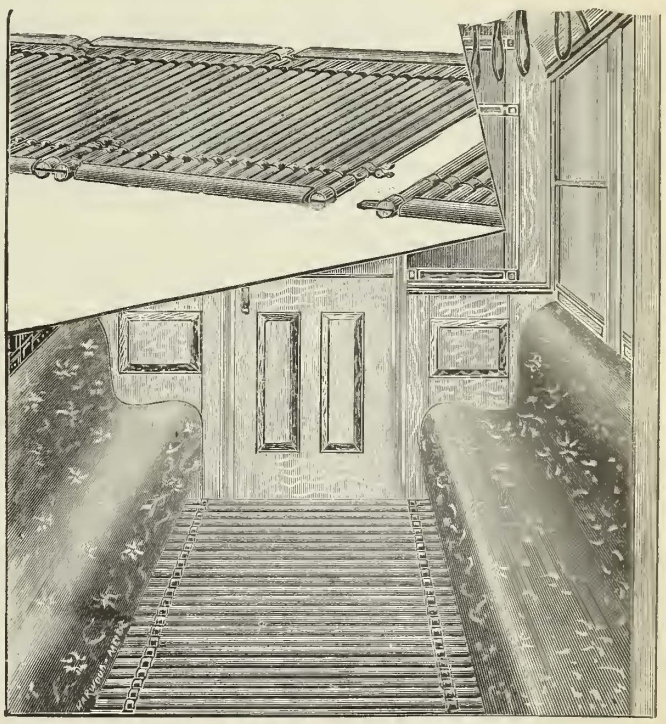


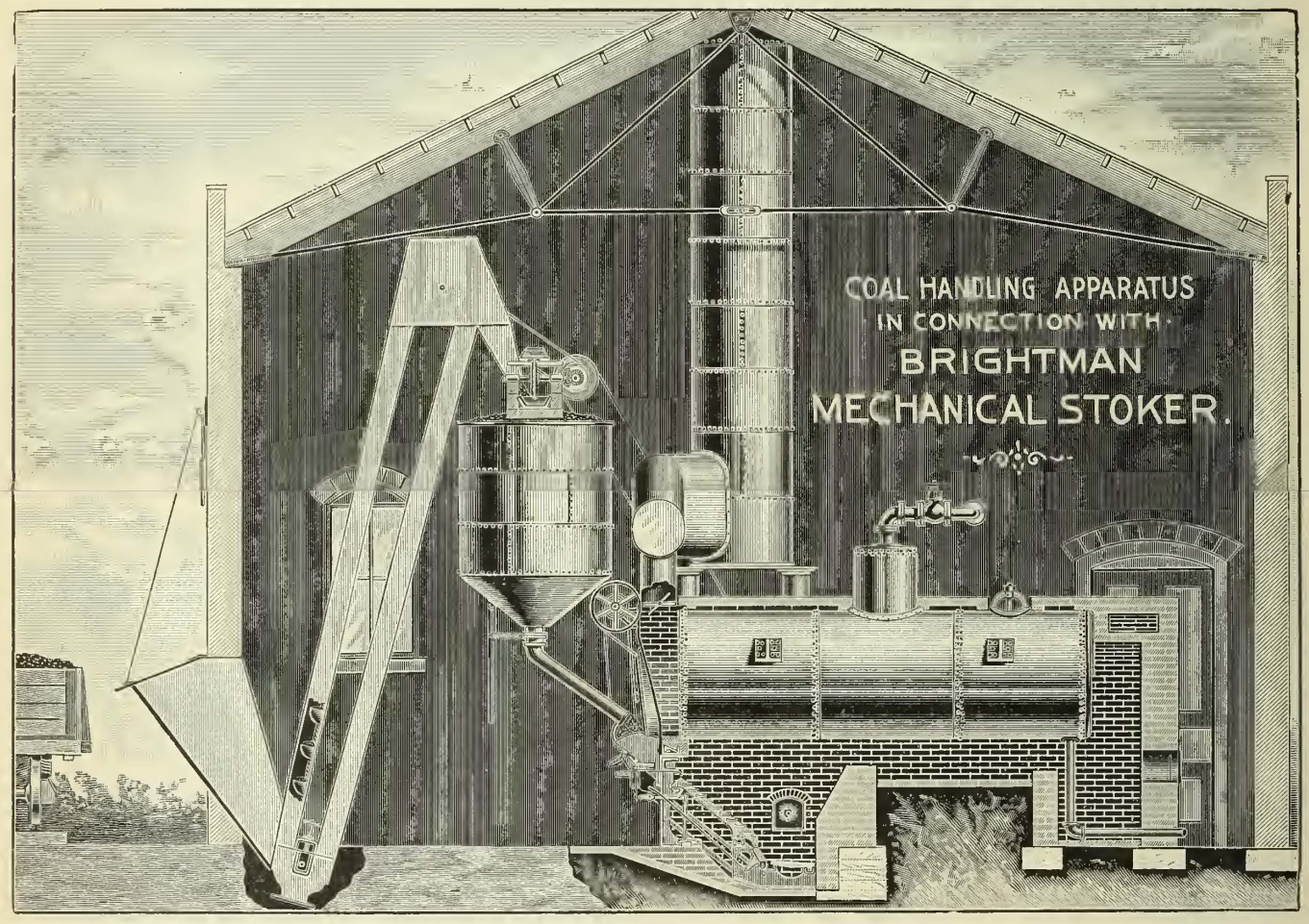
FIG. 3.—ELECTRIC MAT HEATER FOR STREET CARS.

one switch is in circuit to connect and disconnect the heaters, making their control simple and easy. At one end of the car the heaters are joined by passing the connection through and beneath the floor as indicated in Fig. 2. Should extremely cold weather appear, one of the heaters may be short circuited if necessary in order that a greater heat may be generated.

A mat or grating heater is shown in Fig. 3. This lies on the floor of the car and is composed of small gas pipes which inclose the conductor and form a large radiating surface. The grating is in sections so that it can easily be removed for cleaning purposes. As the temperature need not rise above 120 degs. to warm the car, there is no danger of rubber or leather being injured.

A Mechanical Stoker.

A boiler equipped with the Brightman mechanical stoker is illustrated in the accompanying engraving. It is noticed that a complete system of feeding fuel is represented. The special means adopted for conveying the fuel to the furnace is incidental, as other devices may be employed. Beginning with the furnace, it may be stated that the hopper in front of and below the flue cleaning doors is attached to the front and extends across it, its length being equal to the width of the grate surface. The bottom of the hopper is a cast iron feed table which extends into the furnace as far as the front ends of the grate bars. Sliding on the feed table is a "pusher" three inches



MECHANICAL STOKER AND COAL HANDLING APPARATUS.

in height having a horizontal reciprocatory motion. By its action the fuel is periodically crowded into the furnace, being delivered upon the forward ends of the grate bars. Motion is communicated to it by a heavy cast iron rocker, and the extent of the reciprocating movement, and consequently the feed of the fuel, may be controlled and varied by means of a rack and pinion feed adjuster. The rate of feed may also be altered by changing the belt on the cone pulleys. Provision is made so that the feed may instantly be stopped and started again. The power is ordinarily furnished by a small vertical engine, but it may be derived from a line shaft, or hand power may be the operating agency.

The arrangement of the grate bars is such that the great desideratum in a furnace is secured. The air supply is presented to the fuel in the most advantageous form, *i. e.*, in an extremely divided state. It enters through the grate bars, not in a score merely, but in a multitude of small apertures. This result is effected by the following construction: The grate bars are inclined at an angle of about thirty-four degrees from the horizontal, and are made with lateral projecting lugs overlapping each other. By this construction vertical openings through the grate are avoided, and the great waste often occurring by fine fuel falling through the bars is prevented. The overlapping lugs, however, are at a sufficient distance from each other to afford ample horizontal openings into the burning fuel, so that a plentiful supply of air is provided for combustion, and at the same time the bars are kept comparatively cool, and in consequence are not warped, melted or burned out.

Each alternate grate bar is stationary; the others have a reciprocatory and longitudinal motion communicated to them.

The fuel is delivered at the top of the grate, and the motion of the bars causes it to move regularly down the inclined surface toward the rear of the furnace. All fuel moves simultaneously, and this movement is positive and uniform, insuring a constant thickness of incandescent fuel. The motion of the grate bars may be varied from one fourth of an inch to an inch in accordance with the nature of the fuel, the draught and the character of the service. The adjustment is made quickly at any time without stopping the machine. This constant movement of the bars prevents the formation of clinkers. Nearly all the fuel is consumed on the inclined grate, and the feed is to be regulated accordingly; all clinkers and ashes and other incombustible matter and some unburned fuel pass from the principal grate to a *pit grate*, situated eight inches below the rear end of the principal grate, which is formed of ordinary bars, one-half inch thick by two inches wide with spaces of half an inch between them.

The unburned coal is consumed on the pit grate; the ashes fall through to the ash pit below. The clinkers remain on the grate and their heat contributes to raise the temperature of the air entering the furnace.

One of the great advantages of the Brightman furnace lies in the fact that when it is used, little or no smoke is produced, because the combustible gases resulting from the decomposition of fuel are immediately and entirely consumed; in ordinary furnaces, as a consequence of incomplete combustion, these gases are more or less condensed and form smoke.

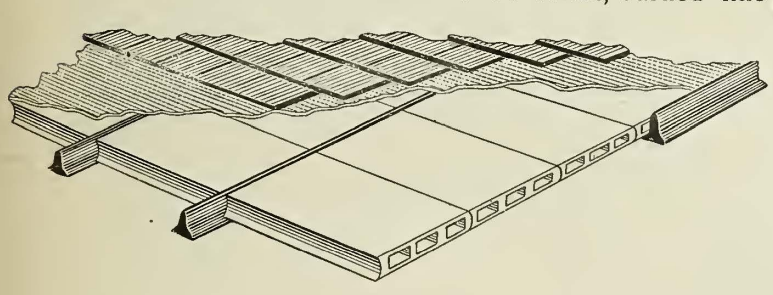
The tests that have been made with the Brightman

furnace seen to indicate a remarkable fuel economy. It has been demonstrated that it will supply from 15 to 30 per cent. more steam using slack than flat grade furnaces produce with the same weight of like fuel. The labor economy is still more marked. The labor required for boiler attendance is less than one-half that necessary in the case of a flat grate furnace.

Finally, it may be stated that the stoker is applicable to any style of steam boiler and to any of the patterns of fronts in common use. The stoker is manufactured by the Brightman Stoker Co. of Cleveland, O.

Terra Cotta Lumber for Roofing.

The use of porous terra cotta, or terra cotta lumber as it is called, for building purposes where a fireproof material is required, seems to be growing rapidly among builders and architects. It has many advantages for this purpose, among which may be mentioned its non-conductivity of heat, cold or sound, its lightness and its ability to withstand a considerable load or continuous fire without breaking. Terra cotta lumber is a composition of clay and sawdust fashioned into hollow forms, burned like common brick in which process of burning the sawdust is consumed. One very successful application of the material and the one illustrated herewith, is that to roofing purposes.



TERRA COTTA ROOF TILES.

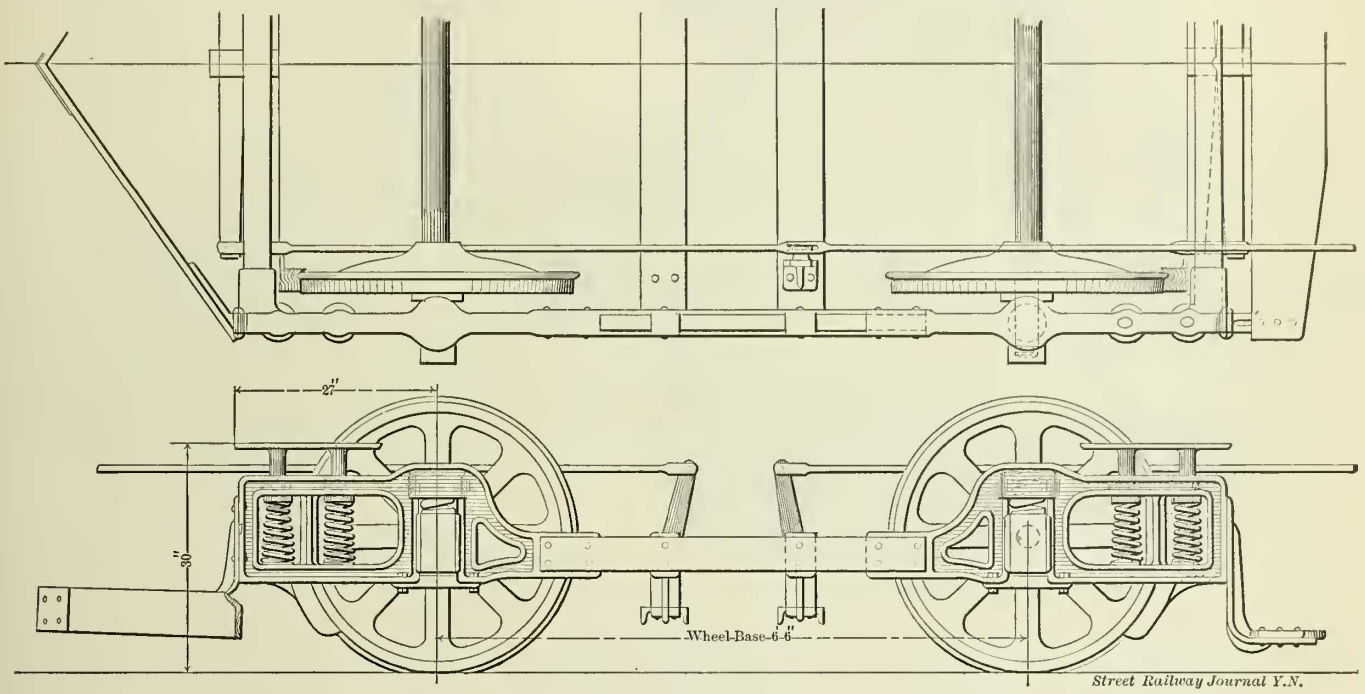
The roofing tiles shown are from one and a half to three inches thick, twelve inches wide and twelve to twenty-four inches long, suitable to set between T iron purlins. The weight is from eight to fifteen pounds per square foot.

The Pittsburgh Terra Cotta Lumber Co., which supplies this material, operates under a license from the International Terra Cotta Lumber Co., by which it has the right to manufacture the composition under the Gilman patents.

New Electric Motor Truck.

The accompanying cuts show the new extended spring base, electric motor truck to be put on the market by the St. Louis Car Co. The entire truck is an improvement on one of somewhat similar design turned out by the car company about six months ago.

It will be seen at a glance that simplicity of construction is one of the crowning features of the truck. There



HALF PLAN AND ELEVATION OF NEW TRUCK—ST. LOUIS CAR CO.

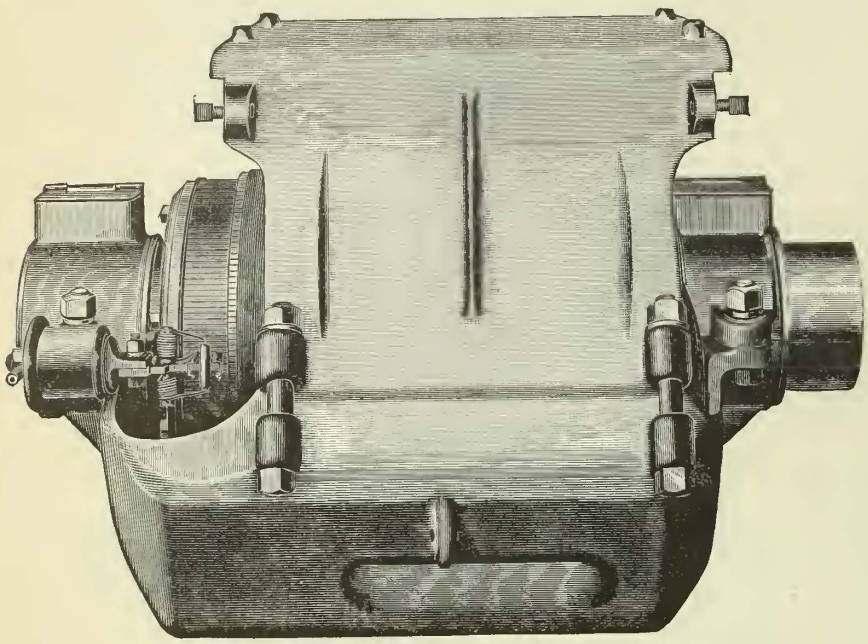
are but four steel castings, one of which is at each point of support of the car body, or, in other words, the frame occupying the region of the oil box, forming the extended spring base, and connecting with the bars which support the motor hangers. It will be seen that a heavy spiral spring is interposed between each oil box and its accompanying casting. These springs enable the entire truck to act as an equalizing bar. The great advantage of this feature is the minimum of noise and rattling caused by obstructions on the rails. The old truck above mentioned did not possess this advantageous feature. There are no bolts or nuts to work loose, and where any do exist they belong to working parts, such as in the brake mechanism. The wheels can be readily removed for motor repairs or other work by simply unscrewing the nuts which hold to the truck the plate beneath each oil box. The body pedestals, of which there are four, are attached to the car body, but are not intended to be removed every time the car body is lifted from the truck. They are released from the truck by loosening a nut at each upper spring cup, which can be seen in the side view. The advantage of this innovation is apparent from the fact that the continual screwing and unscrewing of bolts in the wood sills of a car body tend to wear away the threads, to increase the size of the holes, the consequences of which are well enough known, and to accumulate an account of rust. In the old truck there were four motor hangers, but in the present one there are only two, of flexible, hardened steel. The cut shows two styles of life guard. Both of these do not belong to the same truck, but simply exhibit the two most widely used styles, from which the purchaser can select.

The truck has been tested at the Washington University of St. Louis, by the Shickle, Harrison & Howard Iron Co., of the same city. It showed a tensile strength of 80,000 lbs. to the square inch. The weight of the truck is 3,000 lbs.

The company expects the truck to meet with great favor among street railroad men, as tests are now being made on the Union Depot and Bellefontaine railways of St. Louis, which give the most flattering results.

A New Gearless Motor.

The gearless motor is a machine peculiarly identified with the Short Electric Railway Co. It is only a little over a year ago that the first machine of this type was introduced, and while it proved under the severe conditions of actual service to be of exceptional efficiency, the inventor saw a chance for development and improvement.



NEW GEARLESS MOTOR—END VIEW.

The machine and the subsequent slightly modified types that quickly followed the introduction of the machine attracted such widespread attention, and were so fully described, that a brief reference is essential in this connection only as prefatory to a description of a new gearless motor which was exhibited for the first time at the Cleveland convention. The original gearless was a four-pole machine flexibly mounted directly upon the car axle. The magnets were presented to the sides of the armature. As has been stated, this machine performed good work, but it was heavy and its construction was such that thirty-six inch wheels were necessary on the truck. The second type of machine was somewhat different in construction. The armature was mounted on a hollow shaft connected with the axle by means of a flexible driving device. The armature and magnets were practically the same as in the first machine, and as before, thirty-six inch wheels were necessary.

This machine was exhibited at the Pittsburgh convention of the American Street Railway Association a little more than a year ago, and was inspected with the greatest interest by railway men. In the next type the pole pieces were presented to the face of the armature instead of to the sides, and the armature was somewhat modified in form. Its face was wider, while the diameter was diminished so that thirty-three inch wheels could be used.

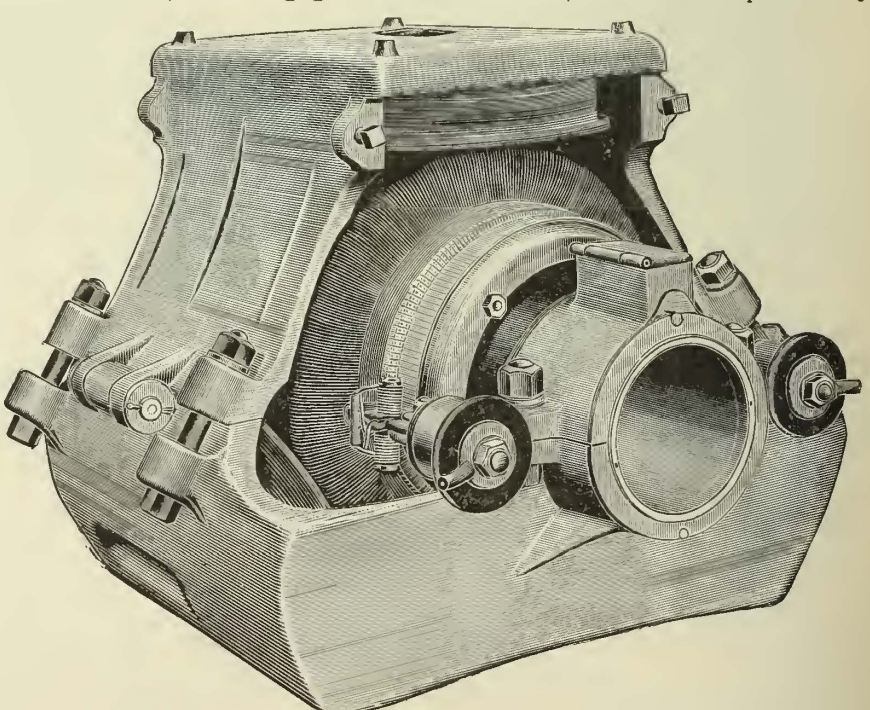
This brief description brings the development of the gearless up to the present latest type which is here illustrated. The motor is a six-pole machine weighing, complete, 2,300 lbs. The frame is cast from steel in two sections; the upper half is supported by the truck; the lower half is hinged to the upper, and may be swung down when a car is over a pit, so that inspection is rendered easy. The lower half of the frame is cast without any opening up to the level of the center of the axle, so that the motor may run through water and slush without any possibility of their penetrating inside the frame. Practically, therefore, the machine may be considered a waterproof motor.

The armature is twenty-one inches in diameter, and, as in previous types, is mounted on a six inch hollow shaft through which passes a four inch axle. To the end of the armature shaft is a flexible driving device for connection with the car axle.

The diameter of the armature is sufficiently decreased in the new type so that thirty inch wheels may be used with a clearance of three inches between the bottom of the motor frame and the track.

At already stated, the machine has six poles which are presented to the face of the armature. The latter is built with ninety-two bobbins, with sixteen turns of wire on each, which are connected to 184 commutator bars. The armature is designed to run at 120 revolutions per minute when developing twenty horse power.

Two of these motors will exert an horizontal effort of 1,500 lbs. in starting a car with eighty amperes, and with from eighteen to twenty amperes will propel an ordinary car at a speed of about twenty miles an hour.



NEW GEARLESS MOTOR—SIDE VIEW.

"A POOR track and imperfect roadbed mean decreased travel and consequent loss. The public are tenacious where their rights are concerned. The jumping of a track by a car and the consequent jolting occasioned thereby, tend to disgust shaken and demoralized travelers, and, with anathemas heaped on the company's head, they leap from the car and wend their way to business by their own private conveyances, namely, their legs. Hence the necessity of having good solid roadbeds, with rails equi-distant from each other, the whole length of the track."—*Chicago Street Railway Convention*, 1883.

PROF. ELISHA GRAY, has returned from an extensive European tour taken in the interest of the electrical congress which will be held in Chicago in connection with the World's Fair. He secured the promise of 200 electricians to attend the congress.

Rocker-Link Cantilever Truck.

Among the exhibits which attracted much attention at the Convention was a model of the above named truck, an illustration of which is given herewith. This is a type of six wheel truck so designed that the principal weight is carried upon the central wheels, while the front and rear wheels, which may be of the same diameter as the central wheels or smaller, perform the ordinary functions of a pony truck; and at the same time, owing to the

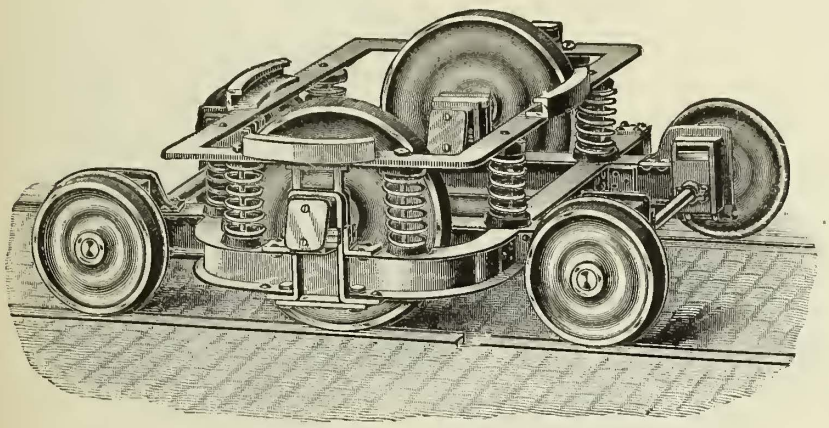


FIG. 1.—ROCKER-LINK CANTILEVER TRUCK.

presence of rocker links upon the axle boxes, take up or destroy the lateral shock that ordinary trucks experience when passing snaky track or entering curves. They also serve to keep the central wheels, which are ordinarily flangeless, upon the track. The front and rear axles are rigid vertically and longitudinally, but, owing to the rocker links, have a free lateral movement independent of each other or of the middle axle which is rigid to the truck frame in all directions. Fig. 2, shows the arrangement of the box with the link in the normal position. Fig. 3, shows the link by itself, and illustrates the principle through which, by means of the half round bearing surfaces of the link, the height of the truck above the rail is kept constant, independently of the position of the box.

The horizontal movement of the front and rear axles does not tend to raise the truck from its true horizontal

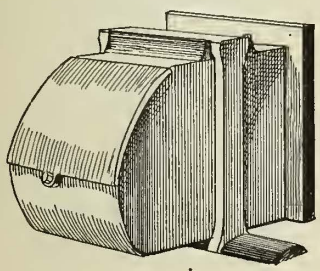


FIG. 2.—BOX.

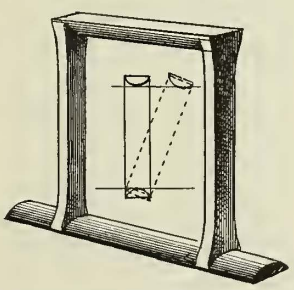


FIG. 3.—LINK AND DIAGRAM.

ROCKER-LINK CANTILEVER TRUCK.

line, however, as is the case with the ordinary swinging links, but the movement is against the gravity of their load, the same as if against a swinging link, so that the central wheels always remain in contact with the track, and their tractive force is not weakened.

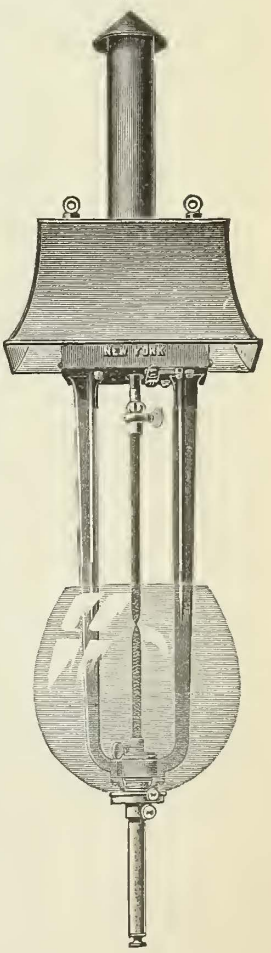
The frame being practically a cantilever balanced upon the central wheels and provided with springs, and having the spiral springs placed in the bottom of the of the frame and not, as ordinarily, between the axle box and truck beam, does not permit the front or rear wheels to drop into depressions or joints in the rail, and these wheels also in turn carry the central wheels over depressions in the same manner, which prevents pounding at joints. The central wheels can be mounted on the same axle, or preferably, as in the illustration, on independent axles with interior journal boxes, which facilitates their movements upon curves.

The truck is adapted to either steam, cable or electric traction, there being ample space within the frame for mounting the grip or the motors, which may be arranged to work independently on the separate axles, or upon a single main driving axle.

The device is the invention of E. R. Esmond, and is being manufactured by the Esmond Street Rail Co., 106 Broadway, New York.

Arc Lamps for Street Railway Circuits.

Most electric railway companies are in a position to operate electric lights from their circuits advantageously, and the number which supply current for arc lamps in this way is constantly on the increase. The accompanying engraving shows the improved Ward arc lamp designed for constant potential circuits, and which has already made a satisfactory record on circuits of 500 volts potential. Each lamp requires for its operation about ten amperes and forty-five volts, and on a 500 volt circuit ten lamps are used in series. Each lamp is provided with an automatic cut-out which, in case of accident to any individual lamp, will throw into the circuit a resistance equal to that of the lamp while burning, thus maintaining a constant resistance for the circuit and keeping the current constant. The resistance for this purpose is placed on the lamp or in the hood. Each group of ten lamps is also provided with a suitable resistance to adjust it to the voltage of the circuit, and this is placed either in one lamp or, if desired, exteriorly in some convenient location. The framework of the Ward arc lamp is of malleable iron, making it strong and durable, and the mechanical and electrical parts are duplicate and interchangeable. The carbon rod is a seamless drawn, rectangular, brass tube, and the pinions and bearings of the feed mechanism are of phosphor bronze. The lamp is manufactured by the Electrical Construction & Supply Co., of New York.



ARC LAMP FOR INCANDESCENT CIRCUITS.

The consumption of current can be measured by meter as easily with this as with an incandescent lamp.

"WE should, therefore, recommend for a well ballasted roadbed good gravel that will bind; and if this cannot be procured, sand or any other ballasting material that will cause the least rot to the timbers by allowing the water to filter through. The paving well and properly laid on this bed cannot fail to give good satisfaction. Where the traffic is very heavy, we should recommend tram rail, from forty to forty-five pounds to the yard, and well spiked to stringers with good cast or wrought iron joint plates at the end of the rails."—*Chicago Street Railway Convention*, 1883.

A NEW material for paving is now being introduced in London. It is made of granulated cork and bitumen pressed into blocks. These blocks are afterward laid like bricks or wood paving. It is said that in this there is a special advantage in that it is exceedingly elastic, and when used for pavements gives a soft tread which is easy for the horses' feet, feels like a rubber carpet, and does away almost entirely with the noise which is such an unpleasant feature of the traffic of the streets of a great city.—*India Rubber World.*

A Cleft Rail System.

This is a type of continuous girder rail, which may be either center or side bearing. It is divided lengthwise vertically through the center of the head and the two members are rolled in the forms illustrated in Figs. 1 and 2. In either case the two parts are designed to be laid together with broken joints and bolted at frequent intervals. As shown in Fig. 1, the web of the inner member is represented as resting on a shoulder provided at the side of the leading member with a rib and groove as before, the former being virtually a continuous fishplate. Fig. 2 shows the rail mounted on a wooden substructure.

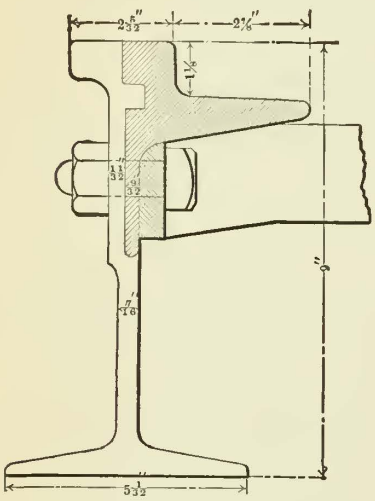


FIG. 1.—SECTION OF CLEFT RAIL.

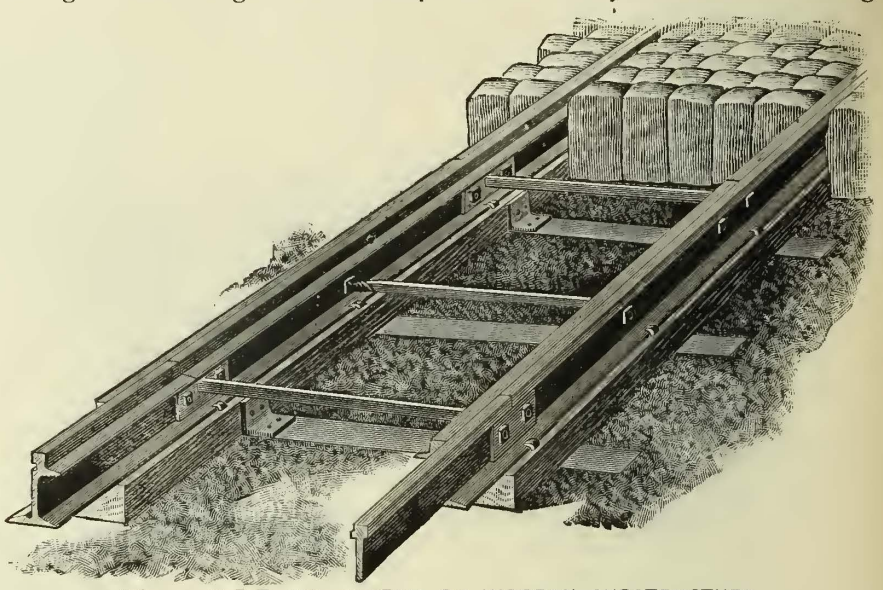


FIG. 2.—CLEFT RAIL SYSTEM ON WOODEN SUBSTRUCTURE.

The system is adapted to an entire metal construction, in which case, circular cast iron chairs having a broad base are employed, which may rest either on the soil or on prepared pedestals; or, it may be laid with the rail resting upon stringers or spiked directly to the ties.

The danger from water collecting and freezing between the members is obviated by making slight corrugations on the shoulder or seat on which the flange of the inner member rests which constitute drains and lead the moisture off before freezing can take place.

The claims made for it are, a smooth surface for the passage of cars, vertical stiffness with sufficient cushion to prevent jarring and pounding, good conductivity, the contact of the members being sufficient to conduct the current without the necessity of bonding; also good paving qualities.

The rail was designed by E. R. Esmond, and models were exhibited at the Cleveland Convention by the Esmond Street Rail Co., of New York, who are the promoters of the system.

Columbus Week Traffic in New York.

October 10, 11 and 12, were days which tested the capacities of the surface and elevated railways in New York City. The elevated railways, of course, carried more passengers than any other, the record for these three days on that road being as follows:

	No. of Passengers.
October 10	945,000
" 11	901,000
" 12	1,075,537
Total for the three days	2,921,537
Average per day	973,845

October 12, the traffic was thus divided between the roads of the elevated system:

Second avenue	114,502
Third avenue	440,442
Sixth avenue	447,634
Ninth avenue	71,852
Suburban	31,107
Total	1,075,537

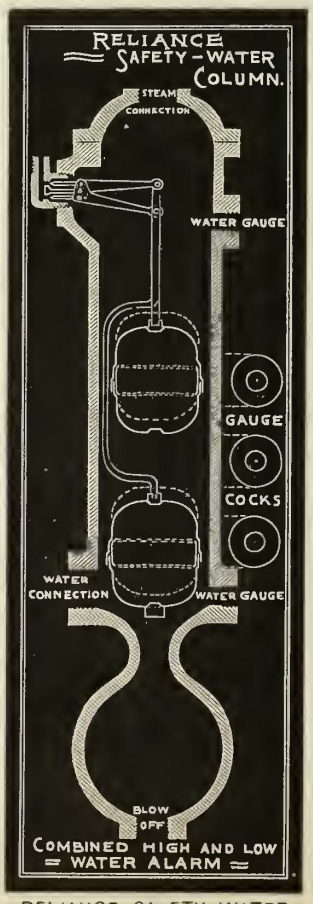
These were the greatest three days in the existence of the company. The average number carried per day was in excess, too, of the largest business done previously by the company on any one day. That was on the occasion of the Washington Centennial parade, when 867,000 passengers were transported in twenty-four hours. Among the surface railways the Third Avenue carried, probably, more than any other, the record of this road being

October 10	109,260
" 11	138,800
" 12	140,200
Total for three days	388,260

A statement of the traffic on the Brooklyn Bridge during Columbus Week will be found on another page.

The Reliance Safety Water Column.

Among the exhibits of auxiliary appliances at the Cleveland Convention, which attracted much attention, was the display of Reliance safety water columns by the Reliance Gauge Co., of Cleveland, the sole manufacturers of this apparatus. The exhibit included as well several iron columns with the various kinds of water gauges and gauge cocks with which they are equipped in accordance with the fancy of the buyer.



RELIANCE SAFETY WATER COLUMN.

But, perhaps, the part that attracted most attention was the aluminum models in section showing the working parts of the water column, as shown in the accompanying cut. As will be seen by a study of the connections, the water tender must keep the water right or be exposed by the whistle, which will sound if the water is too high or too low. The exhibit was in charge of A. J. Wright, president, and L. H. Elliott, secretary and treasurer of the company.

THE West Chicago Street Railroad Co. have posted an order that police officers occupying seats in crowded cars must pay fare.

The Sperry Electric Railway System.

Nine cars equipped with the Sperry electric railway system have been in operation with most satisfactory results, during the past year, at Youngstown, O., where the conditions of road, grade, etc., are particularly severe. In view of the success attained by these cars, the Sperry Electric Railway Co. has been organized under the laws of Ohio with a paid up capital of $250,000 for the purpose of placing the equipments upon the market. Elmer A. Sperry, the inventor of the system and of the Sperry arc system of lighting, has been retained as electrical engineer of the company, and Harry P. Barr, who for the past three years has been connected with the railway department of the Thomson-Houston Electric Co., is secretary and general manager. The main office of the company is 29 Broadway, New York.

In the system a single forty horse power, single reduction, drum type armature, two pole motor is used on each car. These motors are elastically supported from the frame of the truck, and flexibly connected to both axles, beveled gears being used, and the axis of the armature being lengthwise of the car. The armature shaft is hollow, and its bearings form part of the motor frame. The weight of the motor, including the armature, which is about 2,000 lbs., rests upon two cross bars which are in turn supported on cushions from the truck frame. The only weight, therefore, not supported on springs is the weight of the driving gears, housings and pinion shaft, a total of 400 lbs., on each axle.

The flexible connection between the armature shaft and axles is a special feature of the equipment. This includes the use of a cushioned universal clutch consisting of a case having internal projections keyed to a hollow armature shaft and forming the driving element. A piece having radial arms keyed to the pinion shaft forms the driven element, and the two are connected by a floating piece which transmits the rotation from the one to the other through the medium of rubber cushions, allowing eccentric positions of the two while retaining the perfection of transmission.

It is self evident that by this device, while the effort of the motor is transmitted to the wheels, all concussion and vibration of the wheels and axles, with their destructive tendencies, are prevented entirely from being transmitted back to the motor. The yielding element in this drive is also found to greatly reduce the strain on gear teeth and to add materially to the life of both pinion and gear. This is exemplified by the fact that gears are running to-day in Youngstown which have been in continuous operation in actual service for the past year.

The method of control adopted embraces the series multiple combination of fields with variable resistance. On starting, two fields are in series with each other, and with the whole resistance. As the speed increases the resistance is gradually cut out, until when it is all cut out the fields are connected in parallel. The fields are particularly adapted to this method of control as they work far below magnetic saturation.

The controlling device is placed on the platform where it occupies the space afforded by the forward bulge of the dasher. From the fact that only small amounts of the resistance are cut out at a time, and from the method of making connections there is practically no sparking, and the arc formed on the last contact is mechanically blown out by an air blast formed by a small bellows operated directly by the contact lever. The reversing switch is within the controlling box, and is so arranged as to make it impossible to reverse while the current is on.

All the details of the system have been carefully worked out, and each part is especially strong and durable.

The contract for rebuilding the Newark & Orange Street Railway has been awarded to Wm. P. Craig, of East Orange. N. J., and is being pushed rapidly forward. The track will consist of nine-inch girder rails, spiked direct to the ties, which are laid two feet six inches between centers. Fish plates two feet long are used at the joints and fastened with eight one-inch bolts.

Some European and American Methods Compared.

By G. Herbert Condict.

It has been a source of great wonderment to the writer that American street railway managers should be so slow in adopting the double deck car. While the horse furnished the only motive power, this slowness could be accounted for by the fact that nothing in the shape of horseflesh could stand any increase in the burden already imposed upon it. On English and Continental tramways where the limit of load for a sixteen foot, double deck car is fixed at forty-six or forty-eight passengers, and that limit usually strictly adhered to, the power required to move the car is far below that necessary for a single deck car packed with weighty humanity to the very hand rails. Since the introduction of the almost unlimited power of the cable and of the electric motor, this reason for adhering to the old standard car does not exist. Certainly the patrons of the street car lines would be benefited by having the increased accommodations, and this plan of obtaining the same without occupying greater street surface, and also without increasing the number of cars, does seem most feasible. It would be most interesting to hear from the street railways in this country, which have tried the double decker, in regard to the advantages and disadvantages attendant on its use.

Now, as to the system of limiting the load to the available seating capacity of the car. This subject has often been discussed, not only by the foreigner who visits these shores, but by the native who has been brought up in the midst of the much decried American system of "there's always room for one more." Why do not the American municipal authorities compel the street railways to limit the number of passengers carried on their cars, is a question often asked. After some experience on both English and Continental street railways, the writer feels justified in saying that the average American public would not agree to any such restriction. That such a plan is the most comfortable for those who have seats, cannot be questioned an instant; but how about the poor unfortunate who, at a busy time, in inclement weather, is compelled to stand on a street corner for an indefinite period, watching car after car pass because all the seats are occupied? Isn't it better to stand in a car that is making progress toward the desired haven, than to stand on a wet, cold and exasperatingly stationary curbstone? It is not within the scope of this article to demonstrate that the oft repeated solution of the overcrowding question, namely, that "street railways should be compelled to run enough cars during 'rush' hours to carry the traffic," is no solution at all, in most cases.

The Paris plan has its advantages over the English, especially for the women, as it places them on an equal footing with the men, in regard to obtaining seats. Small offices are placed on the corners at points of heaviest traffic. By application at any one of these offices a prospective passenger may obtain a numbered ticket, entitling the holder, in regular turn, to board a passing conveyance of the company in which there may be a vacant seat. This is a decided improvement over the English system, as in the latter the women fare very badly when a heavy traffic is on, as the men jump on the vehicle before it has come to a stop and secure any vacant seats, leaving the fair sex to wait for a more favorable opportunity, which often means when there are no men desirous of obtaining seats. This, coupled with the fact that in the most crowded streets the busses and trams are not allowed to stop, either to take on or let off passengers, except at certain designated points, compels the English woman to be more active than her American cousin, and it is not at all unusual to see a woman getting on or off a conveyance while the same is moving at quite a lively pace.

The Chicago Street Railway Co. has placed an additional order for motors with the Westinghouse Electric & Manufacturing Co., making a total of sixty-one motor cars and four 200 H. P. generators ordered.

The Exhibits.

The exhibition of apparatus for street railways formed a notable feature of the Convention. At no previous meeting of the Association had there been shown such a varied and complete display of the devices and machinery designed for use by street railways, and the arrangements for exhibiting the apparatus were such as to facilitate a careful inspection. The exhibit demonstrated the variety of equipment which manufacturing companies are compelled to supply, and illustrated by its completeness the progress that has been made by these concerns within the last few years. The list of exhibitors is an extended one; for the number of inventors in this particular field is continually growing, and the multitude of specialties in certain lines is almost confusing. From the supply man's point of view the exhibit was entirely successful, for the greatest interest was shown in the varied display; and also from that of the street railway man, for none of them is so well informed that he could not extend his knowledge to advantage by inspecting the specialties and new machinery exhibited.

The main exhibit was located in the Army and Navy Hall almost directly opposite the Hollenden Hotel, and in a temporary building adjoining. Temporary stands were built for apparatus directly in the rear of the hotel, and cars were exhibited on a temporary tracks. The East Cleveland Railroad Co., made a liberal provision for all those requiring power. Current for the special cars and for all machinery in the exhibit halls was furnished from its power station. Following is a list of those who made exhibits:

C. S. Van Nuis, of New York, exhibited his Fulmen lightning arrester.

The Cleveland Frog & Crossing Co. showed frogs, crossovers, switches, etc.

D. H. Carpenter, of Toronto, exhibited a case containing automatic wrenches.

The Osborn Manufacturing Co., of Cleveland, exhibited several of its wire brushes.

John H. Graham & Co., of New York, showed two different styles of rotary alarm bells.

Koelher & Roskoph of Cleveland, exhibited their automatic street railway switches.

The Crescent Manufacturing Co., of Cleveland, exhibited a number of its specialties.

The Kuhlman Co., of Cleveland, showed to the visitors some of its interior street car work.

H. C. Burke, of Cleveland, exhibited a model of his patented underground trolley system.

The Reliable Manufacturing Co., of Boston, exhibited some of its street railway appliances.

The Foreman-Bassett-Hatch Co., of Cleveland, exhibited samples of street railway tickets.

The United Tramway Sprinkler Co., of Louisville, Ky, exhibited one of its tramway sprinklers.

John Kuehnle, of Detroit showed a line of trolley wheels for which special claims are made.

The Crossley Car Brake Co., exhibited a model of its friction brake which attracted no little interest.

The Partridge Carbon Co., of Sandusky, O., showed a line of brushes designed for electric railway motors.

Alfred G. Hathaway, of Cleveland, exhibited his transfer table, which is well known to all street railway men.

The Campbell & Zell Co., of Baltimore, exhibited a handsome model of the Zell improved water tube boiler.

The Hackney Hammer Co., of Cleveland, showed one of its lightest hammers operated by an electric motor.

The Hartford Woven Wire Mattress Co., of Hartford, Conn., exhibited samples of its woven wire car seats.

The Miller Chemical Engine Co., of Cleveland, made an exhibit comprising several Miller hand fire extinguishers.

The H. M. Loud Sons Lumber Co., of Au Sable, Mich., made an exhibit of poles designed for street railway purposes.

Horace A. Loomis, Hightstown, N. J., showed samples of the Jones adjustable metallic spring weather strip for street cars.

Pierce & Miller, of New York, were represented by Mr. Miller, who described the merits of the McIntosh & Seymour engines.

The Paige Car Wheel Co., of Cleveland, exhibited several of its steel tired wheels designed for use on electric and cable railways.

The Burrowes Car Shade Co., of Portland, Me., exhibited samples of car shades. C. M. Fuller was in charge of the exhibit.

The Charles Scott Spring Co., of Philadelphia, made a complete exhibit of its spiral and elliptic springs for horse, cable and electric cars.

Joseph Fischer exhibited models of two forms of brake which he had invented, and showed patents for a new underground trolley system.

The Siemens & Halske Co., of America, distributed to delegates photographs of its machinery designed for railway and lighting stations,

The International Register Co., of Chicago, showed several of its portable registers. The company was represented by A. H. Englund.

The Robinson Electric Truck & Supply Co. invited delegates to ride on the cars on the East Cleveland road, equipped with the Robinson truck.

The Mehling Car Co., of Cleveland, made no exhibit in the hall, but its summer and winter car, No. 288, on the East Cleveland line, attracted much attention.

The Automatic Cable Grip Release Co., of St. Louis, exhibited a model of its grip release which was examined with interest by all connected with cable roads.

The Chapman Valve Co., of Boston, exhibited a full line of valves, which are familiar to engineers of electric power stations. Special forms of valves were also shown.

The Toledo Electric Heating Co., of Toledo, O., exhibited car heaters. As they were connected to the railway circuit in the Hall, visitors were able to examine them in actual operation.

The American Electrical Works, of Providence, R. I., exhibited a line of samples of wire designed for street railway use. Their merits were explained by P. C. Ackerman and W. A. Hathaway.

The Eureka Tempered Copper Co., of North East, Pa., exhibited a number of its specialties. There were shown commutator segments, trolley wheels, brushes, etc., made of pure tempered copper.

R. A. Crawford, of Pittsburgh, gave a practical demonstration of the value of his guards for cars. The guard can be attached to any style of truck, and can be adjusted or taken off in a short space of time.

The Q. & C. Co., of Chicago, exhibited a rail saw which was examined with great interest. The saw was operated by hand power. Photographs of other apparatus sold by the company decorated the booth.

The Porter Tramway Switch Co., of Cleveland, made an extensive exhibit of its switches just outside of the exhibition hall and announced on a placard that these switches were used by all the Cleveland railroads.

The McIntosh-Huntington Co., of Cleveland, which furnished the wire for the Woodland Avenue & West Side Street Railroad Co., made a very complete exhibit showing wires, car trimmings and railway supplies.

The Aluminum Brass & Bronze Co., of Bridgeport, Conn., was represented by Gilbert M. Smith, of Chicago, who exhibited samples of silicon bronze trolley wire, for which many special advantages are claimed.

The Genett Air Brake Co., of Chicago, exhibited one of its air brakes which was attached to one of the Brill trucks. The brake was examined with great interest by many. The company was represented by D. Reid of Chicago.

The New Process Rawhide Co., of Syracuse, N. Y., displayed in its booth a line of rawhide pinions. One pinion shown had a record of 22,000 miles on the West Bay City Electric Railway, but scarcely any wear was perceptible.

The P. Wall Manufacturing Supply Co., Allegheny, Pa., exhibited a full line of steel gongs, and their interests were carefully looked after by Mr. J. P. Wall, who received substantial appreciation of his exhibit in the shape of orders.

The Bodifield Belting Co., of Cleveland, made an exhibit showing a variety of sizes up to a sixty inch dynamo belt. Among the new belts were two designed for use on motors. These are made of a combination of cotton and leather.

The Forest City Electrical Works, of Geneva, O., exhibited a line of switches and showed a slate switchboard completely equipped with devices of the Cleveland type. These consisted of ammeters, circuit breakers, fuse switches, etc.

The Cleveland Electrical Manufacturing Co., exhibited several of the American Watchman's time detectors, of which it is the sole manufacturer. The instrument is designed to keep an exact record of the doings of the night watchman.

The Billings & Spencer Co., of Hartford Conn., exhibited an assortment of Billings patent drop forged commutator bars, and a variety of tools made by the company. The bars and tools were neatly arranged on an exhibition board.

The W. H. H. Peck Co., of Cleveland, exhibited a line of samples of its electric railway and mill supplies. Among the articles exhibited were, waterproof trolley cord, tan cord for bells and registers, rubber goods, leatheroid, vulcanized fibre, etc.

The Wrought Iron Casting Co., of South Boston, Mass., exhibited specimens of their work in connection with the Hirt six wheel truck, the clamps, jaws and other wrought iron castings on the truck having been made by the Wrought Iron Casting Co.

The W. D. Graves Electrical & Manufacturing Co., of Cleveland, had an exhibit which was scattered, but was interesting to street railway men. The exhibition hall was lighted by Graves' arc lamps, which were operated on the 500 volt railway circuit.

The Shultz Belting Co., of St. Louis, was represented by J. A. Ferguson, who exhibited samples of the company's link belt and celebrated dynamo belt. He also showed the Shultz patent leather pulley covering which has been recommended by so many power users.

The Hill Clutch Works, of Cleveland, made an interesting exhibit of its specialties. These included one of the new Hill clutches, belt tighteners, couplings, shaft stands, etc, The machinery was set as if to be operated, so that it could be examined to the best advantage.

The Peckham Motor Truck & Wheel Co., of Kingston, N. Y., exhibited one of its No. 5 A trucks, constructed for electric railway service. Parts of the truck were shown in order they might be carefully inspected. Peckham's cushioned car wheels were also exhibited.

The Lodge & Shipley Machine Tool Co., of Cincinnati, exhibited one of its motor gear lathes, designed by William Lodge. It was constructed with a view of producing machine work of excellent quality, with great rapidity, and its operation was watched with equal interest.

The Pittsburgh Steel Hollow Ware Co., of Pittsburgh, Pa., showed a line of rolled steel gongs. The company has perfected a process by which a steel gong is rolled of uniform size, thickness and hardness. The company guarantees to replace all gongs broken or cracked.

The Stillman Light Railway Development Co., of Providence, R. I., exhibited a model of its track construction in which T rails and beveled stringers are employed. Economy and long life are claimed for the construction. Their new triple compound rail interested many delegates.

The Taylor Electric Truck Co., of Troy, N. Y., exhibited its truck designed for use on electric railways. It is claimed that it is non-teetering, noiseless, easy riding, durable, and that it may be quickly disconnected from the car body. A complete model was also exhibited.

Hooven, Owens & Rentschler Co., of Hamilton, O., had headquarters in which were shown photographs of the Hamilton-Corliss engines. What the company considered its real exhibit was to be found at the Cleveland Electric Light Co., where two Hamilton-Corliss engines are in operation.

The Supply Manufacturing Co., of Pittsburgh, Pa., exhibited a number of commutators, which the company makes in all sizes for railway and lighting machines. Their characteristics are beauty of finish, excellent material and accuracy in workmanship. The company also refills commutators.

The Robinson Machine Co., of Altoona, Pa., was ably represented by Mr. Albert Hay, president, who explained the special features of the Robinson all-steel truck and entertained many of the delegates with a ride on the car equipped with his truck and which showed excellent results.

Taylor, Goodhue & Ames, of Chicago, were represented by Mr. William Taylor. This firm has the Western agency of the Philadelphia trolley, Wagner motors for street railway circuits, the Columbia incandescent lamp and the Nutting arc lamp, both of which are for use on street railway circuits.

The Sheffield Car Co., of Three Rivers, Mich., exhibited the latest type of its truck. In this truck the equalizing of strains is effected by a side equalizing bar introduced upon one side of the truck, thus giving a three-point suspension to the car body, resulting in easy motion even over a heavy track.

The Edison Manufacturing Co., of New York, exhibited for the first time two electrostatic voltmeters, one intended for a 500 volt and the other for a 1,000 volt circuit. These devices are simple in construction and are not affected by magnetism. They are designed for use on both direct and alternating circuits.

The E. S. Greeley & Co., of New York, made a unique exhibit, which attracted no little attention. The special feature of popular interest was a miniature Statue of Liberty, whose torch was represented by a tiny incandescent lamp. The company showed resistance sets, lamps and general electrical supplies.

The Van Dorn Iron Works Co., of Cleveland, exhibited a number of its tubular steel poles. The joints of the poles are secured by Van Dorn locking steel keys, and are covered by a malleable iron ring shrunk on. The poles are painted inside and outside, and all wood insulating parts are boiled in paraffine.

The C. & B. Manufacturing Co., of Troy, N. Y., exhibited a simple trolley finder which has been in successful use on the Troy & Lansingburgh railway for several months. In connection with this exhibit was shown the Smith changeable signal light box in which the signal color can be changed as desired.

The Morton Safety Heating Co., of Baltimore, made an exhibit showing its method of car heating. The system consists in storing heat in earthenware tubes. It is claimed that the application of steam for five minutes stores sufficient heat to keep the cars comfortable for two hours in zero weather.

The Cushion Car Wheel Co., of Indianapolis, was represented by P. F. Leach, of Chicago, the vice-president. The exhibit comprised the wheels under the special car of the General Electric Co., which was mounted on a McGuire truck, and under a nickel-plated truck exhibited by the McGuire Manufacturing Co., of Chicago,

The Brownell Car Co., made an exhibit in addition to its Accelerator car. In a booth in the exhibit hall were shown a trolley bridge and a model of the Brownell truck. The booth was ornamented with photographs of Brownell cars. The company was represented by Mr. Brownell, B, F. Craw, C. W. Joslin, and F. A. Baier.

The Mitchell-Brant Copper Co., of Erie, Pa., showed an extensive line of pure tempered copper, designed for electrical purposes. A complete assortment of commutator bars which are made exactly to gauge, so that they are ready for immediate use. The company was represented by Thomas Brown and A. L. Daniels.

The Star Headlight Co. exhibited one of its new headlights, built with the idea of destinguishing cars. The device was constructed to carry out the idea advanced at the Saratoga convention of the New York State Street Railway Association, that the cars of different routes could be distinguished by headlights showing different colors.

The Pittsburgh Trolley Co. made an exhibit which street railway men found of marked interest. A. P. Manning, the representative of the company, explained the merits of the Duncan compression spring trolley, for which special claims are made. The self-oiling trolley wheel introduced by this company was a feature of the exhibit.

The Stirling Boiler Co., of Chicago, was represented by T. E, Bruce at the headquarters in the exhibit hall. Mr. Degan of the Chicago office, was present at the Convention. In the way of an exhibit the Stirling Co. had much to show. In Cleveland the new boiler house of the Otis Steel Co. contains one of these boilers.

The Bradley General Electric Co., of Chicago, exhibited a full sized model of its electric railway conduit. The construction of the conduit is somewhat similar to that built for cable service, but is less expensive. The construction is such that dirt, mud and water cannot enter into the section of the conduit in which the trolley wire is run.

The John Stephenson Co., Limited, of New York, was represented by Messrs. D. W. Pugh and J. A. Tackaberry. Mr. Pugh distributed among his friends a very nice leather bound memorandum book. On the back was printed a Stephenson electric car, and on the front the seal of the Association, making a handsome vest pocket souvenir.

The Standard Railway Supply Co., of Chicago, exhibited two of its car stoves, which may be applied to any style of car without cutting the seats. These points were particularly emphasized by Garson Myers, the manager of the company. The exhibit was so arranged that it was easy to demonstrate that no injury would be caused to cushions.

The Washburn & Moen Manufacturing Co., of Worcester, Mass., exhibited some of the wires made by that company. Specimens were shown of sizes ranging from a magnet wire to the heaviest railway feeder cable ever made. There was also exhibited striking evidence of the fireproof qualities of the company's new wire, known as "Salamander."

The Pennsylvania Steel Co., exhibited sections of its T rails ranging in sizes from 40 to 100 lbs. Girder rails were exhibited, varying in height from 4½ to 10 ins. Switch pieces for T and girder rails were shown, as well as samples of special work. The representative of the company was John F. Ostrom. Ralph Lee Crump was in charge of the exhibit.

The Esmond Street Rail Co., of New York, made an extensive exhibit showing the different styles of its novel and effective track construction. Visitors were especially interested in the statement that the rails were practically jointless requiring no fishplates and no bonding when used for electrieal service. The novel Esmond rocker link truck was exhibited by a model.

The Jewell Belting Co., of Hartford, Conn,, made an exhibit of several belts, the largest of which, forty-eight inches in width, is to be used by the General Electric Co., in New York City. The regular dynamo belting and the railway dynamo belting were shown. The company was represented by Charles E. Newton, Secretary, C. L. Tolles and George W. Bancroft.

The R. D. Nuttall Co., of Pittsburgh, made an extensive display of its street railway supplies. Particularly noticeable was the Nuttall trolley, which is giving such general satisfaction on electric roads. A full line of the well known Groetzinger Dermaglutine pinions was displayed. Among the other specialties were overhead switches, gears for all systems, commutators, drills, etc.

Mark & Sterling, of Cleveland, made an exhibit of their special devices for track equipment. They were arranged in a prominent position and attracted no little attention. The special joint devised by Mr. Mark was examined with special interest. The firm uses malleable iron in the production of its specialties, as it has been found to give the most satisfactory service under all conditions.

Dorner & Dutton, of Cleveland, made their exhibit on an extensive platform directly in the rear of the hotel. In all the firm exhibited five of its solid forged trucks, several of which were equipped with elliptical springs. Short motors were mounted on two of the trucks, and a third carried Westinghouse motors. The firm showed a full line of track cleaners, gears, journal boxes, wheels and transfer tables.

The Walker Manufacturing Co., of Cleveland, had a booth at the entrance of the convention hall. Photographs of the several departments of the works and of some of the ponderous machinery constructed there were shown. Models of gear drive and rope drive cable machinery and block patterns for machine moulded gears were exhibited. In a booth in the exhibit hall a second display somewhat similar in character was made.

The National Fare Box Manufacturing Co., of Chicago, exhibited its new aluminum fare box. F. H. Roeschlaub, the manager,

explained its working, and showed the impossibility of abstracting fares once deposited. The lightness and manifest advantages of the new box interested many attendants. Mr. Roeschlaub also exhibited a new device for repairing bell cords, that will soon be put on the marked.

The Lima Register Co., of Lima, O., exhibited one of its stationary registers, which is now used by seventy street railroad companies. It is giving satisfaction, as it is durable, not likely to get out of order, and is safe from the manipulation of dishonest conductors. The company's business has increased so rapidly of late that it has been obliged to equip a brass foundry which will turn out work entirely for the registers.

The H. W. Johns Manufacturing Co., of New York, made a complete exhibit, showing insulators of every form used by street railway companies. The goods made of Vulcabeston and moulded mica cover all requirements for electrical insulation. They are made under enormous pressure and are very dense. Street railway men who appreciate the value of good insulating material found the booth of great interest.

The Electrical Supply Co., of Chicago, showed samples of its new overhead line material. Some of the new devices are novel in construction, and show that the company has a proper appreciation of what is needed by the railway companies. The new pull-over brackets, the strain insulators and hangers were examined with especial interest. The company showed me one of the Carpenter electric heaters which it is introducing.

The Barnes Brake Co., of Cleveland, showed a model of its friction brake for cable and electric roads. The brake is simple, consisting of only twelve parts, none of which is complex or delicate in mechanism. It is durable, as the only wearing part is a leather washer that will last six months, it is stated, and can be replaced in a few moments at trifling cost. The brake is exceedingly effective and by its use the car is kept at all times under control.

Charles A. Schieren & Co., of New York, made an exhibition which attracted general attention. Its most prominent feature was a three ply belt, 116 ft. in length, seventy-two inches wide and weighing 2,200 lbs. The belt was made for the Brooklyn City Railroad Co., and will transmit 1,600 H. P. from engine to generator. The firm showed several smaller belts, and photographs of its belts now used in electric railway power stations.

Edward C. White, of New York, intended to make an exhibit of the West End radial and West End short trucks manufactured by him and adopted on the West End Street Railway of Boston. The trucks forwarded did not arrive in time for the Convention owing to some delay in transit, causing much disappointment to Mr. White as well as to a number of delegates who had become interested in this new design of truck from descriptions given of it.

The Meaker Manufacturing Co., of Chicago, exhibited samples of its street car registers in both the portable and stationary form. These registers are so well known to street railway men throughout the country that no description of them is required here. They have been adopted by 150 companies. One of the new combination registers was shown, which combines an additional check on the collection of fares with less labor than under the old system.

The Reliance Gauge Co., of Cleveland showed in its exhibit a large number of the Reliance safety water columns, including several finished in brass with heavy trimmings. A number of floats was exhibited, ranging in size from twelve inches in diameter to two and a half inches in diameter. The booth was decorated with photographs, the most interesting of which was one of the boiler room of the East Cleveland Railroad Co., where fourteen Reliance water columns are used.

The Dewey Electric Heating Co., of Syracuse, N. Y., made an exceedingly interesting exhibit of heaters intended for street cars and for office use. The car heater is 26 ins. long, 2 ins. wide and 10½ ins. in height. It is made of cast iron, japan finished and weighs about 15 lbs. On an ordinary car a heater takes three amperes on a 500 volt circuit. Four heaters are ordinarily used for heating a car. They are placed under the seats, and distribute the heat equally throughout the car.

The Brightman Stoker Co., of Cleveland, made an exhibit of one of its mechanical stokers which was examined critically by those interested in power stations. Motive power was supplied by an electric motor. The advantages attending the application of the stoker were manifest. Economy in fuel is one of the important considerations of the power user, and this stoker is found to contribute greatly to this end. The device is simple in construction, and can be applied to any boiler.

J. M. Jones' Sons, of West Troy, made no exhibit of street cars, for the reason that a number are in operation and giving great satisfaction in Cleveland, so that all delegates had an opportunity to inspect them under working conditions. Two novelties were shown by the company. The most interesting was the auger feed sand box, the operation of which is simple and effective. It was regarded by visitors as a great improvement. A new style of platform alarm was also exhibited, and photographs of Jones cars were distributed.

The Fulton Foundry Co., of Cleveland, exhibited two trucks of its latest type. These were equipped with double tread wheels, elliptic springs and were connected by Robison draw bars. Attached to the frames were Lyons brush holders. The Haycox patent brake shoes with interchangeable slippers formed part of the equipment. The Haycox door fastener was shown, and the firm exhibited samples of its switches, turnouts and crossovers. An interesting model in the exhibit was that of the Robison patent wrecking truck.

The Technic Electric Works, of Philadelphia, exhibited the Philadelphia trolley which has been designed to meet the requirements of the electrical railway superintendent. It is simple, being made of nine parts, and it is stated that it can be dismantled in seven seconds and assembled in twenty-two seconds without a wrench. There is no nut, bolt, screw or washer in its construction, and no chains, coil springs or similar parts. No oil or grease is required. The design is substantial but still light. The parts are interlocking and interchangeable. It is pivoted and free to turn, besides having a side motion.

William Wharton, Jr., & Co., of Philadelphia, made an extensive exhibit of rails, general track construction and special work. Girder rails were exhibited spiked to ties with brace plates and tie plates. The construction of composite and integral styles of switches were shown, and the process of making this special work was illustrated by castings brought from the foundry. Saussy's spring tongue switch was shown, and many of the well known specialties of the firm, and sections of the various sizes of T and girder rails were exhibited.

The Massachussetts Car Co., of Boston, made an exhibit which illustrated the principle of its new combination car. The section of a car was transformed speedily from an open to a closed car. The car is equipped with a balanced roller blind, which can be raised or lowered, if desired. A person when riding in the car when it is open can lower the shade if it rains slightly. Protection is afforded and the air is not excluded. As an additional protection, one half the opening may be closed by a window and if that is not sufficient the window can be entirely closed.

The W. Bingham Co., of Cleveland, exhibited a line of tools, car trimmings and railway supplies. In charge of the exhibit was C. E. M. Young. In connection with the exhibit was that of the Cleveland Motor Lift Co., which showed one of its hydraulic jacks. This appliance has been in use in a number of street railway repair shops and has been found extremely useful in lifting street railway cars. It is in use in the shops of the East Cleveland Railroad Co.; in fact the machine was designed to supply the need which that company found for a device of this kind. In the exhibit hall the jack was employed for lifting a heavy load of lead.

The Carpenter Enamel Rheostat Co., of Bridgeport, Conn., made an exhibit of its specialties. The principle of the new rheostat consists in the conduction and dissipation of heat by holding a resistance wire in close relation to a metal plate so that the heat generated in it by the passage of a current is rapidly conducted to the plate which becomes the radiating surface. This is accomplished by the use of an enamel which permanently attaches the wire to, but insulates it from, the radiating surface plate and which also completely surrounds and protects the wire from chemical action.

The St. Louis Register Co. showed a number of its new registers, which have just been placed on the market. The manager of the company, E. F. Wickham, explained the merits of the new register. It is simple in construction, and has few parts, and is not liable to get out of order. The mechanism is all worked by the movement of one shaft. The totalizer bell and indicator are all geared together, and one movement works them all. It totalizes 99,999, and is furnished either with or without a hood for the totalizer. It has a detent attachment on the ringing device, which makes it impossible for a conductor to snap the rope without ringing the bell.

The Ford-Washburn Storelectro Co., of Cleveland, interested visitors in its storage battery car which was run over the different street railway lines of the city. Visitors were afforded every facility for examining the car and its batteries on the several trips, and beyond all question they were both pleased and surprised to note the speed, and the ease with which the car was controlled. Many of those attending the Convention regarded the car as the feature of chief interest. In the exhibition hall the company showed several of its stationary motors adopted for use on street railway circuits. An exhibit of unusual interest was a test of the storage batteries, which was frequently made. The test comprised a direct short circuiting of the cells.

The Duplex Street Railway Co., made a complete exhibit which illustrated very thoroughly the general and special construction of the company. The exhibit consisted mainly of two 30 ft. sections of track one of 66 lb. center bearing rail and the other of 75 lb. 5 in. head rail. There was shown a tongue switch and mate, frog, section of curve, and sections of the several styles of rail. The frog was examined with particular interest, owing to the fact that it is exceedingly well supported and that the point may be replaced and practically a new frog produced at the cost of 10 ft. of rail and the machine work necessary for cutting it. The company showed a series of photographs illustrating the Duplex track work in different stages of construction.

The Johnson Co., of Johnstown, made an extensive exhibit illustrating the various styles and weights of rails, and some samples of special work. Among the latter was a railroad crossing electrically welded; a welded three-way curve weighing 3,200 lbs., tongue switch and mate. A rail built up of four sections electrically welded was a noticeable feature of the exhibit. Samples of special devices including the standard suspended girder joint were shown. The temporary track on Bond Street, on which the special cars were run to the Convention headquarters was properly a part of the Johnson Co.'s exhibit. The following representatives were present: Daniel Coolidge, Johnstown; Major H. C. Evans, New York; W. E. Boughton, Philadelphia; W. B. Kingston, Atlanta, Ga., and O. C. Evans, Cincinnati.

The New York Car Wheel Works, of Buffalo, N. Y., exhibited their "machined" car wheels. The system of comparative tests used by this company fixes positively the conditions of chill and strength in each wheel. The machining process which the wheels undergo after leaving the foundry consists of boring out, grinding true to center, and balancing. The result of this thorough system is shown

by the average mileage of the machined wheels far exceeding that of the ordinary wheels, which are put in service in the same condition in which they come from the foundry. Being made mechanically perfect, less power is required to operate a car equipped with them, and the wear and tear on track and equipment is reduced to a minimum. The company was represented by Robert J. Mercur, Buffalo, and J. R. Ellicott New York.

The McGuire Manufacturing Co., of Chicago, exhibited several trucks, most of which were in use, and the exhibit was the more desirable on this account. In the exhibit of the General Electric Co. was placed a nickeled truck of the 19 F type. In the Sperry Electric Railway Co.'s exhibit was shown a second truck of the same type. The General Electric Co.'s special car, which was built by the Newburyport Car Co., was mounted on two McGuire maximum traction trucks, and equipped with Thomson-Houston motors. The Thomson-Houston special vestibule car, built by the Gilbert Co., was mounted on a McGuire truck of the latest design. The Sperry Electric Railway Co.'s car, built by the Pullman Co., for use at Youngstown, O., was also carried by a McGuire truck. The company was represented by J. A. Hanna, M. P. Hubbard and D. B. Dean.

The Johnson Electric Co., of Cleveland, made a very extensive exhibit of the electric material made in its shops. The exhibit included iron and steel gears designed for all systems, rawhide pinions, the Harris trolley wheel, which has a wonderful record for length of service, and trolley poles. The company does an extensive repair work, and to illustrate this department several refilled commutators were shown, which were in all respects as good as new. The company showed a line of fixtures which was examined with great interest. The company is managed by A. L. Johnson and Samuel Harris, of the Brooklyn Street Railroad Co., two practical street railway men, and the results of their extended experience in the details of electric railways are embodied in the apparatus manufactured by the company. Jilson J. Coleman was in charge of the exhibit.

The Rochester Car Wheel Works made a handsome exhibit of wheels and axles. They sent six motor axles of various diameters, from 3¼ ins. to 3¾ ins., turned for different oil boxes, and filled with different patterns of wheels. Also eleven loose wheels, mounted on stands, and ranging in weight from 130 lbs. up to 500 lbs., and in diameter from 22 ins. to 36 ins., which included "Wharton" wheels, reverse dish for narrow gauge roads, and illustrated other details of size, weight, pattern, tread and flange. A Barr contracting chill was also shown, and there were several fractures from various wheels, displaying the chill. Another feature of the exhibit, and one entirely novel, was a 30 in. motor wheel broken in pieces at and between the spokes, and secured to a disk of wood in such a way as to show the metal in the spokes and the depth and regularity of chill all around the rim—a point in which the user of wheels is materially interested.

The Sperry Electric Railway Co., of New York, exhibited for the first time its railway system. The practical workings of the motor were shown to the attendants who gathered in numbers about this exhibit. The motor is a forty horse power, single reduction machine, and is geared to both axles, so that the best tractive effects, it is claimed, are secured. The machine is flexibly connected and is elastically supported. Those interested had a chance to make a careful inspection of the machine, as all parts were visible, and were also given an opportunity to see the motor in actual service. A Pullman car, mounted on a McGuire truck, and equipped with a Sperry motor, was operated on the street car system, starting from the special track on Bond Street. The car carried large numbers of passengers, who were highly pleased with the system. The car is to go to Youngstown, O., where the Sperry system has been in successful operation for a considerable time. The company was represented by H. P. Barr, of New York, and C. A. Pratt, of Chicago.

The Railway Equipment Co., of Chicago, made an exhibit which was located in one of the most prominent points in the hall. The display of its specialties attracted general attention. The most prominent feature was the Ahearn electric heater, which the company is introducing. The heater was used last winter in Ottawa and proved highly successful. The device was connected on the circuit, and raised the temperature very decidedly in the vicinity of the booth. The company exhibited its new line material which has been received with such favor by street railroad companies. Special material made for the Atlantic Avenue Railway, Brooklyn, N. Y., was shown. The devices were neat, and attracted no little attention. A line of carbon motor brushes was shown. The headquarters of the company, on the parlor floor at the Hollenden, were attractively decorated by flowers and potted plants. A handsome ornament in the room was a cluster of colored lamps arranged to form the letters "R. W. E." W. R. Mason, the president, and W. L. Adams, the secretary, were present. The exhibit was in charge of J. F. Macartney, the Buffalo agent, and Mr. Rowe, the Boston representative.

The J. G. Brill Co., of Philadelphia, had an exhibit of peculiar interest to visitors, The cars to be used on the Woodland Avenue & West Side Street Railroad were shown for the first time. In front of the exhibit hall was located one of these new cars which are twenty-one feet long, and thirty feet over all. It was mounted on a No. 21 truck of the latest pattern. Near by was shown the solid frame of one of the trucks of this type. There was also exhibited a Eureka maximum traction truck with solid frame. In the exhibit of the General Electric Co. was a Brill No. 21 truck, equipped with two waterproof motors. In a booth in the upper hall were shown handsome models of the several styles of Brill trucks. Ten of the forty Brill cars built for the Woodland Avenue & West Side Street Railroad Co. were operated on the lines of the company for the first time. The cars are exceedingly handsome, and made a splendid showing. They were equipped with Westinghouse motors, and were operated as successfully as if they had been in use for weeks. The headquarters of the company were located in one of the parlors, and were elaborately decorated with flowers and plants. The company was represented by G. M. Brill, president; W. H. Heulings, Payson A. Andrews, Chicago; Samuel Curven and F. C. Randall.

The Westinghouse Electric & Manufacturing Co., of Pittsburgh, obtained a large floor space at the entrance of the Army and Navy Hall, and its exhibit, while it immediately attracted the attention of every visitor who came, was in a position to show off to an excellent advantage. Alexander J. Wurts, the well known electrical engineer of lightning arrester fame and the discoverer of non-arcing metals, divided the honor of entertaining the visitors with Mr. A. Franz. Immediately upon the left on entering the hall, a Dorner & Dutton truck, equipped with two Westinghouse single reduction motors, was noticed. The equipment was complete in all its details. It afforded an excellent opportunity for inspecting the construction of the motor, and it showed at the same time the facility with which the apparatus can be handled when on the truck, as well as the accessibility of the different parts, commutator, brushes, armature, etc. At one end of the truck a platform had been erected upon which the new series multiple controlling device was noticeable, This exhibit attracted a great deal of attention. However, one of the most interesting exhibits of the Westinghouse company, and perhaps the one which attracted the most general attention, was the 150 H. P. railroad generator. This generator had all the attachments of wires just as if installed in a power house in actual operation. It was connected with the current line of the East Cleveland Railroad Co., and was operated as a motor. The smoothness of its running, the absence of sparking at the brushes, and the general appearance of the apparatus, in design and thorough workmanship, were the subjects of general remark. The Westinghouse exhibit also included a switchboard with voltmeters, ammeters, resistance box, automatic cut-outs, circuit breakers, and lightning arresters. In addition to the switchboard, there was shown a single reduction motor elevated on a special platform. This motor was taken apart in order to give the visitors an idea of all the details of this apparatus. On two large tables were spread out all the details connected with the Westinghouse system of electric railways, and they claimed a great deal of attention. The company also afforded a good opportunity to the guests of the Convention of seeing its system in practical operation. This was on the Woodland Avenue & West Side Railway Co.'s cars, which have only recently been equipped. The cars were built by the J. G. Brill Co., and are painted in a handsome green color. As many of the cars as were ready were taken out and were kept busy in carrying the guests over the city. In spite of the fact that cars and equipments were quite new, their operation was generally pronounced to be perfect. The motors ran smoothly, noiselessly, and they responded to the guiding hands of the motormen as if they had been running for a week at least. The Westinghouse company was well represented at the Convention by the following gentlemen: Lemuel Bannister, vice-president and general manager; W. C. Clark, general agent and assistant treasurer; Albert Schmidt, superintendent; E. H. Heinrichs, advertising agent; A. J. Wurts, electrical engineer; H. McL. Harding, W. F. Zimmermann, New York; A. C. Bragg, Philadelphia; R. S. Brown, Boston; S. A. Stewart, Chicago; A. T. McCarthy, J. A. Rutherford, T. W. F. Gray, J. L. Ludwig, Pittsburgh; W. J. Lingmore, assistant purchasing agent; E. F. Lamme, R. J. Davis, Pittsburgh.

The General Electric Co. made an exhibit which was superior to those which were made in the old days of the Edison and Thomson-Houston companies. The General Electric Co. is now enabled to show what is considered best in modern systems by the combined talent of the two former rivals. The exhibit, which was in every way worthy of the company, was arranged in such a manner that an excellent idea of the entire railway system could be gained without any effort on the part of the visitor to locate the various devices. On a Brill truck two W. P., single reduction motors were mounted, and the visitor was struck with the lightness, compactness and ease of adaptation of the machines. A W. P. 50 motor was exhibited, with the hollow field and field coil thrown back, so that the interior parts could be readily inspected. The S. R. F. 30 motor and the familiar standard S. R. G. were also shown. An Edison No. 14 was exhibited in the center of the exhibit. Street railway men were particularly interested in a new gear press for applying and removing the gear wheels from motors. This device is adapted for use with all styles of motors. The new series parallel car controller was a noticeable feature, as its use greatly increases the economy of operating cars.

Arranged on a long, sloping board was a full line of new overhead parts. They had been carefully plated and polished, and made a splendid showing. Near by was shown a collection of the ancient appliances of six years ago. The contrast illustrated in a very striking manner the rapid development of electric railway apparatus. Another interesting exhibit was a station switchboard, equipped with automatic circuit breaker and current indicator of the latest type. Near by were several Thomson wattmeters shown in operation, so that their action and method of recording could be seen.

Small electric lamps outlined the name of the company in different points about the exhibit, and in the center was an American eagle perched on a shield formed of small incandescent lamps of the national colors. A new railway lamp was also exhibited in which the filament was coiled in the form of a spiral.

The General Electric Co. operated two handsome cars over the lines of the East Cleveland Railroad Co. One was a special vestibuled car upholstered in brown plush and provided with easy chairs. The car was equipped with two W. P. 30 motors. The second car was forty feet in length, mounted on a double truck, and equipped with two W. P. 50 motors. The floor was removable so that passengers could watch the operation of the motors. Measuring instruments of the

Weston type were placed on each car so that it was possible to note at all times the amount of power required by the motors.

The headquarters of the company at the Hollenden Hotel were most tastefully decorated with ferns, potted plants and flowers, and the walls were hung with photographs of various installations of the General Electric Co. Mr. W. J. Clarke, the general agent of the railway department, in whose hands the entire management of the General Electric Co.'s exhibit was placed, acted as host, and his geniality and cordial greeting won for him the good will of every visitor. Mr. Clarke was ably seconded in his efforts by Mr. Elmer P. Morris of the railway supply department, Mr. G. K. Wheeler, assistant manager of the Chicago railway department; Mr. F. J. Clarke, manager at Washington; Mr. H. H. Harrison, Mr. C. S. Rusling, Mr. I. Silverman, Mr. W. A. Stern, and a thoroughly competent staff of General Electric Co. men. The representatives of the company at the Convention were: O. T. Crosby, general manager railway department, Boston, Mass.; W. J. Clarke general agent railway department, New York; G. K. Wheeler, assistant manager railway department, Chicago, Ill.; Paul T. Brady, general manager Central Thomson-Houston company, Cincinnati, O.; F. H. Clarke, district manager General Electric Co., Washington, D.C.; C. S. Rusling, general manager railway department, Cincinnati, O.; W. H. Knight, chief engineer railway department, Boston, Mass.; E. W. Rice, superintendent, Lynn, Mass.; Theo. Stebbins, superintendent construction, railway department, Boston, Mass.; Arthur W. Jones, assistant manager Thomson-Houston International company, New York; A. A. Glasier, manager Industrial Improvement Co., Boston; Caryl D. Haskins, manager meter department, Boston, Mass.; John McGhie. manager advertising department, New York; Geo. W. Mansfield, special agent, Boston, Mass.; E. G. Waters, general manager, Pittsburgh, Pa.; W. A. Stern, manager railway department. Philadelphia, Pa.; H. H. Harrison, supply agent, New York; C. E. Hart, supply agent, Cincinnati, O.; A. H. Lewis, special agent railway department, New York; T. H. Feary, state agent, Syracuse, N.Y.; R. J. Randolph, special agent, Cincinnati, O., F. H. Strieby, superintendent construction, Cincinnati, O.; C. T. Hamilton, special agent, Pittsburgh, Pa.; F. E. Jackson, representative lamp department, Harrison, N. J.; F. E. Allen, agent, St. Louis, Mo.; S. P. Wells, agent, St. Paul, Minn.; C. R. Stearn, superintendent construction; Percy Hodges, manager shipping department, Boston, Mass.; T. F. Mullaney, electrical engineer, Boston, Mass.; M. H. Hamilton, private secretary, New York; J. A. Kimball, electrical engineer, Boston, Mass.; W. S. Elliott, agent railway department, Boston, Mass.; Mr. Ewing, agent snow sweeper department, Boston, Mass.; F. H. Bostwick, agent, Cleveland, O.; B. M. Barr, agent, Cleveland, O.; F. Houghton, agent, Cleveland, O.; G. H. Stout, agent, Cincinnati, O.; E. P. Sharp, electrical engineer, Boston, Mass.; W. P. Potter, electrical engineer, Boston, Mass.; G. H. Alton, superintendent meter department, Boston, Mass.; Mr. Woolsey, electrical engineer, Boston, Mass.; R. E. Hood, electrical engineer, Boston, Mass.; Geo. M. Haskell, electrical engineer, Boston, Mass.; F. J. Reynolds, railway expert, Cincinnati, O.

The Short Electric Railway Co., had made every preparation for the entertainment, reception and even instruction of delegates and attendants at the Convention. The company felt that an especial obligation rested upon it as a local corporation. It certainly discharged its obligations in the most liberal manner. The company dispensed a most lavish hospitality and every attendant at the Convention is indebted to it for its untiring efforts to promote the success of the meeting. To summarize what the company exhibited is contemplated here, and only a comparatively brief reference can be made. Wherever he went the delegate found Short apparatus of one kind or another. The company decided that a special track on Bond Street which adjoins the Hollenden Hotel on the west would afford unusually good facilities for exhibiting electric cars. The Johnson Co. agreed to furnish rails leading to the tracks of the East Cleveland Railroad Co., which expressed its willingness to supply the power necessary for operating the cars. Permission was obtained from the City Council for laying the track, but the franchise did not permit the Short company to begin the track laying until seven o'clock on the evening on which the Association convened. Promptly at that hour work was commenced. The rails, which are of the Johnson Co.'s latest pattern, with electrically welded chairs, were laid on ties resting on the granite blocks. The work was prosecuted in spite of a drenching rain, and cars were operated on the following day. The Short company equipped with motors five cars which made trips, starting from the hotel doors. These were, first, the private car, built by the Gilbert company, mounted on an Anger truck; Accelerator car, constructed by the Brownell Car Co., mounted on a Brownell truck; East Cleveland car, mounted on a Fulton Foundry truck; Lamokin car, mounted on a Robinson all-steel truck. These were equipped with two single reduction motors, with the exception of the Lamokin car, which is operated by a twenty horse power, single reduction motor. The fifth car was built by the St. Louis Car Co. especially for the Short company. It is mounted on a truck designed by Professor Short. Each pair of wheels is contained in a separate channel bar frame supporting the boxes and springs. The frames are connected by a single spring steel bar in the center. The bar allows the two axles to spring to a curve, and thus prevents the grinding of the wheel flanges. The result is practically the same as if the truck were radial. The car is equipped with two of the new Short gearless, six pole motors, which have just been introduced, and are controlled by the new series multiple switches of the Short company. These cars were inspected continually by street railway men who accompanied the cars on their periodic trips.

Short apparatus was to be seen in several different parts of the exhibit department. In the temporary building was installed a 175 K. W., railway generator, which was operated as a motor. It was belted to an incandescent and an arc machine. The former dynamo furnished the current for all the incandescent lamps used throughout the exhibition hall. In the main exhibition hall the Short Electric company occupied the space on the stage, and immediately in front of it. Very pretty electric effects were produced by lamps furnished by the Swan Lamp Co. Over the stage the words "Short Electric Railway Co." were spelled out in incandescent lamps. At the back of the stage was the word "Gearless." in huge letters formed by incandescent lamps. The exhibit was arranged particularly to illustrate the development of the gearless motor. On the left of the stage was the first machine of this kind constructed by Professor Short. It was not a commercial machine, and was not designed as such, but was constructed to prove that a machine could be built in which the armature speed was not too great to be communicated to the car axles. The next machine was the familiar type of 1891, which was exhibited at the Pittsburgh Convention. This machine, as well as its predecessor, required 36 in. wheels. The next machine, with a 23 in. armature, was shown. With this motor a 33 in. wheel could be used. The last in the series was the six-pole gearless motor which has just been introduced, and with which 30 in. wheels can be employed. This machine embodies in its construction all the experience which the inventor has gained in the previous motors, and was the chief electrical feature of the exhibit. In every respect, including the matter of appearance, it is far superior to its predecessors. Tests made in the presence of street railway men at the Convention proved beyond all question that the great trouble with a gearless motor—taking an excessive amount of current on starting—had been overcome. It operates fully as well as the single reduction machine. On the wall were two curves, drawn on a large scale, representing graphically the tests made of the former type and the present gearless. The latter has an efficiency of 85 per cent., this figure falling to 75 per cent. as a minimum with the decrease of the load. Curves were also shown of tests of the twenty horse power and thirty horse power single reduction motors. The method of winding the gearless motor was illustrated by an actual exhibition of the work. On the stage were placed single reduction and gearless motors, with the frames opened to facilitate inspection. On tables were arranged such parts of the machines as could not readily be seen. The stage was ornamented by flowers and aquaria in which floated tiny swans carrying miniature incandescent lamps. The exhibit was planned and under the supervision of C. F. Uebelacker, of the Short company, assisted by Messrs. Culver and Nicholson.

The headquarters of the Short company at the Hollenden were located in one of the largest parlors which was handsomely decorated with flowers. The walls were hung with photographs of Short apparatus, and of railways on which Short motors are operated. On tables about the room were bound volumes containing prints and photographs of apparatus. One of the ornaments in the room was a large swan significant of the Swan Lamp Co., carrying a large incandescent lamp. One interesting novelty was a huge block of ice in the center of which three incandescent lamps were burning. The representatives of the Short company present at the Convention were J. Potter, president; Prof. S. H. Short; William Hazelton, 3d., assistant general manager; Frank A. Rogers and C. C. Curtiss, special representatives; John E. Ridall, Pittsburgh; W. S. Atchinson, Atlanta; E. J. Wessels, New York; F. R. Ford, Chicago; F. A. Scheffler, superintendent of the works.

The Car Exhibit.

The car manufacturers exhibited cars on the special track on Bond Street as follows: The St. Louis Car Co. built the car equipped with Short gearless motors. It was handsomely fitted up in all respects. It was mounted on a Short truck constructed by Dorner & Dutton, of Cleveland. Weston direct reading voltmeters and ammeters were located on a shelf on the platform. The Gilbert Car Manufacturing Co. constructed the Short company's private car, which was handsomely decorated and provided with easy chairs for passengers. It is mounted on an Anger truck. Pullman's Palace Car Co. constructed the car, which was operated by a Sperry forty horse power motor, and which will be sent to Youngstown, O. The McGuire pressed steel truck was used. The General Electric Co.'s exhibition car was built by the Newburyport Car Co., and was mounted on a McGuire truck. Weston measuring instruments were located inside the car. The General Electric Co.'s special car was built by the Gilbert Car Manufacturing Co., and was mounted on McGuire trucks. It was handsomely furnished, and easy chairs handsomely upholstered were provided for passengers. The Lamokin Car Co.'s car was mounted on a Robinson all-steel truck, and was equipped with Short motors. The car is to be sent to Oskaloosa, Ia. The Brownell Car Co., of St. Louis, exhibited one of its famous Accelerator cars, which was inspected with great interest. The car was mounted on a Brownell truck, and was equipped with Short motors.

THE Lewis & Fowler Manufacturing Co., and the Lewis & Fowler Girder Rail Co., were represented by Messrs. L. E. Robert, Geo. S. Whipp and Frank A. Morrell. It is needless to say that there were many inquiries for the Lewis & Fowler special train which had become a popular feature of the Convention.

Souvenirs.

A large number of souvenirs were distributed by exhibitors. Among these were noticed the following: Jewell Belting Co., leather cigar case; Short Electric Railway Co., card case with handbook of electrical data; Ansonia Brass & Bronze Co., alumimun lizard; Charles Scott Spring Co., pocket book and card case; Reliance Gauge Co., match safe; Swan Lamp Co., fancy glass vase; Railway Equipment Co., novel leadpencils; Hartford Woven Wire Co., memorandum book.

At The Convention.

Angier, G. M., Mather Electric Co., Boston, Mass.
Andrews, Payson K., J. G. Brill Co., Chicago, Ill.
Andrews, R. L., Brush Electric Co., Cleveland, O.
Ackerman, P. C., American Electrical Works, Providence, R. I.
Aldrich, H. L., *Electrical Industries*, Chicago, Ill.
Adams, W. L., Railway Equipment, Co., Chicago, Ill.
Aitken, John W., Carbondale Traction Co., Carbondale, Pa.
Atkinson, E. P., Charles A. Schieren & Co., New York.
Allen, J. H., *Dixie*, Atlanta, Ga.
Alton, Geo. H., General Electric Co., Lynn, Mass.
Anderson, A. A., Citizens' Street Railroad Co., Indianapolis, Ind.
Bancroft, Geo. W., Jewell Belting Co., Boston, Mass.
Bailey. Theo. P., General Electric Co., Chicago, Ill.
Brown, F. Wayland, Youngstown St. Ry. Co., Youngstown, O.
Bostwick, F. H., General Electric Co., Pittsburgh, Pa.
Bowman, W. P., J. A. Roebling's Sons Co., Trenton, N. J.
Baumhoff, George W., Lindell Railway Co., St. Louis, Mo.
Baker, R. F., Columbia Railroad Co., Washington, D. C.
Bean, W. Worth, St. Joseph & Benton Harbor Electric Railway Co., St. Joseph, Mich.
Bartlett, A., Syracuse Consolidated St. Ry. Co., Syracuse, N. Y.
Barr, Harry P., Sperry Electric Railway Co., New York.
Bunch, George H., East End Railway Co., Memphis, Tenn.
Bone, W. H., Walker Manufacturing Co., Cleveland, O.
Bronsdon, M. H., Providence Cable Tr'way Co., Providence, R. I.
Blackwell, J. H., Trenton Passenger Railroad Co., Trenton, N. J.
Browning, G. Genge, Camden Horse Railroad Co., Camden, N. J.
Baker, Clifford C., Topeka Railway Co., Topeka, Kan.
Barclay, J. L., Chicago, Ill.
Bradford, H. P., City Electric St. Ry. Co., Little Rock, Ark.
Bole, Geo. M., Westinghouse, Church, Kerr & Co., Pittsburgh, Pa.
Break, Sam. R., Toronto Railway Co., Toronto, Ont.
Bullock, Geo., Cincinnati Street Railway Co., Cincinnati, O.
Baldwin, B. H,. United Tramway Sprinkler Co., Louisville, Ky.
Brayton, Robt., Riverpoint Supply Co., Riverpoint, R. I.
Beckley. John N., Rochester Railway Co., Rochester. N. Y.
Brennan, M. F., Lowell & Suburban Railway Co., Lowell, Mass.
Bragg, C. A.. Westinghouse Elec. & Mfg. Co., Philadelphia, Pa.
Bolton, Lyman B., Combination Car Co.. Boston, Mass.
Billings, Frederic C., Billings & Spencer Co., Hartford, Conn.
Broadhead, A. N., Jamestown Street Ry. Co., Jamestown, N. Y.
Butler, A. E., Merrimac Valley Street Ry. Co., Lawrence, Mass.
Barnes, C. E., Plymouth & Kingston Ry. Co., Plymouth, Mass.
Boughton, W. E., Johnson Co., Philadelphia., Pa,
Benedict, Washington, G., Boston & Revere Electric Railway Co., Boston, Mass.
Babcock E. L., Falls Rivet & Machine Co., Cuyahoga Falls, O.
Barnard, George A., Buckeye Engine Co., Salem, O.
Bergholtz, H., Ithaca Street Railway Co., Ithaca, N. Y.
Bruce, H. P., General Electric Co., Boston, Mass.
Benton, C. A., Sprague Elevator Co., New York.
Bidwell, C. S., Ashtabula Rapid Transit Co., Ashtabula, O.
Belden, D. A., Aurora Street Railway Co., Aurora, Ill.
Brill, G. M., J. G. Brill Co., Philadelphia, Pa.
Baird, M. E., Eddy Electric Motor & Mfg. Co., Windsor, Conn.
Bannister, Lemuel, Westinghouse Elec. & Mfg. Co., Pittsburgh.
Carey, P. H., R. D. Nuttall Co., Chicago. Ill.
Collins. L. W., *Electrical Engineer*, New York.
Carthy, Louis M., N. T. C. Macallan Co., Boston, Mass.
Coffman, John R., Eureka Tempered Copper Co., Detroit, Mich.
Corey, R. B., Electric Construction & Supply Co., New York.
Clarke, W. J., General Electric Co., New York.
Candee, W. L., Okonite Co., New York.
Cicott, Frank X., *Railway World*, London, Eng.
Cochran, Henry, Lamokin Car Works, Chester, Pa.
Curtiss, C. C., Short Electric Railway Co., New York.
Connett, A. N., Baltimore City Passenger Ry. Co., Baltimore, Md.
Chapman, Jas. R., Consolidated St. Ry. Co., Grand Rapids, Mich.
Coolidge, Daniel, Johnson Co., Johnstown, Pa.
Colvin, F. R., *Electrical Engineer*, New York.
Chamberlain, James, Ford-Washburn Storelectro Co., Cleveland.
Cummins, M., Central Railway Co., Peoria, Ill.
Caldwell, Edward, *Electrical World*, New York.
Crane, W. F. D , H. W. Johns Manufacturing Co., New York.
Crawley, H. J., General Electric Co., Atlanta, Ga.
Carr, W. Frank, Roanoke Street Railway Co., Roanoke, Va.
Coleman, Jilson J., Johnson Electric Co., Cleveland, O.
Crump, Ralph Lee, Pennsylvania Steel Co., Merchantsville, Pa.
Carleton, W. F., U. S. Street Ry. Advertising Co., Boston, Mass.
Coles, Stephen L., *Electrical Review*, New York.
Condict, G. Herbert, Philadelphia, Pa.
Coolbaugh, F. W., Coolbaugh & Pomeroy, New York.
Crossman, T. E., Brooklyn, N. Y.
Crouse, J. B., Standard Carbon Co., Cleveland, O.
Clark, F. H., General Electric Co., Washington, D. C.
Clark, James M., Windsor, Sandwich & Amherstburg Railway Co., Windsor, Ont.
Carter, E. J., Fremont Street Railway Co., Fremont, O.
Crider, J. S., Washington Carbon Co., Pittsburgh, Pa.
Chamberlain, J. C., J. C. Chamberlain & Co. New York.
Cogswell, G. P., Norwich Street Railway Co., Norwich, Conn.
Dickerson, J. W., STREET RAILWAY JOURNAL, Chicago, Ill.
Davies, H. J., Brooklyn Street Railroad Co., Cleveland, O.
Dean, D. B., McGuire Manufacturing Co., Chicago, Ill.
Dewey, M. W., Dewey Electric Heating Co., Syracuse, N. Y.
Delany, W. H., Royaline Manufacturing Co., New York.
Dyer, D. B., Augusta Railway Co., Augusta, Ga.
Dutton, A. W., Short Electric Railway Co , St. Louis, Mo.
Dickerman, Alton L., Seattle, Wash.
DeBevoise, Alfred, North Hudson Co. Ry. Co., Hoboken. N. J.
Dickinson, Wallace D., Gr't Falls St. Ry. Co., Great Falls, Mont.
Denman, C. A., Consolidated Street Railway Co., Toledo, O.
Dodge, S. D., Mehling Car Co., Cleveland, O.
Derr, C. A., Rochester Electric Railway Co., Charlotte, N. Y.
Dean, William W., Hamilton Street Railway Co., Hamilton, Ont.
Durbin, C. K., Denver Tramway Co., Denver, Colo.
Dewar, D. C., Ottawa Electric Street Railway Co., Ottawa, Ont.
Dixon, A., City Electric Railway Co., Port Huron, Mich.
Dorner, H. A., Dorner & Dutton, Cleveland, O.
Dutton, W. A., Dorner & Dutton, Cleveland, O.
Evans, H. C , Johnson Co., New York.
Eppley, F. M., Orange Crosstown & Bloomfield Street Railway Co., Orange, N. J.
Elwell, John D., Duplex Street Railway Track Co., New York.
Elkins, Wm. L., Pittsburgh and Duquesne Trac. Co's.
Esmond, E. R., Esmond Street Rail Co., New York.
Eindolph, Allen, Citizens' Street Railway Co., Vincennes, Ind.
Esty, William, Lynn, Mass.
Everett, H. A., Toronto Railway Co., Toronto, Ont.
Englund, A. H., International Register Co., Chicago, Ill.
Everts, D. T., Simplex Electrical Co., Boston, Mass.
Eno, W. G., Wilkes-Barre & Wyoming Valley Traction Co., Wilkes-Barre, Pa.
Ely, Alfred, Alfred Ely & Co., Baltimore, Md.
Ellis, George, Ellis Car Co., Amesbury, Mass.
Everett, A., East Cleveland Railroad Co., Cleveland, O.
Fairchild, C. B.,, STREET RAILWAY JOURNAL, New York.
Flesh, F. M., Piqua Street Railway Co., Piqua, O.
Fortenbaugh, S. B., Short Electric Railway Co., Cleveland, O.
Ferguson, J. A., Shultz Belting Co., St. Louis, Mo.
Ford, Geo. A., Ford-Washburn Storelectro Co., Cleveland, O.
Field, C. J., Field Engineering Co., New York.
Frenyear, T. C., Cayadutta Elec. R. R. Co., Gloversville, N. Y.
Flood, J. F., Steubenville Street Railway Co., Steubenville, O.
Field, Arthur W., Peckham Motor Truck & Wheel Co., N. Y.
Ford, F. R., Short Electric Railway Co., Chicago, Ill.
Fuchs, W. C., Cicero & Proviso Street Railroad Co , Chicago, Ill.
French, Hollis, Massachusetts Electrical Engineering Co., Boston,
Frederick, C. R., Davenport & Rock Is. R. R. Co., Davenport, Ia.
Foote, C. W., Nicholson Electric Hoist Co., Cleveland, O.
Gordon, W. H., W. H. Gordon Co.. New York.
Geriken, H. J., A. French Spring Co., New York.
Groetzinger, W. C., A. Groetzinger & Sons, Allegheny City, Pa.
Griffith, T. B., Hamilton Street Railway Co., Hamilton, Ont.
Gathright, J. R., United Tramway Sprinkler Co , Louisville, Ky.
Gates, J. Holt, Siemens & Halske Elec. Co., of America, Chicago.
Gates, C. A., Massillon Electric Railway Co , Massillon, O.
Good. Brent, U. S. Street Railway Advertising Co., Boston, Mass.
Grubner, A. J., Mintz, Grubner & Co., Baltimore. Md.
Graham, J. H , Consolidated Railway Supply Co., Boston, Mass.
Geise, Frank, York Street Railway Co , York, Pa.
Graham, John, Wilkes-Barre & Wyoming Valley Traction Co., Wilkes-Barre, Pa.
Green, Alfred, Rochester Railway Co., Rochester, N. Y.
Gheghan, John J., J. H. Bunnell & Co., New York.
Greene, B. E., *Electricity*, New York.
Groves, Samuel, Walker Manufacturing Co., Cleveland, O.
Graham. G. H., Chicago, Ill.
Graves, W. D., W. D. Graves Electrical & M'f'g Co., Cleveland, O
Godfrey, J. W., New York Insulated Wire Co., New York:
Holmes, John G., Citizens' Traction Co., Pittsburgh, Pa.
Harrison, H. H., General Electric Co., New York.
Hanna, J. A., McGuire Manufacturing Co., Chicago, Ill.
Hathaway, W. A., American Electrical Works, Providence, R. I.
Hart, Charles E., Central Thomson-Houston Co., Cincinnati, O.
Hunt, W. T., *Street Railway News*, New York.
Heinrichs, Earnest H., Westinghouse Elec. & Mfg. Pittsburgh.
Hazelton, William, 3d, Short Electric Railway Co., Cleveland, O.
Hay, Albert E., Robinson Machine Co., Altoona, Pa.
Hassan, K. D., Short Electric Railway Co., Cleveland, O.
Hanna, J. B., Woodland Ave. & West Side St. R.R. Co., Cleveland.
Hartman, H. C., Bradley Electric Conduit Co., Chicago, Ill.
Hamilton, Campbell T., General Electric Co., Pittsburgh, Pa.
Hayward, H. T., Jersey City & Bergen H. R. R. Co., Jersey City.
Hutcheson, J. E., Ottawa Electric St. Ry. Co., Ottawa, Ont.
Hauss, D. J., Cincinnati, O.
Hoopes, Maurice, Lynn & Boston Railroad Co., Lynn, Mass.
Hannum, L. K., Pottsville & Orwigsburg El. Ry. Co., Pottsville, Pa.
Hough, A. H., Brush Electric Co., Cleveland, O.
Hatch, A. S., Windsor, Ont.
Hathaway Alfred G., Cleveland, O.
Heald, E. W., Wilmington, Del.
Haynes, George D., Newark, N. J.
Holmes F. S., with C. H. Davis, New York.
Hall, John D., Fort Clark Street Railway Co., Peoria, Ill.
Hoover. P. H., Standard Paint Co., New York.
Hubbell, Z. S., Walker Manufacturing Co., Cleveland, O.
Haycox, C. E. Fulton Foundry Co., Cleveland, O.
Hurley, P. E., Trenton Passenger Railway Co., Trenton, N. J.
Hight, C. B., Baxter Electric Motor Co., Baltimore, Md.
Hills, C. I., Perkins Electric Lamp Co., Manchester, Conn,
Herenden, G. B., Brightman Stoker Co., Cleveland, O.
Hayward. A. H., Allent'n & Bethlehem Rap. Tran. Co., All't'n, Pa.

Hathaway Charles, Cleveland, O.
Hand, S. Ashton, Detroit Electrical Works, Detroit, Mich.
Hoadley, Geo. M,, Bemis Car Box Co., Springfield, Mass.
Hall, J. H., Fort Clark Street Railway Co., Peoria, Ill.
Heulings Wm. H. Jr., J. G. Brill Co., Philadelphia, Pa.
Hamilton, M. H., General Electric Co., New York.
Hazelbrigg, S. F., Citizens' St. R.R. Co., Indianapolis. Ind.
Hawks, J. D., Citizens' Street Railway Co., Detroit, Mich.
Hill, H. W., Hill Clutch Works, Cleveland, O.
Irish, W. E., Cleveland, O.
Issertel Henry G., Alexander, Barney & Chapin, New York.
Johnston, W. J., *Electrical World*, New York.
Johnston H. C., Charles Scott Spring Co., Philadelphia, Pa.
Janney, W, H., Fifth & Sixth Streets R.R. Co., Philadelphia, Pa.
Jacobs, F. B., Johnston Safe Automatic Elec. Co., Richmond, Pa.
Jewell, W. S., Citizens' Street Railroad Co., Indianapolis, Ind.
Johnson, Tom L., Brooklyn Street Railroad Co., Cleveland, O.
Johnson, A. L., Brooklyn Street Railroad Co., Cleveland, O.
Jones, J. H., J. M. Jones' Sons, West Troy. N. Y.
Kenfield, H. J.,*Street Railway Review*, Chicago.
Klock, G. F., Murphy Varnish Co., Cleveland, O.
Knight, M. L., Shenango Falls St. R. Co., Beaver Falls, Pa.
Kenfield, F. L., *Street Railway Review*, Chicago.
Kendall, A. C., Connellsville, New Haven & Leisenring Street Railroad Co., Connellsville, Pa.
Kingston, Wm. W., Johnson Co., Atlanta, Ga.
Keyes, O. J., Cleveland Electric Manufacturing Co., Cleveland, O.
Keating, G. H., H.M. Loud & Sons Lumber Co., Au Sable, Mich.
Kissam, George, Carleton & Kissam, New York.
Kilgour, John, Cincinnati Street Railway Co., Cincinnati, O.
Kilgour, Charles H.,Cincinnati Street Railway Co., Cincinnati, O.
Kilgour, B. L., Cincinnati Street Railway Co., Cincinnati, O.
Kerr, Walter, Westinghouse, Church, Kerr & Co., Philadelphia,
Koch, John, Cleveland City Cable Railway Co., Cleveland, O.
Kelsey, Israel A., New Haven & West Haven Horse Railroad Co., New Haven, Conn.
Kohler, G. A. E., Kohler Bros., Chicago, Ill.
Knight, M. L , Shenango Valley St. R. Co., Beaver Falls, Pa.
Kelley, W. J., Columbus Street Railway Co., Columbus, O.
Lynn, A. W., Milwaukee Street Railway Co., Milwaukee, Wis.
Langdon, C. J., Fulton Foundry, Cleveland, O.
Laughlin, F. M., Solar Carbon Co., Pittsburgh, Pa.
Leidenger, P., Dayton Manufacturing Co., Dayton, O.
Leidenger, Jos., Dayton Manufacturing Co., Dayton, O.
Lockwood, Joseph E., Detroit Electrical Works, Detroit, Mich.
Long, Wm. B., Valentine & Co., New York.
Luther, H. R., Barbour, Stockwell & Co., Cambridgeport, Mass.
Lincoln, F. H., Consolidated Street Railway Co., Toledo, O.
Luther, C. F., Pawtucket Street Roilway, Pawtucket, R. I.
Lanius, W. H., York Street Railway Co., York, Pa.
Le Vake, L. B., Brush Electric Co., Cleveland, O.
Low, F. R., *Power*, New York.
Lesley, H., Electro-Dynamic Co., Philadelphia, Pa.
Louttit, W S., Pullman's Palace Car Co., Chicago, Ill.
Littell, H. M., Cincinnati Inclined Plane R. Co., Cincinnati, O,
Littell, H. H., Buffalo Railway Co., Buffalo, N. Y.
Leach, P. F., Cushion Car Wheel Co., Chicago, Ill.
Luhn, Max, Helios Electric Co., Cologne, Germany.
Longstreet, D. F., Denver, Colo.
Lang, Albion E., Toledo Street Railway Co., Toledo, O.
Littlefield, A. S., O. W. Meysenburg & Co., Chicago, Ill.
Ludwig, J. L., Westinghouse Elec. & Mfg. Co., Pittsburgh, Pa.
Leonard, H. Ward, H. Ward Leonard & Co., New York.
Leonard, S. S., Hill Cluch Works, Cleveland, O.
Lewis, Frank J., Johnson Electric Co., Cleveland, O.
Lufkin, H. L., C. & C. Electric Motor Co., New York.
Mark, C. E., Mark & Sterling, Cleveland, O.
McGraw, J. H., STREET RAILWAY JOURNAL, New York.
Morris, Elmer P., General Electric Co., Boston, Mass.
Mason, W. R., Railway Equipment Co., Chicago, Ill.
Morris, Dwight, General Electric Co., Boston, Mass.
Manning, A. P., Pittsburgh Trolley Co., Pittsbugh, Pa.
Myers, Garson, Standard Railway Supply Co., Chicago, Ill.
Magee, Frank A., E. S. Greeley & Co., New York.
Macartney, J. F., Railway Equipment Co., Chicago, Ill.
Macartney, Rutherford, Railway Equipment Co., Buffalo, N. Y.
Mailloux, C. O., New York.
McTighe, T. J., Barry & McTighe, New York.
Milbank, L. A., Holmes, Booth & Haydens, New York.
McQuaide, James, P., National Conduit Manufacturing Co.
McCulloch, Robert, Citizens' Railway Co., St. Louis, Mo.
McGhie, J., General Electric Co , New York.
Mercur, Robt. J., New York Car Wheel Works, Buffalo, N. Y.
Morrison, William H., Brooklyn City R. R. Co., Brooklyn, N.Y.
McClure, J. H. Short Electric Railway Co., Cleveland, O.
McNairy, A. B., Cleveland, O.
McDonald, D., Pleasant Valley St. Ry. Co., Allegheny City, Pa.
McLean, Thos. H., Houston, West St. & Pavonia Ferry RR Co., N.Y.
Mayer, Charles J., R. D. Nuttall Co., Pittsburgh, Pa.
McClary, J. B., Birmingham Ry. & Elec. Co., Birmingham, Ala.
McKenzie, Wm., Toronto Railway Co., Toronto, Ont.
Marker, W. C., Cleveland Electric Mfg, Co., Cleveland, O.
McRae, J. W., Ottawa Electric Street Railway Co., Ottawa, O.
Madison, G. L., Oshkosh, Wis.
Myers, L. E., Detroit Electrical Works, Chicago, Ill.
McElroy, J. Y., Consolidated Car Heating Co., Albany, N. Y.
Martin, T. C., *Electrical Engineer*, New York.
Mowatt, J. H., Mowatt Detective Service, Cleveland, O.
Mechem, A. M., New Process Rawhide Co., Syracuse, N. Y.
MacQuesten, W. J., New York.
Mason, J. H., Simplex Electrical Co., Boston, Mass.
Morse, Geo. C., Taunton Street Railway Co., Taunton, Mass.
Mears, James F., Ohio Auxiliary Fire Alarm Co., Cleveland, O.
Mintz, Jacob, Mintz, Grubner & Co., Baltimore, Md.
Morrell, Frank A., Lewis & Fowler Mfg. Co., Brooklyn, N. Y.
Minary, T. J., Louisville Railway Co., Louisville, Ky.
Morton, N. E., Merrimac Valley St. Ry. Co., Lawrence, Mass.
McLaughlin, Chas., Paterson Central Elec. Ry.Co., Paterson, N.J.
McLaughlin, Wm., Paterson Central Elec. Ry. Co., Paterson, N.J.
Maltby, Geo. E., Jamestown Street Railway Co., Jamestown, N.Y.
Melms, G. J., Milwaukee Electric Railway Co., Milwaukee, Wis.
McNamara, John W., Albany Railway Co., Albany, N. Y.
Newton, Charles E., Jewell Belting Co., Hartford. Conn.
Nicholson, L. W., Short Electric Railway Co., Cleveland, O.
Nuttall, R. D., R. D. Nuttall Co., Allegheny City, Pa.
Neftel, Knight, Neftel & Marsh Co., New York.
Nold, L. S., E. Liverpool & Wellsville St. Ry. Co., E. Liverpool, O.
O'Hara, J. B., *Western Electrician*, Chicago, Ill.
Orr, A. M., Piqua Street Railway Co., Piqua, O.
Osgood, C. B., Chicago, Ill.
Oswald, E. H., Benedict & Burnham Mfg Co., New York.
Odell, Chas., Newburyport & Amesbury Ry.Co., Newb'yp't, Mass.
Ostrom, J. F., Pennsylvania Steel Co., Philadelphia, Pa.
Owen, B. F., Reading City Passenger Railway Co., Reading, Pa.
Ogden, D. H., *Western Electrician*, Chicago, Ill.
Olds, E. W., Denver Tramway Co., Denver, Colo.
Partridge, Arthur S., St. Louis, Mo.
Potter, W. B. General Electric Co., New York.
Packer, E., Rochester Car Wheel Works, New York.
Peckham, E., Peckham Motor Truck & Wheel Co., Kingston, N.Y.
Pugh, D. W., John Stephenson Co. Ltd., New York.
Phipps, C. W., Brush Electric Co., Cleveland; O.
Pratt, G. E., Lamokin Car Works, Philadelphia, Pa.
Perrine, Lewis, Jr.,Trenton Passenger Railway Co.,Trenton, N.J.
Pugh, J. S., Baltimore Car Wheel Works, Baltimore.
Paiste, H. T., Philadelphia, Pa.
Parker, L. H., Trenton Passenger Railway Co., Trenton, N. J.
Patterson, N. H., Bloomington City Ry. Co., Bloomington, Ill.
Powers, E. L. *Electrical Industries*, Chicago, Ill.
Pfetch, J. F. Erie Electric Motor Co., Erie, Pa.
Possons, N. S., Eureka Tempered Copper Co., North East Pa.
Pfingst, L., Boston, Mass.
Pullen, C. L.. Globe Iron Works, New York.
Parmelee, G. F., Cuyahoga Falls & Akron Railway & Passenger Co., Cuyahoga Falls, O.
Pool, H. W.. STREET RAILWAY JOURNAL, New York.
Pond, A. E., New Haven & W. Haven H.R.Co..New Haven, Conn.
Price, W. F., Rapid Transit Co., New Brunswick, N. J.
Payne, H. C., Milwaukee Street Railway Co., Milwaukee, Wis.
Peckham, M. D., New York.
Pratt, Mason D., Pennsylvania Steel Co., Steelton, Pa.
Reid, D., Genett Air Brake Co., Chicago, Ill.
Rutherford, J. A., Westinghouse Elec. & Mfg. Co., Pittsburgh, Pa.
Robison, Frank De H.,Cleveland City Cable Ry. Co.,Cleveland, O.
Randall, F. C., J. G. Brill Co., Philadelphia, Pa.
Russell, F. D., Rochester Car Wheel Works, Rochester, N. Y.
Rowe, Charles E., Railway Equipment Co., Boston, Mass.
Richardson, William, Atlantic Ave. R. R. Co., Brooklyn, N. Y.
Richardson, Wm. J., Atlantic Ave. R. R. Co., Brooklyn, N. Y.
Ridall, John E., Short Electric Railway Co., Pittsburgh, Pa.
Rogers, Frank A., Short Electric Railway Co., Cleveland, O.
Ruff, D. A., York Street Railway Co., York, Pa,
Ross, Edward L., Chapman Valve Mfg. Co.,Indian Orchard,Mass.
Reynolds, Edward C., *Street Railway Gazette*, New York.
Robinson, Wm., Robinson Elec. Truck & Supply Co.,Boston,Mass.
Rice, Walter P., Cleveland, O.
Rugg, J. E., Citizens' Traction Co., Pittsburgh, Pa.
Ramsey, Wm. M., Federal Street & Pleasant Valley Passenger Railway Co., Allegheny City, Pa.
Rusling, C. S., Central Thomson-Houston Co., Cincinnati, O.
Rand, C. F., Everett Washington Ry. & Elec. Co., Cleveland, O.
Randolph, R. J., Central Thomson-Houston Co., Cincinnati, O.
Rae, Frank B., Detroit, Mich.
Roeschlaub, F. H., National Fare Box Mfg. Co., Chicago, Ill.
Radel, Andrew, Newark & South Orange Street Railway Co., Newark, N. J.
Register, A. L., Pepper & Register, Philadelphia, Pa.
Rice, E. W.. General Electric Co., Lynn, Mass.
Richards, H. T., *Electrical Review*, New York.
Rhoads, H. R., Williamsport Pass. Ry. Co., Williamsport, Pa.
Rusling, F. O., West Bay City St. Ry. Co., West Bay City, Mich.
Robinson, E. I., La Clede Car Co., St. Louis, Mo.
Robert, Louis E., Lewis & Fowler Mfg .Co., Brooklyn, N. Y.
Ring, Wm., Paterson Central Elec. Ry. Co., Paterson, N. J.
Roberts, E. P., Swan Lamp Co., Cleveland, O.
Reynolds, John N.,*National Car & Locomotive Builder Supplement.*
Runser. Frank D., Shenango Valley St. Ry. Co., Sharon, Pa.
Rommel, W. B., Pittsburgh & Birmingham Trac. Co., Pittsburgh.
Smith, Gilbert M., Aluminum Brass & Bronze Co., Chicago, Ill.
Sharp, E. P., American Mica Co., Boston, Mass.
Smith, Frank B., Metropolitan Elec. Ry. Co., Springfield, Mo.
Stanley, Henry D., Okonite Co., New York.
Scott, Charles Jr., Charles Scott Spring Co., Philadelphia, Pa.
Shinn, Luthur E., Esmond Street Rail Co.. New York.

Stephenson, Wm., Columbia Railroad Co., Washington, D. C.
Smith, W. A., Omaha Street Railway Co., Omaha, Neb.
Shay, J. H.. Munson Belting Co., Chicago, Ill.
Sawyer, E. C., Steam Gauge & Lantern Co., Syracuse, N. Y.
Seguine, W. P., Frost Veneer Seating Co.
Smith, Charles G., Cleveland, O.
Silver, Wm. S., William S. Silver & Co., New York.
Shaffer W. H., Richmond City St. Ry. Co., Richmond, Ind.
Stark, E. C., Peckham Motor Truck & Wheel Co., Kingston, N. Y.
Sterling, Willis B., Mark & Sterling Cleveland, O.
Soper, Warren, T., Ottawa City Pass. Ry. Co., Ottawa, Ont.
Scull, Wm. S., Camden Horse Railroad Co., Camden, N. J.
Sperry, Elmer A., Chicago, Ill.
Scheffler, Frederick A., Brush Electric Co., Cleveland, O.
Stearns, Charles G., Bemis Car Box Co., New York.
Smith, John A., Cincinnati Inclined Plane Railway Cincinnati, O.
Suckow, Gus, Richard Vose Car Spring Co., New York.
Scheerer, W , Newark & South Orange St. Ry. Co., Newark, N. J.
Silverman, S. H., General Electric Co., Philadelphia. Pa.
Smiles, E. N., Edison Manufacturing Co., New York.
Smith, F. W., Automatic Cable Grip Release Co., St. Louis, Mo.
Schieren, Chas. A. Jr., Charles A. Schieren & Co., New York.
Stump, C. E., STREET RAILWAY JOURNAL, New York.
Sturges, Wm. M., Utica Belt Line Railroad Co., Utica, N. Y.
Smith, H. W., Smith Closed Conduit Co., Newark, N. J.
Stillman H. L., Stillman Lt. Ry Development Co., Providence, R. I.
Smith, J. T., Citizens' Electric Railway Co., Fishkill, N. Y.
Schermerhorn, G. L., General Electric Co., Pittsburgh, Pa.
Stearns, C. K., Northwest General Electric Co., St. Paul, Minn.
Stevens, E. H., Johnson City & Carnegie Street Railway Co. Johnson City, Tenn.
Stewart, John A., Central Thomson-Houston Co., Cincinnati, O.
Sporling, Fred. H., John A. Roebling's Sons Co., Trenton, N. J.
Strieby, F. H., Central Thomson-Houston Co., Cincinnati, O.
Saunders, C. L., Cleveland Engineering Co., Clevelahd, O.
Stanley, John J., Broadway & Newburgh Street Railroad Co., Cleveland, O.
Shipherd, John J., Cleveland City Cable Railway Co.
Tolles, Charles L.. Jewell Belting Co., Hartford, Conn.
Traggardh, J. G., Pittsburgh Traction Co., Pittsburgh, Pa.
Taylor, Wm., Taylor, Goodhue & Ames, Chicago, Ill.
Ticknor, J. S., West End Street Railway Co. Rockford, Ill.
Turk J. C., King Bridge Co., Cleveland, O.
Tucke, E. M., Lowell & Suburban Railway Co., Lowell, Mass.
Taft. J. A., Babcock & Wilcox Co., Cincinnati, O.
Uebelacker, C. F., Short Electric Railway Co., Cleveland, O.
Van Dorn, W. T., Fitzgerald-Van Dorn Co., Lincoln, Neb.
Van Nuis, C. S., New York.
Valentine, J. W., Short Electric Railway Co., Cleveland, O.
Wheeler, Howard, New York.
Woolsey, C. A., General Electric Co., Boston, Mass.
Wyman, Edward B., Dewey Electric Heating Co., Syracuse, N. Y.
Webb, H. E., Solar Carbon Co., Pittsburgh, Pa.
Wallace, Edward J., Smith & Wallace. Boston, Mass.
Wheeler, G. A., General Electric Co., Chicago, Ill.
Windsor, H. H., *Street Railway Review*, Chicago, Ill.
Wills. Joseph, Short Electric Railway Co., Cleveland, O.
Wessels, Edward J., Short Electric Railway Co., New York.
Wheelhouse, S. H., Star Headlight Co., Rochester, N. Y.
Wharton, Wm., Jr.. Wm. Wharton, Jr., & Co., Philadelphia, Pa.
Whittemore, W. F., N. Hudson County Ry. Co., Hoboken, N. J.
Webster, E., Stillwell & Bierce Manufacturing Co., Chicago, Ill.
Whitney, Louis B., A. Whitney & Sons, Philadelphia, Pa.
Wardwell, Fred., Duluth Street Railway Co., Duluth, Minn.
Woodruff, R. S., Trenton Passenger Railroad Co.. Trenton, N. J.
Wright, Aug. W., Siemens & Halske Electric Co. of America, Chicago, Ill.
Weaver, W. D., *Electrical World*, New York.
Wickham, E. F., St. Louis Register Co., St. Louis, Mo.
Wood, E. E., *Electrical Industries*, New York.
Washburn, Geo. A., Ford-Washburn Storelectro Co., Cleveland, O.
Wason, Charles, W., East Cleveland Railroad Co., Cleveland, O.
Whittlesey, J. E., Gilbert Car Manufacturing Co., New York.
Wheildon, Louis B., Massachussetts Car Co., Boston.
White, Edward C., Globe Iron Works, New York.
Walker, John, Walker Manufacturing Co., Cleveland, O.
Whitla, J. C., Beaver Valley St. R. R. Co., Beaver Falls, Pa.
Williams, Chas. A., Rochester Railway Co., Rochester, N. Y.
Wurts, Alexander J., Westinghouse Elec. & M'f'g. Co., Pitts. Pa.
Whipp, George S., Lewis & Fowler M'f'g. Co., Brooklyn, N. Y.
Wackerman, L. A., Walker Manufacturing Co., Cleveland, O.
Wheeler, K., P., A. & M. Traction Co., Pittsburgh, Pa.
Wilkes, Gilbert, Detroit Electrical Works, Detroit, Mich.
Wells, S. P. Jr., North West General Electric Co., St. Paul, Minn.
Wrightman, Merle J., Scranton Pa.
Waterman, F. N., Westinghouse Elec. & Mfg. Co., Pittsburgh, Pa.
Wright, A. J., Reliance Gauge Co., Cleveland, O.
Willson, Fred. J. Battle Creek Elec. Ry. Co., Battle Creek, Mich.
White, J. G., J. G. White & Co., New York.
Young, C. E. M., W. Bingham Co., Cleveland, O.
Young, A. M., Waterbury Horse R. R. Co., Waterbury, Conn.
Zerbey, J. H., Scuylkill Electric Railway Co., Pottsville, Pa.

THE Whiting, Hammond & East Chicago Railway Co. has asked for a number of franchises in East Chicago, and for an electric line connecting at the Robey race track in Whiting with one from South Chicago.

Street Railway News.

New Roads.

Allegheny, Pa.—A charter has been issued to the Allegheny & South Side Railway Co, capital $50,000. The road will be constructed from a point in the city of Allegheny to Pittsburgh.

Atchison, Kan.—The Atchison Electric Motor & Street Railway Co. has applied for a charter. The incorporators are: W. F. Dolan, J. C. Fox, A. J. Harwi, J. T. Hersey and A. W. Simpson. The capital stock of the company is $500,000.

Atlanta, Ga.—The Atlanta City Street Railway Co. is a new railway company which has been granted a charter to build a road from Atlanta to Decatur. W. 1. Zachry, Aaron Haas, Clyde L. Brooks and others are interested. The capital stock is $25,000.

Beaver Falls, Pa.—A company composed of J. C. Whitla, M. L. Knight, Harry Reeves and others, was organized lately, and has purchased the franchise of the Sharon & Sharpsville electric road, a new line four miles long, connecting the towns of Sharon and Sharpsville. J. C. Whitla has been elected president, F. G. Barker treasurer, and W. L. Knight, secretary. Work of building the road will be begun at once.

Boone, Ia.—The Boone Electric Street Railway & Light Co., with a capital of $200,000, has filed articles of incorporation.

Bowling Green, O.—The Fostoria & Bowling Green Street Railway Co. has asked permission of the Council here to construct a street railway within the corporate limits on certain streets. The road will be continued to Fostoria by way of Portage, and will be operated by electricity.

Chicago, Ill.—The Jefferson Street Railway Co. has secured a license to incorporate, with a capital stock of $500,000. The intention is to build an electric line on Elston Avenue and connect with the West and North Chicago street railway lines on Milwaukee and Clybourn Avenues—seven miles in all. The incorporators are George H. Parker, Joseph B. Bickerdike, Fred E. Eldred and four others.

Cripple Creek, Colo.—Articles of incorporation of the Cripple Creek Street Railway Co., with the principal office in Fremont, were recently filed, the incorporators being A. C. Hickman, Albert B. Calaway, George Jordan and W. S. Montgomery. The company propose building a line through the towns of Cripple Creek and Fremont, and connecting with the towns of Barry and Mound City. The capital stock is placed at $100,000. The proposed line will be about five miles in length.

Dayton, O.—Albert M. Crisler and Robert Appleby of Eaton, have filed with the board of county commissioners an application for permission to erect poles and string wires for a single track electric railroad from the county line to Dayton.

Dravosburg, Pa.—Homer H. Swaney, of McKeesport, has formed a company of Pittsburgh capitalists and has bought the stock and charter of a company that was formed some years ago to operate an electric line between Dravosburg and Elizabeth, and he will put the project through.

Elizabeth, N. J.—Articles of incorporation were filed last month by the Elizabeth & Plainfield Street Railway Co. The road will run through Linden and Cranford townships, and will first be constructed to Westfield. The capital of the company is $100,000 in stock of 1,000 shares. The incorporators are James B. McGiffert, William A, Peddle, J. H. Vail, Westfield; Luther M. Whittaker, Westfield; Dwight F. Burritt, James Garwood and Foster M. Voorhees. The line will start from the Union Depot, Elizabeth, and run through what is known as the old road to Westfield, will be seven miles long and operated by electricity.

Galesburg, Ill.—A new company, entitled the Galesburg West Side Street Railway Co., has been incorporated, with capital stock, $75,000. The incorporators are Sol Frohlick, N. P. Glann and others.

Grand Forks, Minn.—The Grand Forks Electric Street Railway Co. has been incorporated by Charles F. Arrol, Wilford G. De Celle and Frederick C. Stevens, all of St. Paul. The capital stock is $100,000.

Green Bay, Wis.—A franchise has been granted Jackson J. Case and Charles H. Holmes, of Racine, for an electrical railway, to be commenced by May 15, 1893, and finished within one year from that date.

Hammond, Ill.—The Whiting, Hammond & East Chicago Street Railway Co. has been incorporated; capital $100,000. A. R. Shroyer, A. Bloch, M. Joel and C. F. Griffin are the incorporators. The principal office will be at Hammond.

Hanover, Pa.—The Hanover & McSherrystown Street Railway Co. has been organized, with a capital of $30,000. John C. Tanger, of Hanover, is president. Others interested are A. H. Melhover, Aaron Hostetter and Thos. Ehrehart, all of Hanover.

Houston, Tex.—The Houston City Street Railway Co. has been organized with a capital of $400,000. The incorporators are H. F. McGregor, T. W. House, C. A. McKinney, George C. Adams and O. M. Carter.

Lockport, N. Y.—Goodwin & Swift, of 2 Nassau Street, New York, and Reed & McKibbin, of 2 Wall Street, New York, with Ashley & Hodge, of this place, will commence construction soon on the proposed Lockport and Olcutt road.

THOS. H. FEARY, of Syracuse has asked the aldermen whether they would consider a petition for a franchise in the city.

Mauch Chunk, Pa.—The Council has voted to grant the right of way petitioned for by the Carbon County Electric Railway Co. Fred. Bertolette is attorney of the company.

McKeesport, Pa.—The Citizens' Passenger Railway Co. has been incorporated here. The capital stock is $30,000, and the president is James S. Kuhn, of McKeesport. Others interested are W. A. Dunshee, W. E. Harrison and Horace Crosby, all of this place.

Meadville, Pa.—The Select Council lately received a petition from George D. Trawin and thirty-seven citizens, asking the privilege to construct an electric railway on certain streets.

Medford, Mass.—The city has granted a franchise for the Middlesex Fells electric road, and its completion is assured. The road is backed by Ex-Governor Ames, F. L. Ames and others.

Montgomery, Ala.—The West End & Riverside Electric Street Railway Co. has filed articles of incorporation. The incorporators are Dr. S. D. Seelye, M. E. Satchwell and J. M. Garrett, Jr. The capital stock is $100,000.

Nanticoke, Pa.—People's Street Railway Co., of Nanticoke and Newport, has been chartered; capital, $60,000.

New Glasgow, N. J.—The New Glasgow Electric Co. has asked the Council to approve of a route for their proposed electric street railway.

Oakland, Cal.—The Twenty-third Avenue Electric Railway Co. has been incorporated, with $300,000 capital stock. The directors are W. J. Landers, H. W. Meek, C. E. Palmer, B. C. Hawes and A. C. Hammond, Jr.

Passaic, N. J.—The Passaic, Rutherford & Carlstadt Railway Co. has been organized by James A. Morrisse, of Paterson.

Pottstown, Pa.—The Citizens' Passenger Railway has received a charter; capital, $75,000. The road will be twelve and a half miles in length, beginning at Douglassville, and extending to Pottstown. The directors are John P. Dunn, John A. Weber, Pottstown; Samuel M. Zacharias, W. Wilkins Car, Philadelphia; James C. Herlig, Reading.

Quakertown, Pa.—It is contemplated to build an electric railway from here to Richlandtown.

Reynoldstown, Pa.—The Reynoldstown & Port Vue Traction Co. has been organized with a capital stock of $18,000 to build an electric railway. Horace Crosby, of Pittsburgh, is president. A. Chandon, W. A. Dunshee, James S. Kuhn and James Simpson, all of McKeesport, are interested.

Richfield Springs, N. Y.—The Trustees of Richfield Springs have granted a franchise for a street railroad. The road will extend from the Spring House corners to the Lake House.

Sacramento, Cal.—H. P. and Charles E. Livermore, Albert Gallatin, A. J. Ralston, J. D. Fry and R. D. Fry, all of San Francisco and owners of the Folsom Water Power Co., have applied to the City Trustees for a franchise for a system of electric railways covering a number of streets in this city.

Salt Lake City, Utah.—A franchise has been granted to the Great Salt Lake & Hot Springs Railway Co.

Sioux City, Ia.—Articles of incorporation of the Morning Side Street Railway Co. were filed last month. The capital stock is fixed at $100,000. The incorporators include James A. Jackson, William L. Joy, E. C. Peters and J. H. Quick.

Tampa, Fla.—Articles of incorporation have been filed of the Consumers' Electric Light & Street Railroad Co. Among those interested are E. S. Douglass, W. H. Kendrick, A. C. Wuerpel, H. H. Kinyon and W. B. Henderson.

Tamaqua, Pa.—The Tamaqua Board of Trade has passed a resolution urging the construction of the electric railway between that town and Lansford.

Toronto, Ont.—At a recent meeting of the shareholders of the Toronto & Scarboro' Electric Railway, Light & Power Co., at the offices of John Stark & Co., 28 Toronto Street, it was voted to push the work of construction without delay. The intention of the company is to connect Scarboro' Heights and the city, and overrun that part of Toronto east of Don with a system of electric cars. The officers of the company are: President, W. G. Stephenson; vice-president, John Hallam; secretary, treasurer and managing director, A. W. Dingman.

Washington, Ind.—This place is to have an electric street car line. The City Council has granted a franchise for fifty years to Graham & Cox, and released them from taxation for ten years.

Extensions and Improvements.

Andover, Mass.—A petition by residents has been presented to the Merrimack Valley Street Railway Co., asking for an extension of the tracks from North Andover centre to Andover.

Ashland, Wis.—Work on the electrical equipment of the street railway line here has been commenced.

Baton Rouge, La.—The Capitol Railway & Lighting Co. has purchased the Baton Rouge Street Railway, and will operate it by electricity.

Buffalo, N. Y.—The directors of the Buffalo & Williamsville Electric Railway Co. have let contracts for the construction and equipment of an electric railway from Buffalo to and through the village of Williamsville, N. Y. The road will be four and a half miles long, and will be a continuation of the Main Street line of this city. The contract for the construction has been awarded to J. D. Murray, of New York City, who also furnishes the electrical equipment and rolling stock. The former is of the Thomson-Houston type. The contract for a 150 H. P., compound condensing engine has been awarded to the John T. Noye Manufacturing Co., of this city.

THE Buffalo Railway Co. has been granted by the Board of Aldermen the right to substitute electricity for horse power on all its lines except the Elmwood Avenue Line.

Chattanooga, Tenn.—The street railway company contemplates the early completion of the proposed line out Fourth Street to Sherman Heights. The survey has been made and the poles erected for part of the distance. The extension of the Ridgedale line one mile further, to East Lake, is also being talked of. Some important improvements are also in progress on the St. Elmo road.

Chicago, Ill.—By an action of the City Council last month the extreme southern electric street railway systems of the Calumet Electric Street Railway Co. are connected with the system of the Chicago City Railway Co. by way of Stony Island Avenue. The importance of this lies in the fact that it gives transportation to the World's Fair by electric railway (overhead wire system) from Grand Crossing and southern points, and perfects the connection with the present cable system. A license fee of $50 for each car is fixed.

APPLICATION for a permit to build from Ashland to Western Avenue has been made by the Lake Street Elevated Railway Co.

Cincinnati, O.—The Cincinnati Street Railway Co. has become the owner of the franchise for what is known as Route 23, granted some time ago to Simeon M. Johnson.

THE Board of Aldermen have been petitioned by the Consolidated Street Railway Co. for permission to change the Eighth Street line to electricity; also to build a new inclined plane at a point 100 ft. north of the present one. The road is to be finished in a year from the time of getting the grant. Route 21, on top of Price Hill, is to be made electric also, and thus the rapid transit will be continuous to the west corporation line. The company has also received permission to equip the Sedamsville line with electric power.

Danville, Va.—At a recent meeting of the directors of the Danville Street Car Co. it was voted to begin at once the work of extending the line towards the reservoir.

Denver, Colo.—An ordinance has been passed granting the franchise to the Tramway company to construct a line connecting with the Agate Avenue line.

Detroit, Mich.—The street railway company has received permission to equip its Woodward Avenue line.

Duluth, Minn.—A contract has been let by the Duluth Street Railway Co. to W. C. Doherty to build an extension to Lakeside. It is to be completed before November 15.

Everett, Mass.—The Lynn & Boston Railroad Co. has petitioned the selectmen for a location for a second track in the city.

Lancaster, Pa.—The West End Railway Co. has been granted rights by the Council to make several important extensions.

Lansing, Mich.—Real estate dealers in the northwest portion of the city are agitating the matter of extending the street line west on Franklin Street to the Blind School, north on Pine to Willow Street, and thence west to West Street, and from this point to the fair grounds, thus forming a complete belt line.

Malden, Mass.—The Stoneham & Boston Street Railway Co. has petitioned for right to construct a single electric track over Highland Avenue, Pleasant and Sumner Streets.

New Bedford, Mass.—The Union Street Railway Co. has petitioned the town of Fairhaven for permission to extend its track from its present terminus to the Howland Road, or East Coggeshall Street.

New Haven, Conn.—The State Street Horse Railway Co. has received permission to double track its entire line.

THE Board of Public Works has given permission to the Winchester Avenue Street Railroad to extend its tracks from the present terminus, corner of College and Chapel Streets, through College, George and Commerce Streets, to connect with the New Haven & West Haven railroad's tracks.

AN extension to the Morris Cove electric road has been laid up Farren Avenue and along Meadow Street to the east end of the Quinnipiac drawbridge.

New Rochelle, N. Y.—The Board of Village Trustees has granted a franchise to the Union Railroad Co. to lay tracks and operate a trolley railroad in connection with their New York system.

New York, N. Y.—On October 5 the board of directors of the Houston, West & Pavonia Ferry Railroad Co. which operates all but two of the lines controlled by the Metropolitan Traction Co. in New York City, voted to cable the extensions on Ninth and Lexington Avenues, which they petitioned for. The petition has been granted. Previous to this vote it was generally understood that the trolley system would be installed on the first of these extensions. The directors state in their resolutions that "whatever may be the merits of other systems of traction, it is not open to this company to consider the same for these extensions after having invested millions of dollars in the present cable system."

Newton, Mass.—The Newton & Waltham Street Railway Co. will commence work at once on the construction of the connecting line of tracks between Waltham and Watertown.

Norristown, Pa.—The Citizens' Passenger Railway Co. has received permission to operate its road by electric power. The usual conditions and restrictions are made.

Providence, R. I.—The Union Street Railway Co. has been granted a twenty year franchise over certain streets in East Providence.

St. Paul, Minn.—Thos. Lowry, president of the Twin City Rapid Transit Co., has been granted permission to build a line to Como Park.

Scranton, Pa.—The new managers of the People's Railway Co. will probably double track a considerable portion of the line which has now only one track, and will introduce other improvements.

Springfield, Ill.—The City Railway Co. has been granted the right to extend its line on Monroe Street, Capitol Avenue and East Grand Avenue.

Springfield, Mass.—The Springfield Street Railway Co. has petitioned for right to make a number of extensions.

Springfield, O.—The street railroad company has been granted the right to construct its line over Sycamore and Warder Streets.

Vancouver, Wash.—The Columbia Land & Improvement Co., of this city has sold its street railway franchise, horses, cars, etc., to the Washington Street Railway Co. This latter company will extend the line and will install a new engine and boiler.

Washington, Pa.—The electric railway company has made a liberal proposition to parties interested in the extension of the line. They propose to make it on condition that all unpaid stock subscriptions in the vicinity be paid in full, and a subscription be made in cash sufficient to justify the extensions, with consequent additional expenses of operation. A rebate of 10 per cent. on tickets is also offered.

Wellesley, Mass.—The Natick & Cochituate Street Railway Co. proposes to ask for a franchise to extend its tracks from Natick through Wellesley.

Williamsbridge, N. Y.—The Board of Trustees of Williamsbridge, have granted a franchise to the Union Railroad Co. to extend its system through the streets of the village.

Personal.

Mr. Frank C. Randall, formerly superintendent of the Tripp Manufacturing Co., has accepted a position with the J. G. Brill Co.

Mr. Henry D. Stanley, formerly connected with the Bridgeport Brass & Copper Co., has accepted a position with the Okonite Co., of New York.

Mr. John A. Brill was unable to attend the Convention on account of serious illness, which has confined him to his home for about six weeks. Mr. Brill has been a constant attendant at the conventions, and it is needless to say that his absence was generally noted. The interests of the Brill company, however, were well cared for by the president, Mr. G. M. Brill, and Mr. W. H. Henlings.

The Ammonia Motor.

The Railway Ammonia Motor Co., whose motor car was described in the last issue of the STREET RAILWAY JOURNAL is building in Brooklyn an improved ammonia motor car which will be completed shortly, and will then be put in operation on one of the street railway lines in New York City.

This motor is the invention of P. J. McMahon, an ex-naval engineer, who has operated a car on the World's Fair grounds in Chicago, and has also introduced the system in England, where a car is in successful operation. The motor carries no coal or fire, and there is no escape in the atmosphere. The anhydrous ammonia used is prepared at a stationary plant, and the cost of producing the power is claimed by the manufacturers to be less than one cent per car mile run. The motor is easy to operate, and can be worked by any ordinary conductor, stopping and starting much more quickly than a horse car. On a level road and with a free track a speed of twenty miles an hour can be maintained. The cars are considerably lighter than electric cars of the same size, and as each car is operated independently and carries its own motive power, the manufacturers claim it to be more desirable than the electric system. This company has moved its offices from 280 Broadway to Drexel Building, Wall Street, New York.

The Origin of Feed Water Purifiers.

A novel illustration, showing the principle upon which the feed water purifier is based, has been issued by the Hoppes Manufacturing Co., of Springfield, O. This illustration, which appears in our advertising pages, shows in the center a Hoppes purifier complete, and the view of a purifier pan after use. The latter exhibits a considerable deposit of solid matter which was formerly held in the feed water, but which has been caught by the pan. The rest of the picture shows the interior of a cave in which many stalactites are hanging from the roof, left there by the solid matter of water dripping through the roof, while on the floor of the cave are a number of stalagmites. As stalactites are found longer and greater in number than stalagmites, so this manufacturing company has found in its heater that in actual practice about three-fourths of the solid matter caught by the purifier is found clinging to the under side or bottom of the pan; while the inside shows a deposit usually amounting to one-fourth of the total scale.

Profit Sharing.

The subject of co-operation and profit sharing is a theme that has engaged the thoughts and attention of persons well versed in the art of governing or managing great and productive enterprises requiring a large number of operatives. While this has been a thoughtful subject with limited experiments during the past years, it is now a subject which occupies the attention of those in every walk or class of life. Centralization of capital has strengthened its power; this is evident, as revealed in the many successful attempts by financiers to consolidate capital. During this time labor has not been idle, but has exemplified its power in its efforts to organize or unionize with a view to restrict or defeat any infringement of capital on labor. The inhabitants of a state or government co-operate for the purpose of strength and prosperous gain. If these are governmental facts in a large way, why is not the subject of co-operation more thoroughly studied and adopted by those controlling and managing enterprises which represent a government within themselves?

Railway lines are merged into one system in order to become a unit which, with skillful management and co-operation, are enabled to attain results impossible of consummation in any other way. These are not rare instances. Street railway companies consolidate for the fulfillment of centralized strength, that desirable results may be attained. The whole drift and tendency of capital engaged in operating systems of traffic for the benefit of the people is to consolidate, and few are ready to deny that such consolidation and co-operation is not wise and beneficial.

Then, if this principle of unity will bring to aggregate wealth salutary results, why is it that men whose capital is their labor cannot in a measure attain similar results. There is no reason why an organization of men whose capital is their labor may not produce for themselves the same ratio of profit. Neither large nor comfortable fortunes have ever been accumulated from the savings or profits of one man's labor, who did not either employ others or acquire land or other property bearing interest, increase in value or return large rents. It is this apparent fundamental wrong or inequitable condition which the labor movement is striving to correct at the present time. Profit sharing produces an individual, or self interest, which is natural to man. Little or no respect is shown to the individual who does not, in this age, look out for self. Attempts to foster a system of gain or profit may be so strained as to breed selfishness, and may be impregnated with such tyrannical shortsightedness as to fail of its purposes, while a wise self interest can look beyond the present day advantage.

"The employer who pays starvation wages," says Geo. Chace, of Mass., "and expects to get the measure of work by sweating and grinding, who is bothered by frequent shifts, poor production and occasional strikes, is as short sighted as a poor teamster, who half starves his horses and hopes by blows to force the stint of work from his thin ribbed beasts, and perhaps more so, inasmuch as the capability and sensibility of human beings are greater than those of dumb creatures." As a matter of business, it pays to trust human nature and anticipate adequate returns for your confidence. The lack of good faith and fidelity are, as a rule, cause for the treachery and fraud that are often apparent and complained of. The underlying principle of profit sharing relies for its success upon the natural appreciation of a good turn by reciprocal parties.

Low and inadequate wages, viewed from the standpoint of an employer, whether the manager of a street railway system or any other kind of work, if made so low as to hinder the employes from doing the full measure of work, or injures the quality of the service, is not productive service. It is not difficult to correctly estimate the difference in value between the labor of an eager and commensurately paid workman and a reluctant, half paid servant, between one who works for your interest and one who works against it, and one whose chief aim is only to accomplish enough to secure his pay and retain his place.

Will profit sharing supply a sufficient impulse to so advance the whole interest of employer and employe? It is claimed to offer the safest practicable solution of the labor problem. In such event, it is claimed that the affairs and business would be kept in the hands of men of brains, skill and gumption, and at the same time preserve every incentive of self interest intact, proffering employes an appreciable share which may from time to time be distributed, and ultimately increased when results are sufficient to justify such increase.

If it has been and can be demonstrated that profit sharing pays a manufacturer, is it a sensible thing to recommend to a street railway management? If such a scheme pays the employer, it also pays the employe; hence, can it not be presumed to pay the community in general and the customer or patron who in turn increases the receipts correspondingly? Would not the adoption of such a system give a better quality of service, and thereby make thrifty citizens of a class heretofore unsteady as to habits and permanency? If profit sharing teaches employes thrift, and gives them steady employment where prudence, skill and interest mean profit, and profit means forehandedness, there can be little doubt about the betterment of his citizenship.

Profit sharing is the oil that cools the friction of interests. If a servant is given to know that a fair chance is open to him he is not indulging in inflammatory advocacy of strikes. He cannot well afford to strike against his own interests, but rather finds it to his interest to attend strictly to business. When an employer or management takes his employes into quasi-partnership, he thinks more highly of them, and by a word of encouragement and appreciation obtains more and better service than could have been accomplished under the "low wages, non-interest" system with harsh and commanding usages. There is much in favor of profit sharing, and but little against it. The strongest side considered herein is that of self interest. The question is, after considering all its social and economical relations, can it be successfully adopted by street railroad management. The proof of this does not

depend so much upon argument as upon experience. A simple plan would of necessity first be adopted which would enable the management to keep within their own knowledge the true state of affairs, earnings, etc. The workmen should share with the stockholders.

It would be difficult to determine the influence such an experiment would have upon street railway management. It would, doubtless, work admirably when business was good and profits ample, but when business was slow and there were no profits to divide, a discontent, even greater than that produced by low wages, might be expected. Such an experiment might be made for a given time—six months or a year—with no promise beyond that time. Would it not be a surprise to some managements that are not paying any dividends now to experiment with profit sharing, and thus to be able to pay a healthy dividend? It is evident that a generous business policy counts for something, and the interested co-operation of few or many employes cannot be well overlooked as an insignificant factor in the successful operation of any enterprise. Profit sharing is entitled to a fair trial in this age, and a wise self interest on the part of both employer and employed in the management of street railway systems affords an average opportunity for mutual success. R. D. F.

New Station of the Metropolitan Street Railway Co., Washington.

Within a short time ground will be broken for an electric power plant, to be built by the Metropolitan Street Railway Co., at the intersection of O, P and Four-and-a-half Streets and Delaware Avenue, Southwest, for the Four-and-a-half and Ninth Street lines. A storage battery building, machinery building, boiler house and car house will be put up, and they will occupy a frontage of 252 ft. and a depth of 512 ft.

The feature of this structure will be the corner tower, with a base twenty-six feet square and an elevation of eighty feet above the sidewalk. The storage battery building will be on the corner.

Adjoining this building on the east and fronting O Street will be located the car house, 90 × 268 ft., the roof of which will be carried upon eighteen iron trusses (ninety feet span), making one of the largest street car houses in the country. South of the storage battery building will be the machinery building, 85×69 ft., with an elevation of thirty feet to the eaves, and inclosed with a steep trussed roof. In this building will be placed the machinery.

Adjoining the latter building, and extending to P Street, will be placed the boiler house, 58×65 ft., and corresponding in elevation with the machinery building. This will contain four large boilers, two large water tanks, steam pumps, heaters, etc. A one story fuel house, fronting P Street, will be annexed to the boiler house. The feature of the boiler house building will be the smokestack, skirting with base twelve feet square up to the roof lines, and from this point the section will be made octagonal, and topped with a terra cotta capital coped with stone at an elevation of 107 ft. above the surface. The interiors of the buildings will be finished in a plain but substantial manner. All floors will be laid with granolite, and Georgia dressed pine lumber used in roof construction, and iron beams, girders, columns and corrugated iron arches enter largely into the construction.

Report of the Melbourne Tramway & Omnibus Co.

The annual meeting of the Melbourne (Australia) Tramway & Omnibus Co. was held August 9. The report of the directors showed during the year ending June 30, 1892, a profit (including £13,043 13s. 7d., brought forward from last year) of £95,715 4s. 1d. From this three quarterly dividends of 5 per cent. each had been paid, amounting to £72,000, leaving a sum of £23,715 4s. 1d. to be carried forward. The receipts had been largely interfered with by the depression which had existed throughout the year in every class of business, and until some revival took place the directors stated they could not anticipate any marked improvement, but they had no misgivings as to the real prosperity of the company when matters resumed their normal condition. To meet the lessened receipts, besides considerable savings in other accounts, large reductions had been made under the heads of directors' fees, salaries and wages, and further reductions were arranged for.

The traffic receipts for the year were £511,914 12s. 3d., a decrease of £50,626 7s. 3d. on the preceding year. The amount was made up thus: Omnibuses, £9,541 14s. 5d., being £2,082 12s. 8d. less than last year: tramways, £502,372 17s. 10d., being £48,543 14s. 7d. less than last year. During the year sixteen cable lines and three horse lines have been operated.

Passengers carried were: 43,825,439, a decrease of 4,056,125; miles run, 8,892,077, a decrease of 576,950; miles operated, 41⅝ double track, cable; and 4½ double track, horse.

Power Hack Saws.

Although the power hack saws manufactured by the Millers Falls Co., of 93 Reade Street, New York, have been on the market only a short time, they have already achieved a remarkable success. They are designed to run with a belt, and are adapted to various lengths of the Star hack saw. The manufacturers state that with one twelve inch blade they have cut off a four inch steel shaft ten times, and have run the saw steadily on cast iron for a week. Further particulars in regard to this saw can be found in the January issue of the STREET RAILWAY JOURNAL for this year. Among the users of this saw are numbered many street railway companies and other companies and individuals who have occasion to use this apparatus.

Professor Thomson on the Electric Railway.

In the following extract on the "Future of Electricity" is given Prof. Elihu Thomson's idea of the modern electric railway. He refers also briefly to developments which may be expected in the field. The article appeared in a recent number of the *New England Magazine.*

In our day we cannot, even with effort, realize how great a change was wrought in means and methods of transportation by the introduction of the steam locomotive. To do so we must make a journey through a country where the railroads have not yet gone. How vast has been their influence on the development and prosperity of a country! Even with no other means of propulsion than horses, the strips of iron or steel called rails have had an incalculable influence on the growth of cities. The horse car system, the introduction of which is within the memory of persons of middle age, is however, being rapidly revolutionized. To realize this fully, one has only to stand in or near Boston Common and to notice that on Tremont Street, which at one time was covered with poor horses struggling with their heavily loaded cars, there is now a lively procession of "electrics," or, as Dr. Holmes has quaintly called them in his charming poem, "broomstick trains." What witchery is here! Simply a great exhibition of transmission of power by electricity as applied to moving vehicles. But it is certainly more. It is a grand example of organized human effort in the solution of difficult problems. In one of its aspects it signalizes a victory even over prejudice and conservatism. It is a living testimonial of the wisdom and energy of the men who have stood back of the work and have been able in a sense to move mountains. From the engineering standpoint it has shown that even under conditions the most exacting, the electric motor has proven its merit. But those who are not familiar with such work can not realize how much of strenuous battling with obstacles and difficulties is involved in effecting such a revolution. Back of the visible expenditure of mechanical energy in moving the cars, we shall find for generating and supplying the current a gigantic power station, with its ponderous engines, dynamos, regulators, switches, together with a huge steam boiler plant, the whole constituting the largest electrical generating station in the world to-day and aggregating over 20,000 H. P. when in full work. All of this energy is put into the lines leading from the station in the form of electric current under a moderate pressure. The revolution thus exemplified in Boston is going on extensively in other places, and will constitute, without doubt, one of the most active of enterprises for a considerable time to come.

In a modified form railways in factories and mines are already being run by electricity. In such cases electric trucks or electric locomotives do the haulage work. The time is probably not far distant when there will exist electrically operated railways connecting different cities and towns wherever the traffic is considerable. The steam locomotive itself will on some roads be replaced by the electric locomotive, where the conditions are such as to warrant it. Water powers may thus be rendered available for the operation of the railways, and new water powers may be created for the operation of roads such as skirt along rivers having a sufficient fall. But it is not at all likely that the lines of road which have but a very few lines per day passing over them will be operated electrically by generating current at a station and conveying it to the moving trains. In such cases the problem is like that of the steamship, which will become an electrical ship when means are found for cheaply generating electricity from fuel carried on board. Or perhaps this and many other such problems may receive another solution. Could we, for example, consume our fuel efficiently in setting free from combination two chemical elements or substances which could afterwards be combined in a compact battery and give out an equivalent electrical energy, and were it also possible to again use fuel in decomposing for a second time, and so on, the two substances, the result would be attained indirectly. Were the processes required simple and unattended with great wastes, our much-to-be-desired cheap supply of electricity, either in a station or in a moving vessel or vehicle, might become a realization. We shall suggest this solution of the problem, without daring to prophesy that it will come to pass.

Proposed High Speed Electric Railway.

The plan for a boulevard and electric road between Baltimore and Washington has been enlarged to include Philadelphia. The company has been incorporated in Maryland as the Washington & Baltimore Boulevard & Electric Railroad Co., The incorporative act requires that work on the road shall begin within six months, and be completed within twenty-four months after the passage of the act. It is expected to run trains at the rate of sixty miles an hour.

A House Warming.

The Electrical Engineer entertained its many friends on Wednesday afternoon, October 26, in its handsome new offices in the *Mail and Express* Building, 203 Broadway, New York. An elaborate luncheon was served to the several hundred gentlemen present, who thoroughly enjoyed the hospitality of the popular staff of our esteemed contemporary whose marked success in the field of electrical journalism is so pronounced and so deservedly earned.

QUOTATIONS OF STREET RAILWAY STOCKS.

BROOKLYN STOCKS AND BONDS.—Corrected by C. E. STAPLES & Co., 215 Montague Street, Brooklyn, Oct. 19. Stock quotations are per cent. values.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Atlantic Avenue R. R. Co ...	50	1,250,000	Q.—J.	1½	.....	124	.....
Broookiyn City R. R. Co.....	10	6,000,000	Q.—J.	2	.....	212	.....
Coney Island & Brooklyn R. R. Co.....	100	500,000	Oct. 1.	4	.....	150	.....

BONDS.	Date of Issue	Amount Out-standing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Atlantic Ave. R. R. Co., 1st mort.....	.....	140,500	M. & N.	7	May. 1894	104	.....
Atlantic Ave. R. R. Co. Cons.	.....	900,000	A. & O.	5	Oct. 1909	.....	104
Broadway R. R. Co.....	.....	350,000	J. & J.	5	6 m. notice	100	.....
Coney Island & Brooklyn R. R. Co., 1st bonds.....	.....	300 000	J. & J.	5	Jan. 1909	.....	103
Coney Island & Brooklyn R. R. Co., certificates.....	.....	300,000	J. & J.	6	July, 1894	100	.....
South Brooklyn Central R. R. Co., 1st.....	.....	125,000	F. & A.	7	Aug. 1897	106	.....
South Brooklyn Central R. R. Co., 2d.....	.....	150,000	F. & A.	6	July, 1941	102	.....
Brooklyn City R. R. Co., 1st.	.....	3,000,000	J. & J.	5	July, 1916	109	.....

ALBANY STOCKS AND BONDS.—Corrected by SPENCER TRASK & Co., Bankers and Brokers, corner State and James Streets, Albany, N. Y., Oct. 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Albany R. R. Co.....	100	750,000	Q Feb.	1½	1890	121	127
Watervleit Turnpike & R. R. Co.....	100	240,000	.....	...	1863	3	.....

BONDS.	Date of Issue	Amount Out-standing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Albany R. R. Co., 1st Mort...	1865	40,000	J. & J.	5	1905	105	.....
" " " 2d Mort....	1873	20,000	M. & N.	7	1893	102½	.....
" " " 3d Mort....	1875	28,500	J. & J.	7	1895	102	.....
" " " 4th Mort...	1880	11,500	M. & S.	6	1905	102	.....
" " " 5th Mort...	1888	50,000	M. & S.	5	1913	102½	.....
" " " Consol Mtg	1890	350,000	J. & J.	5	1930	105	.....
" " " Debenture..	1891	200,000	M. & N.	6	1901	113	.....
Watervliet Turnpike & R. R., 1st Mort.....	1889	350,000	M. & N.	6	1919	115	118
Watervliet Turnpike & R. R., 2d Mort.....	1889	150,000	M. & N.	6	1919	109	113

NEW YORK STOCKS AND BONDS.—Corrected by H. L. GRANT, 26 Broad St., New York, Oct. 19. Stock quotations are per cent. values.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Bleecker St. & Fulton Ferry...	100	900,000	J. & J.	¾	.....	28	30
Broadway & Seventh Avenue..	100	2,100,000	Q.—J.	2½	.....	197	200
Cen'l Park, North & East River	100	1,800,000	Q.—J.	1½	.....	.....	150
Central Crosstown.....	100	600,000	Q.—F.	1¾	.....	135	138
Dry Doek, E. B'way & Battery.	100	1,200,000	Q.—F.	2	.. ..	126	.....
42d & Grand St. Ferry.....	100	748,000	Q.—F.	3	.....	295	.....
42d St., Manhat. & St. Nich. Av.	100	2,500,000	.....	...	.....	54	56
Eighth Avenue.....	100	1,600,000	Q.—J.	3	.....	250	.....
Houston, W. St. & Pav. Ferry.	100	1,000,000	Q—F.	2	.....	200	.....
Second Avenue.....	100	1,862,000	Q.—J.	1	.....	113	116
Sixth Avenue.....	100	1,500,000	Q.—J.	1¾	.....	195	200
Third Avenue.....	100	2,000,000	M. & N.	4	.....	203	210
23d St.....	100	600,000	Q.—F.	2½	.....	250	.....
Ninth Avenue.....	100	800,000	Q —J.	1½	.....	132	135

Bonds.	Date of Issue	Amount.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Bleecker St. & Fulton Ferry...	.....	700,000	J. & J.	7	July, 1900	112	115
B'way & 7th Ave., 1st mort....	.....	1,500,000	J. & D.	5	June, 1904	105	.....
2d mort.....	.....	500,000	J. & J.	5	July, 1914	102	.....
Broadway Surface Guaranteed	.....	1,500,000	J. & J.	5	July, 1924	104	.....
Additional.....	.....	1,000,000	J. & J.	5	July, 1905	92	.....
Cen'l Park, North & East River	.....	1,200,000	J. & D.	7	Dec., 1902	115	118
Central Crosstown.....	.....	250,000	M. & N.	6	Nov., 1922	115	.....
Dry Dock, E. B'way & Battery. 1st mort.....	.....	840,000	J. & D.	7	June, 1893	101	103
Scrip.....	.....	1,200,000	F. & A.	6	Aug. 1914	101	.....
42d & Grand St. Ferry.....	.....	236,000	A. & O.	7	April, 1893	100	103
42d St. Manhat. & St. Nich. Av 1st mort.....	.....	1,200,000	M & S.	6	Sept., 1910	110	112
2d mort.....	.....	1,200,000	J. & J.	6	1915	63	65
Eighth Ave., Scrip.....	.....	1,000,000	F. & A.	6	Aug., 1914	105	109
Houston, W. St. & Pav. Ferry.	.....	250,000	J. & J.	7	July, 1894	112	115
Second Avenue.....	.....	1,600,000	M. & N.	5	Nov., 1909	99	101
Third Avenue.....	.....	5,000,000	J. & J.	5	Jan., 1937	110	112
23d St.....	.....	250,000	M. & N.	7	May, 1893	102	104

BOSTON STOCKS.—Corrected by R. L. DAY & Co., 40 Water Street, Members of Boston Stock Exchange. Oct. 19. Stock quotations are prices per share

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
West End Pref.....	50	$6,406,000	J. & J.	4	1887	87¾	... .
West End Com'n.....	50	9,085,000	J. & J.	5	1890-1892	72⅝	72¾

PROVIDENCE STOCKS.—Corrected by CHACE & BUTTS, Bankers, Providence, Oct. 19.

Company	Par.	Capital.	Period	% last div.	Date of Issue.	Bid.	Ask'd
Pawtucket St. Ry. Co.....	100	$270,000	New.	...	Oct., 1887	92½	97
Union R. R. Co., Prov.....	100	2,000,000	Q.—J.	2	1862-1863	204	210
Providence Cable Tramway ..	100	300,000	Owned by Union Railroad Co.				

HOLYOKE STOCKS.—Corrected by J. G. MACKINTOSH & Co., Bankers, Holyoke, Mass. Oct. 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
Springfield Street R. R. Co....	100	1,000,000	J. & J.	4	.....	210	225
Holyoke Street R. R.....	100	200,000	J. & J.	4	.....	212	225
Northampton Street R. R.....	100	50,000	.....	...	.....	25	50

CHARLESTON STOCKS AND BONDS.—Corrected by A. C. KAUFMAN, Charleston, S. C., Oct. 19. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Charleston City Ry. Co.....	50	$100,000	J. & J.	3	.....	.....	65
Enterprise Ry. Co.....	25	250,000	.....	...	.....	.....	8

BONDS.	Date of Issue	Amo'nt Out-stand-ing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Charleston City Ry. Co	.....	100,000	J. & J.	6	1915	.....	.....
Enterprise Ry. Co.....	.....	50,000	J. & J.	5	1906	.....	.....

NEW ORLEANS STOCKS AND BONDS.—Corrected by GEORGE LE SASSIER, 174 Common Street, New Orleans, La., Oct. 19. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Carrollton R. R. Co.....	100	800.000	Quart.	1½	1867	132	135
Crescent City R. Co.....	100	1,150.000	"	1¾	.866	100	101½
Canal & Claiborne R. R. Co..	40	240,000	.....	...	1888	27	31
New Orleans City & Lake Co.	100	1,500,000	Quart.	1¾	1860	140½	144
Orleans R. R. Co.....	50	185,000	"	2	1868	67	68
St. Charles Street R. R. Co ..	50	600,000	"	2	1866	94	95½

Bonds.	Date of Issue	Amount Out-standing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
Canal & Claiborne Sts. R. R.	1879	150,000	A & O	6	1887	.....	.....
Crescent City R. R. 1st Mort.	1883	100,000	M & N	6	'93-'99	.....	.....
do do new	1886	40.000	M & N	6	1896	... .	.....
N. O. City R. R. Co.....	1879	495,200	J & D	6	1903	120	.....
N. O. & Carrollton R. R. Co..	1882	300,000	F & A	6	'92-'06	.....	.....
St. Charles Street R. R. Co...	1881	165,000	J & D	6	'89-'01	.....	.....

NEW HAVEN STOCKS AND BONDS.—Corrected by H. C. WARREN & Co., Bankers and Brokers, New Haven, Conn. Oct. 19. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
F. Haven & Westville R. R. Co.	25	$300,000	J. & J.	4	.....	37	.....
State Street Horse R. R. Co....	25	23,000	J. & J.	3	.....	40	.....
New Haven & W. Haven R. R. Co	25	. .....	.....	...	.....	26	.....
New Haven & Centville H. R. Co.	.....	.....	.....	...	.....	.....	.....
Whitney Ave. Ry. Co.....	50	25,000	.....	...	.....	7	.....
Bridgeport Horse R. R. Co....	100	140,000	.....	...	.....	.....	.....
Hartford & Westfield Horse R. R. Co.....	100	200,000	J. & J.	3	.....	125	.....

BONDS.	Date of Issue	Amo'nt Out-stand-ing.	Inter-est Paid.	%	Principal Due.	Bid.	Ask'd
State Street Horse R. R. Co...	1874	20,000	J. & J.	7	Jan., 1894	104	.... .
New Haven & W. Haven R. R. Co	1889	50.000	J. & J.	5	July, 1899	104	.....
Bridgeport Horse R. R. Co....	.....	50,000	.....	6	.....	.....	.....
Hartford & Wethersfield Horse R. R. Co., Deb. Series A....	1888	100,000	M. & S.	5	Sept., 1908	.....	.....
Hartford & Wethersfield Horse R. R. Co., Deb. Series B....	1890	100,000	M. & N.	5	May, 1910	.....	...
Hartford & Wethersfield Horse R. R Co., Deb. Series C. (Not yet issued).....	.....	100,000	M. & N.	5	May, 1910	.....	.....

MONTREAL STOCKS AND BONDS.—Corrected by GORDON STRATHY & Co., Members Montreal Stock Exchange, 9 St. Sacrament Street, Oct. 19. Stock quotations are per cent. values.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Montreal St. Ry.(p'd up sh.)	50	$900,000	M. & N.	4	May, '91.	245	246

BONDS.	Date of Issue	Amount Out-standing.	Interest Period.	%	Principal Due.	Bid.	Ask'd
Montreal St. Ry.....	1885	£60,000	.....	5	1905	.....	.....

LOUISVILLE STOCKS AND BONDS.—Corrected by ALMSTEDT BROS. Stock and Bond Brokers, 510 West Main Street, Louisville, Ky., Oct. 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Louisville St. Ry, Co., pref...	100	$1,000,000	A. & O.	5	Jan. 1891	90	91
Louisville St. Ry. Co., com....	100	5,000,000	.....	...	Jan. 1891	34	35

BONDS.	Date of Issue	Amount Out-standing.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Louisville St. Ry. Co., 1st mort	1890	6,000,000	J. & J.	5	1930	99	99½
Louisville City Ry. Co. Cons .	1884	1,000,000	J. & J.	6	1909	115	.....
Central Passenger Ry. Co....	1888	400,000	M. & N.	6	1908	115	.....
New Albany St. Ry. 1st Mort.	1888	150,000	J. & J.	6	1913	95	100

CHICAGO STOCKS AND BONDS.—Corrected by WILLIAM B. WRENN, 82 Washington Street, Chicago, Ill., Oct. 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Chicago City.....	100	$7,000,000	Q.—J.	3	.....	470	480
Chicago Passenger.....	100	1,000,000	A. & O.	2½	.....	99½	.....
North Chicago City.....	100	500,000	Q.—J.	7½	.....	500	.....
North Chicago Street.....	100	5,000,000	J. & J.	4	.....	270	275
West Division City.....	100	1,250,000	Q.—J.	8¾	.....	625	.....
West Chicago Street.....	100	10,000,000	Q.—F.	1½	.....	215	218

BONDS.	Date of Issue	Amount Out-standing.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Chicago City.....	.....	4,619,500	J. & J.	4½	.....	98⅜	98¾
Chicago Passenger.....	1883	400,000	F. & A.	6	1903	109	.....
North Chicago City, 1st mort.	.....	500,000	M. & N.	6	1900	101½	102
" " "	.....	1,850,000	M. & N.	4½	1927	96½	.....
North Chicago Street 1st mort	.....	2,350,000	J. & J.	5	1906	100⅝	.....
West Chicago Street.....	.....	4,160,000	M. & N.	5	.....	101½	.....
West Chicago Street, Tunnel.	.....	1,500,000	F. & A.	5	.....	.....	96¼

PITTSBURGH STOCKS AND BONDS.—Corrected by JOHN B. BARBOUR, Jr., 421 Wood Street, Pittsburgh, Pa., Oct. 19. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Central Traction R. R. Co ...	50	1,500,000	.....	...	.....	...	29¼
Citizens' Traction R. R. Co ..	50	3,000,000	J. & J.	3	.....	62½	63
Pitts. & Birmingham R. R. Co	25	3,000,000	.....	...	.....	25	25¼
Pittsburgh Traction R. R. Co.	25	2,500,000	.....	3	.....	58	59
Federal St. & Pleasant Valley	50	1,400,000	J. & J.	3	.....	25⅛	25⅝
Pittsburgh, Allegheny & Man	50	3,000,000	....	1¼	.....	44½	45
West End R. R. Co.....	50	200,000	J. & J.	...	.....	...	.....
Second Avenue R. R. Co.....	50	300,000	J. & J.	3	.....	...	.....
Penn Incline Plane Co.....	50	250,000	.....	...	.....	.....	.....
Monongahela Incline Plane Co	50	140,000	F. & A.	...	.....	.....	.....
Fort Pitt Incline Plane Co...	50	60,000	.....	...	.....	.....	.....
Mount Oliver Incline Plane Co	50	100,000	J. & J.	3	.....	.....	.....
Pittsburgh Incline Co.....	100	150,000	J. & J.	5	.....	.....	.....
Duquesne Traction Co.....	50	3,000,000	.....	...	.....	28½	28⅝

BONDS.	Date of Issue	Amount Out-standing.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Citizens' Traction R. R. Co ..	...	1,250,000	A. & O	5	1927	106	107
Pitts. & Birmingham Traction Co.....	1890	1,500,000	M. & N.	5	1929	102½	103
Pittsburgh Traction R. R. Co.	1887	750,000	A. & O.	5	1937	101	.....
Pleasant Valley Ry.....	1892	1,250,000	J. & J.	5	1919	102¼	.....
P., A. & M. R. R. Co.....	1891	1,500 000	J. & J.	5	1931	102½	102¾
Duquesne Traction Co.....	1890	1,500,000	J. & J.	5	1930	101⅛	101⅝
Second Ave. Electric R. R. Co	1889	1,500,000	J. & J.	5	1909	.....	.....
Central Traction Co.....	1889	375,000	J. & J.	5	1919	.....	.....
Union R. R. Co.....	1881	100,000	A. & O.	5	1901	.....	.....
West End R. R. Co.....	1887	75,000	J. & J.	5	1907	.....	.....
Fort Pitt Incline Plane Co...	1881	30,000	.....	6	1901	...	.....
Mount Oliver Incline Plane Co	1871	44,500	M. & N.	6	1901	.....	.....
Penn Incline Plane Co. 1st Mort.....	1883	125,000	.....	6	1903	....	.....
Monongahela Incline Plane Co.....	1887	50,000	A. & O.	5	1892	....	.....
Monongahela Incl'e Plane Co.	1887	50,000	A. & O.	5	1897	.....	.....
Pittsburgh Incline Co.....	1889	250,000	J. & J.	6	1919	.....	.....

SAN FRANCISCO STOCKS AND BONDS.—Corrected by PHILIP BARTH, Broker, 440 California Street, San Francisco, Cal., Oct. 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
City R. R. Co	100	800,000	.....	...	.....	.....	100
California St. Cable Co.....	100	1,000,000	Monthly	5	.....	114½	115
Central R R. Co.....	100	1,000,000	.....	...	.....	.....	12
Geary St., Park & Ocean R.R.Co	100	1,000,000	.....	1	.....	95	110
North Beach & Mission Ry. Co	100	1,000,000	.....	...	.....	68	72½
Ferries & Cliff House R. R. Co.	100	2,500,000	.....	...	.....	30	35
Omnibus Cable Co.....	100	2,000 000	Monthly	4	.....	48¾	50¾
Presidio & Ferries R. R. Co....	100	1,000,000	.....	...	.....	28	29¼

Bonds.	Date of Issue	Am't Out-stand-ing.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Ferries & Cliff House.....	.....	650,000	M. & S.	6	1914	101½	105
Market Street R. R.....	.....	3,000,000	J. & J.	6	913	123	.....
Omnibus R. R.....	.....	2,000,000	A. & O.	6	1918	114	.....
Powell Street R. R.....	.....	700.000	M. & S.	6	1912	110	.....
Park & Ocean R. R.....	.....	250,000	J. & J.	6	1914	.....	115¼
Park & Cliff House R. R.....	.....	350,000	J. & J.	6	.....	96	.....
Cal. St. Cable R R.....	.....	.....	.....	...	.....	105½	.....

ST. LOUIS STOCKS AND BONDS.—Corrected by JAMES CAMPBELL, Banker & Broker, 307 Pine st., St. Louis, Mo., Oct. 19. Stock quotations are prices per share.

Company.	Par.	Capital Issued.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Benton-Bellefontaine.....	100	$324,000	.....	3	1864	110	150
Cass Ave. & Fair Grounds.....	100	2,500,000	.....	...	1876	46	47
Citizens'	100	1,500,000	Oct. '91	4	1887	90	95
Jefferson Avenue.....	100	112,000	.....	..	1885	102	105
Lindell	100	2,500,000	Q.—J.	...	1890	76	80
Missouri.....	100	2,000,000	Oct. '92	2	1891	225	250
Mound City	100	1,000,000	.....	..	1890	190	200
People's.....	50	1,000,000	M. & S.	6	18-9	45	50
St. Louis.....	100	2,000,000	July '92	6	1890	150	160
4th Street & Arsenal.....	50	150,000	Jan.	.50	1872	10	12
Union Depot	100	1,200,000	.....	...	1890	200	250
St. Louis & Suburban.....	100	2,500,000	... .	...	1891	48	50

BONDS.	Date of Issue	Amount Out-stand-ing.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Benton-Bellefontaine.....	1891	$500,000	F. & A.	6	1911	102	102½
Cass Avenue & Fair Ground...	1892	1,800,000	J. & J.	5	1912	97	98
Citizens' Cable.....	1887	1,500.000	J. & J.	6	1907	106	107
Lindell	1890	1,500.000	J. & J.	5	1895-1910	99	100
Mound City.....	1890	525,000	A. & O.	6	1900-1910	105	106
Missouri Cable.....	1887	500,000	M. & S.	6	1907	102	105
People's 1st mort.....	1882	125,000	J. & D.	6	1902	102	105
" 2d mort.....	1886	75,000	M. & N.	7	1902	104	105
People's Cable.....	1889	800.000	J. & J.	6	1889-1914	97	100
St. Louis Cable.....	1890	1,500,000	M. & N.	5	1900-1910	97½	98
Union Depot.....	1890	1,000,000	A. & O.	6	1900-1910	105	106

PHILADELPHIA SECURITIES.—Corrected by ROBERT GLENDINNING & Co., 143 South Fourth st. (Bullitt Building), Philadelphia, Oct. 19. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS							
Citizens'.....	50	$500,000	Q.—J.	4	1858	260	265
Continental.....	50	1,000,000	J.—J.	6	1873	120	124
Frankford & Southwark.....	50	1,250,000	Q.—J.	5	1854	220	223
Germantown.....	50	1,500,000	Q.—J.	2¼	1858	105	107
Green & Coates...	50	500,000	Q.—J.	3	1858	120	122
Hestonville...	50	2,050,000	.....	...	1859	34	35
Lombard & South.....	25	500,000	A.—O.	8	1861	58	60
People's Common.....	25	1,500,000	M.—S.	2½	1873	52	54
" Preferred.....	25	750,000	M.—S.	2½	.....	52	55
Philadelphia City.....	50	1,000,000	J.—J.	7½	1859	151	152
Philadelphia & Gray's Ferry..	50	617,500	J.—J.	3½	1858	70	72
Philadelphia Traction (50 pd.)	50	5,000,000	M.—N.	3	1883	92	93
Ridge Avenue.....	50	750,000	Q.—J.	5	1872	225	227
Second & Third.....	50	1,060,200	Q.—J.	5	1853	160	162
Thirteenth & Fifteenth.....	50	1,000,000	J.—J.	9	1858	206½	208
Union.....	50	1,250,000	J.—J.	9½	1864	191	192
West Philadelphia...	50	750,000	J.—J.	10	1857	202	204
Metropol tan (N.Y.) Traction	100	20,000,000	Q.—F.	1	.....	118	119
Baltimore Traction.....	25	5,000,000	.....	1	1889	27½	28
Buffalo (N. Y.) Railway.....	100	6,000,000	.....	...	.....	44	45
Newark (N. J.) Passenger....	100	6,000,000	.....	...	.....	28	29
Pitts. & Birmingham Trac. Co.	50	3,000,000	J.—J.	...	.....	26	27

BONDS.	Date of Issue	Amount Out-standing	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Baltimore Traction 1st Mort .	1889	1,500,000	M.—N.	5	1929	110	111
" " Imp.	1892	1.250,000	M.—S.	6	1901	105	106
Balt. Tr., No. Balt. Div., Gold	1892	1,750,000	J. & D.	5	1942	106	107
Germantown, 1st mort.....	.....	67,000	J.—D.	5	1904	103	.....
" 2d mort.....	.....	160,000	A.—O.	5	1899	103	.....
Hestonville, 1st mort.....	.....	300,000	M.—N.	6	1895	104	.....
" " "	.....	124,500	J.—J.	6	1901	105	.....
" 2d mort.....	.....	75,000	M.—S.	6	1902	103	.....
People's, 1st mort.....	.....	219,000	J.—J.	7	1905	115	.....
" " "	.....	285,000	J.—J.	5	1911	100	.....
" Cons. mort.....	.....	247,000	M.—S.	5	1912	95	.....
West Philadelphia, 1st mort..	.....	246,000	A.—O.	6	1906	117	.....

OMAHA STOCKS AND BONDS.—Corrected by RICHARD C. PATTERSON, Banker and Broker, 907 N. Y. Life Building, Omaha, Neb., Oct. 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Omaha St. Ry. Co.....	100	5,000,000	M. & N.	....	Jan. 1, '89	60	.....

BONDS.	Date of Issue	Am't Outstanding.	Inter'st Paid.	%	Principal Due.	Bid.	Ask'd
Omaha St. Ry. Co.....	1889	2,250,000	M. & N.	5	M'y 1, 1914	95	98

CINCINNATI STOCKS AND BONDS.—Corrected by GEO. EUSTIS & Co., Bankers and Brokers, 26 West Third Street, Cincinnati, Oct. 19. Stock quotations are per cent. values.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Cincinnati.....	50	$6,000,000	Q.—J.	5	.....	109¾	110
Mt. Adams & Eden Park....	50	1,400,000	Q.—J.	5	.....	108⅝	108¾
S. Covington & Cincinnati..	50	275,000	J. & D.	6	.....	125	135
Mt. Auburn Cable.....	100	300,000	.....	...	.....	.....	.....
Cin. Inclined Plane Ry.....	100	500,000	.....	...	.....	92	95
" " " Pref.	100	100,000	.....	6	.....	99½	100

BONDS.	Date of Issue	Amount Outstanding.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Cincinnati Street.....	.....	50,000	J. & J.	7	July, 1892	.....	.....
" "	.....	50,000	J. & J.	7	July, 1893	102¾	.....
" "	.....	50,000	J. & J.	7	July, 1894	107	.....
" "	.....	50,000	J. & J.	7	July, 1895	108½	109
" "	.....	50,000	J. & J.	7	July, 1896	110½	111½
" " extended	.....	100,000	J. & J.	4	July, 1896	99¾	100¾
	.....	50,000	J. & J.	5	July, '96	102	103½
Mt. Adams & Eden Park....	.....	50,000	A. & O.	6	July, 1895	.....	.....
" " "	.....	50,000	A. & O.	6	July, 1900	104½	106
" " "	.....	100,000	A. & O.	6	July, 1905	.....	.....
" " 10-20's	.....	200,000	J. & D.	6	Je.'94-1924	105½	.....
" " Cable.	.....	280,000	M. & S.	5	Mar. 1906	104½	105¾
Cin. Inclined Plane Ry.....	.....	125,000	J. & J.	7	July, 1899	116	.....
" " " "	.....	300,000	J. & J.	6	Jan. 1914	107¾	108¼
Mt. Auburn Cable.....	.....	200,000	J. & D.	5	June, 1907	.....	90
" " 5-20's 2d.	.....	100,000	A. & O.	7	Ap.'93-1908	.....	111¼
S. Covington & Cincinnati..	.....	250,000	M. & S.	6	Mar. 1912	115	.....

BALTIMORE STOCKS AND BONDS.—Corrected by HAMBLETON & Co., Bankers, 9 South Street, Baltimore, Md., Oct. 19. Stock quotations are prices per share,

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Balto. City Pass. Ry. Co.....	25	1,000,000	Quart.	3	.....	78	85
Union Pass. Ry. Co.....	50	750,000	.....	...	.....	.....	.....
Balto. Traction Co. (Cable)..	25	5,000,000	Quart.	1	.....	27	27½

BONDS.	Date of Issue	Amount Outstanding.	Interest Paid.	%	Principal Due.	Bid.	Ask,d
Central Pass. Ry.....	1882	250,000	J. & J.	6	1912	108	109
" " " cons. mort..	1892	500,000	.....	5	.....	105	106
Union Ry. Co. 1st mort.....	.....	50,000	M. & N.	6	.....	105	110
" " gen. mort.....	.....	1,500,000	.....	5	.....	105	105½
Balto. Traction Co. (Cable)..	1889	1,500,000	M. & N.	5	1929	110	110½
Balt. Trac. Co., No. Balt. Div	1892	1,750,000	J. & D	5	1942	106	106½
" " "	1891	1,250,000	M. & S.	6	1901	105½	106
City Pass. R. R. Co.....	1891	2,000,000	"	5	1911	112	112½

WASHINGTON STOCKS AND BONDS.—Corrected by CRANE, PARRIS & Co., Bankers, 1344 F Street, N.W., Washington, D. C., Oct. 19. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Wash'ton & Georgetown R.R.	50	500,000	Q. F.	5	1863	320	.....
Metropolitan R. R.....	50	750,000	Q. J.	2	1864	96	100
Columbia R. R.....	50	400,000	Q. M.	1	1870	57	65
Capitol & North O St. R. R...	50	500,000	Q. J.	...	1875	33	.....
Eckington & Soldiers' Home.	50	352,000	.....	...	.....	25	31
Georgetown & Tenallytown..	50	200,000	.....	...	.....	.....	50
Rock Creek R. R.....	100	401,700	.....	...	.....	100	.....
Glen Echo R. R.....	50	100,000	.....	...	.....	.....	.....

BONDS.	Date of Issue	Amount Outstanding.	Interest Paid.	%	Principal Due.	Bid.	Ask'd
Washington & Georgetown..	1883	500,000	J. & J.	6	1893-1923	102	.....
do. do. convert.	'83-'91	3,000,000	J. & J.	6	1899-1929	140	150
Eckington & Soldiers' Home.	.....	150,000	J. & D.	6	1896-1911	100	.....
Capitol & North O St. R. R...	1921	240,000	J. & J.	5	1921	103½	104½
Metropolitan R. R. convert...	1901	200,000	J. & J.	6	1901	108	.....
Anacostia R. R.....	.....	200,000	A. & O.	6	1901-1931	.....	.....

ROCHESTER, BUFFALO, PATERSON, NEWARK AND COLUMBUS STOCKS AND BONDS.—Corrected by E. W. CLARK & Co., 139 So. Fourth St. (Bullitt Building), Philadelphia, Oct. 19.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid	Ask'd
STOCKS.							
Rochester (N.Y.) Ry.....	100	5,000,000	.....	...	1890	50	55
Buffalo (N.Y.) Ry.....	100	6,000,000	.....	...	1891	63	65
Paterson (N. J.) Ry.....	100	1,250,000	.....	...	1891	.....	25
Newark (N J.) Pass. Ry ...	100	6,000,000	.....	...	1890	28¾	29
Columbus (O.) St. Ry.....	100	3,000,000	.....	...	1892	55	.....

BONDS.	Date of Issue	Amount Out standing.	Interest Paid.	%	Principal Due.	Bid	Ask'd
Rochester (N.Y) Ry.....	1890	3,000,000	A & O	5	1930	94	96
Buffalo (N.Y.) Ry.....	1891	5,000,000	F & A	5	1931	91½	.....
Paterson (N. J.) Ry.....	1891	850,000	J & D	6	1931	90	100
Newark (N. J.) Pass. Ry ...	1890	6,000 000	J & J	5	1930	90	92
Columbus (O.) St. Ry.	1892	2,600,000	J & J	5	1932	94	97½

CLEVELAND STOCKS.—Corrected by W. J. HAYES & SONS, Bankers, Cleveland, O., Oct. 19. Stock quotations are prices per share.

Company.	Par.	Capital.	Period.	% last div.	Date of Issue.	Bid.	Ask'd
STOCKS.							
Broadway & Newburgh R. R..	100	1,000,000	.....	....	.....	106	110
Brooklyn St. R. R.....	100	310,000	.....	2	.....	170	175
Cleveland City Cable, common	100	4,000,000	.....	....	.....	22½	25
" " pref'd ..	100		.....	....	.....	95	105
East Cleveland R. R.....	100	2,000,000	Quart.	2	.....	166½	170
Woodlawn Ave. & West Side.	100	1,100,000	Quart.	1½	.....	136	140

Financial.

THE Columbus (O.) Street Railway Co. makes the following report for September, 1892 :

	1892.	1891.		
Gross earnings.....	$52,143.54	$43,199.12	Inc.	$8,944.42
Operating expenses.....	23,552.64	24,900.61	Dec.	1,347.97
Net earnings.....	$28,590.90	$18,298.51	Inc.	$10.292.39

$ $ $

THE Newark (N. J.) Passenger Railway Co. gives the following comparative statement of its operations for the month of September :

	1892.	1891.		
Gross earnings.....	$107,924.15	$97,472.24	Inc.	$10,451.91
Operating expenses.....	70,887.91	77,738.35	Dec.	6,850.44
Net earnings.....	$37,036.24	$19,733.89	Inc.	$17,302.35

$ $ $

THE Louisville (Ky.) Railway Co. reports for August :

	1892.	1891.		
Gross earnings.....	$111,778.51	$104,949.65	Inc.,	$6,828.86
Operating expenses....	76,047,91	68,404.80	Inc.,	9,643.11
Net earnings.....	$35,730.60	$36,544.85	Dec.,	$ 814.25

$ $ $

THE Buffalo (N. Y.) Railway Co., for the month of September, 1892, shows :

	1892.	1891.		
Gross earnings.....	$114,471.48	$87,633.65	Inc.,	$26,837.83
Operating expenses....	64,328.55	53,749.51	Inc.,	10,534.04
Net earnings.....	$ 50,142.93	$33,839.14	Inc.,	$ 6,303.79

$ $ $

THE capital stock of the Citizens' Street Railway Co., of Fishkill N. Y., has been increased to $75,000.

$ $ $

THE directors of the Brockton (Mass.) Street Railway Co. have declared a dividend of 1½ per cent.

$ $ $

THE Citizens' Passenger Railway Co., of Steelton, Pa., proposes increasing its capital stock from $100,000 to 200,000.

$ $ $

AT the annual meeting of the Plymouth (Mass.) & Kingston Street Railway Co., a dividend of 7 per cent. was declared.

$ $ $

THE Northwest General Electric Co. have declared a quarterly dividend of 2 per cent. on the common stock of October 7, payable October 15.

$ $ $

THE Columbus (O.) Street Railway Co. report receipts for September, 1892, $52,143. The receipts for the same period last year were $43,060.

$ $ $

THE Newton (Mass.) Street Railway Co. has voted to petition

the railway commissioners for an increase of capital, the amount not to exceed $100,000.

$ $ $

THE Rochester (N. Y.) Street Railway Co. report receipts during September, 1892, $66,213. For the same period last year the receipts amounted to $56,043.

$ $ $

THE gross earnings of the West End Street Railway Co., of Boston, for September were $606,000, or $67,141 more than for September, 1891. This shows an average daily taking of $20,200, repreenting over 400,000 fares.

$ $ $

THE Worcester, (Mass.) Leicester & Spencer Railway Co.'s directors have voted to pay a dividend of $4 a share on the earnings of the month of September, payable November 15 to all stockholders of record November 5.

$ $ $

AT a meeting of the board of directors of the Northwestern Street Railway Co., of Chicago, held September 19, at their office, 79 Clark Street, it was decided to increase the capital stock of the corporation from $25,000 to $100,000.

$ $ $

KOUNTZE BROS. and Clark Dodge & Co., of New York, and Lee, Higginson & Co., of Boston, offer for sale $1,000,000 of 5 per cent. cable consolidated bonds of the St. Paul Street Railway Co. at 95 per cent. and accrued interest.

$ $ $

ON September 29, at a meeting of the Norwalk (Conn.) Tramway Co., the capital stock was raised from $30,000 to $70,000. The road is under contract, that at least one and a half miles are to be constructed and in operation before January 1, 1893, and the remainder on or before June 1, 1893.

$ $ $

THE Philadelphia Traction Co. are showing an increase in gross receipts over last year of about $1,000 a day. The gain during September was $29,003.00; in August, $32,944.00. The gross receipts during September, 1892, were $399,670.90. The day of greatest traffic was September 17, when $15,838.00 was taken in.

$ $ $

THE gross receipts of the Baltimore Traction Co. during September 1892, were $81,648.00; during September, 1891, the receipts were $58,086.00. The gross gain from January 1, to September 30, was $150,710.00. The day of greatest traffic during September was September 17, when the receipts amounted to $3,844.00.

$ $ $

THE stockholders of the Pittsburgh (Pa.) & Birmingham Traction Co. met October 11. The secretary's report for the year ending on July 1, showed the gross earnings for three months past to be $89,132.71; expenses $39,585.20, leaving the net earnings at $49,451.51. It was decided by the meeting to issue bonds on the Knoxville branch of the road.

$ $ $

THE *Worcester* (Mass.) *Telegram* says the Worcester Consolidated Street Railway Co.'s stock is considered to be practically sold to a syndicate representing Philadelphia and New York capitalists, through the banking houses of E. W. Clark & Co., of Philadelphia, and H. B. Hollins & Co., of New York. The latter concern is supposed to be a Vanderbilt house.

$ $ $

THE annual report of the Springfield (Mass.) Street Railway Co. is as follows: Increase of capital stock, $650,000 to $1,000,000; increase in number of miles run, 758,608 to 1,088,965; increase in number of passengers carried, 4,391,251 to 6,395,519; increase in amount of track operated, 21⅝ to 32½ miles; total earnings, $333,550; expenses, $251,001; interest, $3,473; 8 per cent. dividend, $44,000; surplus, $34,476.

$ $ $

THE Interstate Bridge & Street Railway Co., of Omaha, Neb., which was organized by the East Omaha Co. several years ago, has changed its name to the Omaha Bridge & Terminal Co., and increased its capital to $7,500,000. A loan for $5,000,000 has been already placed. it is said, with Drexel & Co., of Philadelphia, and a mortgage for that amount has been placed upon the plant, the money to be furnished as required in the progress of the work.

Lamp Decision.

A decision was rendered October 4 in the United States Circuit Court of Appeals, by Judge Lacombe, in the case of the Edison Electric Light Co. *vs.* the United States Electric Lighting Co. This case has been before the courts for about five years, and the decision rendered was in favor of Edison and awarded him the right to be considered as the inventor of the incandescent electric lamp as used to-day. The case was brought up on appeal from the United States Circuit Court, where a decision by Judge Wallace had been rendered, July 14, 1891, in favor of the complainant.

In the decision the various defenses based upon the phraseology of the patent in suit, and upon the termination of the Edison Canadian patent, and certain technical defenses in reference to the title of the complainant were carefully considered by the court and overruled. The conclusion of the court is that the defendant's lamps are plainly infringements of the second claim of the patent and that the facts do not make out "a case that the injunction should be refused on any theory of laches or equitable estoppel by reason of undue delay in bringing suit, or acquiescence in known infringements."

The patent thus upheld was No. 223,898, and was granted to Thomas A. Edison, November 4, 1879. Its four claims are:

1. An electric lamp for giving light by incandescence, consisting of a filament of carbon of high resistance, made as described, and secured to metallic wires, as set forth.

2. The combination of carbon filaments with a receiver made entirely of glass and conductors passing through the glass, and from which receiver the air is exhausted for the purposes set forth.

3. A carbon filament or strip coiled and connected to electric conductors so that only a portion of the surface of such carbon conductors shall be exposed for radiating light, as set forth.

4. The method herein described of securing the platina contact wires to the carbon filaments, and carbonizing of the whole in a closed chamber, substantially as set forth.

Storage Battery Decisions.

On October 4 the United States Circuit Court of Appeals for the Second District, handed down two important decisions effecting storage battery interests. The first was in the case between the Brush-Swan Electric Light Co., of New England, and The Brush Electric Co., and was decided in favor of the latter company, reversing the decision of the lower court. The action was brought to enforce a contract by which the Brush-Swan Electric Light Co. acted as exclusive agents of the Brush Electric Lighting Co. in certain territory.

The contract was made May 23, 1878. The Brush-Swan company's

business was to furnish electrical machinery bought by it from the Brush Eelectric Co. at a discount of about 20 per cent. The agreement made in 1878 was to continue in force for seventeen years, unless sooner abrogated by mutual consent or by the decision of arbitrators. It was agreed that if at any time the pecuniary responsibility of the Brush-Swan company became so impaired as to be insufficient to enable the Brush Electric Co. safely to transact the business in the specified territory through them the contract should be dissolved. On October 27, 1887, the Brush Electric Co. declared the contract annulled and refused to deliver any more goods. To compel a specific performance of the contract, suit was begun by the Brush-Swan people.

When the case was brought for trial before the Circuit Court, the only question in doubt was whether the Brush-Swan company had violated the contract so as to justify the Brush Electric Co. in declaring the contract annulled. The Circuit Court held that there had been no breach of contract on the part of the Brush-Swan company. The Court of Appeals, however, reverses that decision with this remark:

"In our view, the complainant is asking a court of equity to compel the specific performance of a contract which it has not kept, which it cannot truthfully assert that it will keep, and which apparently it cannot help violating, and desires to compel the defendant to furnish it with merchandise which it cannot pay for and the ultimate payment for which it cannot attempt to secure."

The second decision was in the case of the Electrical Accumulator

SPECIAL NOTICES.

FOR SALE.

FOR SALE.—30 twelve-foot cars, one-end type, with one fare box; in fair order. Gauge 4 ft. 8½ in. For all particulars apply to METROPOLITAN RAILROAD CO., Washington, D. C.

FOR SALE.—Fifty-one ten foot, second-hand, one-horse, closed cars. Gauge, 4 ft. 8½ ins. These cars were built by Stephenson and by Jones, well known manufacturers, are in good condition, and will be sold at a reasonable price. Address, GEO. WHITE, President Belt Railway Co., Washington, D. C. 1t

HELP WANTED.

WANTED.—A bright young man, acquainted in Western New York, to solicit trade in a mechanical line. Address, "MECHANICAL," care of STREET RAILWAY JOURNAL, New York. 1t

WANTED.—An additional belting salesman this fall. Young, energetic, capable man to represent standard goods in New York or New Jersey. ENGINEERING EQUIPMENT CO., 143 Liberty St., New York.

POSITIONS WANTED.

WANTED.—Competent and Experienced Draughtsman in Car Work seeks re-engagement. First-class credentials. Terms moderate. Addre s, "WHITLEY," care of STR ET RAILWAY JOURNAL, New York. 1t

WANTED.—Mechanical engineer, college graduate with extensive practical business and engineering experience in construction work, desires permanent position. Address H. A. Z., care STREET RAILWAY JOURNAL. 2t

WANTED.—Position as Superintendent of a Street Railway. Fully competent to take charge, having had ten years' experience on both horse and electric lines. Address, "SUPERINTENDENT." care STREET RAILWAY JOURNAL, World Building, New York. 1t

WANTED.—Position wanted by thorough practical and theoretical electrician of 10 years' experience in the different departments of the electric business. Considerable experience in railway work. Address S. H., care STREET RAILWAY JOURNAL, New York. 2t

WANTED.—By a Practical Man, position with Street Railway Company as Superintendent or Manager. Have had experience with Electric Steam Motor and Horse Lines. Satisfactory references as to ability and character in the construction, operation of Street Railways and Surburban Lines. Address, "STREET RAILWAY," 6,608 Evans Ave., Chicago, Ill.

WANTED—A position as chief engineer by a thoroughly competent man who understands doing all repairs, and also understands repairing and managing railway generators and motors, having had charge of the assembling and testing those machines in the Thomson-Houston works; also understands wiring and repairing cars. Can take entire charge of mechanical department of power house and station. Can furnish the best of city reference in Brooklyn and New York. Have first-class papers from both cities. Address ECONOMICAL, STREET RAILWAY JOURNAL.

WANTED TO PURCHASE.

WANTED to Purchase Entire Issue of Good Street Railway Bonds. Correspondence solicited. Address, V. I. HASKELL, 39 Dey St., N. Y. City

Co., *et al.*, appellee and defendant, *vs.* the Brush Electric Co., appellee and complainant.

The question before the court was an appeal from a decree of the Circuit Court for the Southern District of New York which enjoined the Electrical Accumulator Co. against the infringement of the 7th and 14th claims of the Brush patent No. 266,090, October 17,1882, and the 1st, 2d, 3d, 6th, 7th and 12th claims of the Brush patent No. 337,299, dated March 2, 1886, for improvements in secondary batteries.

In discussing the latter patent the court first referred to the question of the novelty of the invention, taking into account the claims to priority of Camille A. Faure. This was disposed of by reference to Judge Coxe's recent decision which limited Faure's claims to the application of active material in the form of "paste, paint or cement." The inventions of Percival and Leclanché are disposed of as follows by the court. "These do not affect Brush's patent. Not only the invention, as described in the 1st, 2d and 3d claims, belongs to him, but he was the first who rammed or pressed the dry powder, the form in which his absorptive substance was used, into grooves or receptacles in the plates, as described in the 6th and 7th claims."

The court then discusses the validity of the various claims, which were solely the subject of appeal, in view of other patents to Mr. Brush of a prior or of the same date, including the Italian patent. On these points the court paraphrases Judge Coxe's previous decision which mantains the full scope of the claims, 1, 2, 3, 6, 7 and 12. In respect to the patent No. 266,090 the court holds that the broadening of the scope of the patent by the insertion of new matter while the patent was pending in the Patent Office should not have been allowed by the latter, and hence it takes a narrower view than that held by Judge Coxe who found an infringement by the defendants of two claims only. As construed by this court there is no infringement of patent No. 266,090.

The decree of the lower court is modified to the extent indicated above, with costs to the appellants. In other respects the decree of the lower court is affirmed.

Coverings for Steam Pipes.

In the transmission of steam in pipes the question of loss of power by radiation of heat should be as carefully attended to from an economical standpoint as that of loss of steam through leaks. Unfortunately, while the condition of the iron pipe is made the subject of careful inspection, the condition of the pipe covering is often shamefully neglected, and not only is leaky covering continued in service but, materials are used which, as regards the radiation of heat, are about as efficient as would be a perforated pipe for the restraining of pressure.

Of the various materials used in insulating pipes the most universal is asbestos fibre. In greater or less proportion it enters into the composition of nearly every pipe covering found in the market, and yet by a strange inconsistency, asbestos is itself a most excellent conductor of heat, and by itself assists rather than retards the loss of heat from the steam. This material is employed, however, because the conditions of service require a fireproof material, and also because its lightness and loose or porous structure, make it of value as a bond-fibre for the covering. On the other hand, the air inclosed within the material has high value as a non-conductor, and in some coverings constitutes the only offset to the heat conductivity of the asbestos.

We may therefore consider that the conditions of highest efficiency of a steam pipe covering depend, first, directly on the quantity of inclosed air, second, inversely, on the quantity of asbestos fibre used for bonds, and third, inversely, on the heat conductivity of the third material.

These qualifications appear singly and in combination in the various kinds of coverings now on the market. Thus we have asbestos and sponge, plaster of Paris and asbestos, and the combination of carbonate of magnesia and asbestos. In regard to the latter, the manufacturers of it claim that it has special value for this purpose because it is the lightest material used, and it contains the most air with the minimum of asbestos only 6.85 per cent. The magnesium carbonate, they state, is one of the very best non-conductors of heat known to chemistry, and that in practice this covering seems to meet the requirements with a surprising degree of efficiency.

Great Railroad Traveling.

"I happened to take the 10:30 A. M. train the other day, from Chicago, on the Lake Shore and N. Y. Central, and thought the entire trip would be a bore," said Geo. W. Lederer to a DRAMATIC TIMES reporter. "But imagine my surprise, when I found upon entering the train, a *fac-simile* of their famous Chicago limited, and positively the same comfort, convenience and equipment which I have so often enjoyed on the latter. I arrived in New York City at 2:10 the next day, the train being on time to the minute, and had sufficient time left that day to transact a great deal of very important business. I shall return again to Chicago on the very same train, as it leaves here at 1.55 P. M., and gives me a good half day to settle up my unfinished business."—*New York Dramatic Times.*

The 10:30 A. M. train to which Mr. Lederer refers, is the popular "Chicago and Boston Special," the latest addition to the train service of the Lake Shore & Michigan Southern R'y. The equipment, which is of Wagner build, consists of two Vestibule Sleeping Cars, one Vestibule Buffet Smoking and Library Car, running through to Boston, arriving at 3:40 P. M. next day; one Vestibule Sleeper through to New York, arriving at 2:10 P. M.; a vestibule Dining Car, Chicago to Cleveland, and Utica to Boston, and day Coach, Chicago to Buffalo, and Buffalo to Boston.

The train leaves daily from Van Buren Street Station at the hour named above, and is the greatest favorite with business men and tourists, as by it not only are the cities on the B. & A. R. R. reached early in the afternoon, but the Atlantic Coast resorts are reached before dark.