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Changes of advertising copy should reach this office by 10 a. m. Monday preceding the date of publication, except the first issue of the month, for which changes of copy should be received two weeks prior to publication date. New advertisements for any issue will be accepted up to noon of Tuesday for the paper dated the following Saturday.

Of this issue of the Street Railway Journal, 8200 copies are printed. Total circulation for 1906 to date, 326,700 copies, an average of 8167 copies per week.

Car Cleaning by the Transportation Department or the Mechanical Department

The question often arises as to how far the responsibility of the department in charge of the maintenance of the rolling stock shall extend, and in what condition the cars shall be turned over to the transportation department. On some systems the car cleaning is carried out by the transportation department, and again this work is found in charge of the master mechanic. There are good arguments for and against both practices. When the car is on the road the conductor is usually held responsible for the cleanliness of its interior, and especially of the floor. If he tries he can prevent considerable dirt being brought into the car, can stop spitting on the floor, and he can, and on many roads is compelled to, sweep the floor at frequent intervals. The conductor, of course, is under the superintendent of transportation, and if the cleaning of cars comes under the transportation department he can be censured directly when it is found that he is not keeping his car in proper condition. But if the master mechanic's department has charge of the work and cars come in unusually dirty, any complaint as to the condition of the cars as regards cleanliness must be sent through several channels before it reaches the man at fault, consequently much of the effect of the complaint will be lost through the attendant delay. Again, all complaints from patrons of the line concerning the conduct of trainmen and the condition of the car usually come direct to the superintendent of transportation, and when the car-cleaning force is under him this superintendent may personally reprimand those at fault.

On the other hand, so far as the cleaning concerns the upkeep of the car this work rightfully belongs to the car maintenance department. It is well known that the car cleaner can keep the dirt off the car at a reduced cost if he has no regard for the varnish or the paint. The fact that the transportation department is not responsible for the condition of the paint and varnish is likely to result in lack of care as to the nature of the cleaning compounds used. We do not mean that the operating department will injure the varnish intentionally, but in many cases as vigorous efforts to avoid injury will not be made as when the car cleaning and car maintenance departments are under the same head.

On city lines when, during the morning and evening rush hours, all of the available cars are in service, and when at all other hours the yards are full of cars, there is an additional advantage gained by putting the car cleaning department in charge of the car maintenance department. When the departments are distinct the car cleaners are often idle during the rush hours because there are no cars in the yards to be worked upon. When the cars begin to come in after the rush hours the car inspectors and the cleaners are likely to get into difficulties due to the fact that both want to work on the same car at the same time.

When the inspectors, repair men, and cleaners are under the same head, the men may be taught to inspect cars and do repair work on them as well as to clean them. They may then be made to change from one kind of work to another in order to keep busy. During the rush hours the cleaners may be kept at repair work on the disabled cars in the shop, and when the cars begin to come in they can assist the regular repair men and inspectors to set the cars.

The cleaning of cars, moreover, is usually done in a repair house or in an adjacent building. At any rate, the men of the

shop department proper and of the cleaning department are usually working side by side, and it is therefore desirable to have them under one head.

A Standard Brake-Shoe

The adoption of a standard brake-shoe that is now under consideration is a problem of no mean proportions, owing to the multiplicity of conditions that have to be considered. Laying aside for the present the matter of form, which should be such that it is applicable to all classes of trucks and diameters of wheels, a discussion on the character of the metal to be used may not be out of order. According to the best experience the proper composition of a brake-shoe varies according to local conditions, of which the chief are the class of service in which the shoe is to be used and the type of wheel to which it is to be applied.

In the first place, people are apt to confuse friction with abrasion. The common illustration of frictional resistance is that of a number of saw teeth being dragged over each other and the lifting of the point of one over the point of the other. If these teeth mesh with each other the lift is naturally higher and the consequent resistance greater than where they do not mesh. Hence the coefficient of friction is naturally greater between similar than between dissimilar substances. The resistance of abrasion is that due to the wearing away of the points of these saw teeth. Of course there can be no frictional action without some abrasion, but it is a delicate point to determine just where the resistance due to one leaves off and that of the other begins.

We know, for example, that the coefficient of resistance of a soft cast-iron shoe is approximately .28, while that of a hard one is .18. We also know that for the same pressure and service performed the wear of the soft shoe is about 16 per cent greater than that of the hard. These figures are given for the purpose of comparison only because, as a matter of fact, the soft cast-iron shoe is not used widely in practice, because of its rapid rate of wear and short life. But this very extreme shows what exists to a less degree through the several brake-shoe metals and marks the fact that the cost of the metal abraded and the time required to effect renewals, due to the frequency of the same, are elements affecting the advisability of using one or the other from the commercial standpoint of the cost of brake-shoes, while the final solution is complicated by the relative wear of the wheel as subjected to the action of the two. On this latter point we have comparatively little information.

In the elaborate series of brake-shoe tests made under the auspices of the Master Car Builders' Association a number of years ago, the idea of weighing the wheels after the service test was abandoned on account of the difficulty of accurately determining the loss of a small weight from so great a mass as a pair of wheels with their axle. Casts were made, however, of the treads, and these seem to indicate that, on chilled cast-iron wheels, there is but little, if any, difference in wear with plain shoes of different qualities of metal, though where there were inserts that could form cutting edges that of steel wheels was markedly increased, while the chilled cast-iron wheel remained about the same. Whether these results would be confirmed in a test on street cars where track conditions are different remains to be seen, though it seems probable that they would, because of the essential duplication of steam railroad experience in urban service along other lines affecting the wear of wheels.

As far as the coefficient of friction is concerned, it is a matter of comparatively minor importance. Of course it is desirable on general principles that this coefficient should be as high as possible, so that a corresponding reduction may be made in the diameter of brake cylinders and the weights of the operating parts. But when it comes to efficiency, the same retarding force can be obtained with a brake having a low coefficient of friction as with one that is high by merely making a corresponding increase in the pressure with which it is applied: the chief point being that the narrowest safe margin possible shall be left between the retarding effect of the shoe and the adhesion of the wheel to the rail.

As for the best form of shoe, the experience of the steam roads should have an influence; though, perhaps, it may not be well to let it act as an exclusive guide. The beauty of the M. C. B. Christie brake-shoe is its symmetrical design with a central lug always of the same height and width and opening, so that no matter what brake head has to be attached to a variety of beam connections, that part of the head which engages the lug of the shoe is the same in all heads, and the same brake-shoe can be applied to all heads. As the shoe is symmetrical as regards the head connection, it can be used on either end of the brake beam. With this arrangement the waste of metal in the worn shoe is apparently reduced to a minimum, while recent designs have made it possible to so strengthen the shoe that breakages even when worn exceedingly thin are very rare. The difficulty that arises in the adoption of this sort of a shoe in street railway work lies in the persistency with which street railway officials are squeezing the wheel base of the trucks and the equal persistency in insisting upon inside-hung brakes. In a great many cases it may be necessary to detach the brake head as well as the shoe, in removing worn shoes and applying new ones, for the reason that there will not otherwise be enough room to slide in a flange shoe between the head and the wheel. But the adoption of a uniform design of shoe and head connection to receive the shoe will simplify things wonderfully. From an operating standpoint the inside-hung brake is undoubtedly to be preferred to the outside-hung pattern in decreasing the disagreeable features of brake application, but it is doubtful if the short wheel base is a paying proposition.

An investigation will undoubtedly show that the long wheel base truck will pass curves as easily if not more easily than one where the distance between wheel centers is less than the gage of the rails, so that, under ordinary working conditions there is no advantage to be gained by cutting the wheel base down to less than 5 ft. If this is found to be the case, then it would seem that the committee of the Engineering Association which has this matter in charge is warranted in deciding upon a design of shoe regardless of the requirements to be met in many of the trucks of exceedingly short wheel base that have been built. This is not saying that the Christie design, adopted by the Master Car Builders' Association, is the one best adapted to urban service, but that its essential characteristic of an easily removable and renewable shoe is one that should and probably will receive most careful consideration. The shoe can be made so as to be applied on either side of the truck; and if it is found that a shoe on one side is wearing tapering it may be reversed and applied on the other side of the truck so as to get the full wear from the shoe before scrapping.

So while the problem of the selection of the best form and substance for a standard brake-shoe is not one that can be

solved offhand, it does seem that there are enough data at hand upon which a wise and satisfactory recommendation can be based, the adoption of which will tend to the economic advantage of the railroads and which can be changed if, at any time, any additional data may be obtained from experience or observation that will make a modification of the standard advisable.

The Farmer and the Interurban

The American farmer is a rather conservative personage, and this fact is no doubt largely responsible for the opposition he formerly showed to proposed interurban roads. Of course those farmers whose land lay in the immediate path of the road were the most vigorous in discouraging the new road, but others a mile or more away from the right of way also declared themselves in many cases as objecting to its construction. We are glad to note, however, that this opposition is being rapidly replaced in the Middle West, where the advantages of interurban lines are best recognized and where they have received their fullest development, by offers of special inducements to have a proposed line built. In fact, in some communities the farmers are so enthusiastic that they make every effort to get a road through districts that are not thickly enough settled to support a road. Moreover, instead of trying to get the road built across their neighbor's land they often endeavor to have it pass through their own and within a few hundred feet of their residence. The only exception to this rule is that they do not want the right of way to pass diagonally through their farms. To this plan almost any farmer will object seriously. All prefer rectangular fields, and nothing will call forth condemnation more quickly than a scheme to cut their farms up into angular patches.

The change in the attitude of the farmers through the Middle West has come about simply through learning how such roads benefit the agricultural interests in the communities through which they have been built. Such information has been gained by general reading, as in newspapers and periodicals of various kinds, and farm journals have teemed with the subject during the last few years.

Some interurban systems, we must acknowledge, are not of much use to the farmers along the line. We refer to those roads which cater particularly to through passenger service and offer few if any special inducements for the farmer to use the road. Such roads are of little more benefit to him than the steam railroad with its two or three trains a day which stop at his station. Again, some interurban roads make the mistake of not going after the farmers' business in the proper manner. As we have just said, farmers are conservative. It has been their habit probably for years gone by to drive 10 or 15 miles to town once or twice a week. Such a trip requires a day's time of both farmer and team. Unless an agent of the road gets out among the farmers and shows up to them in dollars and cents just how much they are losing by driving to town when they could drive to an interurban station, board the car, make the required trip to town and be back again in one-third the time required to drive in, the farmer is likely to continue to pursue his old method. But if he can be broken of the habit, the passenger receipts of the road will be increased materially. And after he fully appreciates the convenience of and the saving effected by the interurban, certainly the road will have no warmer friend than he.

Cutting Down the Sub-Station Labor Item

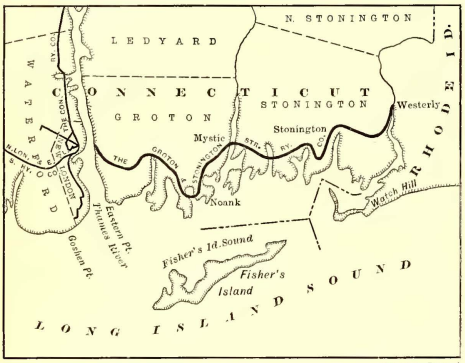
In the last few years sub-station apparatus has been improved and automatic devices have been developed to such a point that very little training is required by a man of ordinary intelligence to operate a rotary converter sub-station as long as there are no derangements of the apparatus or as long as nothing goes wrong. As a consequence we frequently find employed in the smaller sub-stations men who have no electrical training whatever and who know practically nothing about the machinery, other than the operations they are told to go through when starting up or shutting down the machinery. The employment of such men reduces considerably the cost of labor, as they can usually be obtained at a much lower price than men with some mechanical and electrical knowledge. These cheaper men, however, should not be employed where serious results will follow if the station is unexpectedly shut down for an hour or two at a time.

There are many small roads upon which the schedules are slow, the runs short, or layovers at the ends of the line of such duration that the cars can be operated with very little inconvenience when one of the sub-stations is shut down for a few hours, and in such a case it is often a very sensible and very economical move to employ cheap labor in the sub-stations. But when this is done the man employed should be given to understand thoroughly that he is not to attempt to repair apparatus in case anything goes wrong. If he were to make such an attempt his ignorance of the machinery upon which he is working might cause him to endanger himself and probably cause him to injure the apparatus to such an extent that it would have been more economical to have employed a higher-priced man in the first place. He should be instructed simply to telephone for help when anything out of the ordinary happens to the machinery, and then to sit down and wait patiently for its arrival. And, too, when such men are employed, frequent and thorough inspections of the sub-stations should be made by competent men in order to catch any loose connections, loose bolts, undue wearing of parts or anything of a like nature which might with a few weeks' neglect result in serious damage.

Rather than employ the cheapest labor obtainable and run the risk of getting the densely ignorant type of man who at a critical moment is likely to do exactly the wrong thing, it is better, where possible, to combine the sub-station man's work with some other duties so that the sub-station labor item can still be kept low, yet a man of intelligence can be left in charge. Often it is possible to build the sub-station in connection with a freight and ticket office, and in such an instance the agent can operate the sub-station machinery. Whenever the operation of the cars is dependent entirely on one sub-station, it is of course very necessary that the man in charge have a general electrical knowledge and that he know the connections and the switchboard thoroughly, so that he may be able to make repairs of a temporary nature or change connections without delay when necessary in order to keep the station in operation. Such a man, of course, demands fair wages. But a man of this type is usually capable of doing electrical repair work of the better class, and as there is always plenty of this to be done on the system, the cost of operation of the sub-station can be cut down by bringing such work to him and charging a portion of his wages to other accounts. Wherever possible, this plan in general appears to be the better one, and in the long run it may be found to be the cheapest.

THE GROTON & STONINGTON STREET RAILWAY

When the Groton & Stonington Street Railway Company was organized in the spring of 1903 to build a line from Groton, Conn., to Westerly, R. I., it was freely predicted that the project would not pay, owing to the small population along the line and the fact that the towns to be served were already connected by a steam railroad. That there was some ground for this opinion is apparent from the population sta-



ROUTE OF THE GROTON & STONINGTON STREET RAILWAY, ALONG THE CONNECTICUT SHORE LINE, SHOWING ALSO CONNECTING TROLLEY LINES AT NEW LONDON

tistics, which show a total of about 18,000 inhabitants for the 18 miles of the route, or 1000 per mile, including the terminals. But in this instance conclusions based on such data proved misleading, for the scenic features along this line are so attractive that it has since been noted many people will travel 10 to 20 miles on connecting lines to enjoy a trip on the Groton & Stonington. Hence the tributary population may be considered as extending to within several hours' ride of the terminals to such towns as New London (17,548), Norwich (24,637) and Willimantic (8937). In fact, one of the most popular trolley excursions in Connecticut is to travel down from Willimantic by way of Norwich to New London along the west bank of the beautiful Thames River, and thence cross by ferry to Groton to continue the trip to Westerly and Watch Hill.

A glance at the accompanying map, while showing the irregularity of this portion of the coast line of Connecticut, conveys no adequate idea of the picturesque character given to it by the numerous estuaries of the sea, the rocky peninsulas of the islands and the quaint villages. It will be noted that the Groton & Stonington Street Railway is so laid out as practically to follow the coast. Naturally a line with such a tortuous course is not one to attract patronage by giving a high-speed service, nor was the attainment of such speed the intention of the projectors. In general the public highway is used, so that nearly all the inhabitants of the region are within easy reach of the railway. The many bays and water courses made a straighter route prohibitive from the standpoint of cost aside from the fact that much of the charm of the ride would be lost if the line did not follow the many twists and turns of the shore and climb up hill and down dale in the manner so relished by those who ride for pleasure rather than for business. Of course, as this class of traffic is of importance only for a few months, it must not be supposed that means for securing good all-year business are neglected. Connecticut towns are famous for their manufacturing industries, and the mill workers must be transported to and from their homes morning and evening. Besides this, the maintenance of a liberal and accurate schedule during the rest of the day attracts many short-distance riders.

Starting from the Groton ferry opposite the prosperous town of New London, the Groton & Stonington Street Railway passes through long stretches of quiet woods and pleasant homesteads; past the granite shaft and bust erected to John Avery, of Puritan fame; over the half-forgotten battle fields of the Pequot Indians, thence to the shipyards at Noank and Mystic; along the "rock-bound coast" and over hills from which are obtained glimpses of Fisher's Island, Block Island, Long Island and famous Watch Hill; into the quaint town of Stonington, and finally to the State line to Westerly, the home of Rhode Island's granite industry. From Westerly, connections can be made with a line running to Watch Hill.

TRACK AND OVERHEAD CONSTRUCTION

The line is single track except for five turnouts, and totals 20.7 miles for the 18 miles between Groton and Westerly. Seventy-lb. T-rails are used throughout, laid on gravel ballast on standard wood ties and double bonded with "Protected" bonds. Despite the fact that the line follows the shore highway so closely, quite a number of short trestles and bridges had to be erected in addition to the three overgrade and two undergrade steam railroad crossings. The general type of the bridge and trestle work is shown in some of the accompanying illustrations.

The overhead construction is principally of side-span type

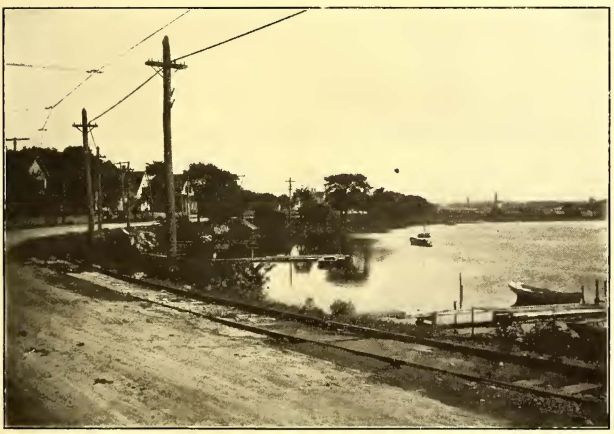
WAITING FOR THE CAR NEAR DEVIL'S FOOT HILL, JUST BEYOND NOANK

with wood poles spaced 125 ft. The trolley wire is No. 00. The poles carry a telephone wire and 500,000-circ. mil feeder cables, two running each way from the power house.

CAR HOUSE AND ROLLING STOCK

The car house is adjacent to the power station, and has six tracks, affording room for eighteen cars. For general inspection two of the outer tracks are furnished with pits and one corner of the building is walled off as a room for minor repairs. The number of cars operated by the company is too small to make it worth while to have a winding room. The company has just purchased a Wright lathe, however, which will be used for a variety of purposes, including the turning of steel wheels. This machine has a 40-in. swing on a 16-ft. bed, and will be run by a 5-hp Crocker-Wheeler motor. Owing to the many curves on the line the company has found it advisable to use on its closed cars the steel wheels made by the Standard Steel Company; on the open cars 500-lb. Griffin wheels are used with good results. The first pair of steel wheels was put on in July, 1905, and is still in service, having been returned. At present 58 wheels are in use, but the experience with them on a mileage basis has not been long enough to allow the presentation of any conclusive data.

The original rolling stock consisted of eight closed cars and the same number of open cars, all made by the Jewett Car Company. These cars are mounted on Peckham M. C. B. swivel trucks No. 18 C X, furnished with Westinghouse 68-C motors and corresponding controllers, Ham sand boxes, Barbour-Stockwell gray cast-iron brake-shoes, Climax combination arc and incandescent headlights, Wilson trolley retrievers, etc. Four of the closed cars are of the convertible type and four of the regular winter type, all being 29 ft. 4 ins. over the body and 40 ft. over all. Four of the original open cars have thirteen benches and the others fifteen benches. Owing to the heavy travel this season two fifteen-bench open cars have been added.



ON THE ROAD TO WESTERLY, R. I.

In addition to these cars the company owns a Taunton double-truck, four-motor snow plow and an old passenger car which is used for repair work. This car has been replaced by a new work-car and is now used for the express package business which the company started on Oct. 1 with three trips a day.

POWER HOUSE

The power house is located at Mystic, which is about the middle of the line. As the distance to the terminals is therefore less than 10 miles each way, and only a few hundred kilowatts capacity are required for the service, a direct-current station was deemed better than an alternating-current plant with sub-station. The building is located along the bank of the Mystic River and is constructed of brick walls resting on a natural rock foundation. The boiler room is located at a lower level than the engine room, and is 71 ft. long by 37 ft. 6 ins. wide. The equipment consists of three hand-stoked Stirling boilers, each of 200-hp capacity. In another room on the same level and alongside the boiler room are located the feed pumps and heaters which, together with the jet condenser placed in the basement of the engine room, are of the Stillwell-Bierce & Smith-Vaile type. Next to this room is installed one Green fuel economizer, containing 2304 sq. ft. of heating surface. The economizer is composed of thirty-two sections, each section containing six tubes, 4 9-16 ins. external diameter by 9 ft. long, connected at the top and bottom by headers, and provided with self-acting, triple-bevel edge scrapers, lifting bars, guards, rods, chains and improved scraper gear with positive reversing lever. It is guaranteed to show a saving of at least 8 per cent in fuel, under the consumption required when operating the plant without the economizer in service. The scrapers are operated by a 2-hp Crocker-Wheeler motor. This economizer has been installed nearly two years, and to date the company has not been obliged to make any repairs to any part of the apparatus. The Custodis chimney erected outside of this room is 11 ft. 8 ins. in diameter at the base and 125 ft. high.

A WOODLAND SCENE NEAR MIDWAY

The engine room is 110 ft. long and 50 ft. wide. At present it contains two 485-hp Cooper-Corliss cross-compound engines each connected to a 325-kw Westinghouse generator giving 600 volts d. c. at 100 r. p. m. These units are set on concrete piers resting on bed rock. It will be seen from the plan of the power station that space has been reserved for

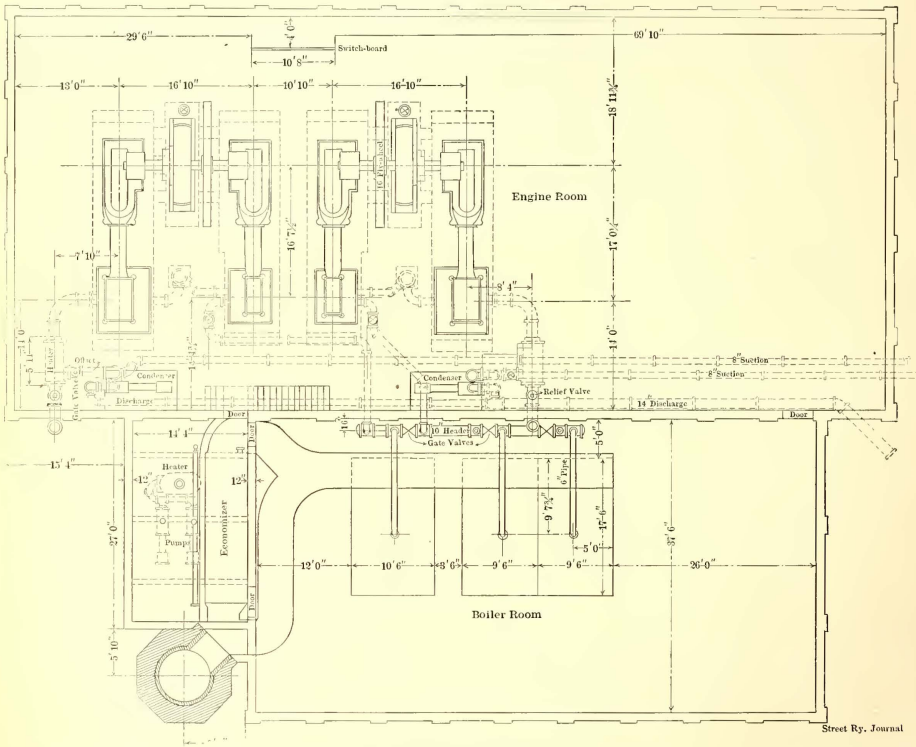
additional equipment. This free area is on the side nearest the river, where a large opening has been left in the wall. The transportation of heavy parts is effected by a Maris crane which runs the entire length of the engine room. Although rated at 15 tons this crane has frequently handled pieces weighing 19 tons.

The switchboard is composed of seven white marble panels with a total width over all of 10 ft. 8 ins. The four feeder panels are each furnished with a Cutter I-T-E 300-750-amp. circuit breaker, 700-amp. Weston ammeter and switches. On the fifth panel is mounted a voltmeter and Thomson recording wattmeter. The generator panels each carry the neces-

	Amount
Wages	$353.48
Fuel (211.5 tons)	846.04
Water	58.68
Lubricants and waste	30.00
Miscellaneous supplies and expenses	15.00
Light	5.39
Total	$1,308.59

Wattmeter reading in kw-hours, 106,400.
Mileage, 32,531.33.
Cost per kw-hour, .012 cents.
Cost per car-mile, .0402 cents.

These figures vary considerably according to the amount



PLAN OF POWER HOUSE OF THE GROTON & STONINGTON STREET RAILWAY COMPANY, SHOWING THE LAYOUT OF THE STEAM AND ELECTRICAL GENERATING MACHINERY AND PIPING. THE BLANK AREA SHOWN IS RESERVED FOR ADDITIONAL APPARATUS

sary switches, a 300-1000-amp. circuit breaker and 1200-amp. ammeter of the types mentioned. The board was built by the Crouse-Hinds Company, of Syracuse, N. Y.

The excellence of the apparatus installed and the careful manner in which it is maintained have kept the power cost quite low for a station of this size and load factor. The coal used is Georges Creek bituminous, which is delivered in barges alongside the station at $3.70 a ton, but as the cost of handling by mast and gaff to the coal pile is 30 cents, the actual cost at the boilers is $4. On an average the coal consumption is 4 lbs. per kw-hour, dropping, however, to 3¼ lbs. under good load conditions. The power statistics are carefully compiled on the form reproduced in one of the illustrations and afterward made up as a monthly report like the following typical one for March of this year:

of power required, but the costs per kw-hour and car-mile are fair averages.

DESPATCHING SYSTEM

All despatching is carried on by telephone with headquarters at Mystic. Telephone boxes are located at each of the five turnouts, at the ends of the line and at the Wequetequock Casino. The turnouts are about fifteen minutes apart. The telephones used are of the special outdoor type No. 278-A, made by the Western Electric Company. They are so constructed that the key used to open the box cannot be taken out until the telephone door is shut.

The despatcher has in his office a board containing a number of pegs corresponding to the different conductors on the line, these pegs being moved from point to point as the cars advance. When a conductor reaches a turnout he telephones

the despatcher, who then orders him to go ahead if all is well. If there has been any delay, the despatcher uses a second board which is set for a difference in time of half an hour. The conductors are given orders to wait at a turnout

POWER STATIONS DAILY REPORT.

GROTON AND STONINGTON ST. RY. CO.

.....Power Station 190

BOILERS RUN. ENGINES RUN.

No 1.....to..... No. 1 ..... to .....

2 .....to..... 2..... to .....

3. .....to..... 3..... to .....

4. .....to..... 4..... to .....

5 .....to..... 5 ..... to .....

6 .....to..... 6 to

7.....to 7 ..... to

WATT METER READINGS.

.....Start..... Finish..... Difference .....

.....Start..... Finish..... Difference .....

.....Start..... Finish..... Difference .....

.....Start Finish..... Difference.....

WATER METER READINGS.

Boiler—Start.....Finish..... Difference.....

City—Start.....Finish..... Difference .....

—Start.....Finish..... Difference .....

COAL USED.

Bituminous.....lbs. Anthracite..... lbs. Total ....lbs.

CIRCUIT BREAKERS OUT

MACHINE. FEEDER.

No. 1.....to..... .....to.....

2.....to..... .....to.....

3.....to..... .....to.....

4.....to..... .....to.....

5.....to ....to.....

.....to.....

.....to.....

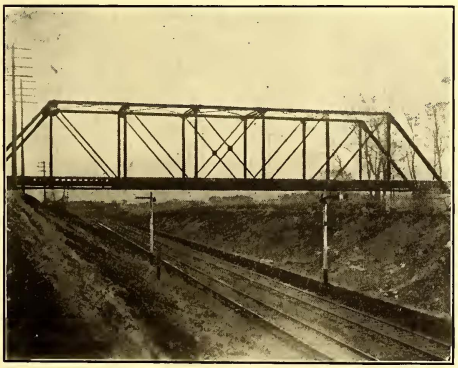
Remarks:

(Signed)

Engineer.

BLANK FORM OF DAILY REPORT SENT TO GENERAL SUPERINTENDENT BY ENGINEER OF POWER STATION

until they meet a certain car. In case two cars are following one another in the same direction, between the same turnouts, the car going the other way is not permitted to go ahead,



OVERHEAD BRIDGE ON THE GROTON & STONINGTON STREET RAILWAY, EAST OF POQUONNOCK, CONN.

the first car holding the turnout until the following one comes in sight.

FILING SYSTEM

For filing records the company uses an adaptation of the Railroad Correspondence File Index devised for steam railroads by W. H. Williams. This is a decimal classification system according to which every record to be filed is first divided under a number of main headings, such as "General," "Executive," "Finance and Accounts," "Railways and Structure," "Equipment of Shops," "Transportation and Storage,"

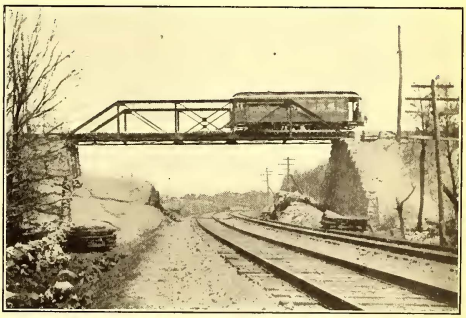
Article	QUOTATIONS		Size or Kind	
Date	Name and Address	Details of Quotation	How Made	Catalog Price List
		Price		
		Terms		
		Price		
		Terms		
		Price		
		Terms		
		Price		
		Terms		

FILING CARD FOR KEEPING TRACK OF COMPETITORS' PRICES FOR SUPPLIES

"Traffic Rates," etc. These classes are each assigned an even number in the hundreds, such as 400 for "Maintenance and Equipment." The first sub-heading may be taken as "Rolling

A LONG TRESTLE NEAR NOANK, ON THE LINE OF THE GROTON & STONINGTON STREET RAILWAY COMPANY

Stock," and to this a classification in the tens is given like 410. This heading in the case of electric railways can be given a sub-heading "Motors" and a number 400. The principal "Motor Parts" would come under 411.1, and anything composing these parts under 411.11, 411.12, 411.13, etc. In this way everything coming up in the work of a railway



GROTON & STONINGTON CAR CROSSING BRIDGE BETWEEN WEQUETEQUOCK AND CLARK VILLAGE

company can be classified to the smallest detail. In filing a package of data according to this system, the top of the envelope is marked in a manner similar to the following: Wheels, Rolled Steel, 410,313. In addition to this filing method, the company keeps a set of quotation cards of the type shown in one of the accompanying illustrations.

AMUSEMENT TRAFFIC FROM LOCAL SOURCES

The splendid scenic features of this line have already been mentioned, but besides this incentive for pleasure riding there is, about half way between Stonington and Westerly, a popular casino which contains the largest and finest dancing pavilion in that part of the country. This casino is not owned by the railway company, but the latter derives as much benefit therefrom as if it did, since the extra traffic induced often amounts to 500 or 600 passengers, most of whom have to ride through several fare zones. At present the

WEQUETEQUOCK CASINO—A NOTED RESORT ON THE LINE OF THE GROTON & STONINGTON STREET RAILWAY

casino affords opportunities for dancing and boating only, but next season a theater and other attractions will be added. Most of the patrons are summer visitors who are glad to ride a considerable distance to reach the one large amusement resort in this territory. The only extra expense to which the railway company has been placed has been the erection of a handsome shelter near the casino, aside from the free transportation of the casino employees.

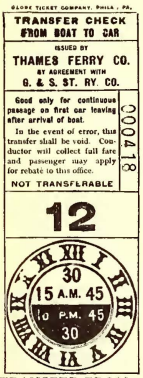
With this season the company inaugurated the scheme of giving free concerts along the line every Sunday afternoon during pleasant weather. One time the concert is given near the Westerly terminus and the next time near the New London end. For this reason a large number of passengers pay three or four fares to reach the grounds. The musicians, some twenty in number, are local amateurs who regard these entertainments in the light of an outing and are therefore willing to play for a nominal amount and their transportation. No special buildings have been erected for these entertainments, although a number of benches are placed on the grounds, the idea being to give the concert on some favorite hill from which the visitors can enjoy the beautiful scenery as well as the music.

The company also offers special cars to picnic parties at 60 cents and 75 cents a car-mile, according to the capacity of the car.

FARES AND TICKETS

The 18 miles of route operated by the Groton & Stonington Street Railway Company between Groton and Westerly are divided into six five-cent fare zones. The Groton zone, however, includes the privilege of crossing on the ferry to New London on the next boat after the arrival of a car, or vice versa. To prevent the transfer abuses common with the old ticket printed in small type, the management adopted the accompanying transfer which is too plain to admit abuse. The boat-to-car and the car-to-boat transfers are alike in their main features, but worded in accordance with their uses and differently colored.

FOLLOWING THE SHORE BETWEEN STONINGTON AND MYSTIC



TRANSFER FROM BOAT TO CAR

GROTON AND STONINGTON ST. RY. CO. Date _____ 190__

Trip Letter	Started from	Time	A. M. or P. M.	Ferry Transfers Rec'd	Ferry Transfers Sold	Number of Fares Registered 1st Coll	2nd Coll.	3rd Coll.	4th Coll.	5th Coll.	6th Coll.	Employes Passes	Tickets Cash	Tickets Comp.	Tickets School	Mileage	Car Number	Register Reading		
A																	L			
B																	T			
C																	L			
D																	T			
E																	L			
F																	T			
G																	L			
H																	T			
I																	L			
J																	T			
K																	L			
L																	T			
M																	L			
																	T			

TOTAL TRANSFERS RECEIVED — Total Fares Reg.
TOTAL TRANSFERS SOLD — Tickets, Passes, & Trans.
TOTAL FARES COLLECTED — Total No Fares
TOTAL PASSES — Total Amount of
TOTAL FARES REGISTERED — TOTAL TICKETS — Cash Deposited
TOTAL MILEAGE

CONDUCTOR NO. NAME MOTORMAN NO. NO. NO. NO.

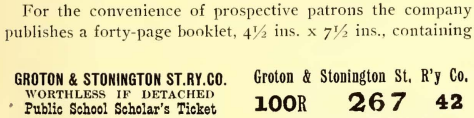
THIS REPORT MUST BE CORRECTLY FILLED OUT, AND DEPOSITED WITH ALL MONEY, TICKETS, AND TRANSFERS, EACH DAY.

CONDUCTOR'S DAILY REPORT

The company is now preparing a reduced rate ticket book for the run between Stonington and Westerly. These tickets will be sold in books of 80 for $3, making the fare 3¾ cents to the holder of the book. In consideration of the reduced rate, the tickets will be good between 5 a. m. and 7 p. m. on week days only. This reduction is popular with the working classes, but as most of the pleasure traffic comes on Sundays and evenings the earnings will not be appreciably affected. It is likely that the increased riding will more than make up for the reduction.

The company also sells for $1.50 a fifty-ride ticket book for school children. This is good between the hours of 7 a. m. and 5 p. m. Aside from this, a few complimentary tickets are given out and a pass good for six rides a day for thirty days. It will be noted from the accompanying reproduction of this pass that every number covers an area divided in six parts, each corresponding to a fare zone.

For the convenience of prospective patrons the company publishes a forty-page booklet, 4½ ins. x 7½ ins., containing



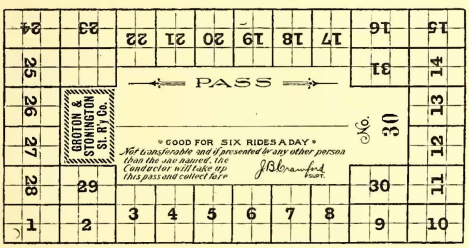
SPECIMENS OF SCHOOL AND COMPLIMENTARY TICKETS, WHICH ARE FURNISHED IN BOOKS

a brief description of the route, numerous views taken along same, and time tables of its own and connecting lines. This booklet is recognized as an excellent advertising medium, and is therefore well stocked with notices which more than cover the cost of publication. The advertisement privilege on the ferry transfer also defrays the cost of the latter.

MISCELLANEOUS OPERATING DETAILS

Many a nickel that should wander to the coffers of a railway company has been turned to other uses because the prospective passenger found no convenient place to wait for a car. The Groton & Stonington Street Railway cannot be reproached for lack of foresight in this respect. Convenient stations have been built at Noank and Stonington; comfortable waiting rooms fitted up at Mystic, Groton and Westerly, and seats and shelters placed along the roadside.

A move which met the cordial approval of the men was the adoption of khaki uniforms for the conductors and motor-



COMPLIMENTARY PASS

men during the summer months. These uniforms do not soil or show dust as quickly as the regulation blue, and as they cost only $6 the extra men put on during the rush season are not obliged to make a heavy outlay.

ORGANIZATION AND TRAFFIC STATISTICS

The Groton & Stonington Street Railway Company was organized Dec. 19, 1903; placed the line to Mystic in service on Dec. 19, 1904; to Stonington on April 8, 1905, and to the State line at Westerly on May 6, 1905. The property is largely held by local interests represented by the following officers: President, Thomas Hamilton; vice-president, B. F. Williams; treasurer, Costello Lippitt; secretary, C. D. Noyes, and attorney, C. W. Comstock. The operation of the line is in charge of J. B. Crawford, general superintendent, whose administration has proved so successful that the directors at the annual meeting last August declared a 7½ per cent dividend on the preferred stock. The company hopes next year to pay a 3 per cent dividend on the common stock if business continues to improve as in the past year. From this it is plain that the company has succeeded beyond expectations.

Comparison of the following figures for the years ending June 30, 1905 and 1906, will show that increases in the company's business (due partly to the completion of the line) have been coupled with decreases in the cost of the different traffic units:

	1906	1905
Passenger car mileage	419,910	150,902
Passenger car hours	29,444	12,789
Car earnings per car-mile	$0.266	$0.232
Car earnings per car-hour	3.794	2.74
Net earnings per mile run	0.16	0.1134
Net earnings per car-hour	3.828	1.338
Operating expenses per car-mile	0.108	0.119
Operating expenses per car-hour	1.542	1.408
Per cent of operating expense to gross earnings	40.292	61.27

LOW STEAM RATES HAVE HELPED OHIO ELECTRICS

There are fresh evidences that the 2-cents-a-mile rate enacted for Ohio steam roads by the last Legislature of that State is not working to the disadvantage of the electric roads, but rather otherwise. At first the electric railway operators feared that they would lose much of their business on the longer trips because the difference in fare was no longer greatly to the advantage of the electrics. One of the most advantageous instances for studying this effect was that of the Lake Shore Electric Railway on its 120 miles from Cleveland to Toledo. The electric line charged $1.75 for the one-way trip, while the steam road rate under the old conditions was $3.20. The 2-cents-a-mile law cut the steam rate to $2.15, or a difference of only 40 cents where formerly it was $1.45. For a time it was feared that the long-distance business would be badly affected, but the electric company held its ground, and instead of cutting rates it improved the service by cutting off fifteen minutes from the running time by putting on two additional limiteds each way and installing new cars for the service. Figures now given out by the company demonstrate that this policy was the right one and that the steam reduction was not sufficient to get the business in the face of fast and regular service and the advantage of landing in the center of the business district of the large city. It is stated that where a year ago with three limiteds each way the cars were averaging 40 cents a car-mile, with five limiteds at present they are earning 50 cents a car-mile, the number of through passengers being much more than a year ago.

That the steam roads are greatly disappointed with the results of the reduction in fare is further evidenced by the fact that the railroads are cutting out many of their slow accommodation trains. The railroad editor of the Cleveland "Plain Dealer," in commenting upon this point, says:

Managers state that there are several accommodation trains on every railroad out of Cleveland that are being operated at a loss. These trains run to cities 50 miles to 100 miles distant, and have been operated partly to accommodate the people living between these points and to keep the passenger traffic from going to the electric lines. Some of these trains, it is said, do not make money enough to come anywhere near paying the train crews. A prominent official states that the average passenger train must earn $2 per mile to be on a paying basis, and added that some of the roads out of Cleveland were operating trains day after day which have not been averaging more than 10 cents a mile, which is hardly enough to pay the brakeman's wages. The loss which these trains sustain has been made up by the increased earnings on some of the best trains, but the roads have now reached a point where they are going to cut out these unprofitable trains.

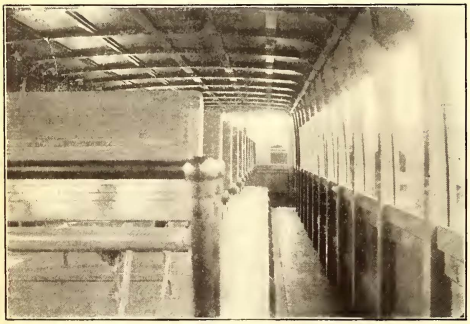
NEW DOUBLE-DECK CAR OF THE TWIN CITY RAPID TRANSIT COMPANY

The STREET RAILWAY JOURNAL of Nov. 5, 1904, contained a description of a type of double-deck car built at that time by the Twin City Rapid Transit Company for service on the lines between St. Paul and Minneapolis. The upper deck of this car was so constructed that it could be put on or removed from the standard car in use in Minneapolis and St. Paul with very little difficulty, and consisted of a framework of one-inch gas pipe bolted to 2½-in. x 5-in. sills, which rested on special fittings built permanently in the roof. The top was covered with awning material and the space between the posts was provided with curtains. This type of double-deck car, however, was found unsatisfactory, due largely to the fact that it did not offer sufficient protection from the weather, and the one that was constructed was not put into regular service.

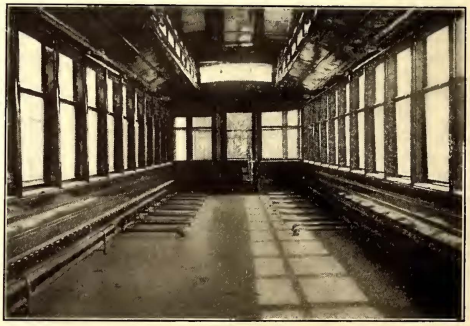
ONE OF THE NEW DOUBLE-DECK CARS BUILT BY THE TWIN CITY RAPID TRANSIT COMPANY

However, the company is now constructing thirty double-deck cars of the type shown in the accompanying illustrations for service on the interurban line to Lake Minnetonka, on which during the summer months the traffic is extremely heavy. The cars are being built in the shops of the company in Minneapolis under the immediate supervision of W. J. Smith, master mechanic of the system, to whom this paper is indebted for the details. As with the previous car of this type, the upper deck is so constructed that it can be removed from the lower portion of the car during the winter when its use is not required, but it is built in a much more substantial manner, its construction being similar to that usually employed in the ordinary closed car. The sides and ends are sheathed in the usual manner up to a rail corresponding with the arm rest. The side posts contain curtain grooves and pantasote curtains fitting close up to the posts and provided with frequent stiffening rods effectually closing the openings against the entrance of water during a rain storm. The front windows, however, are provided with sash fitted with glass after the manner followed in the construction of the lower portion of the car body. Composite wood and steel carlines extend overhead from opposite side posts and form a support for purlines over which the canvas top is stretched. The upper compartment is provided with slat seats running crosswise of the car and resting directly on the roof of the lower portion, which is provided with a grass carpet. The seats, however, do not extend the full width of the car, but space is reserved on one side for an aisle as shown in one of the illustrations. The second deck is well lighted by lamps placed over each window opening just above the curtain, and other lamps supported by carlines in the front and rear. The upper deck seats 65 people.

One of the illustrations shows the stairway over the front vestibule, by means of which access is gained to the upper portion of the car. No stairway is provided in the rear, the idea being that the motorman will observe the people passing to the upper deck, while the conductor will take care of those in the lower portion of the car. Just in front of the stairway and immediately over the motorman's cab is a comparatively large space which will be utilized for the storage of baggage and lunch baskets of picnic parties. The upper deck adds about 5000 lbs. to the weight of the car, while the height of the car with the second story added is 16 ft. 8 ins. As the trolley is placed 20 ft. above the track there is a clearance of 3 ft. 4 ins. between the trolley and the roof of the car. The ordinary type of trolley pole will be used.



SIDE AISLE OF UPPER DECK SEEN FROM THE FRONT OF THE CAR

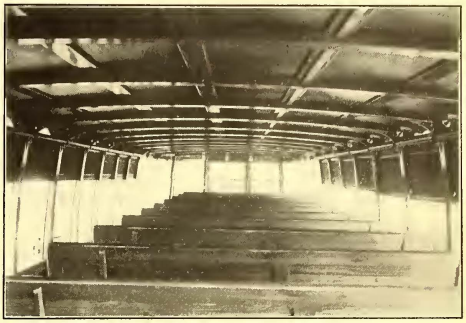


INTERIOR OF DOUBLE-DECK CAR, SHOWING THE SIDE GIRDERS OF THE STEEL BOTTOM FRAMING

The cars upon which the upper decks are being fitted are built in the shops of the company and are constructed on steel floor framings, of which a short description was given in the STREET RAILWAY JOURNAL of July 1, 1905. Some of these steel bottom framings are shown in an accompanying view of construction work in the shops. The sides of the framing are high enough to serve as girders and eliminate the necessity of additional trusses for supporting the car body. These girders serve as the inside finish of the car, and the angle-bar riveted to the top is utilized both as a foot-rest and as a means of protecting the heater pipes, which are carried on light malleable iron castings bolted to the girder. In the construction of the car a sufficient space is left between the girder and the outside sheathing to form pockets into which the side sash drop to within a few inches of the bottom of the framing. This construction is well shown in one of the accompanying illustrations.

The steel bottoms upon which the present cars are being constructed differ slightly from those described in the STREET RAILWAY JOURNAL, and upon which thirty-three cars were built during the year 1905. The later framings are built for a car 6 ins. wider and 12 ins. longer. The additional width of the new cars is placed in the aisle and in the door openings, and the additional length is added to the platforms, where it is utilized in widening the entrances. These entrances, of which there are two, are 27 ins. wide, and are provided with the Minneapolis type of gate. The doorway leading into the body of the car allows for an opening of 3 ft. 9 ins. in the clear. To provide for the addition of the upper deck and the load on the roof the body framing was built somewhat heavier than otherwise. The width of the corner posts was increased and the roof carlines were reinforced, so that with the full load in the upper deck the deflection by actual test does not exceed 1-16 of an inch. At every post the wood carlines are reinforced by steel carlines measuring ¾ in. x 2½ ins. In the forward portion of the car, where the presence of the sign necessitates an extra width of upper-deck window, the steel carlines measure 1 in. x 2½ ins.

HEAD-ON VIEW OF THE TWIN CITY RAPID TRANSIT COMPANY'S DOUBLE-DECK CAR

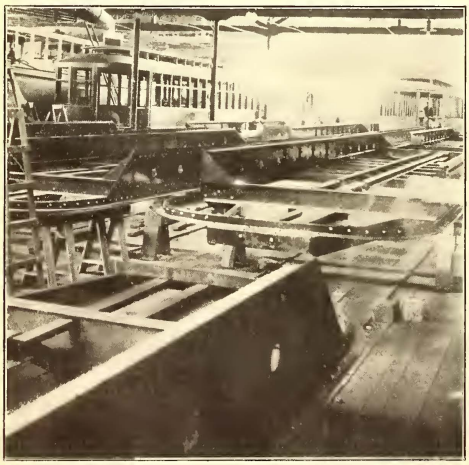


VIEW FROM THE REAR OF THE UPPER DECK, SHOWING SIDE CURTAINS AND FRONT SASH

STAIRWAY ON THE FRONT PLATFORM LEADING TO THE UPPER DECK

In the construction of the car, precaution has been taken to guard against the arcing or burning of electrical apparatus underneath the body setting fire to the car. The whole surface of the under side is lined with ⅛-in. transite board. While this adds about 350 lbs. to the weight of the car, it removes the possibility of the floor and the car catching fire. The motor and resistance wires are run in asbestos tubes cleated to the under side of the car. The cast steel bolster used permits the wires to run through an opening in it immediately over the king bolt. This avoids the necessity of dropping the cables down under the bolster as is frequently done. The king bolt extends only through the lower portion of the bolster, and is held in place by a pin driven through it. Baldwin trucks are employed, and these are fitted with adjustable side bearings so that the trucks can be changed without the necessity of shimming up or lowering the side bearings. This adjustment is made by employing rollers of different sizes as is frequently found in steam road car construction. It is the intention to change trucks when a car is brought into the shop with disabled motors, and thereby shorten the time the car body is required to remain in the shop. Two extra trucks equipped with motors will be provided for every twenty-five cars. The trucks are fitted with rolled steel wheels mounted on an axle 6 ins. in diameter at the gear and wheel seat. The tires of the wheels are 4 ins. wide and are provided with a 2¼-in. tread.

A SPECIMEN OF THE ADVERTISING POSTER USED TO CALL ATTENTION TO THE DOUBLE-DECK CARS



STEEL BOTTOMS OF DOUBLE-DECK CARS IN THE SHOP

IMPORTANT CHANGES IN BALTIMORE

L. B. Stillwell has just taken a contract to reorganize and complete the power station of the United Railways & Electric Company, of Baltimore. The work will be along the same lines as those undertaken by Mr. Stillwell several years ago for the Niagara Falls power plant, viz: the completion of the construction of the power plant and the organization and training of an operating force for its proper operation. This is a specialty of Mr. Stillwell, as he considers the organization and training of a competent operating force as a very essential part of the work in connection with the construction of power plants. In Baltimore he has undertaken to accomplish this in a year.

On Oct. 1 Horatio A. Foster, the well-known consulting and mechanical engineer and author, of Philadelphia, became associated with Mr. Stillwell and moved his office to Baltimore to become resident engineer in charge of this work, with offices in the Continental Building.

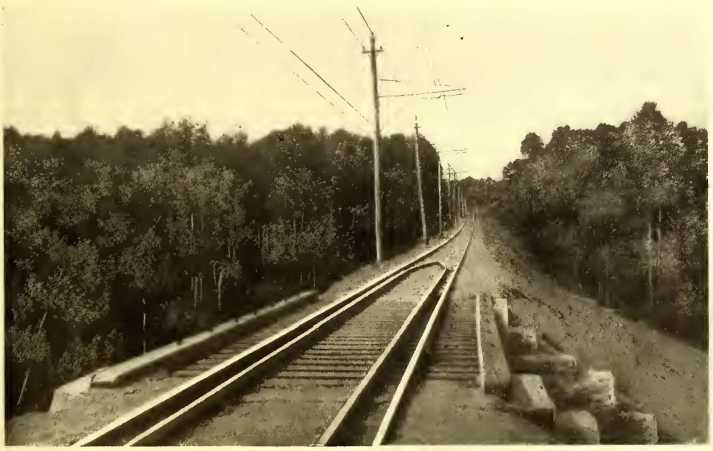
SIDE OF CAR, SHOWING HOW POSTS ARE FITTED OVER SIDE GIRDER AND THE HAND HOLES IN GIRDER FOR CLEANING OUT THE WINDOW POCKETS

THE LOWELL & FITCHBURG RAILWAY

An example of the rapidly developing demand in New England for thorough trolley connections, with fast schedule and the most advanced type of heavy interurban construction, is afforded by the recent installation of the Lowell & Fitchburg Street Railway Company. This railway by its completion directly unites an important connection between the large cities of Lowell and Fitchburg, Mass., and in conjunction with other entering lines to these cities makes available through trolley connections as far as Worcester and beyond to the south, to Nashua, N. H., and other points in its territory on the north and into Fitchburg, Lowell and Boston. While largely subsidiary to Boston, the large industrial communities about Lowell and Fitchburg as centers have much in common, commercially and socially. Hitherto there has been a lack of the ready transportation facilities such as this railway will afford.

The present line of the Lowell & Fitchburg Railway Company's track is 18 miles long from its meeting point at Ayer with the Leominster, Shirley & Ayer line now operating into Fitchburg, to its physical connection with the line of the Boston & Northern Railway at the outskirts of Lowell, over the tracks of which company it operates 4½ miles to the heart of the city and through its center at Merrimac Square, thus making 17¼ miles of operation in all. While crossing a rough section of country a generally low gradient has been established with cuts opened and fills shouldered to standard steam road practice. Where to any advantage of alignment or grade, private way has been secured, and outside of town

CAR HOUSE, SHOWING PLOW AND STANDARD CAR



SECTION OF STRAIGHT TRACK

or village entrances, the location is principally upon the right of way with a small amount of highway location.

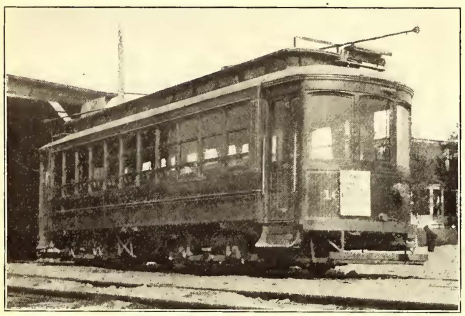
Standard heavy interurban construction has been adapted, a 70-lb. A. S. C. E. T-rail being used with 9-in. Pennsylvania girder where paving has been laid down. Standard oak and chestnut cross-ties 6 ins. x 8 ins. x 8 ft. on 24-in. centers with local gravel ballast for 18 ins. under these constitute the substantial roadbed. This track has been bonded with 2-in. No. 0000 protected type bonds at each joint laid under Weber joints and with No. 0000 flexible cross-bonds every 500 ft. A double-grooved No. 0000 trolley has been used on extra heavy 11-ft. guy and strut bracket arms, all malleable fittings and placed on 35-ft. chestnut poles, except in streets where span construction has been adopted. Garton lightning arresters have also been placed on line every 1000 ft.

From the Lowell power house of the Boston & Northern Railway to Forge Village, Mass., and about centrally located on the railway, a high-tension feeder line of three No. 0 bare and covered wire has been installed, following the railway on private poles of the company to North Chelmsford from whence it enters on heavy pole line to the Boston & Northern Railway power house. Two 225-kw Westinghouse rotaries, transformers, etc., with full equipment on both a. c. and d. c. side, have been installed in brick station, from whence current for operation is supplied.

At present five equipments are owned by this railway. Four cars are in active operation. The car bodies were built by the John Stephenson Company, of Elizabeth, N. J., and are of the Brill grooveless post semi-convertible type. The length over all is 40 ft.; inside height, 8 ft. 4 ins.; width of seat, 35 ins.; width of the aisle, 24 ins. The seating capacity is 44 with cross reversible rattan chair seats.

Outside storm windows which by special device can be quickly placed or removed, allow of the maximum flexibility of operation for these bodies, either as open cars in summer, which can be momentarily converted, through the convertible device, to closed cars for shower protection or with storm windows placed permit of double sash and greatest enclosure from cold in winter. They are mounted upon Brill 27 E. I. steel trucks with 33-in. wheels, carrying 2¼-in. steel tires, with 5-in. axles. These trucks are equipped with four Westinghouse 93 A. motors per car, and with the multiple unit control com-

plete. This allows the operation of the cars in trains up to three cars in number. The new type of Westinghouse automatic air brake with the improved graduated release has also been adopted with proper connections to allow of this feature of train operation. There are also installed combination arc and incandescent headlights of the Millen type, illuminated overhead destination signs, international registers, Climax heaters,

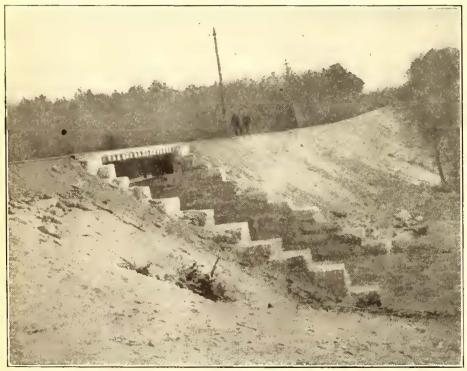


STANDARD CAR

and Knutson retrievers. Oil lubrication for journals with wick feeds is entirely used.

The railway also possesses one large Smith & Wallace double-nosed plow, which has also been provided with a similar quadruple motor equipment and control, but with a somewhat lower gear ratio. The trucks of these plows are arranged on the swivel bolster plan between trucks transmitting any shocks of service to each truck equally and thence to the steel girders of the plow body. This ensures great rigidity under heavy service and has proved its utility in heavy snow-bank work.

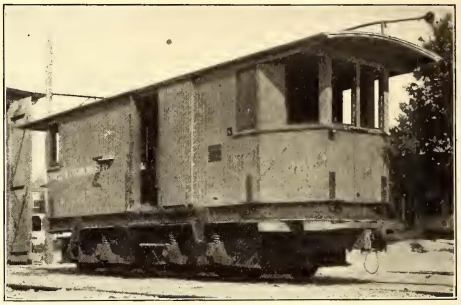
A six-car frame house is located at Ayer with concreted



TYPICAL FILL

pits and machine shop floors, while a separate brick oil and furnace house has been provided at the rear. The house tracks have been arranged to allow of the use of this as a "through" house, eliminating as far as possible all idle mileage in and out of switches.

While principally built as a through connection the population served by this railway as to local patronage is of a general industrial character and considerable in amount. Lowell, the City of Spindles, and of 95,000 inhabitants, is its greater terminus, though Fitchburg and Leominster at its western connection represent a community of 43,000. The towns of Chelmsford, Groton, Graniteville, Forge Village and Ayer are directly served, while Shirley, Leominster, Mitchellville and others are sources of traffic through its Ayer connection to Fitchburg. The greater part of these are smaller manufacturing centers, woolen goods and machine parts being greatly produced. The aggregate population entirely along the line



SNOW PLOW, WITH NOSES REMOVED, USED AS LOCOMOTIVE

and with its termini represents by the 1900 census approximately 160,000, which had increased during the previous decade about 30 per cent, showing a healthy industrial growth. This population represents a constant source of traffic, while a number of lakes and the abundance of high pine wooded hills have made this section an attractive vacation ground available to many who daily travel to Boston and its vicinity. Ayer, the present terminus, is the junction of several intersecting lines of the Boston & Maine Railroad system, and from this fact alone has also proved as especially valuable point of connection.

An hourly schedule is now being maintained between all points from Merrimac Square in Lowell to the center of Fitchburg, and with farther operation an improved schedule will be perfected to bring out the full capacity of the equipment and maintain a fast schedule of not less than 25 miles per hour for entire distance outside of terminal residences. An excellent lake and park resort will be opened at Nabnasset Lake, the nearest attractive body of water of its kind to Lowell, and which, while admittedly possessing great physical attraction, has hitherto lacked means of adequate access commensurate with its value as a park and water resort.

The railway has been running since June, 1906, but contemplates an increased operation of 5 miles more track this fall which is now under construction, and also through its present franchise possesses an opportunity for greater extensions which, it is expected, will be taken in the immediate future. These are also of very promising character, and should their execution be brought about, will, in the near future, make the present existing railway but the nucleus of a considerable and very valuable system of electric transportation in Boston, Lowell, and Fitchburg field.

The present offices are at Ayer, Mass., in charge of J. P. Satterlee, as managing superintendent. Philadelphia, Pa., capitalists have been the builders through the A. L. Register & Co., of that city, who have engineered and financed the property, and are at present carrying forward its farther extensions.

The Brooklyn Rapid Transit Company has begun running trains over the elevated structure from Brooklyn Bridge via the Myrtle Avenue line and the old Bushwick Railroad through Ridgewood to the Lutheran Cemetery, in Queens.

READING CLIPPINGS IN ALBANY

Practically every large street railway company has arrangements by which articles which relate to the road appearing in the daily papers in the territory traversed are brought to the attention of the manager. Sometimes this is done by a clerk who marks the articles in which he thinks the manager will be interested and hands them to him. Sometimes the notices are clipped and laid on the manager's desk. Often they get no farther. On most roads the manager will call the attention of the heads of his departments, or some particular head, to any clipping which concerns that department, but quite as frequently the clippings are either consigned to the waste basket or else are pasted in a large book after they have passed the manager's desk.

The method of handling clippings by the United Traction

THE BULLETIN

Issued Daily by the Operating Department U. T. Co.

ALBANY, N. Y. July 18th 1906

The Troy Press.

TROY, N. Y., TUESDAY, JULY 17, 1906.

WATERVLIET.

Committee to Have Conference About Transfers—Two Runaways.

It is expected that the special transfer committee of the common council will have another conference with the officials of the United Traction company the early part of next week, at which the transfer question will be definitely settled City Attorney Russell will attend the conference. The committee was greatly encouraged by the result of the first conference. It is expected that Mr. Fassett will state definitely what the company wishes and the committee will make a report to the common council at the meeting Wednesday evening.

—An appeal was taken to-day to the Appellate Division in the action of Patrick Healy, as administrator of his wife, Bridget Healy, against The United Traction Company, in which a verdict of $4,500 for the plaintiff was secured in the Supreme Court for the death of Mrs. Healy, who was killed while crossing the tracks on Fifteenth Street in May, 1904. The case was tried three times before a verdict was secured.

This morning the forward wheel of a buggy owned by George Brenner of Wynantskill, came off on Congress street, near Farm. The wheel became caught in the switch of the Albia line at that point, and caused the accident. Mr. Brenner was thrown out of the vehicle, but was only slightly injured.

Evening Standard.

TROY, TUESDAY, JULY 17, 1906.

NO REPLY MADE TO DEMANDS OF EMPLOYES

The United Traction company has not yet replied to its employes as to what action it will take regarding the proposed agreement which was submitted to General Manager Fassett. It is believed that the compact council of the Troy and Albany associations which has the matter in charge will receive an answer within a few days. Mr. Fassett when seen yesterday said that he could not say when he would reply to the demands made by the men.

An officer of the employes' association when seen yesterday said:

"We have not as yet heard from Mr. Fassett. We are not in any special hurry as we are working under the old agreement, which is almost the same as the agreement which we have just submitted.

"Just what the procedure will be when we get Mr. Fassett's reply, in the event of our agreement being rejected, has not yet been determined. We may call a special meeting or we may take a referendum vote.

"I believe all this talk about a strike is a little premature. We could not strike until after we had placed the dispute before the international association, which naturally would take some time. Then again there are several matters to be considered before a strike is declared. Arbitration might bring about a settlement if the men and company could not come to terms. We are still hopeful that the differences will be adjusted without trouble."

The Troy Times.

Founded in 1851 by JOHN M. FRANCIS.

SATURDAY AFTERNOON, JULY 14, 1906.

The Double Tracks

Troy, N. Y., July 14.

Editor Troy Times:

It is with great satisfaction that I learn that the city administration has at last granted to The United Traction Company the privilege of spreading its tracks on Franklin Square so that north and southbound cars can pass each other between Bridge Avenue and Grand Street. This consummation of efforts started in May, 1905, and persisted in with more or less activity until now, is most agreeable to the 40,000 patrons of electric cars passing Franklin Square each day, because it means a saving to them expressed financially in lost time of about $5,000 per annum, to say nothing of other losses not reducable to an expression in money, but nevertheless just as actual.

A scrap of ancient history in reference to this matter may be interesting to your readers. Immediately after the merging of the Albany and Troy street car lines into The United Traction company the General Manager ordered that but one seat, and that the rear one of the open cars should be devoted to smokers instead of the two seats formerly allowed by the old Troy management. A citizen of Troy who appreciated the undesirable condition this arrangement created in the Executive Committee of The United Traction Company his "honest effort" to obtain what was termed double tracks at Franklin Square in return for a restoration of a second smokers' seat in the open cars. This offer the committee accepted and at once issued the order for the convenience asked for.

To fulfill his part of this agreement the citizen above referred to has for the last three years been making as "honest effort" to achieve the result that has now been reached, and he rejoices with the rest of his long-suffering fellow citizens that all obstacles to this improvement seem now to have been brushed aside by our present elicit municipal administration and that the insufferable blockade at Franklin Square will soon be but an uncomfortable memory.

Very truly yours,

FREDERICK W. ORR.

Trolley Company Doesn't Want to Pay.

According to a Glens Falls paper, the reason that the Hudson Valley Railway officials stopped negotiations with the Saratoga officials looking to a franchise to lay tracks and run cars over Broadway, in that village, is the unwillingness of the prospective management to pay for the privilege. The conditions imposed by the Saratoga commission at the granting of the tentative franchise necessitated a payment of $500 annually for the keeping of Hamilton street in repair and keyed and new and improved rails on Broadway. The cars were not allowed to cross Broadway at a fast rate of speed and were not to be permitted to stand on the crossing. Freight traffic across the street was prohibited and the overhead power wire was to be arranged that in case of parades it could be taken down. A flagman was also to be stationed at the crossing.

WHO CONTROLS THE HUDSON VALLEY RY.?

Caldwell Positively Refuses to Say Whether He Represents the D & H. Or Not—May Be Made Known at Meeting of Directors Saturday—A Strong Protest Filed.

Although the annual meeting of the stockholders of the Hudson Valley Railway Co. was held at Glens Falls yesterday and James H. Caldwell of Troy had the controlling votes and elected himself a director, no one but those on the inside know whether he represents the D. & H. or the Andrews syndicate in the purchase of the road. There will be a meeting of the directors in Troy Saturday and at that time some statement is expected from Mr. Caldwell. Yesterday he refused positively to discuss the matter

A Protest.

In the election of directors James H. Caldwell himself, represented the voting trust, casting votes for 25,000 shares. To this action on the part of the trust, Attorney Hanford of New York, representing D. H. Feather stone, filed a strong protest, claiming that only one trustee of the bonds was present, when there should have been two. The Featherstone interests represented the E. Clarence Jones Company of New York, a concern which is working, it is understood, to get control of the road. These interests cast 9,67 votes for a board of directors materiality different from the one elected.

The report of Treasurer F F Prnyn, as read at the meeting, showed a deficiency of $22,000 for the year, as against $75,000 last year.

The meeting marked the retirement of Addison B. Colvin of Glens Falls, who has been president of the company since it was organized. Mr Colvin is to sail to-day for Europe.

New Board of Directors.

The stockholders elected the following board of directors: Peter McCarthy, Frank H Howe, James O'Neil, James H Caldwell John G Hawley, John T Christie, Henry J Speck and Harold K Downing, of Troy Thomas Breslin of Waterford; L W Emerson of Warrensburg; F F Pruyn, of Glens Falls; William H Blackmore of Saratoga Springs and A L Nichol, John A O'Brien and Arthur Braun of New York The inspectors of election were William Henry Warren of Troy; James McPhillips of Waterford and Frank L Cowles of Glens Falls As there was not a quorum of the new board of directors present, it was decided to hold a meeting of the directors at the office of the Troy Trust Co. Saturday afternoon at 11:45 o'clock to organize and elect officers.

No Statement Made.

No statement was forthcoming after the meeting as to what interests Mr. Caldwell and the directors, who were evidently named by him, represented in the new control of the road. Mr. Caldwell declined to say anything concerning the change in control. Seven of the fifteen directors in the old board were re-elected as follows: Peter McCarthy, Thomas Breslin, Frank H. Howe, James O'Neill, James H. Caldwell, A. L. Nichol and John A. O'Brien. The following directors in the old board were retired: Addison B. Colvin of Glens Falls, John W. Herbert of Helmetta, N. J.; W. L. Kiley of Glens Falls; William O Bamstead, of Jersey City, N. J., and Groesbeck Fowler, George A. Heinz and John P. Munn, of New York.

Trojans in Majority.

That Mr. Caldwell and the interests he represents dominate is evident from the makeup of the oard of directors. Nine of the directors are Trojans and six of these are associated with Mr. Caldwell in The Troy Trust Co. John G. Hawley is secretary and treasurer; Harold K. Downing, assistant secretary and treasurer, and Peter McCarthy, Thomas Breslin, John T. Christie and Henry J Speck are directors of the Trust Co. of which Mr. Caldwell is president. A. L. Nichol represents E. Clarence Jones & Co. of New York and John A. O'Brien is secretary to John W. Herbert, former vice president of the Hudson Valley company, Arthur Braun is a director in the Hudson Navigation company and the Citizens' Steamboat company and represents G. W. Morse in the board.

No Change in Management.

It was stated that for the present at least there would be no change in the management of the business of the company, and the present general manager and other employes of the company will be continued.

At the stockholders' meeting 28,386 shares of stock out of the 30,000 shares in the company were represented and voted

OBJECTIONS NOT VALID

MANAGER FASSETT ON THE CONTENTIONS OF JUDGE GRIFFITH.

OLD REGULATIONS IN FORCE

The New Ordinance Has Nothing to Do With the Original Grant of Privilege Judge Griffith Tells How He Would Like to Have the Ordinance Amended.

General Manager Fassett of the United Traction company was a caller at the city hall to-day. He did not appear disturbed over the objections made to the ordinance adopted by the common council granting the traction company the privilege of double tracking certain streets. Mr. Fassett was interviewed by a Record reporter on the objections raised by L. E. Griffith, representing property owners on River street between Grand and Fulton streets

Mr. Fassett said he had read the objections raised by Attorney Griffith. Discussing the matter he said: "Judge Griffith misconstrues what we ask for in the latest ordinance granted us by the common council there is nothing embodied which repeals the contents of the original franchise. Our proposition for double-tracking is nothing more than a lengthening of the switches."

During the administration of Mayor Hoffay, General Manager Fassett said the Traction company was given authority to extend a track in order to permit the entrance of Schenectady Railway cars to the city. That was done, he said, to eliminate any cause of railway travel, and the double track proposition was to remedy the same.

"What about the charge made by Mr. Griffith that the new ordinance contains no provisions compelling the company to keep its tracks clear of snow?" was asked.

"We can't get away from the provisions of our original charter. We are bound to live up to the original franchise. The new ordinance makes no change in the old charter under which we operate here," replied Mr. Fassett.

Attorney Griffith's Amendments.

Former Judge L. E. Griffith, representing property owners on River street between Grand and Fulton streets, called at the mayor's office this afternoon. The executive was not in at the time, but Mr. Griffith made it known that his visit was in relation to the double track ordinance recently granted the United Traction company by the common council. He had in his possession amendments which he intends to ask the mayor to have incorporated in the new ordinance.

One of the amendments provides that in case the city decides to change the grade of a street at any time the company shall also be compelled to so place its tracks that it will conform with the city grade. It will also be asked to have inserted in the ordinance a provision which will force the company to change the pavement between its tracks on any city street at any time in which the city of Troy decides to change the pavement on any thoroughfare on which the company operates its cars. The idea is to have the street pavement and pavement between the company's tracks uniform.

Another amendment is a provision that the company shall at all times run suitable care for the accommodation of the traffic and that the operation of the lines shall be under restrictions of the common council. It is also arranged in the proposed amendments by Mr. Griffith that the Traction company shall not construe the new ordinance in a light that would make the original charter null and void.

Mr. Griffith did not see the mayor during his stay in the municipal building, and left in search of the executive.

EXAMINED:

Eug. W. Fassett
GENERAL MANAGER

Chas. H. Arnott
SUPERINTENDENT

Samuel R. Leslie
TREASURER

P. C. Dugan
ATTORNEY

To be finally returned to Superintendent for filing.

Company, of Albany, is interesting. The company's lines extend into several counties and are operated in four divisions. All of the local papers in the different towns, that is, in Albany, Troy, Rensselaer, Cohoes and Watervliet, are taken by the company and are distributed among the division superintendents. Each division superintendent thus receives two or more daily papers which he is expected to go over thoroughly every day. The superintendents make the clippings from the daily papers and send them to the general office, where they are edited by a clerk, so that the same matter will not be put on twice, unless it is handled in a different manner by the different papers. They are then pasted on a piece of stiff manila paper measuring 12½ ins. wide by 16½ ins. high. This sheet is called the "Bulletin," and a sample is reproduced on page 509.

In the lower right-hand corner of this bulletin are seven blank lines, and in these blanks the general manager, superintendent, treasurer and attorney and any others to whom the manager may send the card sign their names, but these officers always read the bulletin. Finally it is returned to the superintendent's office for filing. The articles are then indexed by a clerk in a regular index book which is kept with the files.

ELECTRIC RAILWAY CONDITIONS IN VERMONT

BY H. S. KNOWLTON

The study of electric railway development and operation in sparsely settled territory is full of significance to the transportation engineer who is familiar with purely urban propositions. The contrast between the resources and facilities for doing a prosperous business on a great city system and those which handicap a small road operating in thinly inhabited districts is too great to be passed by without comment. As electric railway practice in great cities has developed, there has been no lack of means to secure the best possible service which money can buy, and while the expenses of larger urban systems are enormous, there should be no question of financial success as long as the traffic density remains high. The manager of a small road, on the other hand, is handicapped at the very start by the reduced tributary population of his territory. Every expenditure must be watched with the keenest discrimination of what will certainly pay and what may be of doubtful value. There is little room for costly experiments. Although a nickel means as much in itself to the large city system, operated according to the most modern ideas, as it does to the small road, yet the relative value is far different, when it comes to experimental service. When one finds thoroughly good service, therefore, in a small community, there should be given the fullest credit to the management which makes it possible. The difficulties of the systems are often unrealized.

In a recent trip to Vermont, the electric railway situation was one of the most interesting subjects of the journey. The conclusion was emphatically favorable to the electric road as a factor in the industrial well being of the inhabitants of the State, and the general character of the service given to the public was good in the cities and towns visited. Considering the financial status of some of the companies in the State, it is manifestly impossible to give the very best service found in large cities, but there is not the slightest question of the value of the electric railway to the communities which it serves, and in some cases it is remarkable that anything like as good service should be given. Vermont has no large cities, its most populous community having but 21,000 inhabitants. After Burlington, Rutland, the second city, has about 16,000, including East Rutland. The total completed electric railway mileage in Vermont is now 94.16, divided as follows:

	Miles
Barre & Montpelier Traction Company	9.18
Bellows Falls & Saxton's River	6.25
Bennington & Hoosick Valley	8.25
Brattleboro Street	4.
Burlington Traction Company	10.76
Military Post Street (leased to Burlington)	4.64
Mt. Mansfield Electric	10.50
Rutland Street	23.30
Springfield Electric	4.58
St. Albans	12.70
Total	94.16

Within the last two or three years there has been little or no increase in mileage in these systems, though an important line is now under construction between Bennington and Northwestern Massachusetts by the New York, New Haven & Hartford interests. At the present time the Burlington and the Springfield systems are the only roads paying dividends, but the Rutland system has been reorganized as a component of the Rutland Railway, Light & Power Company; its business is rapidly increasing, and on Sept. 1, 1906, the first bond interest coupons of this road were paid, with a prospect of dividends in the near future, as the earnings are now more than sufficient to pay the fixed charges. This property was originally composed of the Chittenden Power Company, the Rutland Street Railway Company, and the People's Gas Light Company. It had a total capitalization of $2,750,000 and a bonded indebtedness of $1,650,000. In March, 1906, the Railway, Light & Power Company was organized, with a bond issue of $1,200,000, and a stock issue of $1,500,000. The present company has expended about $75,000 in improvements and is now practically out of debt. A description of the power plant improvements of this road is reserved for a later issue.

The last biennial report of the Vermont Railroad Commission, published in 1904, gives the earnings and expenses of four respective roads for the year ending June 30, 1903, as follows, and the figures for the year ending June 30, 1905, are appended by the courtesy of Hon. Fuller C. Smith, chairman of the Commission, in the table on the opposite page.

In all of these roads comparable in 1903 and 1905, the gross earnings showed gratifying increase; thus the Barre & Montpelier gained 18 per cent, the Burlington 17.7 per cent, and the Bennington 5 per cent. The Burlington, Rutland and Springfield systems are improving both physically and financially, according to the best opinions. The latest available gross operating expenses and net earnings of the above roads per mile of track (1905) are:

	Gross.	Operating Expense.	Net.
Barre & Montpelier	$4,530	$3,200	$1,330
Burlington	7,950	5,500	2,450
Rutland	3,750	2,440	1,310
Hoosick Valley (Bennington)	5,050	3,800	1,250

The Barre & Montpelier road is essentially an interurban line, although it handles a considerable local traffic. The Rutland Street Railway operates a suburban line about 16 miles long to Fairhaven and Lake Bomoseen, which accounts for its relatively low earnings per mile of track. These figures exhibit considerable room for improvement, in point of stimulated traffic, but they are not as far below those of other roads serving relatively small cities as some deprecators of Vermont urban traction securities would have one believe. Thus, the Burlington gross earnings compare very favorable per mile with those of the Worcester (Mass.) Consolidated Street Railway system in 1905, which were $9,930; the Barre

& Montpelier gross shows up pretty well against the noted Boston & Worcester interurban earnings of $6,100, as do those of the Bennington & Hoosick Valley. Burlington's net earnings per mile are somewhat better than the figures for Pittsfield, Mass., a city of about the same size. These figures represent the more favorable situations in Vermont at this time, and it is of course true that on most of the roads other than those mentioned in the dividend or close-to-dividend class, the traffic density is not as yet sufficient to create a thoroughly profitable business.

The physical status of the electric railways in Vermont varies considerably. Without any desire to draw invidious comparisons, it is apparent to the visitor that the urban lines are, on the whole, in better shape than the lines serving the remote country districts or the small villages. This is to be expected from the considerations outlined at the beginning of these comments. The Barre & Montpelier road competes very successfully with a steam railway branch line which connects these two points; it supplies a 30-minute service in each direction against a much less frequent service on the steam line, and the running time of the latter is scarcely better than 50 per cent faster, on account of the numerous stops which are made in the run. The fares are the same in each case. This road is the possessor of five grade crossings, which are protected by special electric hand operated semaphores.

The rolling stock in Burlington, Rutland and Montpelier is maintained well, and the service in the cities is thoroughly acceptable. It is certain that the withdrawal of electric traction in any of the communities visited would be regarded as little short of a calamity by the public. It is unfortunate that the system of accounting used by many of the companies is so unsatisfactory that their reports are imperfect and furnish no sufficient data upon which to base a comprehensive report of their financial operation or condition. The law requiring such reports from electric railways to the Railroad Commission is not sufficiently specific to justify the Commission's enforcing the forms prescribed by the Street Railway Accountants' Association of America and approved by the National Association of Railroad Commissioners.

Among the improvements which it is desirable to effect on some of the Vermont roads may be mentioned the better surfacing and alignment of the roadbed and track, and the establishment of more settled standards of examination in the selection of car service employees. Power brakes are coming into wider and wider use, the rolling stock is in several cases superior to many of the cars found on more prosperous and larger city systems, and in every city visited, the power supply was found to be derived from a hydro-electric generating station. There should be no difficulty, therefore, in securing a thoroughly reasonable power cost.

As for the future of the electric railway in Vermont, predictions are always uncertain in great detail, but there is no reason to doubt the increasing value of all the urban systems, if the present development of the cities continues. The rural systems cannot be expected to make as good a showing financially, but it would seem that there are a good many points which could be connected profitably with the city centers in the not distant future. The famous marble town of Proctor, only about 7 miles from Rutland, has no electric connection with the latter city. The granite quarries near Barre are relatively inaccessible from that enterprising city. The market gardening and dairy business near Rutland is an important industry, and there would seem to be a field for the carriage of light freight in this region. The main range of the Green Mountains is so accessible by carriage from the Burlington and Rutland regions that in time there ought to be a summer business of consequence here. All these developments must be handled cautiously, but with the improvement of local urban systems and the gradual expansion of lines into the surrounding country there ought to be good returns in the future, even though the immediate present may lack incentive for expansion. If the State develops steadily, the rural systems will doubtless become links in through routes. There seems to be no very great demand for high speed at present, and the track layout seldom permits it. The great point is this: without the electric railway, the urban citizens and many of the rural dwellers of Vermont would be sorely handicapped by being forced to walk between the points at issue, or else travel by team—always a serious expense—or by the infrequent steam roads. The total mileage of the State is very small, of course, but that mileage should be worked for all it will yield. It is certain that the use of publicity methods of traffic stimulation would be a good plan on the Vermont trolley systems. In this rather frank discussion of present conditions in Vermont electric railway practice, the writer's sole object has been to endeavor to show the situation as he found it. If there are discouragements on some of the roads because of the sparsely settled territory which they serve, there are many hopeful signs for the future of the urban systems, and the smaller roads cannot but share in part, the prosperity of the State at large.

TABLE SHOWING REPORTS OF FOUR ROADS IN VERMONT

	Barre & Montpelier.		Burlington Traction.		Rutland.	Bennington & Hoosick Valley.	
	1903	1905	1903	1905	1905	1903	1905
Gross Earnings	$35,339	$41,676	$72,878	$85,700	$87,574	$39,610	$41,672
Operating Expenses	25,148	29,303	47,371	59,323	56,907	28,314	31,236
Net Earnings	10,191	12,373	25,507	26,377	30,667	11,296	10,436
Deductions from Income	.....	5,799	.....	9,468	36,814	.....	10,195
Net Income	10,191	6,574	25,507	16,909	*6,147	11,296	241

* Deficit.

BROOKLYN "L" LOOP PLAN ADVANCED

Controller Metz, of New York, triumphed last Thursday when the committee on plans and contracts of the City Council instructed George L. Rives to prepare a formal resolution laying out the route of the elevated loop plan to connect the Brooklyn and Williamsburg bridges, which will be submitted for adoption by the Rapid Transit Commission. With the adoption of this resolution by the commission and concurrent action by the Board of Estimate, application can be made to the Appellate Division of the Supreme Court for the appointment of a commission if it be found that the necessary consents cannot be secured from the abutting property owners. The action just taken means that the Rapid Transit Commission intends to give the Stevenson plan equal consideration and place it on the same basis with the subway loop plan.

ACCIDENT BULLETINS

BY F. W. JOHNSON,
Claim Agent Connecticut Railway & Lighting Company.

Some operating men have a fondness for sitting up late at night devising ponderously complicated rules and regulations for the guidance and instruction of their employees, and guaranteed to cover every possible contingency and emergency with which they may be confronted in this world or in the next. These regulations are embodied in nicely-bound Rule Books, one of which is given to every employee. The idea presumably is that each man will carefully study his book and thus become conversant with all of the company's rules and regulations. At least one man in every hundred does this conscientiously. The accident man of the company also apparently has the same object in mind, for we find him grinding out instructive material to an extent sufficient to qualify every one of his readers as a full-fledged claim agent, surgeon and expert accountant if he should read his dissertations carefully—which he won't.

The principal trouble with books of this character is that they shoot straight over the heads of those for whom they are written. They're too ponderous, too complicated and too involved. They fall of their own weight. They lack brevity, force and simplicity, and invariably attempt to cover far too much territory.

After all, the accidents which occur with the greatest frequency and which a concern fears the most are comparatively few in number. For this reason the field for work is fortunately limited, and accident instructions should not attempt to spread out over the entire map of the accident problem.

There is a certain middle of the road policy in accident work which offers the richest field for their prevention, and it will be found that the other branches will follow in easily and logically after you once have a good foundation laid.

The idea of attempting the entire instruction of railway employees in the work of preventing and of handling accidents by giving them one or more books on the subject and in then dropping the matter is like handing a man a set of medical books and expecting him to qualify himself as a physician without any opportunity of asking questions or of

DANGER POINTS.

WE are striving to make this summer the safest and altogether the most successful summer that our Company has ever had, so far as our work is concerned. Thus far the results have been splendid.

It is but a simple matter for us to instruct you concerning the handling of, and the prevention of accidents. The actual work comes in successfully carrying into execution those instructions.

And so we say, the credit for the good results achieved thus far this season, belongs entirely to our Conductors, Motormen and Inspectors. We take this means of assuring you that your careful work has been greatly appreciated by this office.

We are now on the last quarter of the open car season for this year. The summer is the most dangerous season of the year in our business. Naturally we are extremely anxious to keep up the fine work for the balance of the summer.

Within we offer you a few timely suggestions to refresh your recollection of the danger points. We wish that you would personally read these.

Heads up all along the line and let every man do his level best to finish out the summer season with a slashing good record for careful work on our cars.

F. W. Johnson, C. A.

August 22d, 1906.

MOTORMEN.

Are you the man who starts on one bell?

Bang the gong. It prevents accidents.

Keep your eye on the children in the streets.

Watch the autos. They're reckless cusses, you know.

When carrying a red flag or lantern. A moment's forgetfulness may mean a terrible catastrophe.

Get busy with your Witness Cards. Land those passengers on the first two seats.

Passing standing cars. Speed of your car right down and your gong on the jump.

Track or street under repairs. Pick out a safe spot to let passengers off. Be careful of the laborers for they are slow thinkers.

Open switches. Approach every switch with great care. Make sure that it is right before you go into it. Open switches pave the way for terrible accidents.

Passengers on your running-board. Slow down and pass all teams or obstructions close to your track with great care. Read this one again.

Passing teams going in the same direction as your car. Slow down, clout your gong and pass in safety. He will pull across in front of your car when you least expect it. Be on the safe side. Be careful.

Following the car ahead. Rear-end collisions result from careless work in this respect. Hold back——hold back ——give that car ahead a whole block if possible. We warn you against rear-end collisions caused by following the car ahead too closely.

CONDUCTORS.

Prompt report on every accident.

Abundance of witnesses on every accident.

Look the car over carefully before starting.

"Wait until the car stops." And roar it out.

Keep yourself supplied with Witness Packets.

On your life, don't be careless with your signals.

Several Conductors badly injured this summer in falling from the running-boards.

Keep a sharp eye on the passengers on your running-board. Don't want any of them raked off by poles, teams or obstructions of any sort.

Tracks or streets under repair. Dangerous for passengers alighting from cars. Women especially liable to be hurt. Caution and assist them.

Lower that running-board before you put up that side-bar. And let down that side-bar before you turn up the running-board. No exceptions.

Don't take chances. A moment's carelessness and some person's life is sacrificed as a result.

Read our Bulletins every week. It takes but two minutes and they always have something of interest for you.

Remember that that passenger who jumped from your car yesterday while it was in motion, will be claiming to-day that you started the car while they were getting off.

Get wise and get your witnesses and lots of them, and thus protect yourself and the Company from these grafters.

THE THREE-PAGE MONTHLY BULLETIN ISSUED DURING AUGUST

All of this system is very beautiful to look upon, but its practical value to a two-dollar-a-day man is somewhat questionable, if you're looking for results. The man who reports at the car house for work at 5 a.m. will accept your bound volume of "The Universal Encyclopedia of Accidents" with a cheerful smile, but if you fondly imagine that he is going to sit up nights struggling through that book with the aid of a dictionary and by the light of a tallow dip, you're doomed to disappointment. Not that the book will go to waste, for you may be sure that the man will find it handy to use in keeping his day-card, or for the purpose of jotting down little memoranda upon its blank leaves. The old hands aren't going to wade through that volume, for while they appreciate your thoughtfulness, they realize down deep in their hearts that they themselves really know as much about the subject as does the author. And the new employee, to whom everything in railroading is new, and who is working early and late, has trouble enough on his mind without sitting up nights reading a lot of stuff that is all Greek to him.

receiving the benefits of other people's ideas and suggestions. Accident instructions to conductors and motormen must be given by degrees and in a systematic manner. Men who are able to acquire proficiency in any particular branch of the world's work at a single stroke are not working on trolley cars.

To the virtues of brevity, force and simplicity in your instructions should be added that of "stick-to-it-iveness." For unless you keep pounding away at the points which you are endeavoring to drive home, constantly disguising your real objective points in order to cover the same ground repeatedly without losing the interest of your readers, you're going to lose ground. You've got to hold the older men right up to the mark while you are bolstering up and educating the new men.

Unquestionably the most powerful battery in the work of preventing accidents is that of verbal instruction. It is, however, with the problem of holding ground so gained, and of keeping in constant touch with the men, that we are now concerned.

You've got to get into direct communication with the men on the firing-line, and what is more, you've got to keep there in order that they may realize that you are hot on their heels in this work; that you're going forward, and not backward. Your information, suggestions and warnings must be hot off the bat, right up to the minute and straight from the shoulder.

An outgrowth of this idea has been the development of the weekly accident bulletin, so called. This bulletin has proven of immense advantage in educating conductors and motormen in the work of preventing and of the proper handling of accidents.

The accident bulletins deal entirely with the accident situation, giving advice, suggestions and warnings adapted to the classes of accidents occurring or anticipated during the various seasons, and are couched in short, sharp language, plain and to the point. They are written in the every-day language of the men themselves as nearly as possible, and every effort is made to make them interesting and readable.

The success or failure of the bulletin idea depends absolutely upon the style in which the bulletins are written. They've got to hit straight from the shoulder without being in any way sensational or offensively personal. They must contain no dry matter or stilted language, yet they must preserve a certain dignity to command the respect of the men.

The bulletins are issued regularly on a certain day each week. They are printed upon a good quality of heavy white paper, in good readable type, with wide spacing between paragraphs. The paragraphs are short, that the idea may be easily grasped, and surrounding all is a good wide margin of several inches to set it off well. The bulletins average from 150 to 400 words, the idea being to make them short, sharp and to the point.

These weekly bulletins are immediately posted upon special bulletin boards of a simple but pleasing design, conspicuously placed in all car houses, offices and lobbys where they may

HUSTLERS

During the past week the accident reports have, almost without exception, been of exceptionally good calibre.

Below we call attention to some of those which appealed to us as being even above the general high average for the week.

On the next accident that happens on your car, let's see what you can do in the way of securing an abundance of witnesses and in making out a good report.

Conductor J. Kelley, Waterbury Division, turns in EIGHTEEN witnesses on a recent accident.

Motorman Fred'k K. Miller, Norwalk Division, landed SIXTEEN witnesses on a recent accident, while his conductor, John A. Seymour, ran him a close second with FIFTEEN witnesses on the same accident. That's going some.

Conductor J. C. Laird, Waterbury Division, secured FIFTEEN witnesses out of nineteen passengers. Good work.

Conductor H. F. Smith, Derby Division, turns in FIFTEEN witnesses. All right.

Conductor Peter Aspell, Derby Division, keeps his general high average by landing THIRTEEN witnesses on his last accident.

Motorman G. N. Rempp, New Britain Division, breaks into fast company with THIRTEEN witnesses, though he had but three passengers on his car at the time. He nailed them right and left on the street.

Motorman M. J. Nolan, Norwalk Division, gathered in TEN witnesses on a recent mishap.

Motorman F. C. Kirley, Waterbury Division, gets NINE witnesses on a recent accident.

Conductor C. Fleuwellin, Norwalk Division, turns in EIGHT witnesses, though he had but one passenger on his car.

Conductor John J. Carroll, Derby Division, had a slight accident recently. After its occurrence I tendered him an additional witness packet. Much to my surprise and gratification, he produced three spare packets, making a total of four in all.

He was well supplied with witness cards, and didn't propose to be put out of business by one lone accident.

Compare with him the man whom we occasionally discover who hasn't foresight enough to carry even one packet when on duty.

Remember that we cannot give credit for exceptionally good work unless you sign your own name on the front of every witness packet that you hand in with your accident report.

P. A. B. No. 54. F. W. JOHNSON, C. A.
Aug. 29, 1906.

OPEN CARS

1. Many people are hurt in jumping onto and off of open cars.
2. Shout at them "WAIT UNTIL THE CAR STOPS."
3. When you see women, children, aged persons or foreigners trying to jump from your moving car, grab them and hold them on, regardless of what they think about it.
4. Foreigners are especially adept at jumping off backwards from moving cars. Shout at them, and hold them on if possible.
5. Don't start your car while people are BOARDING or ALIGHTING.
6. Don't start your car on ONE BELL.
7. In passing standing cars, sound your GONG loudly, and have your car under complete control.
8. Side-bars. NEVER put up your side-bar while your running-board is turned UP on the same side.
9. Keep your platform gates and chains closed on their proper side.
10. On EVERY accident, a good report and a good lot of WITNESSES. Eight to ten is good work.

We've had a grand good record this past winter in our freedom from serious accidents, and we are looking forward to an equally successful summer's work.

P. A. B. No. 35. F. W. JOHNSON, C. A.
May 2, 1906.

DERAILMENTS

In passing moving cars on turnouts and double-track lines, clang your GONG vigorously. For this reason—

It warns the passengers of both cars of the danger. It is a safeguard to the passengers against broken arms, legs and crushed skulls.

You recall the accident which happened recently on the New Haven Road, where a woman passenger was instantly killed by reason of her head being crushed between two passing cars.

EASY on your curves. We've been having quite a number of derailments of late. Dry rails on curves should be reported AT ONCE.

Had a serious derailment recently due to the fact that a motorman gave more attention to getting into his rubber coat than he did to the operation of his moving car. (A word to the wise, you know.)

Last week Conductor Thomas Fenton, of the Bridgeport Division, witnessed an accident on one of our cars, from a window of his home. He immediately turned in a full report of the affair, together with some excellent witnesses. Good work.

Conductor John Carroll, of the Derby Division, turned in seventeen witnesses on a recent accident. That's going some.

Always sign your name on the front of each witness packet envelope that you turn in. In no other way can we tell who is doing the good work in the way of securing witnesses.

If you are not able to secure any witnesses to an accident, you do not hand in your envelope of blank cards.

Go after the witnesses strong. We've got to have them.

P. A. B. No. 46. F. W. JOHNSON, C. A.
July 11, 1906.

SPLENDID

Hats off to the men of the Westport Division.

The month of August proved to be the biggest month in the history of their division, and they achieved the remarkable distinction of handling this traffic without a single accident.

That doesn't mean that they had accidents and failed to report them. It means that they had no accidents of any description.

Superintendent Purdy and his boys are to be complimented upon such fine work, and our company is to be congratulated upon having such careful men in its employ.

For many months past the streets of New Britain have been torn up in all directions due to excavations for sewer pipes. The conditions have been particularly dangerous.

We were pleased to note a recent article in the "New Britain Herald" complimenting the men of this division upon their splendid work in safeguarding their passengers from these dangers.

Nothing but the most vigilant work under such trying conditions made possible so splendid a record, and the compliment paid Superintendents Risley and Foss and the conductors and motormen of the New Britain Division by the "Herald" was well deserved.

The hustlers during the past week in the work of securing witnesses to accidents proved to be:

Conductor E. M. Flood, Waterbury Division, who takes the flag with TWENTY-THREE witnesses on a recent mishap.

Conductor Asa Loundes, Norwalk Division, lands FIFTEEN witnesses on an accident, and then just to show his friends how easy it is, he nailed TWENTY witnesses on a second accident. Both mishaps were unavoidable.

Motorman C. Ethier, Norwalk Division, secured NINE additional witnesses on Conductor Loundes' first accident, while Motorman H. C. Marshall, of the same division, likewise got busy on Conductor Loundes' second accident, and rounded up FIFTEEN additional witnesses.

There's some team work for you to think over.

Motorman J. J. Forbes, of the Bridgeport Division, had no difficulty in securing THIRTEEN witnesses in addition to those secured by his conductor on a recent accident.

Conductor P. A. Parmelee, of the Bridgeport Division, also secured THIRTEEN witnesses on a recent mishap.

Car ahead. You know the answer.

P. A. B. No. 55. F. W. JOHNSON, C. A.
Sept. 5, 1906.

TYPICAL WEEKLY BULLETINS

catch the eyes of the men. Nothing but these bulletins ever appear upon these particular boards. When a new one is printed, the preceding one is removed, that attention may be directed to but one at a time. An outgrowth of this weekly accident bulletin idea is the monthly accident bulletin, which is founded upon practically the same principles, with these exceptions: The monthly bulletin is an individual affair, being much smaller in size, and being delivered personally to every conductor and motorman by the paymaster on payday once a month. Its objects are somewhat similar to those of the Government's weather forecast. It sounds a warning concerning the character of accidents which are likely to occur during that particular month, and suggests certain cautionary measures. It also furnishes an additional opportunity to pound away on any special subject desired. Furthermore, it is an effort to reach the men who are not reading the weekly bulletin, for it must not be supposed that every man will read them.

It is possible that the following hints and suggestions pertinent to the issuing of accident bulletins may be of interest:

Hit from the shoulder, but don't knock.

Avoid sermons, sarcasm, ridicule, offensive personalities and dry rot.

Your one object should be to secure the interest of the men so that they will work with you and not against you.

Make them always optimistic in tone; always working for a better showing next month. If one division is doing rank work, compare it with the division which is doing well.

Don't be afraid to show enthusiasm in your work. It may prove infectious.

Be versatile in your subjects and original in your manner of handling them.

Use the bulletins to arouse a spirit of friendly rivalry between different divisions or houses in their efforts to do good work.

Make the word CAREFUL your guiding star and hurl it at your readers at every opportunity.

Put a printed card in the pay envelope occasionally, briefly calling attention to your bulletins.

Watch the returns carefully and don't be afraid to give credit in the bulletins to the men who are excelling in the good work.

Experience has shown that a good word in the bulletin to a man who has hard luck in his work helps a whole lot in getting him back onto his feet..

Hold up men who have been discharged for careless, reckless or incompetent work, as "horrible examples." But finish strongly with appreciative words for those who are doing their best for you.

Drive a single point home solidly, rather than confuse your readers with a number.

Your bulletins should be of such length that they may be read through and easily understood in from two to three minutes.

Advise your readers that your office is always at the immediate service of any conductor or motorman who may desire further information or assistance in the work. And don't say it in such a way that none of them will ever dare to seek needed explanations.

Use the bulletin to call attention to serious accidents on other roads in any part of the country—explaining the cause of the mishap—then follow it right up with your warning.

Remember that it is human nature to feel pleased with a word of commendation in appreciation of careful work.

Issue bulletins prior to all holidays or big riding days, calling attention to the expected rush of business, and asking for particularly careful work on these days.

Adopt the practice of using a single word as a head-liner. Make it short, sharp and energetic. Have the type of a eleancut block letter.

Your opening paragraphs have got to be of sufficient interest to arrest the attention of your reader, or he will not stop to go through the bulletin.

A bonus offered the men in appreciation for exeelling in any partieular branch of the work can be used to splendid advantage in your bulletins by eontinually referring to the contest and thus keeping alive the interest and friendly rivalry.

Have your bulletins absolutely clean and neat. If one becomes soiled before the week is out, tear it down and put up a clean one. No one reads a dirty sign.

Keep your bulletin boards clean and attractive for the same reason.

DISTRIBUTION OF MOTORS ON TRUCKS

BY CALE GOUGH

When two motors are to be used on double-truck cars a question always comes up as to the best location of the motors; whether the two shall be mounted on the same truck or on different trucks, and if on different trucks whether on the inside or the outside axles. The two principal questions for consideration are: what arrangement gives the best traction for acceleration? and, what is the most convenient arrangement as regards motor inspection, repairs and the general mechanical features of the ear? Usually the first question is of more importance.

To get at exaet results as to traction with different dispositions of the motors requires a more extended consideration of the subject than is usually made. The following analysis, though by no means exhaustive, may help to throw some light on the subject and to outline the methods by which the problem ean be solved for any given ease.

The per cent of the total weight of the ear resting on the drivers when the car is at rest must first be determined. This must then be corrected by having added to or subtracted from it the effects due to acceleration and to the action of the motors. Conditions will first be analyzed for inside-hung motors (that is, motors hung between the axle and the truck bolster), and then for outside-hung motors.

INSIDE-HUNG MOTORS—WEIGHT ON DRIVERS WITH CAR AT REST

With inside-hung motors and the car at rest the greater percentage of weight may be shown to rest on the drivers when the motors are both mounted on one truck. In any case one-half of the weight of the trucks and of the ear body rests on the drivers and, in addition, if the motors are inside-hung and are on separate trucks, probably four-fifths of the weight of the motors is on the drivers. The weight of the motors is distributed in about this proportion since the center of gravity of the motor which is near the center of the armature shaft lies about one-fifth of the length of the wheel base of the truck from the driving axle. On a double-truck car with two motors the weight of the motors is approximately 20 per cent of the weight of the complete car. The total weight on the drivers when one motor is plaeed on each truck is then one-half the weight of the ear exclusive of motors, or 40 per cent; to whieh must be added four-fifths of the weight of the motors, or 16 per cent. This gives a total of 56 per eent of the weight of the complete equipment on the drivers when the motors are so distributed. When both motors are placed on the same truek, it is evident that the total weight of the two motors must be added to one-half the weight of the car without them, to obtain the weight on

the drivers. This gives 60 per cent on the drivers, an increase of 4 per cent over the other method of distribution. Usually this percentage is further increased by the fact that when both motors are mounted on one truck the free truck is of lighter design. This not only decreases the total weight of the car, but it also throws a greater per cent of the total weight on the drivers. If the car is built to operate in one direction only, further increase in the percentage is usually secured by the fact that the controller, if of the drum type, and the heater, if it is a car heated by hot water, are in the forward portion of the car, and as the front truck may be made the motor truck, the benefit of the weight of controller and heater is obtained. However, the weight of an extended rear platform may overbalance this increase, but in the later designs of cars the increased weight of such a platform is often taken care of by placing the rear bolster nearer to the end of the car body than in the case of the front truck.

From the standpoint of the repair man it is better to hang both motors on one truck. When so arranged it is necessary to remove only this one truck from under the car when the motors are repaired from above. Moreover, if the car is to be operated in one direction only, the wiring may be simplified by putting the motors on the forward truck. It is then not necessary to run the motor leads the full length of the car.

An argument against placing both motors on one truck is that the rear motor is not cooled by the atmosphere as much as it would be were it not located immediately behind the forward motor. In some tests of a car with both motors mounted on the forward truck the following temperatures of the armatures were obtained after runs of 110 miles: At the conclusion of one test the temperature of the forward motor was 70 deg. C., while that of the rear was 72.5 deg. In another similar test the temperature of the forward motor was 61 deg. while that of the rear motor was 66.5 deg. Another test gave forward motor 60 deg.; rear motor, 74 deg.

Some figures within the writer's knowledge regarding the weight on the drivers of a car with both motors mounted on the forward truck may be of interest. An interurban car weighing 63,100 lbs. had 40,300 lbs. on this truck, as was determined by actually weighing the car. This was more than 63 per cent on the drivers. In this case the motor truck weighed 9565 lbs., the motors 5500 lbs. each, and the trail truck 6670 lbs. The percentage of weight on the drivers was further increased by the fact that the weight of the controller (of the L-2 type) and the hot-water heater was carried largely by the front truck.

WEIGHT ON DRIVERS WHEN CAR IS ACCELERATING

The percentages of the weight of the car on the drivers as shown thus far hold true only when the car is standing still or when it is in uniform motion. When the car is accelerating, forces are created which tend to change these percentages. One of the two most important forces is that due to the inertia of the car body and acts on the center bearing. The other force is caused by the tendency of the pinion to travel around the gear. To determine what effect these forces have in altering the weight on the drivers during acceleration, it is necessary to assume a certain maximum tractive effort. The traction that can be exerted in starting a car without causing the driving wheels to slip will be assumed to be 16 2-3 per cent, or one-sixth of the total weight on the driving wheels. For dry rails 25 per cent, or one-fourth, is usually assumed, but in street railway practice where the most adverse conditions prevail at times, one-sixth will probably give more exact results. The following figures, while only approximate, are believed to be sufficiently accurate for practical purposes.

MOTORS MOUNTED ON THE REAR AXLE OF EACH TRUCK

It will first be assumed that the motors are hung on the rear axles of each truck, between the axles and the bolsters. In this position the weight on the drivers, when the car is standing still, has been shown to be 56 per cent of the total weight of the car. The maximum tractive effort that can be exerted without slipping the wheels under these conditions is 9.33 per cent of the total weight of the car, and is obtained by taking 16 2-3 per cent of the weight of the car on the drivers, or of 56 per cent. The weight of the car body is usually about one-half that of the total weight of the car, and if it is assumed that all the tractive effort is expended in accelerating the car (which, however, is not true, since some is used in overcoming friction), the pull on the car body at the center bearings is one-half the tractive effort, 9.33 per cent, or 4.66 per cent of the total weight of the car. This is divided between the two trucks so that the pull on each

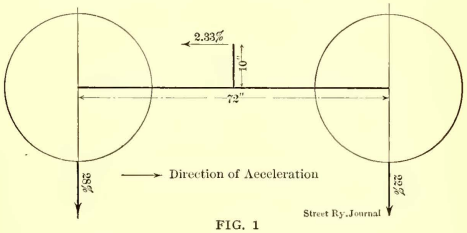


FIG. 1

bolster is one-half this amount, or 2.33 per cent of the total weight of the car.

Fig. 1 shows this force acting at the center bearing in a direction restraining the motion of the truck, the center bearing being assumed as 10 ins. above the line joining the centers of the axles and the wheel base of the truck, which is 6 ft., or 72 ins. The percentage of the total weight carried by each pair of wheels when the car is standing still is also shown. The other truck, of course, carries the remaining 50 per cent.

This retarding action of 2.33 per cent. acts with a lever arm of 10 ins. tending to revolve the truck around the rear axle. It is opposed by the weight resting on the front wheels at a distance of 72 ins. from the rear axle. The turning moment of this retarding action at the front wheels, given in the per cent of the total weight of the car, is 2.33 per cent multiplied by 10, the lever arm in inches, and divided by 72, the wheel base in inches, or 0.32 per cent. This force acting upward at the front wheels of course reduces the weight on these and adds it to the weight on the rear wheels. The weight is then distributed on the wheels as shown in Fig. 2.

The other force changing the weights on the drivers, that due to the tendency of the pinion to climb around the gear, will now be investigated. This force tends to raise the motor and through the motor suspension to raise up the front of the truck. At a distance from the center of the axle equal to the radius of the wheels this force is the same as the tractive effort, which has been assumed to be equal to 16 2-3 per cent. of the weight on the drivers. The weight on the drivers of each truck, considering that due to the retarding action of the car body, is 28.32 per cent of the weight of the car. Taking 16 2-3 per cent of this gives 4.72 per cent of the weight of the car as the turning moment exerted by the pinion at a distance from the axle equal to the radius of the wheels, or say 16.5 ins. This tends to lift the weight of the car body and truck resting on the front axle, and at this distance its moment is 4.72 per cent multiplied by 16.5 and divided by 72, the distance in inches between the axles,

which gives 1.08 per cent. This result is in per cent of the total weight of the car and, like that due to the retarding action of the car body, must be subtracted from the percentage resting on the front wheels and added to that on the rear wheels. Adding it to 28.32 per cent, the weight already computed as being on the rear wheels of the truck, 29.4 per cent is obtained as the total weight on these wheels. The total weight on all of the drivers is then double that on one of the sets, or 58.8 per cent of the weight of the car.

It was assumed in starting the explanation of the forces that the weight on the drivers when the car was standing still was 56 per cent of the total weight of the car. More accurate results would be obtained by another similar process

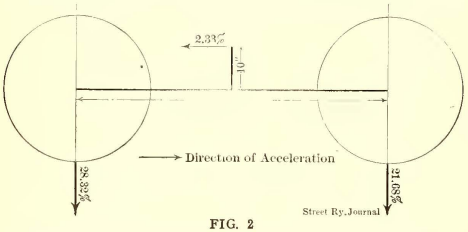


FIG. 2

of reasoning using 58.8 per cent (the result just obtained) instead. The final result would be increased by an amount equal to about 2 per cent of 3 per cent, or .06 per cent, bringing the total to 58.86 per cent. It will be seen, however, that the result is still lower than the percentage on the drivers when both motors are placed on one truck, and it is considerably lower than the figures given of the car where a lighter rear truck and the location of the controller and heater increase the percentage.

BOTH MOTORS ON ONE TRUCK

The question at once arises as to what is the effect of the forces created by the acceleration of a car having both motors mounted on one truck. That force due to the inertia of the car body which acts at the center bearing has the same effect as with the method of distribution just analyzed. The force due to the tendency of the pinions to climb around the gears is also the same. The effect of the rear pinion is of course the same as when no motor is mounted on the front axle, that is, it throws additional weight on the rear wheel. As the pinion of the forward motor is on the opposite side of the axle relative to the direction of motion of the car, the force it exerts is in the opposite direction or upward on the wheel and is almost equal to that exerted by the rear pinion. In other words, it lifts up the front wheels and throws more weight on the rear wheels. Both pinions then tend to lighten the load on the front wheels. Owing to the increased weights on the drivers the forces are slightly greater than when the motors are distributed between trucks, and these forces, together with the effect of the inertia of the car body, give a total reduction of weight on the front wheels of about 2.78 per cent.

Assuming the case cited in which 63 per cent of the total weight was on the drivers, the forward wheels in accelerating bear a weight equal to one-half of this, less about 2.78 per cent or 28.72 per cent, and this is a fraction less than that carried by the rear axle of a truck when the one motor is used per truck and is mounted on this axle. If then we consider that 60 per cent of the weight of the car is carried on the drivers, which would be the case on a double-end car with trucks of equal weight and both motors on one truck, the weight on the front wheel during full acceleration would be 27.33 per cent.

MOTORS ON LEADING AXLES OF EACH TRUCK

When the motors are distributed between trucks and placed on the leading axles, the force due to the inertia of the car body acting at the center bearing decreases rather than increases the weight on the drivers. Another objection sometimes made against placing the motors on these axles is that there is nothing ahead of the driving wheels to clean dirt from the track as is the case when the leading wheels are not drivers. Against this argument, however, it is stated that in case of snow the front wheels if they are not the drivers simply crush the snow into ice, causing the rear wheels of the truck to slip more than the front ones would if they were drivers. When the front wheels are the drivers, it is claimed they grind off the snow rather than crush it.

It is readily seen that when both the motors are hung on the lead or on the trail wheels of the trucks of a car operated in both directions, one very objectionable feature is encountered. When operating in one direction the forces due to the inertia of the car body and the action of the pinion increase the weight on the drivers. On reversing the direction of the car, however, these forces decrease the weight on the drivers in the same proportion. Hanging the motors on either the inside or outside axles of both trucks causes these forces to counterbalance each other so far as the whole car is concerned, so that with the car operating in either direction the same percentage of the total weight remains on the drivers. But this is distributed unequally between the two driving axles, the greater percentage alternating between the two axles as the direction of the car changes

OUTSIDE-HUNG MOTORS—ONE MOTOR ON EACH TRUCK

When motors are outside hung and both are placed on one truck, the forces due to acceleration have the same effect as with inside-hung motors. When one motor is placed on each truck, however, the results as worked out for inside-hung motors do not apply exactly. The effect of the inertia of the car body is the same, but the effect of the pinion thrust is much increased. In the following treatment of outside-hung motors all dimensions and percentages are assumed to be the same as in the treatment of inside-hung motors except that the wheel base of the trucks is considered as being 4 ft. 6 ins. The weight of each motor will be, according to the previous assumption, 10 per cent of the weight of the car. Instead of but four-fifths of this weight resting on the axle, as with inside-hung motors, all of it bears on this axle and in addition, by reason of the motor being hung outside of the axle, its weight tends to tip up the opposite end of the truck and thereby throw more weight on the drivers. The center of gravity of the motor may without appreciable error be assumed, as before, to be at the armature shaft or at about 14 ins. from the axle. The moment exerted by the weight of the motor at the front wheel in per cent of the weight of the car is then 10 per cent multiplied by 14 and divided by 54 (which is the length of the wheel base in inches), or 2.6 per cent. The total dead weight on each of the pairs of drivers when the car is standing is the sum of one-fourth of the weight of the car without the motors or 20 per cent of the total weight of the car, the actual weight of one motor, 10 per cent, and the amount lifted from the front wheel by the weight of the motor 2.6 per cent, giving a total of 32.6 per cent. The total weight on the two sets of drivers is double this percentage or 65.2 per cent.

The pull due to the inertia of the car body and its effect may be obtained in the same manner as before. Taking one-half of 16 2-3 per cent of the total weight on each driver when the car is standing or 32.6 per cent, as in the previous case, 2.27 per cent is obtained as the pull by the car body on each center bearing. The lifting moment at the front wheel

is 2.72 per cent multiplied by 10 and divided by 54, or .503 per cent. Added to the percentage of total weight already on the rear wheels and subtracted from that on the front ones, 33.103 per cent is obtained as the weight on the rear and 26.89 per cent on the front wheels. The tendency of the pinion to climb around the gear adds still more weight to the driver. Since the pinion is on the rear side of the axle, it tends to pull the rear end of the truck down and with the rear axle acting as a fulcrum to raise the front end. The force exerted by the pinion at the tread of the wheels is equal to 16 2-3 per cent of 33.1, or 5.5 per cent of the weight of the car. This tends to lift the front of the truck by a force in per cent weight of the car equal to 5.5 per cent multiplied by 16½, or the radius of the wheel in inches, and divided by 54, the length of the wheel base, or with a force of 1.68 per cent.. This percentage added to that already considered as being on the drivers gives 34.78 per cent as a total of the percentage of weight of the car on each set of drivers when accelerating forward. On the two sets of drivers there is consequently a total of 69.56 per cent. This is far above that obtained for inside-hung motors. When accelerating backward, the acceleration of the car body and the thrust of the pinion take weight off the drivers amounting in all to about the sum of .503 per cent and 1.68 per cent, or 2.18 per cent, which when done gives 30.4 per cent.

TWO OUTSIDE-HUNG MOTORS MOUNTED ON ONE TRUCK

When both motors are mounted on one truck and are outside hung, the effect of the lever action of the dead weight of the motors is lost, since the weight of one motor counterbalances that of the other. The forces of the pinion and of the car body are the same as for inside-hung motors except for the difference in the wheel bases of the trucks used, and in like wise these forces throw increased weight on the rear axle. Figured in the previous manner, 33.48 per cent is obtained as the total weight on the rear wheel and 26.52 per cent as that on the front wheel when the car is accelerating.

EFFECT OF DIFFERENCE OF WEIGHT ON THE TWO SETS OF DRIVERS

A consideration of the action of motors when connected in series makes evident the fact that the greatest total weight on all of the drivers does not always give the best starting effect. The least weight on one of the pairs of drivers is in reality the determining factor, as this weight determines the point of slipping or spinning of one pair of wheels. When this spinning occurs, the rapidly revolving motor driving them builds up such a large counter electromotive force as to seriously cut down the current and to lessen the torque on the other motor.

The accompanying table gives the results obtained by the previous reasoning for inside and outside-hung motors distributed in different ways. The first column gives the axles upon which the motors are hung, considering the axles numbered from the No. 1 end of the car. The second column is the percentage of the total weight of the car on the drivers when the car is standing still. In the third column is given the weight on the drivers when the car is accelerating in one direction, and in the fourth column are tabulated the weights when the car is accelerating in the opposite direction. No. 1 axle being in front for the forward direction and No. 4 axle in the same position for backward acceleration. The two remaining columns give the minimum weight on any driver for both forward and backward acceleration of the car. These latter figures are regarded as the ones that determine the spinning point of the wheels.

The figures show that on a single-end car the best results should be obtained with outside-hung motors mounted on the rear axles of the trucks. The minimum weight on either of the pair of driving wheels is then 34.7 per cent. With inside-hung motors the same arrangement has a slight advantage over that of placing both motors on the front truck and taking advantage of a lighter rear truck, the percentages being 29.4 against 28.7, the minimum weights on any set of drivers in each instance. When a car is to be operated in both directions, if the motors are to be outside hung they should be mounted on separate trucks on axles 1 and 3 or 2 and 4.

	Axles.	Percentage of Total Weight on Drivers.			Minimum Weight (Percentage) on Any Pair of Drivers.	
		Car Standing.	Car Accelerating Forward.	Car Accelerating Backward.	Car Accelerating Forward.	Car Accelerating Backward.
Inside Hung Motors.	1 and 2	60.	60.	60.	27.3	27.3
	1 and 3	56.	53.2	58.8	26.6	29.4
	2 and 4	56.	58.8	53.1	29.4	26.6
	1 and 4	56.	56.	56.	26.6	26.6
	2 and 3	56.	56.	56.	26.6	26.6
	3 and 4	60.	60.	60.	27.3	27.3
	1 and 2*	63.	63.	63.	28.7	28.7
Outside Hung Motors.	1 and 2	60.	60.	60.	26.5	26.5
	1 and 3	65.2	60.8	69.5	30.4	34.7
	2 and 4	65.2	69.5	60.8	34.7	30.4
	1 and 4	65.2	65.2	65.2	30.4	30.4
	2 and 3	65.2	65.2	65.2	30.4	30.4
	3 and 4	60.	60.	60.	26.5	26.5

NOTE.—Weights are given in percentages of total weight of car. *Special case of a single end car with light rear truck.

When the motors are so mounted the car, in traveling in one direction, will have a less total weight on the drivers than would be the case if they were mounted on axles 1 and 4 or 2 and 3, but the minimum weight on any set of drivers is no lower and in the opposite direction the minimum weight is greater.

With inside-hung motors on a double-end car it is somewhat advantageous to mount them both on one truck. This advantage becomes greater when the rear truck is made of lighter design.

In conclusion it may be stated that, considering tractive effort alone, it is better to mount the motors on axles 1 and 3 or 2 and 4, except in the case of a double-end car with inside-hung motors, when they should both be mounted on one truck.

INTERURBAN ROADS INCLUDED IN TARIFF RULING

The Ohio Railroad Commission has included interurban railways in its call for the filing of tariffs with the commission covering freight, passenger and express rates. Explanatory of its position the commission says: "The Railroad Commission of Ohio has given consideration to the question of tariff publishing and filing by the carriers of Ohio, and has come to the conclusion that it were best not to require the filing of tariffs immediately, but that it were only fair to give the carriers a reasonable length of time for preparation. The commission realized just now that the railroads are uncertain as to what the Interstate Commerce Commission will require under the new federal law, and that considerable time and a vast amount of work will be necessary to prepare the tariffs under the regulations that will be prescribed by that body. The commission, in consideration of these conditions, has decided to allow the railroads and express companies operating in Ohio until Jan. 1, 1907, to get ready. The State commission therefore requests that the railroads and express companies of Ohio file with the Railroad Commission of Ohio between Dec. 22 and Dec. 28, 1906, one copy each of all tariffs, classifications, rules and regulations, State or interstate, affecting charges for freight, passenger and express transportation, that will be in effect Jan. 1, 1907."

OBJECTS TO BE SOUGHT IN STANDARDIZING AXLES

BY WARREN L. BOYER

Standardization of axles, especially those of the M. C. B. type where raised gear seats and solid gears are used, is a point that would be of great advantage to everybody concerned in their use. In an article on standardizing trucks, the STREET RAILWAY JOURNAL for March 3, 1906, the writer called attention to the importance of standardizing the dimensions for centers of truck frames. If this is done, it will set the standard for length over all for a given journal, so a standard for the rest of axle would be sure to follow. The present article is intended merely to bring out points in construction which are encountered every day, and to which not a great deal of attention has been given.

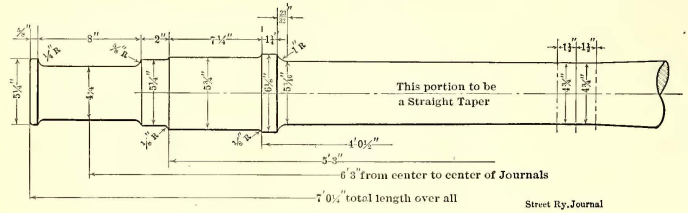


FIG. 1.—STANDARD STEAM RAILWAY AXLE

At present there is no standard for diameters of axles at the different points excepting at the journal, motor bearing and gear seat, where a split gear adapted to electric service is used. The Master Car Builders' Dictionary gives standards for types of axles used in steam railroad work, and these dimensions are reproduced in Fig. 1, but they cannot be followed in electric service on account of providing for motors and gears. As an illustration, take an axle ordered to following dimensions: Length over all, 7 ft. 1¼ ins.; center to center of journals, 6 ft. 4 ins.; journals, 4¼ ins. x 8 ins.; diameter at motor bearing, 5 ins.; diameter at gear seat, 5¼ ins.; to be key-seated for a G. E. 73-C motor; solid gears to be used, pressed on at not less than 35 tons or more than 40 tons pressure; gears to be furnished by ———— Company, and are to be finish bored 5¼ ins. exact. The gear bore in this particular case will govern the diameter of the axle at the gear seat, which now will be 5 17-64 ins., instead of 5¼ ins., if we assume that 1-64 in. is allowed for fitting to obtain a proper pressure. The wheel seat can now be turned to 5¼ ins. exact and wheel bored to 5 15-64 ins. to obtain the same pressure. This, as will be noted, is ½ in. smaller than is specified in the Master Car Builders' Dictionary for a 4¼-in. x 8-in. journal. The dust guard bearing and the button on the end of the axle cannot be finished to a larger diameter than the finish bore of the wheel, or 5 15-64 ins., or the wheel will mar the bearing when being fitted. This is 1-64 in. smaller than M. C. B. practice, and the variation is so small that very few people notice it, but is a point to be considered. There is a variation from the M. C. B. standard in this case, which is one of many, and every truck building company or firm fitting axles seems to follow its own convenience regardless of what anyone else is doing.

There is another point in the design of motors which affects the axles and which offers an opportunity for the manufacturers to work in harmony. Take the motor mentioned, the G. E. 73-C, which requires 48 ins. between the finished hubs of the wheels. The motor bearings and gear fit against the hub of the wheel are bored straight and no provision is made to fit the fillets required on the raised wheel and gear seats. This makes it necessary to run a fillet in the axle under the wheel or gear as far as the size of the fillet requires to give a full bearing for the gear or motor bearing, as the case may be. The wheel or gear projects over its seat as much as ½ in. in some cases, and this gives a very poor bearing for the side thrust of the motors. This is annoying to operators because the gear cases will wear against the gears where not enough bearing has been provided for this side motion. Some of the latest motors are constructed to overcome this trouble, and in time no doubt provision will be made on all motors to overcome this trouble. The standardizing of the axle will do more to bring this about than anything else, for neither motor nor axle can be changed without affecting the other at these points. Fig. 2 has been drawn to suit the dimensions previously mentioned, and does not show the latter point mentioned above as forcibly as a diagram would in which the gear and wheel seat were drawn larger in proportion to their diameter at the motor bearings. Fig. 3 is drawn to a larger scale, and shows how the brass wears under the gear or wheel hub.

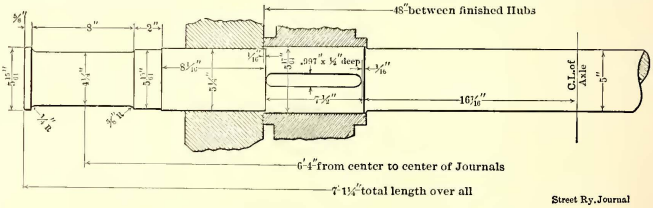


FIG. 2.—ELECTRIC RAILWAY AXLE FITTED FOR G E 73 C MOTOR

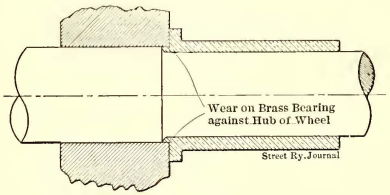


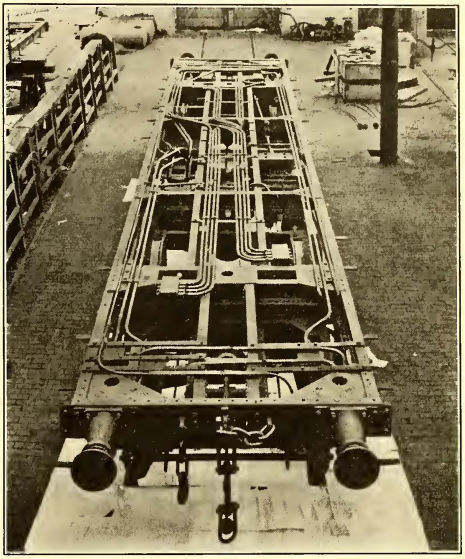
FIG. 3.—SHOWING WEAR ON BRASS BEARING AGAINST HUB OF WHEEL

The shoulders and buttons on M. C. B. journals are not any too large at present to provide a substantial bearing for the end thrust, which is shown by the way the brasses wear in service. It is a very common occurrence to see the brasses worn on their end enough to allow for over an inch of side thrust, and is a very serious point well worth considering. The strain which this puts on brake hangers, links, etc., especially where a flanged shoe is used, can hardly be estimated and probably is never considered as a cause for broken hangers or bent links when really caused by this side

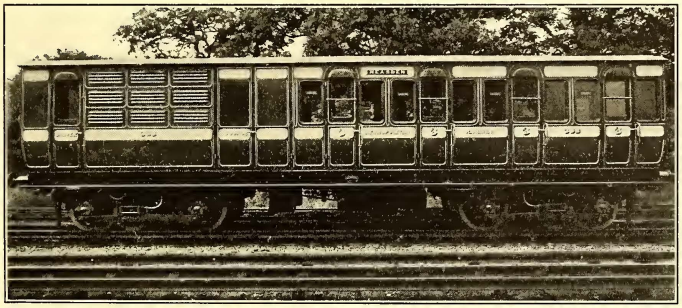
thrust. Short links suffer most from this thrust. This side thrust is very severe on high-speed work, especially so where heavy motors are used, the latter being a condition that was not considered when the M. C. B. design was adopted as standard. An axle could be designed for electric service which would allow enough difference in diameters for raised wheel and gear seats, so that if either wheel or gear were changed, it would not require a change in the button and dust guard bearing to suit, which would be necessary in the axle shown in the sketch.

ELECTRIFICATION OF OLD COACHES ON THE LONDON METROPOLITAN RAILWAY

When electric traction was inaugurated on its lines the Metropolitan Railway Company, of London, found itself possessed of nine trains, each of seven coaches, built as recently as 1900, and which, having been designed for steam haulage, were at first thought practically useless. It was recently determined to make the experiment of electrifying these trains and thus again bringing into service rolling stock which would otherwise have to be written off as a loss. A contract was placed with the British Thomson-Houston Company, Ltd., of Rugby, and the experiment was made with two trains which have now been operating satisfactorily for some time. The trains at present contain seven coaches, consisting of two motor coaches and five trailers. An extra trailer may be added later when the platforms at the stations have been lengthened sufficiently to accommodate the extra length of train. Each motor coach is equipped with four GE-69 motors which are rated at 200 hp each, thus giving a total of 1600 hp per train, a power which is capable of driving the train at a maximum speed of 45 m. p. h. on the level and of making a schedule speed of 16 m. p. h. The method of control is by the Sprague-Thomson-Houston multiple-unit system.



TOP OF ALTERED UNDERFRAME UPON WHICH CAR-BODY RESTS



STANDARD STEAM CAR NOW EQUIPPED WITH MOTORS

The weights of the train, unloaded, are as follows:

Complete seven-coach train	383,620 lbs.
Single motor coach	83,880 lbs.
Single trailer coach	42,052 lbs.

Each train has a seating capacity for 400 passengers, divided between 280 third-class passengers and 120 first-class.

The length over buffers of the complete seven-coach train, coupled, is 289 ft. 7 ins. The height to top of roof from surface of running rails is 11 ft. 6 ins. The under side of the floor of the coach is 14 ins. above the center plate of the trucks. The original trucks, which are of the Fox pressed steel type with 7-ft. wheel base, 5-in. axles and 40⅝-in. Mansel wheels, have been retained under the trailer coaches. New trucks, also of the Fox pressed steel type, with 7-ft. wheel base, 6½-in. axles and 38-in. wrought center, steel-tired wheels, have been provided for the motor coaches of these trains.

Automatic quick-acting air brakes have been substituted for vacuum brakes, formerly in use on these trains, and a hand brake is also provided in each driving compartment. The air compressors used are the B. T. H. CP-22 type.

The underframes of all the cars are identical, being made of 9-in. x 3-in. x ½-in. steel channels in the usual way. No change whatever has been made in the underframes of the trailer coaches, and in those for the motor coaches 7-in. x 3-in. x ½-in. longitudinal channels have been substituted for the diagonals on either side of the bolsters over the center of the trucks in order to facilitate the inspection of the motors and to allow of a better arrangement of the wiring.

All wires and cables are enclosed in cold-drawn, solid steel tubing with standard thread and fittings, and all connections and joints in the wiring are made of special connection boxes containing connectors mounted on slate bases. The entire under sides of the floors of the motor coaches are sheeted over with ½-in. uralite, while the upper surface is provided with a ¾-in layer of Paris cement, such as is used for flooring surface in steel car construction. The surfaces of the floors of the trailer coaches are similarly treated, and that portion of the under side directly above the steel tubes containing the train line wires is also protected by uralite sheeting.

In each motor coach there are four third-class compart-

ments providing seating accommodation for forty passengers, and there is also a luggage compartment. The two trailer coaches attached immediately to the motor coaches each contain seven third-class compartments with seating capacity for seventy passengers. The middle trailer coach contains six first-class compartments with seating accommodation for sixty persons. The two trailer coaches, on either side of

STANDARD SEVEN-CAR TRAIN

the middle coach, each contains three first-class and three third-class compartments with seats for 60 persons. The first of these two trains went into service on July 11, and has been making an average of about 200 miles daily.

NOTES ON THE WATER TANK LIGHTNING ARRESTERS FOR STREET RAILWAY CIRCUITS*

BY A. M. BALLOU,
Chief Electrician, Denver City Tramway Company

On account of the large amount of damage during electrical storms to the railway motors operated by the Denver City Tramway, the company concluded in the spring of 1904 to try the water-tank lightning arresters on the cars. A number of experiments were then conducted to determine the size of box, the amount of water and the current leakage. A size of tank was finally determined on, which was 18 ins. high, 13 ins. long and 6 ins. wide. This held about 5 gallons of water without splashing from the tank, and it was found that a carbon plate of 11-32 in. x 1⅜ ins. by 8 ins. long hanging down completely submerged near the surface of the water would allow 1½ amps. at 500 volts to flow to a galvanized iron ground plate fastened to the bottom of the tank. The water in the tank was of sufficient amount to allow the circuit to be closed for fifty minutes before it would boil over the sides of the box. This it was thought long enough for the arrester to be in circuit, as few electrical storms were of longer duration than forty minutes. The warmth of the water in the tank after use is a check on whether the motorman used the tank during a storm.

The cost of making and placing these arresters on all the cars, 225 in number, was $2,081.

In operating, the attention they required was to see that the tank had the proper amount of water and that it had not become dirty by use, and that the carbon was inserted in the tank when a storm came up.

During the first year of operation the trial showed that the damage to armature and fields had been greatly lessened, although the electrical storms were somewhat more frequent and more violent than the year previous and the motors, having been a year longer in service, would be more easily damaged by static discharges.

* Abstract of paper read before the Colorado Electric Light, Power and Railway Association, Denver, Sept. 20.

In 1904 the damage to motors caused by lightning was $4,876. In 1905 with the tank arresters in service the damage from lightning was only $2,022.

In 1906 the electrical storms in this locality were not so frequent or violent, but the arresters at the power stations showed a large number of discharges from the feed lines. The company's records show that the cost of replacing motors damaged by lightning was $380. To summarize:

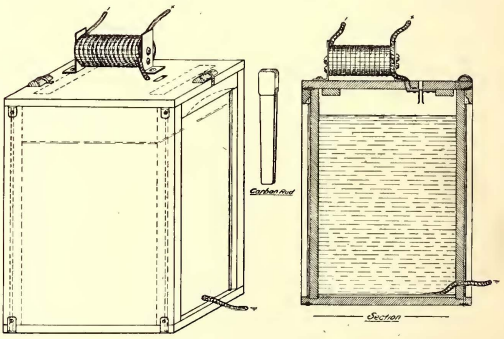
In 1904, tanks not on, lightning damage.....$4,876
In 1905, tanks in use, lightning damage..... 2,022
In 1906, tanks in use, lightning damage..... 380

This shows the value of this type of arrester, and although it is not an absolute protection it certainly protects the motors from a large number of disruptive discharges, and the company considers it has more than paid for the cost of its installation on the cars.

In connection with the tank arrester there is the regulation ten-turn kick coil, but there does not seem to be any benefit from these inductive circuits which are used to force the lightning discharge through a predetermined path to earth.

Damage to the car armatures by lightning has been reported where it had to pass through five kick or inductive coils before it reached the armature of the motor; these inductive coils consisting of, first, the kick coil on the tank arrester; second, the magnet coils on the car circuit breaker; third, the series coils on the car wattmeter; fourth, the ten-turn coil for the regular standard car lightning arrester; fifth, the large magnetic blow-out coil of the car controller, then along the car wiring to the armature. If there is benefit in these coils on grounded circuits it is hard to find it.

Lightning arresters for street railway circuits have not



TANK LIGHTNING ARRESTER USED ON DENVER CARS

reached that point of perfection where manufacturers will guarantee the company against motor burn-outs; there may be a company who will guarantee to replace all arresters damaged by lightning if a very large number are placed on the lines. At the price they get for the arresters they can afford to do it.

The accompanying drawings show the construction of the device. The carbon plate with insulating tape wrapped around one end is kept hanging in the motorman's vestibule. When a storm comes up he sticks it in the tank, the brass clip through which he inserts it making the contact.

In conclusion I would say the company only hoped, in placing the tank arrester on the cars, to stop some of the damage done to the motors and be able to run the cars a while longer after the storm begins and keep the power on the line until the storm was at its height. This it has been able to do, and does not shut down until the arresters at the station show that the discharges are getting severe.

GRID STARTING COILS

BY HENRY SCHLEGEL

Inspection of control devices on cars of a large railway system composed of smaller absorbed systems suggests the paradox that bad devices may do as well as good ones, owing to attention given the former and gross neglect of the latter. Low-class devices are expected to give trouble, and maintenance precautions are taken to forestall them; high-class devices are expected to look after themselves. Passing from general to particular, no device has been more improved in the last few years than the starting coil in its change from band to grid-iron construction. A grid-iron coil is almost a certainty as to condition at sight; if it is bad, that fact can be seen and corrected at small cost. A band-iron coil knows no certainty beyond that of becoming bad sooner or later—generally sooner. A grid coil well selected, properly constructed, safely installed and sanely connected, seems to stand almost any amount of operating abuse. A band-iron coil that would do as well would probably be carried on a trail car provided for that purpose.

Facts about grid coils can be considered under four heads: Selection, construction, installation and connection; we think that any one sufficiently patient to bore through the tale to be told would hate to be a grid.

Selection.—Includes the initial choice of iron to start smoothly and safely and accelerate a car of given motive power and weight; and the more commonplace but often abused selection of a frame to replace a defective one. A coil that starts a given car without undue impulse and operates without excessive heating, would start a lighter car with a jump, and a heavier car probably would not start on the first notch. The former condition inconveniences passengers on the first notch, and the latter on subsequent notches, besides subjecting the coil to prolonged heavy duty, owing to the greater weight requiring greater current $\times$ time to accelerate to full motion.

If the weight and motive power of a car be doubled, the weight and current capacity of the coil must be doubled and its resistance halved, if equal degrees of safety to the coil and comfort to the passengers are to obtain. Thus, assuming a certain coil to start a given car satisfactorily, if two such cars be coupled and operated synchronously, the combination will have the characteristics of a car of twice the weight and motive power; both starting coils will be in use and, as they are in parallel, the resistance will have been halved and the current capacity and weight doubled. This example condemns the practice of indiscriminately applying the same coil to cars of widely different weights, simply because their motive powers are the same. A manufacturing company recommends for a 200-hp equipment on a 25-ton car, a coil resistance of 2.5 ohms; for the same equipment on a 20-ton car, the resistance recommended is 3.5 ohms—a difference of 40 per cent in resistance for a difference of 20 per cent in weight. These conditions are often actually reversed and with the result to be expected. The writer's experiments do not verify the necessity of such a great difference, but they do verify the possibility of much greater difference and in the wrong direction where the practice is permitted of installing any coil that fits the hangers. To be strictly consistent, the gear ratio, size of car wheels and line voltage should be considered, but where the line voltage varies from 300 volts to 600 volts, the matters of gear ratio and car-wheel size pale to insignificance, and the adaption of the coil to the prevailing voltage variations calls for consideration of an average based on "facts of the imagination." On such a line, some cars are bound to start with more impulse than others, the coil being adapted to the prospect of the line voltage eventually being regulated within reasonable limits of 450 to 550 volts. Assuming the average of 500 volts, without any specifications as to car weight, the total resistance is generally made such that the first notch will admit a current of from one and a half to two times the full-load current of one motor on a two-motor car.

Excessive current is needed to give the motors sufficient torque to move the car under all conditions of load and grade; necessarily, then, if a coil starts a heavy load smoothly on a steep grade and on the first notch, the start will be impulsive on a level. As a compromise it is customary to make the resistance such that the car starts with maximum allowable impulse on a level, on a grade it will then be necessary to move the controller beyond the first notch to start. The greater the permissible impulse at starting, the greater will be the speed on the first notch, the less violent the current changes on subsequent notches and the less the maximum current demand of the car. A coil that admits a large starting current, then, will permit the car breakers to be set at a lower value, thereby tending to constrain the motormen to careful handling and limiting the maximum current per line section to a lower value. On the other hand, a car that starts with maximum permissible impulse on good rail, will certainly spin wheels on snow rail, and this is a factor to be considered, especially on eight-wheel cars with but two motors.

A consideration of the preceding statements leads to the conclusion that the conflicting conditions preclude the possibility of a starting coil that will give entire satisfaction; such a conclusion needs to be modified. It is well known that the problem of smooth acceleration is much simplified by using a controller that has many resistance notches, and the more the notches the greater can be made the total starting coil resistance to cover wide variations in line voltage. It is only with a starting coil of many sections that maximum acceleration can be obtained with minimum inconvenience to passengers; indeed, with enough notches the rate of acceleration could be kept just within the limit fixed by the car wheel-rail adhesion. While practical difficulties might make the realization of this ideal unprofitable and undesired, the advantage of a middle course that would enable a car to start satisfactorily under all conditions of voltage, load, grade and rail, cannot be disputed. It might be offered in rebuttal, that with a high resistance coil of many sections there would exist the objection that all notches on which a car fails to start are uneconomical notches. In reply, it can and may be said, that any modern motorman who cannot be relied on to pass quickly over all notches on which a car fails to start is truly a wonder, and not such a wonder has ever come within the writer's observation. An indirect advantage of the high resistance coil is that the current is reduced before the final break and the controller contacts saved.

Assuming a starting coil properly selected for existing conditions, it is by no means certain that the units of this selection will be maintained intact. On the contrary, it is almost certain that they will not. The coils provided, even to-day, are composed of so many different frames and the frames of so many kinds of grids, that to keep a safe margin of each in stock requires attention seldom provided. The result is that if the frame or grids required are not available, "the nearest thing to it" will be used to get the car on the road. As the nearest thing to it is often not very near, confusion must and does result, and in a few years inspection will not reveal what was originally intended as the starting coil combination. The solution of this kind of trouble lies in the adoption of a standard resistance unit of which all starting coils should be composed. Even if a total coil is much

heavier than what is required by theoretical design, a frame composed of heavy grids gives much less trouble than a frame of lighter ones. Where the variety of capacities is such that the available space on some cars will not permit the adoption of a single unit, then adopt two resistance units—the smaller unit to be used for high resistance and the larger for current capacity. With two resistance units in force on a system operating from six to ten kinds of equipment, the cost of maintenance will be reduced 3 to 1, and but one or two kinds of grids need be kept in stock. By using the same starting coil combination on approximately similar equipments, conditions are further simplified.

The unit into which resistance grids are assembled is called a "box" or "frame." To assemble a box or frame correctly is easy; to assemble one incorrectly is equally easy, as inspection of several hundred in operation will show. The master condition of assembly is that current entering at one end of the frame shall traverse every grid before leaving at the other end. As simple as this condition may seem, it is too often ignored either through fault of the man who assembles the frame or that of the man who connects it to other frames under the car. Connection faults will be considered elsewhere; construction faults will be considered here.

FIG. 1

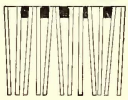


FIG. 2

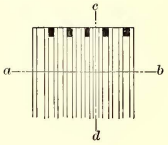


FIG. 3

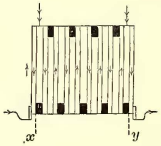


FIG. 4

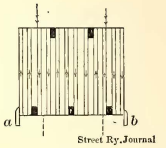


FIG. 5

1. The frames must be sound and straight; the grids must have no cracks, warps or burrs and should be of standard resistance per grid. Factory-made grids meet these conditions; locally-made grids may or may not, especially in the matters of resistance and thickness through the grid eye. The thicker the grids, the greater the trouble to get the required number into the given length between the end plates. If this length be increased it will be at the risk of having to drill new holes in the resistance hangers. Grids of the right resistance are the result of experience and trial in making the patterns from which they are cast. The manufacturing companies have passed through the necessary experimental stage and anyone wishing, in a hurry, grids of standard resistance will do well to avoid home talent until the hurry shall have passed.

2. The contact surfaces of adjacent grid eyes should be squared with the hole through which passes the mica insulated rod on which the grids are assembled, otherwise when the frames are tightened, the lower ends of some of the grids will be drawn toward each other, with the resulting possibility of contact when the grids heat and expand. Final tightening of the frame should be done in a horizontal position so that the grids hang vertically; this will avoid a general deflection of the grids toward one end of the frame where the tendency to flash over is greatest. Fig. 1 is an exaggerated side view of part of a frame that was tightened while resting on end. Fig. 2, of a frame composed of grids not squared to the hole. Fig. 3 indicates part of an assembly correct in both respects—center lines *a-b* and *c-d* are square with each other.

3. When terminal eyes for the car connections are cast in the grid and a set of frames is composed entirely of such grids, the responsibility of connecting the car wires to the frames in the correct relation does not rest with the assembler; where separate terminals are assembled with the grids, however, the assembler can make mistakes which will cut out one or more grids, according as the grids are assembled in series or in parallel. If in series, there will never be more than two grids between mica washers; if assembled two or three in parallel there will be four or six between mica washers, except at the two starting places on the ends of the frame. Fig. 4 shows a top view of a frame composed of ten grids with terminals *a* and *b* so arranged that current entering at *a* must traverse every grid to leave at terminal *b*.

To bring the terminals further from the end plates and thereby reduce the chances of a flash to the frame, it is customary to insert the terminals in the positions indicated by the dotted lines *x* and *y*. It will be noted that the first mica washer still comes between the terminals and the second grid on either end. In shop practice the mistake is often made of inserting the terminals on the opposie side of the mica washer, the result being to cut out two grids on each end of the frame. If the terminals be inserted at the places indicated by the double arrow heads, the result is to cut out one grid on each end of the frame. Where the abused section contains many grids in series, the result is not so serious, but in parallel frames it will cause unequal division of current and not only will the frame deteriorate, but the effect will be felt in the controlling notching.

Fig. 5 shows a frame composed of twelve grids so assembled that the current enters at one end and traverses the grids two in parallel; in this case, except at the ends, there are four grids between every pair of mica washers; this follows from the fact that since the current zigzags across the frame two grids at a time, on that side where two pairs come together, there must be four grids. These characteristics are useful in telling at a glance whether a frame is a series frame or a parallel frame, or, in General Electric parlance, whether it is an A frame or a B frame. With the terminals at *a* and *b*, current entering at *a* crosses over on the first two grids, returns on the second two, recrosses on the third two, comes back on the fourth two, goes over on the fifth two to finally come to terminal *b* on the sixth two after having traversed every grid in the frame. The terminals can be inserted anywhere between the positions indicated and the first mica washer on the same side because those points are electrically the same. If the terminals are inserted at the points indicated by the dotted lines, the result will be to cut out four grids on each end; if inserted at the places indicated by the double arrow heads, a very common mistake, the result will be to cut out two grids on each end. The cutting out of a few grids may amount to little or much; inasmuch as the grids are there and there for a purpose, they should be connected to be active—otherwise leave them out to make room for more insulation.

Assuming that a frame is to be composed of a number of grids in series, for current entering at one end to pass through all grids before leaving at the other, any two adjacent grids must touch or be otherwise connected on one side of the frame, but on the other side of the frame, they must be separated by an insulating washer. If the grids are supported by a third insulated rod passing down the center of the frame, every grid should be insulated fro mthe grid next to it. So far as the frame itself is concerned it is immaterial on which side

the first mica washer is inserted. In laying out a starting coil to be composed of several frames that are to be connected, however, it is desirable that the connecting jumpers between frames shall be short and straight; in such a case the frames must be assembled to suit the local conditions, otherwise it will be found impracticable to arrange them so that terminals that are to be jumped together will be next to each other under the car. Many conditions are simplified by so sectioning the complete starting coil that all terminals will be on the same side of the coil. This obviates the necessity of machining more than one side of the grid makes it possible to have a neat, safe connection under the car and minimizes the chances of a wrong connection. If the frames are composed entirely of grids having terminals and but one or two kinds of grids are used and these are assembled into adopted standards, only one or two kinds of frames will be needed to meet the demands of all manners of equipment.

Having completed a frame, it should be suitably marked with a tag under one of the nuts or with a name plate. The G. E. method of designating frames is a good one because it is descriptive. The G. E. grids are numbered by casting; for example, one grid of a certain section is called 26,507, another smaller one of half the resistance per grid is numbered 26,510 and so on, the resistance per grid approximately doubling every third smaller number and having every third larger number after the manner of the B. & S. wire gage. If a G. E. frame is composed of twenty-four grids of the section known as 26,511 and the grids are all in series, the complete frame would be marked 11-A-24; the 11 indicates the size of grid, the A indicates that all of the grids are in series, and the 24, that twenty-four of the grids are used. If the twenty-four grids were assembled two in parallel and twelve in series, after the manner of Fig. 5, the complete frame would be designated and marked as 11-B-24, the B indicating the grids to be assembled in parallel. The same method can be applied to the Westinghouse frames: thus a frame composed of twenty grids of Westinghouse section No. 7468 in series, would be marked 68-A-20; a frame composed of twenty grids of section 2119 ten in series and two in parallel, would be marked 1-B-20 and so on.

MEETING OF THE CENTRAL ELECTRIC RAILWAY ASSOCIATION

The Central Electric Railway Association held a most interesting meeting at Ft. Wayne, Ind., Sept. 26 and 27. Following the custom adopted last year for the first meeting after the summer vacation, this meeting was in the nature of an outing, and in the neighborhood of fifty ladies attended.

BAGGAGE REGULATIONS

On Wednesday afternoon the traffic representatives of some fifteen roads met and discussed the subject of interline checking of baggage. Some weeks ago the Schoepf properties in Ohio and Indiana announced free checking of 150 lbs. of baggage with an excess above that weight of 20 per cent of the one-way fare for each 100 lbs. or a fraction thereof, with a minimum charge of 25 cents for excess. Other Ohio lines have been falling into line on this subject, the latest announcements coming from the Western Ohio, Dayton & Troy and Toledo Urban & Interurban, forming the connecting lines between Dayton and Toledo. These roads adopted the same schedule as used by the Schoepf roads. While this places the bulk of the roads in the three States on the list of free checkers of baggage, the charge for excess is not uniform. The 550 miles of lines in the Electric Package Company's system charge 15 cents per hundred weight excess above 150 lbs., for any distance. The Toledo & Indiana, Toledo & Western and several other roads in the northern part of the State also follow this rule. There is, of course, a necessity for uniformity of practice on this point before interline checking of baggage can be made satisfactory. The Detroit United system in Michigan, including the Detroit, Monroe & Toledo, continues to charge 25 cents a trunk. The Toledo, Port Clinton & Lakeside also has this rule. An effort was made at this meeting to secure uniformity of practice, but the Detroit United showed no inclination to change its ruling, and the Electric Package Company was without representation, so that unless amicable arrangements can be made later, Toledo will be a dividing point on settlements, and baggage passing through that point will have to be rechecked. Secretary Merrill was instructed to confer with the various roads and undertake an adjustment. Free transfers of baggage have been arranged for in Indianapolis, Ft. Wayne, Lima, Springfield, Cleveland, Toledo and Columbus except with the Scioto Valley in the latter place, where a charge of 25 cents is made for transfers. At Dayton the passenger must pay 25 cents where it is necessary to transfer between any of the four passenger stations in that city.

WHEEL, JOURNAL AND BRAKE-SHOE STANDARDS

Wednesday evening a number of mechanical men held a meeting at the Aveline Hotel to discuss and suggest standards for city and interurban practice on brake shoes, journals and journal boxes, wheel treads and flanges and rails. This meeting was called by President E. C. Spring with a view to placing the association on record as suggesting certain standards in these equipments before the standardization committee of the American Street & Interurban Railway Association at its meeting in Columbus next month. W. H. Evans, of the Indianapolis Traction & Terminal Company, who is a member of the national committee, presided.

Mr. Evans said that the subject of standardization of certain forms of equipment first introduced at the Philadelphia convention of the national association was daily growing more important to the interurban lines that are operating over city tracks. In order to secure speed and safety, the interurbans are adopting heavier equipment of all kinds, but they have been hampered in this movement by the use of lighter and smaller standards by the city companies over whose tracks they operate. The National Association appointed a committee to canvass this subject, and in view of the importance of the interurban roads in the district covered by the Central Electric Railway Association, it was deemed advisable that the members should voice their views and wishes. The national committee has sent out lists of questions covering the various topics mentioned, so that it was thought best that the recommendations of the Central Association should be broad and general rather than specific.

Mr. Evans said that the subject of standard brake shoes was most important. The recent amalgamation of numerous properties in Ohio and Indiana developed that there were innumerable varieties of brake-shoes, making it difficult and unsatisfactory to make repairs where cars of one company were used on another road. While this subject was not to be considered at the present meeting, he thought it important that some sort of a standard height and type of draw-bars should be arranged for as soon as possible, and recommended that it be taken up at at early meeting. He thought that the M. C. B. standards of brake-shoes and heads, journal bearings and axles should be adopted. While a standard of wheel treads and flanges was difficult to get now on account of variations of city rails and special work, he suggested that some sort of a standard wheel, a compromise between street car practice and M. C. B. standard, be adopted. In rails and

special work he thought that the securing of a standard suitable to accommodate the interurbans was largely a matter of influencing the city railways, but he thought that the city companies were willing to co-operate in this matter to secure a reasonable standard. He thought that if efforts were made in this direction it would soon be possible to drop the M. C. B. name for street railway practice and adopt a list of standards covering both street and interurban practice. He urged especially the use of the T form of rail on city streets. He said that the work of the national committee was necessarily slow and tedious because the committee was scattered and all work must be done by correspondence, so that there was an especial urgency for the Central Electric Railway Association, whose members are interested in the subject, to clearly define their position. The subject was then open for discussion.

L. M. Jaques, master mechanic of the Ft. Wayne & Wabash Valley, thought it impractical to secure uniformity of practice on brake-shoes until a standard of wheels had been adopted; then the brake-shoes could be made to fit the wheel. While he would like to see somewhat larger dimensions, he suggested a compromise which he thought would suit the majority of interurban roads and which he considered perfectly safe: a wheel having a 3-in. tread flange ⅞ in. high x 1 3-16 ins. thick.

Mr. Bloss, of the Budda Foundry & Machine Company, thought that the suggested wheel was safe and ample. The 3-in. tread, if adopted by city companies, gave better traction and less pounding on special work and a greater life to the wheel.

The subject was discussed by several others, and it was decided that a flange ⅞ in. deep formed a compromise which was safe, especially so with steel-tired wheels, and would be satisfactory to the companies.

Mr. Evans said that at the Detroit convention a T-rail 7 ins. high with 3-in. head had been recommended for adoption. He said that where properly paved with a nose or special brick adjoining the inside of the rail it made a very satisfactory paving, and that while some city councils objected to this track he thought they could be convinced if shown the experiences in Indianapolis, Ft. Wayne, Dayton, Lima, Findlay, Sandusky and many other cities in the Central West. He said that the T-rail gave less trouble in its own maintenance and the maintenance of equipment than any other type, and it provided for ample flanges on interurban cars. On motion it was decided to recommend this type.

Mr. Jaques moved that the M. C. B. form and dimensions on brake-shoes be recommended. As a great many companies had special hangers for brake shoes, it would be necessary to make a form of head to fit the hanger, but it would be possible to come to a standard on the portion of the shoe which comes in contact with the wheel, which is the most important point.

Mr. Bloss agreed that it would be a great deal of trouble to get a standard head. He thought it would be well enough not to touch on the hanger feature in the recommendation until more of the roads could get together. The M. C. B. form of shoe was adopted for recommendation.

On the subject of journals and journal boxes, Mr. Evans said that these necessarily took into consideration the diameter of axles. He said that some years ago the Master Car Builders' Association adopted a standard of 3¾ ins. x 7 ins. for journals. Later, for 60,000-lb. cars a standard of 4¼ ins. x 8 ins. was adopted. Since then for heavier cars 5 ins. x 9 ins. and in some cases 5½ ins. x 10 ins. have been used. His company uses 5 ins. x 9 ins. on some of its cars. He thought that the three sizes of M. C. B. boxes should be recommended.

Mr. Jaques moved that the standard suggested be adopted. He said that they had been thoroughly tried out by steam roads and there could be no objection to them for use on interurbans. He urged that operators get together on one size of axle and on one of the sizes of journal boxes mentioned as a standard for the heavier interurban cars. He said that, while the numerous varieties now prevailing had come from the truck manufacturers, he thought that a standard could be arrived at if the roads specified the M. C. B. dimensions.

W. W. Rosser said that the steam roads in their passenger equipments presented even more of a chaotic condition than the interurban roads, but that the standards on freight equipment had been clearly defined and closely held to, and he saw no reason why the interurbans could not do likewise.

Mr. Evans' suggestion was adopted.

The report of this committee favoring the recommendations above mentioned with reference to wheel dimensions, brake-shoes, journals and journal boxes and T-rails caused some little discussion when it was presented at the open meeting of the association.

L. C. Bradley, of the Scioto Valley Traction Company, inquired as to what conditions made necessary the recommendation on wheel dimensions. He thought that a 3-in. x ⅞-in. x 1 3-16-in. flange was entirely too small for heavy interurban service. He said that the recommendation should be for the future and not to accommodate conditions which exist on city tracks at the present time. He thought that in renewing tracks city companies should be urged to allow for large flanges, and while he appreciated that the M. C. B. flange 1⅛ ins. deep probably could not be secured for a long time to come, that at least 1 in. should be recommended. He thought that city councils would use this recommendation as a club and would decline to allow for larger flanges.

George S. Davis, of the Street Railway Journal, said that he had recently called on a large number of roads in Ohio, and found that a number of them traversing the city streets were using wheels having flanges 1 in. to 1⅛ ins. deep with 3½-in. tread. He thought that the tendency was for a wheel having a deeper flange than ⅞ in. Two other gentlemen agreed with Mr. Bradley that it would be better to recommend a deeper flange.

Mr. Evans, chairman of the committee, said that the wheel dimensions were in the nature of a compromise between city and interurban lines. There were conditions in a number of cities which made it impossible to secure a deeper flange than ⅞ in. Admitting that all would prefer to use the M. C. B. dimensions, he thought that the dimensions mentioned were ample for safety. He said that certain steam roads were finding a flange 1⅛ ins. deep more than was necessary, and they were reducing to 1 in. He thought that where steel-tired wheels were used the ⅞-in. flange was safe and ample.

F. A. Bundy, of the Lima & Toledo Traction Company, said that they were operating perhaps the heaviest equipment in Ohio at a speed of 60 m. p. h. He could see no object in having a greater depth of flange than ⅞ in., and thought that 1 3-16 ins. width was ample for cast-iron wheels as well as steel-tired wheels. While he did not recommend cast wheels for high speed, he saw no necessity for a deeper flange even with this type. He said that if for any reason a car was derailed he did not believe that an extra ⅛ in. on the flange would have saved it. He strongly urged the recommendation of T-rail for city tracks, saying that grooved and girder rails were dangerous to operate over and increased the maintenance account.

H. A. Nicholl, general manager Indiana Union Traction Company, said that he considered the dimensions recommended as ample for heaviest equipment. They had been

using a 2½-in. tread on city tracks and were now increasing to 3 ins., as it was found that it reduced the pounding on special work. Their interurban cars operate at highest speed and they never had a derailment on account of ⅞-in. x 1 3-16-in. flange.

J. C. Gillette, master mechanic of the Columbus, Delaware & Marion, thought that it would be undesirable to attempt to secure the adoption of larger flanges than city companies could now accommodate. He thought that the city companies thoroughly understood the desirability of allowing for larger wheels on interurban cars and would increase the dimensions on rails and special work as rapidly as possible. He thought that the dimensions suggested were ample and would not be apt to be considered too radical by the city companies.

L. M. Jaques, master mechanic of the Ft. Wayne & Wabash Valley, agreed with him and moved that the recommendations be adopted as outlined.

The motion was carried.

LIGHTNING ARRESTERS

C. R. McKay, acting chairman of the committee appointed to investigate the subject of high-tension lightning protection, presented a paper on that subject.

Mr. McKay first reported that his committee, composed of several prominent railway engineers and representatives of leading manufacturers of electrical appliances, had been appointed to compile information on this subject which was of vital importance to traction operators. The idea was to send out lists of questions to railway operators and secure reports of actual observations during the coming season. Few roads have any comprehensive method of reporting lightning troubles. The manufacturers appreciate that the present forms of lightning protection are not wholly satisfactory. The leading manufacturers have made numerous laboratory and field experiments to determine the conditions surrounding lightning troubles, but such experiments have not been wholly satisfactory or comprehensive, because experts could not be on the ground when the actual troubles occurred. It is proposed that the association shall send to its members suitable blanks so that all lightning disturbances may be reported in details. The blanks will be of very simple form and will be of several classes to be filled in by station engineers, substation men and linemen. He urged that the various companies co-operate with the association and require that their employees make these detailed reports where the occurrences take place. In this way the members will secure detailed evidence of what actually took place and not mere scattered opinions. The committee will classify and summarize these reports, placing the data freely before the members of the association and the manufacturers of protective apparatus. Mr. McKay said that members of his committee had compiled suggested lists of questions, and these will be condensed and arranged into forms for various classes of employees at a meeting of the committee to be held in Columbus during the National Convention. As soon as possible thereafter the blanks will be sent to the various roads, and Mr. McKay urged that the members give the matter careful attention, stating that if the members responded they will promptly reach the benefits, otherwise it could not be expected that the manufacturers would be able to produce the satisfactory results demanded and expected of them.

Mr. McKay's paper was in part as follows:

"The most serious obstacle to the continuous operation of interurban railroads and transmission plants is the interruption of their high-tension line, and apparatus connected thereto, by lightning discharges and disturbances of similar nature. Interurban roads are more exposed to lightning troubles than city roads, and since the transmission lines linked together the entire electric apparatus, the damages may put the entire road temporarily out of service, causing heavy loss. The protection afforded by known methods or apparatus has not been wholly satisfactory to operating companies or to manufacturers. The report of the National Electric Light Association committee on protection from lighting during 1905, which segregates data of voltages from 10,000 volts and upward, is a step in the right direction and furnishes information of an interesting and practical character. Twenty-nine high-voltage plants reported, aggregating 140,500 kw capacity. Thirty-eight per cent of these plants, or 60 per cent of the total capacity, suffered damage during 1905. Thirty-five per cent of a total of 1100 miles of transmission lines suffered serious interference, and but 39 per cent escaped interruption. Forty-five per cent of the companies using choke coils suffered serious damage, an equal portion escaping. Thirty-eight per cent of the companies not using choke coils suffered serious damage, 67 per cent escaping. The figures as to the use of overhead ground wires for protection of pole lines are not very conclusive. In reply to inquiries as to whether their high-tension arresters were satisfactory, 35 per cent answered 'yes' and 65 per cent answered 'no.' Of those answering 'yes,' 78 per cent had suffered no damage. Of those answering 'no,' 53 per cent had suffered serious damage. The report shows clearly as to high-tension lightning protection that great improvement is still possible on devices for this purpose. It also indicates that the companies reporting on high-tension plants formed their conclusions more largely from the absence of occurrences of trouble than from an actual study of the conditions affecting the success or failure of the protective devices. This is but natural, and the cause and remedy will be considered later.

"To most of us the word lightning means a visible discharge of electricity between clouds or between a cloud and the earth. This impression is incomplete and misleading. Dr. Steinmetz has defined lightning as being any abnormal voltage condition on the transmission line whether produced by atmospheric electricity or by internal abnormal surges of electricity.

"Observation shows that the internal condition of the circuit may be such as to respond with a dangerous internal surge to a light, harmless inductive stroke from a cloud. Atmospheric electricity may become manifest either in gradual static accumulations due to wind, rain, induced charges or direct stroke. Static induction may charge the line to an abnormal voltage, whether produced by cloud lightning or by the sudden charging of an adjacent line. Surging or the creation of voltage waves of successive maximum values may be caused by the opening of a switch on a loaded line, by voltage waves of higher frequency than the impressed voltage, by arcs between the line and isolated conductors, or between one phase and the ground, by short circuits in transformer or generator coils, or again by the sudden interruption of the short circuit at the instant of the current wave maximum. The causes producing abnormal voltage effects in transmission circuits develop many different characteristics of discharge. The discharge may vary in frequency from 1000 cycles per second to one billion cycles per second, according to the time element of the circuit traversed by the discharge, and which rarely, if ever, twice has the same constant. Much laboratory experimenting has been carried out and much has been learned therefrom, but much must also be learned from experience under actual operative conditions, and that experience hitherto has taught but little because it has not been carefully collected, preserved and delivered to those fitted by training and study for the logical deduction of profitable conclusions therefrom. The various

frequencies obtainable from static discharges produced by plate machines, inductoriums, condensers, etc., give a wide range for experimentally determining the best designs for general work, and some allowance can be made for such auxiliary strains as are produced by the increased capacity, inductances and output rating of generators, the reinforcement of higher harmonies, disintegration from brush discharges, and mechanical depreciation. There is, however, a large field of investigation still open in which the operator and engineer, as well as the manufacturer, should work. The laboratory cannot include in its equipment leagues of transmission lines, thousands of kilowatts of apparatus, dozens of voltages and frequencies, and real lightning storms with a hundred observations for each.

"Among the principal high-tension alternating current protective devices in present use are:

"First, overhead grounded wires; second, series resistances; third, air gaps without and with resistances.

"The advisability of installing overhead grounded wires depends largely upon the particular conditions of each individual system. Opinion is much divided as to their effectiveness, but there seems good reason to believe that when properly installed and frequently grounded they do offer a material degree of protection to the pole line itself as distinguished from the apparatus connected with the transmission line, which use involves high first cost and its value would be doubtful in protecting a transmission line constructed upon steel supports properly grounded.

"The series resistance arrester in one prominent form consists of grounded streams of water directed against the transmission wires. This type of arrester seems to have little value in protecting apparatus against high-frequency disrupted discharges. It is effective, however, in discharging gradual static accumulations. The stream has variable resistance and presents objectionable inductance to high frequency discharges. The air-gap and resistance type of arrester appeared in many and various forms.

"Both abroad and on the Pacific Coast the horn arrester, with and without resistance, is much used. This type without resistance will maintain an arcing short circuit lasting several seconds, causing bad line surges and throwing out of step synchronous apparatus connected to the line. When used with series resistance the results are improved, but the use of series resistance offers the serious disadvantage of inability to successfully pass a heavy discharge. Under a light discharge it will generally operate satisfactorily, and by limiting the flow of current will aid in extinguishing the arc across the air gap. Series resistance, furthermore, generally possesses considerable impedance, thereby tending to force the discharge across some alternative path with possible resulting damage to apparatus.

"The multi-gap arrester when used without resistance is objectionable in that it offers little obstruction to the unlimited passage of current when the arc has been once established across the gap. The fundamental feature of the present form of multi-gap arrester is a series of metallic cylinders of less than 1 in. in. diameter, placed side by side, with spark gaps of above 1-32 in. intervening. By adding more cylinders, a higher voltage is required to discharge across the series of gaps, and it is therefore at a given frequency not difficult to experimentally determine the number of cylinders necessary for a lightning arrester suitable for use on any given potential. There is, however, danger of too much current flowing across the arrester, and thereby causing disturbance on the system, and in order to prevent this successive current flow during a discharge more gaps are required than would primarily be necessary to prevent a discharge from a normal line voltage. The continual flow of a large quantity of current during a discharge will of course melt and roughen the surface of the cylinders, changing the sparking distance and, in extreme cases, fuse the cylinders together. At the initial discharge a large quantity of current will flow, but it is necessary to interrupt this current at the end of the first half-cycle, and this is accomplished by the non-arcing metal used in the construction of the cylinders. In order to properly limit the current, a large number of gaps in excess of those required for what may be termed "voltage protection" has been found necessary. The increased first cost due to this multiplicity makes an arrester thus built commercially impractical. Auxiliary means for lessening the current flow were therefore investigated. The introduction of resistance in series with the gaps gives questionable results, as stated above.

"When a shunted resistance is used in conjunction with a series resistance, it is customary to reduce the value of the series resistance and thus detract slightly from the common faults of the multi-gap series resistance type. For light discharge, both the series and shunt resistance will be operative, and for heavy discharges the shunted gaps are automatically cut in. The addition of the shunt resistance does not, as stated above, eliminate entirely the troubles encountered with the plain series resistance. The fact still remains that we have a series resistance, which of itself offers considerable opposition to heavy discharges.

"In using the shunt resistance without the series, the best condition of affairs is approached because all light strokes traverse the shunt resistance, whereas a stroke of large quantity and high frequency will balk at the inductive path afforded by the resistance at high frequency and will discharge across the shunted gaps. The shunt resistance, however, if properly adjusted, will extinguish the arc in the shunted gaps, and the shunt resistance then acts in series with the series gaps to interrupt the line current. It should be noted that the shunt resistance comes into action only after the lightning stroke is past. Shunting a large percentage of the gaps with just a sufficient resistance to prevent excessive current from flowing across the series gaps under ordinary discharges, and to serve as a by-pass for the excessive current accompanying a heavy discharge, seems to satisfactorily meet the requirements. A gradual elimination of arrester types proved ineffective by experience under the excessively severe tests of high-voltage transmission has left by two or three types for serious consideration. The multi-gap type is most generally favored, and nearly all lightning protection for voltages exceeding 600 is effected by devices based upon the multi-gap principle in combination with resistance. The chief improvement made during the present year in this type of arrester has been the construction and adjustment of the shunt resistance. Experience shows that the lightning strokes on the line are usually not too heavy to be discharged through the series resistance. Relatively few strokes appear to be of sufficient quantity and frequency to be greatly impeded by the series resistance, but it is essential to pass these heavy discharges when they do come. The resistance is, therefore, so arranged as to include series resistance in the usual inductive stroke of lightning, but it is virtually cut out for the heavy strokes. An instance of the value of this arrangement was furnished by two strokes occurring on a high potential transmission line which were so heavy as to cause reports like artillery in the station. Both these strokes were discharged by the multi-gap arresters without damage to the apparatus. This form of arrester is adaptable to all commercial voltages, since by building up the cylinders in groups on porcelain bases they may be combined to any desired number with the required resistance in shunt. Porcelain

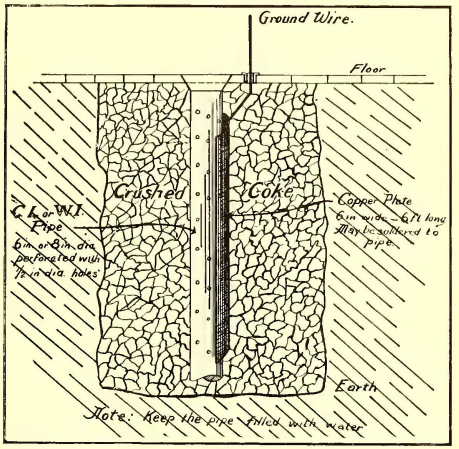
bases appear preferable to marble for preventing discharges across or through the base.

"A form developed by the General Electric Company has the cylinders in two straight lines, on each unit, the lines being placed 'V' shape and reaching to the edge of the porcelain base on each side. When these units are placed adjacent to each other the two sides of the 'V' almost touch, making the proper gap between the adjacent units. There are in the standard forms twenty-four cylinders per unit.

"In the multiplex arrester, a path from line to line is provided with the same number and arrangement of gaps and resistance as from line to ground. Observations made to determine the advantage of the multiplex connection show that frequently the high potential disturbances pass from line to line across the multiplex connection, thus equalizing abnormal strains between the lines without traversing the gaps to ground. In circuits having considerable resistance it is sometimes necessary to increase the number of gaps between line and line, to reduce the danger of an arc forming and holding over the line gaps. The design of the multiple arrester without series resistance fulfils all laboratory requirements and provides for greater security under operating conditions than previous types. It protects from minor static disturbances as well as being always ready for the severest surge or external stroke, and approaches a practical solution of the lightning and static strain problems which now influence long-distance transmission systems.

"It is pertinent to refer to the grounding of protective apparatus, although in recent years much improvement has been made in this direction. Its importance is being more generally realized, but there are many plants wherein a weak link in the lightning protection is found between the visible portions of the ground circuit and the earth itself. Wherever possible the ground wire should be straight, and therefore the ground itself should be directly under the lightning arrester. In designing a new power station this condition can generally be made possible. In older stations with grounds already installed at some distance from the arrester, it is advisable to make an auxiliary earth connection as nearly beneath the arrester as possible. This is advisable even though the resistance of this auxiliary earth may considerably exceed that of the main earth. The ground wire should be attached to a copper plate having an area of at least 4 sq. ft., embedded in charcoal or coke and surrounded by moist earth. The earth surrounding the pit containing the coke can be kept moist by embedding a vertical perforated iron pipe in the coke. The ground wire may run down beside this iron pipe and the plate may consist of a copper strip about 6 ins. wide and as long as convenient, bent lengthwise around the pipe. Either ground wire or plate may be soldered to the iron pipe. Water can both drain or be poured into the perforated pipe, and will percolate through the soil and coke, keeping the 'ground' perfect under most adverse circumstances.

"Generally speaking, we to-day lack conclusive data showing the specific values of various high-tension protective devices, the causes of failures, the relative liabilities to trouble with various voltages, frequencies, topographies, and methods of construction. More particularly is the knowledge limited as to what actually occurs where and when a lightning disturbance takes place. We must thoroughly understand the nature of the disease before we can cure it. It is frequently assumed that manufacturers of electrical apparatus should be held as fully responsible for the production of effective protective devices as they have been for the production of efficient and rugged dynamos, motors and transformers. The growth of long electric railways and transmission during the past few years has been so rapid that practically all of our attention has been concentrated upon building, starting and extending the systems, while the equally important question of insuring their continuous operation has been comparatively neglected. The manufacturers have been conscious of this condition but unable without assistance to remedy it. Consequently there is even to-day a lamentable lack of accurate and intelligent reports upon the actual service per-



APPROVED GROUND CONNECTION FOR LIGHTNING ARRESTER

formance of high-tension protective apparatus. The manufacturer seeking among operators for accurate information on these matters finds it almost impossible to obtain consistent or valuable statements. Different operators utilizing identical protective apparatus under apparently similar conditions give wholly contradictory reports regarding their effectiveness. Companies having the least trouble frequently assume that they have the best protection. No assumption could be less justified. The remedy for this condition lies chiefly in the hands of the operating staffs of the stations and the transmission lines. It cannot be questioned that the existing lack of practical data covering these matters has been due to the failure of the operating company to report, record and preserve it, and this failure is doubtless due largely to a lack of understanding on the part of operators and their employees as to just what information is requisite and valuable. It is hardly conceivable that operators would be so blind to their own interests as to neglect this question were they fully posted as to the character of the information required and the ease of obtaining it. The labor involved in taking and recording the necessary observations is negligible, and technical knowledge is unnecessary. What is wanted are certain facts visible to the operating employees of the stations and lines. These men are the ones who see the phenomena at first hand and the men first on the spot after a breakdown, and it is only through the data thereby obtained that a true conception can be obtained of the nature of the discharge and the causes of such failures as occur. It is well understood that lightning strikes repeatedly in the same spot, but a very small percentage of its discharges come under the observation of engineers qualified to translate what they see into useful recommendations. The great variety and the wide distribution of relieving points for the different classes of strains, renders it impractical for any one man to make a series of observa-

tions. The importance of getting the information at first hand in some suitable shape for future tabulation should be clearly realized. It is desirable and essential to distinguish between the actual observations and the conclusions that may be drawn from these observations; in their relative importance detailed evidence stands first, opinions second. The universal adoption and use by the members of this association of a suitable information blank covering the nature of each disturbance witnessed would, when answered, compiled and tabulated into a suitable report, provide a vast quantity of data immediately useful in determining the best method of installation, and the most suitable device to meet the conditions of any particular system. The use of tell-tale papers properly located in the arresters, and perhaps operating with a time movement, will be of great value in connection with the other observations, especially in furnishing some record of occurrences taking place in too rapid sequence for the eye and brain to catch and note them. In no other manner can so much valuable information on the subject be so quickly obtained and so effectively utilized."

President E. C. Spring said that he thought the subject of great importance to all railway operators, and he urged that everyone co-operate with the committee in securing and compiling the information desired.

PRESIDENTIAL ADDRESS

In a general address to the convention, President Spring urged the attendance of the members at the National Convention to be held in Columbus this month. He said that the national organization had recognized the association in a most complimentary manner by extending an invitation to the president to deliver the opening address of welcome and by delegating to prominent members of the association the delivering of papers on such important subjects as "Express and Freight," "Limited Service," "Tickets and Rates," "Ties, Poles and Posts," and "Distinctions between City, Suburban, Interurban and Railroad Traffic." He thought it up to the association members to do all they could in the way of entertainment and affording facilities for the inspection of their properties. He suggested that managers go to the meeting in their private cars to as great an extent as possible, this being a novel and instructive possibility for the Columbus meeting. General Manager Adams, of the Indiana, Columbus & Eastern, whose line will be traversed by nearly all cars going to the meeting, has notified the president that his company will be glad to handle the cars of members, and requested managers to notify him as to the width of their cars. Cars 9 ft. wide or less can be handled through Dayton and other cities without difficulty. The Columbus Railway & Light Company, operating the city lines, extended a similar invitation, stating that 1300 ft. of double track would be available for storing private cars. Cars up to 62 ft. can be accommodated on all curves in Columbus.

President Spring reviewed some of the work of the secretary's office during the past few months, stating that, while he did not have time to go into full details, he felt sure that all appreciated the value of that office. Several meetings of traffic men have been held during the summer months, which brought about improved conditions in interline traffic. Important work had been done on interline traffic sheets, but unfortunately much of this had been rendered valueless through the consolidation of a number of roads and a change of rates and routes. The work is going on with promise of lasting benefit. Statistics on the sale of interline tickets have been compiled, but they were incomplete owing to the failure of some of the roads to report. The report for August shows that sales of interchangeable tickets increased $3,700 over July.

Considerable work has been done in the way of compiling statistics on other subjects, but this, too, has been held up by the inability to secure prompt replies. President Spring scored the delinquents, saying that it was an injustice to those who were paying their money, not to receive complete and prompt data on subjects inquired about.

The secretary's financial report showed the organization had sufficient funds to carry it through the first year and would have a neat balance if all the members paid their obligations. The secretary reported that Ohio companies were being assessed by municipalities for street sprinkling during the past summer, and he said he had numerous inquiries as to the authority for this assessment. Mr. Merrill read House bill No. 25, covering this subject, passed by the last Ohio Legislature.

ENTERTAINMENTS

The presence of the ladies and the entertainments provided through the courtesy of General Manager Emmons, of the Ft. Wayne & Wabash Valley Traction Company, made this the most enjoyable meeting ever held in the two States. Mr. Emmons was unable to be present on account of illness, and the convention sent him a telegram of regret, but his arrangements were most ably carried out by Auditor H. E. Vordemark and Superintendent of Transportation C. F. Shelton.

The sessions were held in the theater building at Robinson Park, the company's beautiful amusement resort, situated 7 miles north of Ft. Wayne on a pretty little stream. During the morning session the ladies enjoyed steamboat rides on the river. At noon the meeting adjourned for a delightful old-fashioned chicken dinner served in the dancing pavilion. Then followed a baseball game between the "Hoosiers" and the "Buckeyes." To the majority this was the star attraction of the day. The "Hoosiers," under the captainship of Pitcher H. A. Nicholl, had practiced for the event and came armed with all the paraphernalia of the game, but they were vanquished by the heavy batting of the "Buckeyes." The features of the game were the fine work behind the bat of Catcher Charles Clark, of Cleveland, and a wonderful double play by First Baseman L. C. Bradley, of Columbus. George Dusinberre was umpire. The score was 6 to 3 in favor of Ohio, and the "Hoosiers" only escaped a more crushing defeat through the calling of the game so that the spectators might go to the vaudeville show prepared for the occasion. A very interesting programme was augmented by a number of brand new stories related by E. Wickwire, of the Ohio Brass Company, and C. Palmer, of the Cincinnati office of the General Electric Company, who are famous in the district as the champion story tellers of the street railway trade. They were presented with a pair of palm trees by enthusiastic admirers.

THE PARK SEASON OF THE DETROIT, MONROE & TOLEDO SHORT LINE

The Detroit, Monroe & Toledo Short Line closed its season at Monroe Piers a few weeks ago. Through the medium of good service, refined attractions and liberal advertising throughout a wide district, the company has made this resort one of the most popular in the lake region. Interurban roads all over the district ran numerous excursions to the resort, taking cars directly to the Piers over the Short Line. The number of visitors this season was more than double any previous year, and it is figured that additional equipment will have to be purchased to handle the business another season. It is probable that several attractions will be added to the resort next year.

SINGLE-ROPE GRAB-BUCKET CRANE

A single-rope grab bucket for loading and unloading ballast has recently been installed by the Cleveland Electric Railway Company, and is shown in operation in the engravings herewith. It is used with a derrick which is employed for other purposes, and for this reason it was inconvenient to employ a bucket with a trip line. The single-rope bucket, however, has given satisfaction. When the derrick is required for other kinds of hoisting the bucket is simply unhooked, and there are no extra ropes to be taken care of. The cost of handling broken stone with this bucket swinging it from one

GRAB-BUCKET OPENING TO TAKE LOAD OF MATERIAL

GRAB-BUCKET DUMPING LOAD OF DIRT

car to another has been found to be 8 mills per ton. The bucket was manufactured by the Brown Hoisting Machinery Company, of Cleveland.

A paper was read by G. W. Holford, general manager of the Salford Municipal Tramways, on the bases on which depreciation and renewal funds were provided for in municipal undertakings, at a meeting of the Municipal Tramways Association of Great Britain, held at Leeds, Sept. 19 to 21. Mr. Halford presented statistics from seventy tramway systems. Of these 18 have no depreciation of renewal funds; 14 turn over all of their net profits to the fund, and 13 have no system in regard to charging off for the renewal fund. Each of the remaining 15 companies has a different basis, as the following replies indicate: Three per cent, less cost of renewals; not yet settled; track £300 per mile, overhead 5 per cent, cars 10 per cent, depots 3 per cent; £170 for cars; intend to use all profits; track £500 per mile, poles, etc., 3 per cent, cars 7½ per cent, depots 2½ per cent; 3 per cent of total capital expenditure; 3 per cent on cars and tools; track £11,565, overhead 2½ per cent, cars 5 per cent, depots, nil; track £400 per mile, overhead £50 per mile, cars 5 per cent, depots nil; act of Parliament provides that no contribution can be made to other funds until renewals fund amounts to £5,000; £20,000; £1,053; £6,400; 1.47d. per car-mile.

A SEMI-CONVERTIBLE CAR FOR PIKE'S PEAK

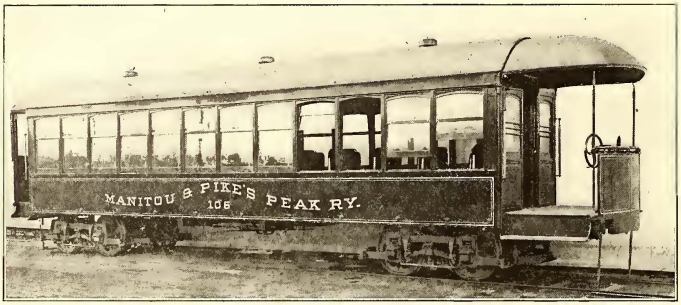
About a month ago there left the works of the American Car Company a car destined for operation on what is in many respects the most wonderful railway in the world—the Manitou & Pike's Peak Railway, more familiarly known as the "Cog Wheel Route." Much has been said and written about Pike's Peak and the means employed for reaching the summit, and as this article goes to press Colorado and the United States government are uniting in the celebration at Colorado Springs of the centennary of the discovery of Pike's Peak; consequently, in addition to a description of the car, which is of a novel type for this road, brief mention is made of the railroad itself.

The line climbs over 14,000 ft., and the road is within a fraction of 9 miles long from Manitou, the starting point, to the summit. It is standard gage with a roadbed that is all in point of excellence that it is possible to make it. Where it is not cut in the solid rock it is very heavily ballasted. On the heavy grades the track is securely anchored at frequent intervals to guard against any possible displacement from the effects of extreme variations of temperature; the mean grade is 16 per cent; the maximum 25 per cent (a rise of one foot in four), and the sharpest curves are 16 deg. The outside rails are of the ordinary T pattern which serve merely to guide the train and bear its weight; it is the rack rails in the middle of the track upon which the propulsion and safety of the train depends. The rack rails are doubled every inch of the way and are made from Bessemer steel and are extra heavy on the steepest grades. The locomotives which draw the cars are of four-cylinder type, weighing about 30 tons each.

Two double cog wheels underneath the locomotive engage the toothed rack rails. Everything has been done to guarantee the absolute safety of passengers by the abundance of brake power—hand brakes, steam brakes, water brakes and automatic brakes. There are five of these engines in

the road's equipment, and seven passenger coaches complete the rolling stock. These latter precede the locomotive on the ascent—which is a distinct advantage from the standpoint of observation—and follow them in the descent; thus the coaches are always protected by the engine. The two, however, are never coupled, and the coaches are provided with powerful individual brakes that operate through cogs on the rack rail. By this arrangement a coach can be stopped instantly and independently of the locomotive. There are six stations on the lines besides the terminals, each situated at some special point of interest along the scenic route. Three water tanks are met with, as the engines require considerable water.

Word pictures of the scenery on the climb up Pike's Peak have been framed too often to need repetition in this article, but it may be mentioned that, although there are higher peaks, there are few other accessible elevations on earth that afford so extended a range of vision or a view so varied and inspiring as that from the summit of Pike's Peak, the reason for this being that the other accessible mountains, having elevations approaching that of Pike's Peak, are in the midst of a chain of mountains; consequently the views from their summits are uninterruptedly mountainous and the range of vision is restricted by the surrounding heights.



TYPE OF CAR FOR THE MANITOU & PIKE'S PEAK RAILWAY

The terminus at Manitou is situated at the end of the Colorado Springs & Manitou Electric Railway, near the famous Ute iron springs, and it can be reached directly by no less than eight steam railroad lines. The round trip can be made from Denver to Pueblo in one day, and from Manitou in four hours. Manitou with its 35,000 inhabitants is, as is well known, one of the most famous resorts in the West, its great scenic beauties having earned for it the title of the "Switzerland of America." The waters of its mineral springs are now shipped to all parts of the world. The United States observatory at the summit of Pike's Peak is one of the most interesting places on the journey. Sunrise excursions which are run weekly by the railway in the latter part of the summer are exceedingly popular, sometimes the entire equipment of the road being required to handle the crowds, who are well provided for over night at Summit Hotel.

That the officials of this road were wise in adopting a car containing the Brill grooveless post window system will be at once apparent. As the summit of the mountain is approached and the train rapidly gains in elevation and jagged rocks take the place of the sylvan scenes which have gone before, the air grows chill and windows must be closed and outer wraps donned to keep out the cold. Almost a parallel is established in the ease with which the changes in the car and its occupants can be performed, as nothing could be simpler than the mechanism that has been devised to operate the sash of the grooveless-post semi-convertible car, conversion from an open car to a closed car or vice versa being the work of a very few minutes. The sashes may also be held at five distinct heights if so desired. Another feature of the car that will appeal to the tourist is the low window sill which will enable him to have a far greater line of vision than would be allotted to him in a car having the ordinary drop-sash. In short, it would be impossible to find a car better suited for observation purposes and excursion travel than this type.

Coat hooks will be found over each seat, as no traveler will board the car without first providing himself with an overcoat or wrap. The seats, which are upholstered in plush, are so arranged that they can adjust themselves to a horizontal plane when the car is on a 11 per cent grade. The plain arched roof will be noted, as also the steam-car type of ventilators. A saloon with the usual requisites is provided.

The car interior is finished in cherry. The car has portable vestibules, that at the front end having doors to close the step openings, the rear platform being left open. The chief dimensions are as follows: Length over the end panels, 33 ft. 4 ins., and over the vestibules 41 ft. 4 ins.; width over the sills, 8 ft. 3½ ins. The same figures will apply to the width over the posts at the belt; from the center to the center of the posts is 2 ft. 8 ins.; height from the floor to the ceiling, 8 ft.; size of the side sills, 4 ins. x 7¾ ins., and the center sills consist of six I-beams filled with yellow pine; intermediate sills, 4¾ ins. x 5 ins.; end sills, 4 ins. x 7¾ ins.; sill plates, ⅜ in. x 12 ins.; thickness of the corner posts, 3¾ ins.; side posts, 3¼ ins.; length of the seats, 35⅜ ins.; width of the aisle, 22½ ins. The car is mounted on No. 27-G trucks which are well suited to withstand the severe strains that will be placed upon them. The No. 21-E single truck is another type used by this road.

TRANSPORTING DOGS IN TACOMA

The question of transporting dogs has been dealt with by the Tacoma Railway & Power Company as follows in a recent circular:

"Commencing Sept. 1 and until further notice, dogs will be carried on the rear platforms of the cars of this company, and will be in charge of and looked after by the owner. A charge of 10 cents will be made for carrying each dog for any distance upon the cars of the Spanaway, Puyallup, Steilacoom or American Lake lines. Upon the cars of other lines, for any distance, 5 cents, and in no case will transfers be given for dogs.

"Conductors will not ring up on their registers the amount collected for carrying dogs, but note on their trip sheet, 'one dog, 5 cents,' or 'one dog, 10 cents,' or 'two dogs, 20 cents,' as the case may be.

"The number of dogs allowed on a car at one time will be left to the discretion of the conductor. When a car is crowded to such an extent that the dogs will be decidedly in the way of, or inconvenience passengers, they will not be carried on the cars.

"On early morning cars, or any trip where the travel is·

light, where hunters desire to take their dogs with them, there may be six or seven dogs to be cared for, the conductor will use his discretion and accommodate passengers desiring to carry the dogs.

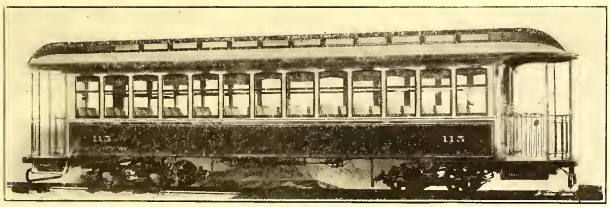
"While it is the desire of the company to accommodate patrons, both during the hunting season and at other times, who wish to have their dogs accompany them, we also wish to discourage the practice of carrying dogs upon the cars during the rush hours, when it will inconvenience passengers."

NEW CARS FOR THE WASHINGTON, ALEXANDRIA & MT. VERNON RAILWAY

The trailer car shown in the illustration is one of seven built for the Washington, Alexander & Mt. Vernon Railway by the J. G. Brill Company, and which will be hauled by motor cars of generally similar design and appearance being built at present by the same car company. A large portion

CROSS SEATING IN TRAIL CAR FOR THE WASHINGTON,

of passengers carried on this line is composed of sightseers, who, having visited the capital, wish to see the historic towns such as Arlington, Mt. Vernon, etc., which line the route of the Washington, Alexander & Mt. Vernon Railway. The cars will be operated in trains and the ends of the vestibules



STANDARD TRAIL CAR FOR THE WASHINGTON, ALEXANDRIA & MOUNT VERNON RAILWAY

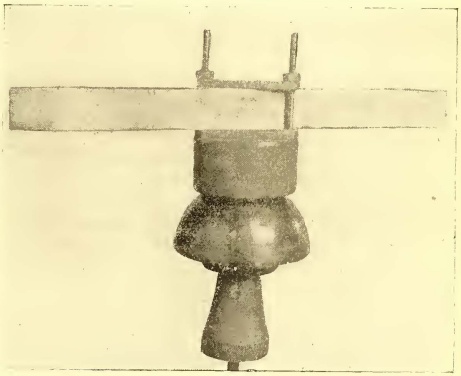
are therefore left open to form the passageway between cars; a chain blocks the entrance when necessary.

The steam-coach style of roof is adopted, and the interiors are richly appointed with comfortable high-back seats upholstered in leather of a shade to harmonize with the mahogany stained woodwork. The aisle is laid with linoleum; the ceilings are of sheet metal painted and decorated in an appropriate manner. There are thirteen transverse seats on each side of the aisle, the car seating fifty-two passengers; the end seats are made a trifle shorter to accommodate the single swinging door. The windows raise in the ordinary manner; top sash is stationary.

The cars are mounted on the No. 23 truck, having a wheel base of 4 ft. The chief dimensions are as follows: Length over the end posts, 33 ft., and over the vestibules, 42 ft.; width over the sills, including the sheathing, 8 ft. 3 ins.; distance between the centers of the posts, 2 ft. 5 ins.; height from the track to the top of the floor, 3 ft. 3¾ ins.; height from the track to the top of the platform, 2 ft. 6¾ ins.; height from the track to the top of the step tread, 17¼ ins.; size of the side sills, 4 ins. x 7¾ ins.; size of the end sills, 5¼ ins. x 6⅞ ins.; sill plates, ⅜ in. x 15 ins.; thickness of the corner posts, 3⅝ ins.; of the side posts, 2¾ ins.

BUS BAR INSULATOR

A new bus-bar insulator made by the Locke Insulator Manufacturing Company, of Victor, N. Y., is illustrated herewith. It is one of those useful things that when an engineer wants he wants very badly, and often has to spend



BUS-BAR INSULATOR

a good deal of time and money in getting up something of his own for the purpose. It will be noted that the insulator is mounted on the pin at the bottom and on top of the insulator is a cast-iron cap. Above this is a wrought-iron strip secured by a pivot at its center to the cast-iron cap. That turns freely on the pivot, so that if the bus-bar is not wide enough to fill up the entire space between the threaded posts at the end of the strip, the whole strip can be turned so that the posts will come in contact on either side as shown, and then the strip across the top of the bus-bar is held securely against the bus-bar by screwing down the nuts on the posts. This makes it impossible for the bus-bar to get out of position or tip over. Hence the device is available for holding a bus-bar of any width securely.

The Indiana Union Traction Company has joined with other merger lines of Indiana in reducing the fares for children. After Oct. 1 half fare only will be charged for children between 5 and 12 years of age.

LONDON LETTER

(From Our Regular Correspondent.)

The fifth annual conference of the Municipal Tramways Association was held during the past month in Leeds, Mr. J. B. Hamilton, general manager of the Leeds City Tramways, having been president of the association for the past year. There was a record attendance, and the delegates were welcomed to the city by the Lord Mayor in the Town Hall, who kindly placed a room at their disposal for the holding of the conference. Mr. Hamilton in his presidential address, said that he thought the time had now come when, with an idea to mutual protection from harassing legislation, they ought to concentrate the whole of the tramway interests, both municipal and company, into one association. It is to be regretted, however, that such is evidently not the view of the delegates representing the Town Councilors, and such an amalgamation between the Municipal Tramways Association and the Light Railways & Tramways Association has not taken place, and it does not appear likely that it ever will take place. Mr. Hamilton also referred to the statistics of the year of all the tramways, and spoke strongly in favor of arbitration in all labor troubles between municipalities and their servants. The following papers were then read: "Municipal Tramway Operation; Some Points of a Committee's Policy," by Councilor R. A. Smithson, of the Leeds Tramways Committee; and in the afternoon a paper on "Car Brakes," by Mr. Henry Mozley, general manager of the Burnley Corporation Tramways. In the evening a dinner was extended to the delegates and their friends at the invitation of the Leeds Corporation, the dinner being held in the Town Hall, which had been handsomely decorated with shrubs and trees for the occasion, the Lord Mayor, Mr. Edwin Woodhouse, occupying the chair. The usual loyal toasts and those of "The Municipal Tramways Association," "Leeds City Tramways," "Kindred Associations and Our Guests," were all eloquently proposed and replied to, and a most enjoyable evening was spent.

On the second day of the conference the business meeting of the association was held, and it is sufficient to state here that Mr. J. M. McElroy, of Manchester, who, since the inception of the association, has been its valuable secretary, has now resigned that position and has been appointed president of the association for the ensuin gyear. Mr. A. R. Fearnley, of Sheffield, was duly appointed secretary to take the place of Mr. McElroy, after which, and after the conclusion of other business, the following papers were read: "Tramway Track Work," by Mr. R. C. Bullough, general manager of the Colchester Corporation Tramways. This paper elicited considerable discussion, especially as to the suggestion that the curves and points and crossings should be made of softer material than what they are at present made of, and that manganese steel was much too hard for such work, Mr. Bullough preferring that the curves and crossings should wear out rather than wheels. This was vigorously opposed in the discussion, most of the managers present thinking that such a policy would be fatal. The subject of the other paper was "Depreciation and Renewals Funds in Relation to Tramway Undertakings," by Mr. G. W. Holford, general manager of the Salford Corporation Tramways. This paper is briefly digested elsewhere and, of course, elicited a never-ending discussion on the subject of depreciation and sinking funds, in the handling of which there appears to be much difference between Scotch and the English tramways. Mr. Dalrymple, of Glasgow, made a most emphatic statement that the sinking fund was an absolutely different matter from depreciation, and that until a tramway undertaking had paid off entirely its sinking fund, the city could not really be said to possess its own tramways. In the afternoon special cars were provided by Mr. Hamilton, and visits were made to the tramways power house and the various works of the Leeds City Tramways. An interesting opportunity was also afforded for seeing about a ½-mile of double track which is now being laid for the corporation by the Romapac Tramway Construction Company on its method of renewable rails, a system which was described some months ago in our columns. An opportunity was also afforded for seeing very successful thermit welding, a method of welding rails which has been largely adopted in Leeds. In the evening a most enjoyable reception was tendered to the delegates and their friends by the Lord Mayor at the City Art Gallery, which was largely attended, and we ought perhaps to say also that during the two days of the conference the ladies were well taken care of by Mrs. Hamilton and other ladies, one of the most pleasant functions being a garden party by Mrs. J. B. Hamilton, at Hotham House, Headingley.

As has come to be customary on such occasions, the final day was given up entirely to pleasure. A special train was provided to take the delegates and their friends to Ripon, where motor char-a-bancs were in waiting, and a visit to Ripon Minister was made, after which the party proceeded to Studley Park, from which point they walked through the park to Fountains Abbey, the grounds having been kindly thrown open on this occasion by the Marquis of Ripon. Luncheon was served at the Abbey and after having satisfied themselves with the beauty of the place, the party returned to Ripon station to enable members and their friends to catch such trains as they desired.

Perhaps the most striking circumstance which would occur to a visitor to London at present, were he to find himself in the vicinity of the Thames embankment, would be to discover at least a third of its surface on the river side in the hands of the contractors (Messrs. Dick, Kerr & Company of London) and all torn up, and a multitude of men busily engaged in laying down the conduit system of tramways which has become so familiar to the Londoner. In a very short time, it is hoped by Christmas, the vast population of London will be able to use the embankment for the first time as a medium of transportation in a tramway car. Very little time has therefore been lost since the royal assent was given to the bill which the London County Council successfully passed through Parliament during the past session, and as soon as the material could be provided the contractors at once began to tear up the side of the road next to the river. It was expected that the work would proceed in record time, but it has been discovered that certain culverts existing under the road will have to be replaced, so that perhaps a little longer time will elapse than was hoped for. The work is proceeding apace, however, and is attracting a large amount of interest. It will be remembered that at the same time powers were obtained for running tramways over both Blackfriars Bridge and Westminster Bridge. No tramway work will be commenced on Blackfriars Bridge for a considerable time, perhaps two or three years, as it will be necessary to widen that bridge before tramways can be put on it. Westminster Bridge is, however, already in the hands of the contractors, and the footpaths or pavements at either side have been narrowed so as to give more room to the tramways on the roadway. The embankment tramways, therefore, will start, in the near future, from the north end of Blackfriars Bridge, and proceed down the embankment to Westminster Bridge, where they will cross and join the existing system which goes out to Tooting, Streatham, Balham, etc. It will thus immensely relieve the congestion of traffic at the south side of Blackfriars Bridge, so far as traffic toward these southern portions of London is concerned. The connection between the embankment tramways and the Aldwych subway is also now being undertaken, so that before long it will be possible to travel in a tramway car from the southern suburbs, across Westminster Bridge, up the Victoria Embankment, through the Aldwych subway and on to Islington, though when the northern system is completed it will practically link up the entire north and south.

A remarkable development of the Lancashire tramway service has just been completed, by means of which the two great cities of the north—Liverpool and Manchester—and fifteen other smaller urban centers are linked together, and a population of over five millions served. The line, 32 miles long, is controlled throughout its entire length by the Lancashire United Tramway Syndicate, which has a combined capitalization of £850,000. The system brings into intimate touch with each other the great seaport of Liverpool, the wide agricultural district stretching from there to St. Helens, and a large number of colliery and cotton manufacturing towns which lie between St. Helens and Manchester. At present the line is only available for passengers, but powers are to be sought to construct a double line, in order that a service of light goods trams may be run. Negotiations are also proceeding to arrange between the Lancashire United Tramways Company, the Liverpool Corporation, the Manchester Corporation, and the new St. Helens Tramways Company for a clearing house system, so that a through booking may be offered to the public from one end of the service to the other.

Judging from the correspondence which it has evoked, a very keen interest is taken in the reopening of the question whether the Corporation of Birmingham should include Harborne in the scheme of tramways which is now being rapidly developed throughout the city. When this scheme was first projected, the feeling against the invasion of Edgbaston thoroughfares by tramway lines was so strong that a general powers bill proposed in 1901 was rejected by the ratepayers.

As a result of this, and of a canvass of Harborne taken later,

proposals for a tramway to that suburb were judiciously omitted by the Council from the tramways bill of 1904. Harborne has, however, had its experience of motor buses, and now an influential canvass of the residents is being made in favor of the tramways, the City Council has practically pledged itself not to move in the matter unless there is an indisputable preponderance of public expression in favor of its so doing.

Eastbourne, one of England's most beautiful towns by the sea, has not as yet enjoyed a system of electric tramways, but the question is now a burning one. A service of motor 'buses has been started, but considerable objection has been made to them on account of noise, dust and bad smells, not to mention the frequent breakdowns. As far as tramways are concerned, it is contended that they would not pay, as there are no populous outlying districts, and as it is largely a residential town for visitors, it is contended that the trams are not desired, as they would spoil the quiet restfulness of the place. The residents of Harrogate, the popular health resort in Yorkshire, are also much perturbed at present about the same question, as the Knaresborough Urban Council has received recently proposals from an outside company to construct a tramway from Harrogate to Knaresborough. The Harrogate Town Council has, however, opposed any tramway system for the present, as the inhabitants do not wish to make Harrogate too "towny" which, they claim, instead of attracting visitors would have the effect of driving them away. Motor 'buses have been mentioned in connection with the argument, but there is much grave objection offered, as the experiences of other towns have not been of the most pleasant character.

During the past month, there have been several tramway disputes between tramway officials and tramway men, and in two cases they have led to strikes and much unpleasantness. In the case of the Halifax strike, it appears that the men are demanding the reinstatement of the driver who was held responsible for the recent accident in that city, and though every effort was made to arrange the matter, the men eventually decided to go out, and the tramway committee were forced to import men from other cities. There has also been an important strike on the Mansfield & District Railway, caused by the issuing of a new duty sheet, changing the working hours of the men. This strike resulted in most unpleasant incidents, but the dispute has at last been amicably settled and the men have now all returned to work.

The carrying of parcels on the tramway cars of the system of the Manchester Corporation has not been a financial success, the loss during the first year's working being as much as £5,500. Some of this, of course, is attributable to the expense in starting the scheme, and also to litigation which it immediately brought forth by the opposition of a firm of carriers in Manchester. The tramways committee is now considering seriously whether it is worth while to continue the service or not.

We referred last month to the very bad report which the District Railway Company recently brought out, and to the immense losses which they had incurred, chiefly and most surprisingly owing to the largely increased cost of operating the system electrically. For some years past all fares in transportation circles in London have been decreased, but the directors of the District Railway have now come to the decision, as we mentioned last month, that they are much too low, and they have accordingly increased their rates very largely. They have brought down upon their heads a storm of disapproval, and meetings in many of the towns served by the railway, notably Wimbledon and East Ham, have been held protesting against this increase. There is much to be said, of course, in their favor, as many residents in these towns have been tempted to go there by the low fares, and it is extremely aggravating after having taken on leases of houses to find that their traveling expenses to and from the city should have been increased from 50 per cent to 150 per cent. On the other hand, the railway claims that as it is making a loss it must do something to retrieve that loss, as the company is by no means a philanthropic institution. Most of the extra expense in operating comes from the fact that so many men are needed on each train, the old style of English railway coach having been given up and the American type of open coach substituted, necessitating a man at each of the gates. We understand that the railway company is now experimenting with a new type of train by which two men will be able to open and close all the gates of the six or seven carriages. There is no doubt that the English public does not take kindly to the American type of open coach, as they appear to be much more shaky and drafty. A few trains are still being run over the system composed of old English type railway stock and hauled by electric locomotives, and it is easy to see that these are much more popular than the open type, which seems to rattle the very bones within one.

According to a return which has just been issued by the Board of Trade, the length of railway line in equivalent of single track which was worked at the end of last year solely by electricity was 140¼ miles, while that worked partly by electricity was 170½ miles. The number of miles run by electrical trains in 1905 was 9,667,429. The total quantity of electrical energy used for electrical train running and other purposes was 100,977,467 kw-hours, Board of Trade units. The first-class passengers showed an increase of £38,000; second-class a decrease of £211,000; third-class an increase of £247,000, and season-ticket holders an increase of £141,000.

The sub-committee appointed to consider a scheme for the electrification of the Accrington Tramways has prepared a report. After visiting various towns where there is electric traction, the overhead system has been chosen as the most suitable. It is recommended that the Corporation should operate the system direct by its own staff rather than lease it. The estimates are: Construction of new and existing tramways, £50,800; cost of electrical equipment, £33,300; total, £84,100.

There is evidently a boom in tramways in Fifeshire since their introduction into Kirkcaldy a few years ago. A line of tramways has been laid between Leven and Kirkcaldy, which is already in working order. In connection with the proposed line of tramways for Dumfernline to Lochgelly work is to be commenced shortly, while another scheme is in contemplation which will include a line from Lochgelly to Lochore, and another from Lochgelly, passing through Bowhill, Kinglassie, on to the Kirkcaldy and Cupar Road, through Thornton, and joining the Kirkcaldy Tramways at Gallatown.

The revolt against the motor omnibus has assumed formidable proportions in the Manchester district. There are outlying suburbs of the city not yet touched by the excellent electric tram service of the corporation, where the vehicles of the Manchester District Motor Omnibus Company ply for hire under the licenses of the local authorities concerned. In Wilmslow and Levenshulme, however—two suburbs on the south side of Manchester—petitions have been extensively signed in favor of a cessation of the motor omnibus services, the ground of compliant being that the noise, smell, vibration and dust caused by them constitute an intolerable nuisance. These petitions have been presented to the district Councils. The result is that the Levenshulme Council has decided unanimously to cancel the motor omnibus licenses already issued.

The construction of a light railway to connect Woking and Bagshot stations of the London & South-Western Railway is to be commenced immediately. The overhead system is to be used, and the line at Woking is to join the London & South-Western goods sidings. The districts of Horsell, Chobham and Windlesham will be touched by the new railway, which is to cost £150,000. Messrs. Johnson & Phillips are the engineers.

According to the annual report of the manager of the Bradford Corporation Tramways, the undertaking in that city suffers seriously on account of the gradients. Two heavy items of expenditure are directly attributable to this fact—namely, power and car repairs. In a level city the consumption of power per car-mile is, roughly, 1 unit as against 1.9 units in Bradford. This would mean a difference of nearly £20,000. Car repairs in a level city were generally about 5d. per car-mile, as against 8d. in Bradford, a difference of 3d. per car-mile, amounting, roughly, to £6,300, so that to the gradients an extra expenditure of £26,000 was directly attributable.

The system of tramways which the Leyton Council has purchased and transformed from horse to electricity was recently opened on the route via High Road, Laytonstone and Whipps Cross to Epping Forest. Both Leyton and Walthamstow now offer a direct route by tramcar from London to Epping Forest.

A. C. S.

CAR HOUSE DESTROYED IN BOSTON

All the cars and equipment at the Washington Avenue car houses of the Boston & Northern Street Railway in Chelsea were destroyed Thursday morning, Sept. 27, in a fire that caused an estimated loss of $300,000. In the houses were stored forty-two open cars, twenty-four closed cars and twelve of the new semi-convertible cars that had never been used. Not one of these was saved. So fiercely did the fire burn that it was impossible to remove anything from the building, and long before the Chelsea Fire Department arrived on the scene it had communicated to nearly every car in store there.

PARIS LETTER

(From Our Regular Correspondent.)

The dispute between the various tramway companies operating in Paris and its suburbs and their employees, which was temporarily patched up last year, was referred to the Prefect of the Seine and M. Musset, the expert of the Prefecture, who have rendered a decision. It includes the following recommendations as desirable: Minimum daily wages, $1; limitation of day's work to ten hours; right to four days' rest per month and ten days' annual holiday with pay; retention of 1.8 per cent of the wages of the men to form a sick fund and indemnity for time lost in military service; payment of a further 6 per cent of the wages into an old age pension fund. The referees, however, admit that from the companies' standpoint the plan is impracticable, especially for the Cie Générale des Omnibus, the largest company in Paris, whose revenue would have to be very materially increased before these wages could be paid. As a result, the plan will probably be held in abeyance until the franchise expires, which will occur within a year or two.

M. Auvert, the chief electrical engineer in the service of the P. L. M. Railway, recently read a paper at Lyons, before the French Association for the Advancement of Science, in which he gave certain explanations relative to the current rectifier on which his force has been working. By means of this rectifier, which he states can be built compact and strong enough to be mounted on an electric locomotive, high-tension single-phase current can be transformed on the locomotive to direct current. It consists, he stated, of revolving and stationary parts, but it is not necessary to transform the electrical energy into mechanical work and back into electrical energy, as in the motor generator type of machine. The only mechanical work required is that required to overcome inertia and friction, and this expenditure of power is constant whatever the state of load of the machine. He calls the machine a governor rectifier, because it not only transforms the alternating current but regulates the potential of the direct current without changing the alternating current potential, simply by a modification of the collector brushes on the revolving part of the machine. A trial of a 400-kw machine in Paris has given an efficiency of 88 per cent, all losses included, for this output, and 86 per cent for half that output. The machine is considered to be of great flexibility, and with its use, by returning to the line the energy thus generated, the trains may be slowed or stopped without the use of any mechanical brakes. M. Auvert, who has been aided in this development by M. Farrand, of the same department, considers that the machine will go far toward solving some of the questions of long-distance electric traction. The communication made by M. Auvert has attracted considerable attention in view of the announcements he has already made on the subject of availability of electric traction for long-distance lines.

STANDARDIZATION OF RAILS, JOURNALS AND JOURNAL BOXES

The committee on standardization of the Engineering Association has issued the following notice:

"Committees from both the 'American' and the 'Engineering' Associations were appointed at the 1905 convention to investigate the general problem of standardization and to undertake such work of this nature as might be considered advisable at the present time. The active work of making the standards devolves upon the Engineering Association committee. This committee has decided to devote its attention at present to the standardization of brake-shoes, journals and journal boxes, tread and flange of wheels, and rails for street and interurban railways.

"Considerable work has been done along all four lines of standardization, but the present communication relates only to the subjects of rails, journals and journal boxes. Data sheets Nos. 12 and 13, covering these subjects, will be found enclosed, and you are respectfully requested to have these blanks carefully filled out and return one copy promptly to Bernard V. Swenson, secretary, American Street & Interurban Railway Association, 60 Wall Street, New York City. Please note that the data sheets ask for sketches with dimensions, and we would call your attention particularly to this matter. It is quite essential to the latter work of the committee that the material asked for is prepared and sent in by the various companies. The information obtained will be carefully collated by the engineering committee, and, together with other material upon these subjects, will form the basis of the report of this committee on the standardization of rails, journals and journal boxes.

"It is confidently expected that the work now under way will be of much value to the street and interurban railway interests, but this can only result through the hearty co-operation of the general managers and engineers of the individual companies."

The questions follow:

RAILS

(1) Company. (2) City. (3) State. (4) Number miles of track; (a) single, (b) double, (c) total.

(5) Gage of track. (6) Average speed of cars. (7) Maximum speed of cars (approximately). (8) Single-truck cars; (a) number operated, (b) weight of heaviest car complete, (1) without load, (2) with load. (9) Double truck cars; (a) number operated, (b) weight of heaviest car complete, (1) without load, (2) with load.

(10) Wheel-base; (a) single-truck cars, (b) double-truck cars (each truck). (11) Give smallest radius of curves over which cars operate; (a) single-truck cars, (b) double-truck cars. (12) Types of rail used for—(A) Urban lines. Give manufacturer's name, catalog section, number and miles of track for each of the following: (a) Plain and grooved girder rails, (b) girder guard rails, (c) high T-rails, and (d) standard T-rails. (B) Give the same for interurban-line service.

(13) Are standard or high T-rails prohibited in municipalities through which you operate? If so, give names of such municipalities. (14) Give sections of track construction used in connection with the various types of rails. (15) Kindly send dimensioned sketch showing what you consider would be a good standard for rails for—(a) urban lines, (b) interurban lines, (c) both urban and interurban lines.

JOURNALS AND JOURNAL BOXES

(1) Company. (2) City. (3) State. (4) Number miles of track; (a) single, (b) double, (c) total.

(5) Gage of track. (6) Average speed of cars. (7) Maximum speed of cars (approximately). (8) Single-truck cars; (a) number operated, (b) weight of heaviest car complete (without load and with load). (9) Double-truck car; (a) number operated, (b) weight of heaviest car complete (without load and with load). (10) Wheel-base; (a) single-truck cars, (b) double-truck cars (each truck). (11) Give smallest radius of curves over which cars operate; (a) single-truck) cars, (b) double-truck cars.

(12) Journals: Give for—(a) Single-truck motor cars, (b) single-truck trailer cars, (c) double-truck motor cars, (1) motor axle, (2) pony axle, and (3) trailer-truck axles, and (d) double-truck trailer cars, the following information: (A) diameter of journal when new, (B) length of journal when new, (C) distance from end of journal to outside face of wheel hub, (D) distance from end of journal to outside end of wheel seat, (E) diameter of wheel seat, (F) diameter of collar (if any) when new, (G) thickness of collar (if any) when new, (H) radius of fillet at inner end of joprnal, (I) load on each journal (car loaded) on heaviest cars. Also give the following: (J) Material of which axles are made, (K) tensile strength of the material in axles, in pounds per square inch, (L) elastic limit of the material in axles, in pounds per square inch, (M) normal lateral play that the journals are allowed, (N) maximum lateral play that the journals are allowed.

(13) Journal boxes, all dimensions to be measured with new brasses. Give for—(a) single-truck motor cars, (b) single-truck trailer cars, (c) double-truck motor cars, (1) motor axle, (2) pony axles, and (3) trailer-truck axles, and (d) double-truck trailer cars, the following information: (A) Opening in jaw of pedestals when new, (B) width of pedestal jaw when new, (C) clearance above top of journal-box when car is loaded, (D) clearance between bottom of journal-box and pedestal tie-bar when car is light, (E) vertical distance from center of journal to outside top of journal-box, (F) vertical distance from center of journal to outside bottom of journal-box, (G) outside dimension from outside end of journal to back of journal-box, (H) dimension from center of journal to inside top of journal-box, (I) dimensions from center of journal to inside bottom of journal-box, (J) material of which journal-boxes are made.

(14) Journal bearing: Give for the same classes of trucks mentioned in (12) and (13) the following information in regard to the journal bearing: (A) Thickness of bearing at center when new, (B) width of bearing at center when new, (C) length of bearing when new, (D) maximum wear allowed on thickness of bearing, (E) material of which bearing is made, viz.: (a) solid brass, (b) tinned brass, (c) filled bearing.

(15) Keeper: Give for the same classes of trucks mentioned in (12) and (13) the following information in regard to the keeper: (A) Thickness at center of keeper or wedge, (B) width at center of keeper or wedge, (C) length of keeper or wedge, (D) material of which keepers are made.

(16) Outline sketches: (A) Give outline sketch (with dimensions) of your various types of journal-boxes complete, with brass, keeper, etc., stating if used on single or double-truck cars, and whether on motor trucks or trailer trucks; note on sketches with what journals the boxes are used. (B) Give outline sketches with dimensions of your various types of journals, marking on each journal the load on same (car loaded). (C) Give outline sketch with dimensions of pedestals, showing features which limit dimensions of journal boxes.

(17) Suggested standard: Kindly send dimensioned sketches showing what you consider would be good standard for journals and journal-boxes, considering different loads.

ANNUAL REPORT OF PHILADELPHIA RAPID TRANSIT COMPANY

The report of the Philadelphia Rapid Transit Company for the year ended June 30, 1906, as presented at the recent annual meeting of the company, of which mention has been made before in the STREET RAILWAY JOURNAL, follows, together with an abstract of the general statement of President Parsons of the condition and prospect of the company:

Year Ending June 30	1906	1905
Number of passengers carried	448,576,785	402,893,245
Receipts from passengers	$17,483,144	$16,188,645
Operating expenses, 52.36 per cent	9,153,603	8,183,437
	$8,329,541	$8,005,208
Miscellaneous receipts, interest, etc.	193,103	185,979
	$8,522,644	$8,191,187
Taxes and licenses, paid and accrued	1,075,216	966,535
	$7,447,428	$7,224,652
Fixed charges, paid and accrued	7,143,431	7,116,442
	$303,996	$108,210

Operating expenses, including taxes and licenses, 58.50 per cent.

FINANCIAL STATEMENT OF THE PHILADELPHIA RAPID TRANSIT COMPANY, JUNE 30, 1906

Assets

Cash	$429,957.93	
Cash in agents' hands	12,500.00	
Fire insurance fund	850,000.00	
Advanced to leased lines	580,315.66	
Supplies	746,858.93	
Construction and equipment	19,863,238.51	
Real estate	891,668.97	
Accounts receivable	8,845.16	
Sundry stocks	2,597,500.00	
Franchise account	115,325.44	
		$26,096,210.60

Liabilities

Capital stock	$12,850,060.00	
Accounts audited, but not due	490,955.19	
Fixed charges and taxes accrued	631,906.59	
Open accounts	3,347,328.29	
Proceeds sale of bonds underlying companies	7,712,000.00	
Profit and loss	1,063,960.53	
		$26,096,210.60

All of which is respectfully submitted, by order of the board of directors.
JOHN B. PARSONS, President.

REPORT OF THE TREASURER OF THE PHILADELPHIA RAPID TRANSIT COMPANY FOR THE YEAR ENDING JUNE 30, 1906

Balance as per report, June 30, 1905		$1,976,230.20

Receipts

Passenger receipts	$17,472,792.59	
Chartered cars	10,352.20	
Advertising	99,583.38	
United States mail	43,413.42	
Rents, real estate	21,753.44	
Interest	11,560.93	
Miscellaneous	521,914.91	
Capital, installment on stock	877,740.00	
Market Street Elevated Passenger Railway Company bonds	3,675,000.00	
Darby & Yeadon Street Railway Co. bonds	37,000.00	
Open accounts	2,700,000.00	
		25,471,110.87
		$27,447,341.07

Disbursements

Pay rolls	$6,880,473.54	
Operation, construction and equipment accounts	10,225,288.56	
Advance to agents	3,000.00	
Sundry advances	4,850.00	
Advances to leased lines	78,107.23	
Taxes and licenses	1,634,866.69	
Fixed charges	8,065,623.71	
Real estate purchased	115,173.41	
		27,017,383.14
Balance		$429,957.93

R. B. SELFRIDGE, Treasurer.

The receipts from all sources for the year were $17,711,598.88; cost of operation, licenses, taxes and fixed charges, $17,407,602.23, showing a net profit of $303,996.65.

The gross receipts of your company show a considerable increase as compared with last year. The expenses of operation have been heavier, owing principally to the relaying of considerable mileage with the heavy girder rail, to the increase in the number of cars operated, to the additional cost of heating all cars in operation and to the thorough overhauling of all cars and snow equipment, and the heavy increase in the payments of accidents settled.

There was built during the year 7.37 miles of new tracks, being extensions to existing lines and the tracks in the subway from Twenty-Ninth Street to Fifteenth Street.

During the year 42 miles of track were relaid with the new heavy rail (141 lbs. to the yard), these tracks being on streets where the traffic is heavy.

The total trackage of your system is 563 miles.

The tracks of the Darby & Yeadon Railway Company running from Sixty-Fifth and Kingsessing Avenue to Darby are in course of construction, and when completed will give you a second railway into Darby.

That section of the Market Street subway from the bridge over the Schuylkill River to Fifteenth Street was opened for traffic Dec. 15, 1905, by the placing in operation of certain of the surface cars through the subway.

The steel work on the Market Street elevated structure is all erected, and the work of cementing the deck of same and the laying of the rails is progressing rapidly.

The large terminal buildings, car houses, inspection shops, etc., for the Market Street Elevated Road are nearing completion.

The power generating plant to operate the elevated and subway and to furnish additional power for increase on the surface lines is in progress of erection at Laurel and Delaware Avenue, and by November one machine of 6000 kw capacity should be in operation. There has been added to the power generating machinery during the year 6600 kw; the total capacity of all your power plants is 48,025 kw.

Car equipment has been added as rapidly as cars are received from the builders, and there are still on order a large number of cars. The snow equipment has been entirely overhauled, and a large number of the small motors replaced by improved and heavier ones.

The following amount of paving has been maintained by the company during the year:

	Square Yards
Belgian block	4,318,918
Asphalt	1,509,829
Macadam	499,072
Brick	344,814
Cobble	27,699

This paving has been maintained in addition to the payments of $1,075,216.57, being licenses and taxes paid and accrued to the city and State.

On Oct. 1, 1905, there fell due an issue of $132,100 of 7 per cent bonds of the West End Passenger Railway Company; these bonds were extended for thirty years at 4 per cent per annum.

On April 1, 1906, there fell due an issue of $246,000 West Philadelphia Passenger Railway 6 per cent bonds; these bonds were extended for fifty years at 3½ per cent.

FIRST ELECTRIC TRAIN INTO NEW YORK OVER NEW YORK CENTRAL LINES

On Sunday, Sept. 30, the first electric train was run from High Bridge to the Grand Central Station, New York, passing en route through the Park Avenue tunnel. The party that made the trip was composed of engineers and railroad men. They gathered at High Bridge to enter the train, made up of two private cars and five Pullman coaches, drawn by electric engine No. 3406. The unofficial time of the run for the 7½ miles is given as 18 minutes. W. J. Wilgus, vice-president of the New York Central, acted as motorman. The forward and the second car carried the guests of the railroad, who had been invited to witness the test. Among them were: A. H. Smith, general manager of the road; O. F. Smith, general superintendent; J. F. Deems, general superintendent of motive power; Bion J. Arnold, Frank J. Sprague and Edward B. Katte, electrical engineers of the electrification corps; J. H. Holst, Azel Ames, Jr., Victor Spangberg, W. H. Knowlton, G. A. Berry and G. A. Harwood, of the construction department; J. Carstensen, vice-president; E. C. Carter, chief engineer of the Chicago & Northwestern Railroad; C. Loomis Allen, vice-president of the Mohawk Valley Railroad, and E. W. Rice, G. H. Hill, J. R. Lovejoy, A. F. Batcheller, E. D. Priest and H. B. Hawks, of the General Electric Company.

A BOSTON-NEW YORK PROJECT

The latest long-distance electric railway to be projected in the East is the Boston & New York Electric Railroad. Announcement of the plan to build a line between the cities named in the title of the company was made in Boston last week. S. D. Reynolds, 35 Congress Street, Boston, made the formal announcement regarding the project. He estimates the cost of the road and its equipment at about $20,000,000, and said there would be no difficulty whatever in securing the necessary funds. He was not at liberty to define the proposed route beyond the boundaries of Massachusetts, except to say that the line would tap Providence and the other important business centers of Rhode Island and Connecticut. While it is not the intention to pass through the centers of the larger cities, it is proposed to have branch lines from them to connect with the main road and thereby permit them to enjoy all the benefits that the new line is expected to give. While nothing definite has been decided upon as to a schedule of rates, assurances are given that they will be considerably lower than those now charged by the steam line. The road will be double tracked its entire length, will run on private right of way, be entirely fenced in and bridged at every street and railroad crossing so as to eliminate all grade crossings. The route is the shortest possible between terminal points, the distance being 190 miles, as against 233 by way of the "Shore line" and 213 by way of Willimantic and Middletown.

The new organization presents the following list of well-known capitalists and business men, who have made application to the Board of Railroad Commissioners for a certificate to show that a public exigency exists for the construction of such a road: A. B. Leach, of South Orange, N. J., of A. B. Leach & Company (formerly Farson, Leach & Company), investment securities, of New York, Chicago, Boston and Philadelphia; James G. Campbell, of South Orange, N. J., of A. B. Leach & Company; William O. Blaney, of Boston, president of the Commercial National Bank; Elwyn G. Preston, of Woburn, Mass., treasurer of the R. H. White Company, formerly secretary of the Boston Chamber of Commerce; S. W. Reynolds, of Brookline, vice-president of the Tezlutian Copper Mining & Smelting Company, and formerly president of the Mexican Central Railway Company, Ltd.; Harry M. Howard, of Brookline, of the Eastern Leather Company; Edward C. Sherburne, of Boston, of the Boston Plate & Window Glass Company; James M. W. Hall, of Cambridge, of Hall Lumber Company, director of the National Bank of the Republic; Theodore N. Vail, of Lyndonville, Vt., director of the American Telephone Company, chairman of the board of directors of La Capital Traction Company, owning an electric railway in Buenos Ayres, Argentine Republic.

PURCHASE OF THE PECKHAM BUSINESS BY THE NEW YORK CAR & TRUCK COMPANY

The New York Car & Truck Company, of Kingston, N. Y., has purchased the entire plant of the Peckham Manufacturing Company, together with all patent rights.

It will manufacture the Peckham system of single trucks, medium and high-speed double trucks, as well as rotary snow plows.

The following gentlemen comprise the board of directors: E. R. Thomas, president Brockville, Westport & Northwestern Railway; E. R. Chapman, vice-president Alabama Iron & Steel Company; O. F. Thomas, banker; Frederick Steigerwald, president Lyons Sugar Refining Company, and Aleck Thompson, late president Republic Iron & Steel Company. It will be seen that the personnel of the company is such as to place it in a position to carry out its contracts in full and to assure prompt delivery of trucks, snow plows and supply parts.

The company also announces that Warren L. Boyer, formerly with the Peckham Manufacturing Company, has been engaged as superintendent of the works of the new company at Kingston, N. Y. Mr. Boyer is well known to street railway engineers throughout the country as a contributor to the STREET RAILWAY JOURNAL on various engineering topics.

"MINNEAPOLIS" GATES AS A MEANS OF PREVENTING ACCIDENTS

Mayor Dunne, of Chicago, after a visit to Minneapolis, was so impressed with the gates used on the cars of the Twin City Rapid Transit Company that he made inquiry as to their efficacy in avoiding accidents. He has received a report from the Twin City Rapid Transit Company to the effect that although the gates are considered a nuisance by some passengers, only 259 persons were injured in getting on and off cars in 1904, whereas in 1894, with no gates and half as many passengers, the number of such accidents was 1655.

IMPORTANT LINE ANNOUNCEMENT AT TACOMA

The Tacoma Railway & Power Company and the Puget Sound Electric Company will build an interurban railway connecting Tacoma, Puyallup, Sumner and Orting, the work to begin just as soon as the franchises can be secured. The line between Puyallup and Sumner will be built first, and will be connected with the present Puyallup-Tacoma line until the line running out of the valley from the end of Puyallup Avenue can be constructed. Manager Dimmock says the company has been preparing for this announcement for about a year, by purchasing rights of way and laying out the line. Work, he says, would have been under way long ago had it not been for the large amount of other work that had to be done first. The material for the Puyallup-Sumner part of the line is here and all other material has been ordered. It is intended to maintain a service something like the Renton-Seattle service, two cars to the train, and as the road runs through a private right of way, high speed will be allowable. The line will be 21 miles long. Between Puyallup and Orting, via Sumner, it is said the road will be one of the most beautiful in the West. It crosses and recrosses the Puyallup River, and there is always an imposing view of the mountains. The line between Tacoma and Puyallup will follow the interurban until it has crossed the Puyallup River. The course is then almost straight up the valley to Puyallup.

CONVENTION OF THE COLORADO ELECTRIC LIGHT, POWER & RAILWAY ASSOCIATION

The fourth annual convention of the Colorado Electric Light, Power & Railway Association was held at Denver, Sept. 18, 19 and 20. The first session was called to order at 11:20 Tuesday morning. President Freuauff stated in his address that the association had now in this its fourth year an active membership of thirty-two companies and an associate membership of thirty-two. The recent amendment to the by-laws whereby companies from adjoining States could come in has served to cause several such companies to join the association. At 2 p. m. E. P. Dillon, of Colorado Springs, read a paper on "Transformer Testing and Line Records for Transformers." Following this, W. A. Carter, of Denver, read a paper on the "Use of Polyphase Motors in Outlying Districts," in which he described some changes from direct to alternating-current service recently made in some parts of Denver. The remainder of the session was taken up with a discussion of the questions in the Question Box.

Wednesday morning was largely devoted to illuminating engineering. On Wednesday afternoon C. C. Chapelle, of Denver, read a paper on "Steam Turbines," and the Question Box was then taken up for the remainder of the session. After adjournment the Denver City Tramway Company placed a car at the disposal of the visitors for the purpose of taking them to its power station in the northern part of the city.

Thursday morning the Question Box was again taken up. After an extended discussion of the questions a paper on "Voltage Regulation" was presented by Leonard Wilson, of Denver, which gave a comprehensive review of the methods of voltage regulation used on alternating-current circuits. A. M. Ballou, of Denver, gave a paper on "Water Type Lightning Arresters," describing a novel practice of the Denver City Tramway Company in placing a tank lightning arrester on each car to be cut in during severe thunderstorms. This paper is published in abstract elsewhere in this issue.

On Thursday afternoon a brief session was held to elect officers and hear the reports of committees. The following officers were elected on recommendation of the nominating committee: President, George B. Tripp, of Colorado Springs; vice-president, W. G. Matthews, of Denver; secretary and treasurer, John F. Dostal, of Denver. Executive Committee—The officers and F. W. Frueauff and John A. Beeler, of Denver. Finance Committee—John F. Vail, of Pueblo; William Mayher, of Greely, and E. P. Dillon, of Colorado Springs. Membership Committee—J. W. Stearns, of Denver; F. C. Webber, of Leadville, and M. T. Morrell, of Golden. Advisory Committee—W. J. Barker, of Denver; Irving Hale, of Denver; L. M. Cargo, of Denver; W. T. Wallace, of Canon City, and V. D. Sickman.

PRESIDENT MELLEN OF N. Y., N. H. & H. R. R. EXPLAINS TROLLEY SALE IN ANNUAL REPORT

In presenting the annual report of the New York, New Haven & Hartford Railroad, made public Wednesday, Sept. 26, President Mellen of the company made the following interesting reference to the sale by the company of its electric railway interests in Massachusetts, to which reference has been made before in the STREET RAILWAY JOURNAL:

Owing to opposition in Massachusetts to the ownership by this company of the securities of certain street railway companies in that State, a sale was made on June 25, 1905, of all of such securities (except those of the Worcester & Webster and Webster & Dudley Street Railway Companies, which are also held under lease approved by the properly constituted authorities of the State) to a voluntary association known as the New England Investment & Security Company. Promissory notes were given for the payment of a sum equivalent to the cost of such securities and the association issued its common and preferred shares to a banking house in sufficient amount under contract of sale to pay said notes as the shares are disposed of.

Hereafter the interest of the Consolidated Railway Company will be limited to the securing of payment of the notes which were given for the securities sold and to limiting its liability upon its indorsement upon the preferred shares of the association. An option of call at 105 upon said preferred shares was given in consideration of the endorsement of the same, and it is believed the association will within a reasonable time develop sufficient financial strength to enable such call to be exercised and such endorsement to be canceled. The securities were acquired in the hope and opinion that the union of the lines in question into one company through the construction of certain connecting links and feeders which were under consideration, would have developed sufficient earning capacity and economy of operation to have made the securities desirable investments. It was useless, however, to continue the investments and be the target of attack and misrepresentation that would have been the result, and it was thought better to retire without loss than engage even in successful litigation for a profit that at the best was only prospective.

PERSONAL MENTION

MR. FRANK W. CURTIS, formerly with the Rhode Island Locomotive Works, has been appointed general sales manager of the New York Car & Truck Company, with his headquarters at 29 Broadway, New York.

MR. H. BALUSS has been appointed general superintendent of the Cincinnati, Georgetown & Portsmouth Railroad, succeeding Mr. H. E. Sawyer, resigned. Mr. Baluss will also assume the duties of freight and passenger agent.

MR. F. H. FROELICH, for several years chief engineer of the Patrick Hirsh Company, of Toledo, has opened an office at 309 St. Clair Building, that city, and will follow his profession of consulting and mechanical engineer. Portions of the Toledo & Indiana Railway and the partly constructed Toledo, Ann Arbor & Detroit were built under Mr. Froelich's direction.

MR. JOHN B. COX, of the traction department of the British Thomson-Houston Company, is enjoying a vacation of two months in this country. He has been connected with the British Thomson-Houston Company for the last six years, during which he has been engaged in traction construction in France, Portugal and England. Previous to going to Europe Mr. Cox was associated with the General Electric Company.

MR. N. McD. CRAWFORD, recently appointed first vice-president in charge of operation of the Indiana, Columbus & Eastern Railway Company, has been making an inspection of the roads under his charge. He was tendered a reception and dinner by citizens of Lima a few nights ago. Mr. Crawford will relieve Mr. W. Kelsey Schoepf of a great bulk of his work in the operation of the Schoepf properties in Ohio.

MR. CHARLES A. BARTON, superintendent of equipment of the Worcester Consolidated Street Railway, has resigned to become superintendent of motive power of the Rio Janeiro Street Railway, Light & Power Company, of Rio Janeiro, Brazil, of which company Mr. Frederick A. Huntress, formerly of Worcester, is general manager. Mr. Barton has been connected with the Worcester company twelve years. To fill the vacancy at Worcester, Mr. A. J. McPherson has been promoted from foreman of the Market Street car shops.

MR. PHILIP FERDINAND KOBBE, director and assistant secretary of the Westinghouse Electric & Manufacturing Company, died at his summer home at Stockbridge, Mass., on Friday, Sept. 21, aged sixty-four years. Mr. Kobbe was one of the pioneers in the electrical business, his efforts always having been devoted to the financial end. In 1883 he was elected treasurer of the United States Electric Lighting Company, which position he held until 1890, when the United States Electric Lighting Company was absorbed by the Westinghouse Electric & Manufacturing Company, at which time Mr. Kobbe was made treasurer of the latter company. In 1896 Mr. Kobbe was made vice-president in addition to his duties as treasurer, and in 1902 he became a director of the company. Mr. Kobbe was born in New York, Oct. 24, 1842, and received his education in Germany.

MR. R. E. DANFORTH, general manager of the Rochester Railway Company, has announced a number of changes in the personnel of the company. Mr. J. W. Hicks, superintendent of transportation, is now assistant general manager; Mr. E. J. Wilcoxen, former superintendent of Sodus Bay division, is transportation superintendent, and Mr. B. C. Amesbury, who has been supervisor of the Sodus Bay division, has been promoted to the place left vacant by the appointment of Mr. Wilcoxen to his new post. Mr. Hicks is the oldest employee of the company in point of service, having been in its employ continuously for forty years. He started with the company when he was seventeen years old as a driver. Mr. Wilcoxen was with the Rochester & Sodus Bay road during its construction and has been superintendent since it was built. Before he came into the service of the present company he was employed by the Wagner Palace Car Company. Mr. Amesbury has also grown up with the company, having started in as a motorman several years ago. He was for a time foreman of the track department of the Sodus Bay division and later was made supervisor.

MR. WILLIAM WAMPLER has resigned from the New York Car & Truck Company, successor to the Peckham Manufacturing Company, to accept a position with the American Locomotive Company, in charge of sales of electric trucks. He will supervise the exhibit of the company at the Columbus convention. Previously Mr. Wampler acted as New York representative of the Stuart-Howland Company, of Boston, dealers in electrical supplies and specialties. Mr. Wampler, who is thirty-eight years of age and a native of Crawford County, Pa., has had an experience of sixteen years in electric railway work. His first connection with the business was with the roads in Pittsburg, and before he left that city he was a division superintendent. Then for a year and a half he was mechanical superintendent of the Union Railway Company, of New York, but resigned that position to accept that of master mechanic of the Atlantic Avenue Railway Company, of Brooklyn, now a part of the Brooklyn Heights Railroad Company. He continued with this company till 1894 when he accepted the position of superintendent of rolling stock and equipment of the Union Traction Company, of Philadelphia, which at the time had 2800 complete car equipments. He remained with that company four years. In 1898 he joined the forces of the Peckham Manufacturing Company, for whom he served as general sales agent. Mr. Wampler is widely and favorably known in the electric railway field.

PROF. DUGALD CALEB JACKSON, of the University of Wisconsin, has been called to the Massachusetts Institute of Technology to become the head of the course in electrical engineering. He is to fill the chair left vacant two years ago by the resignation of Prof. Louis Duncan. The chair has been temporarily filled by Prof. Clifford, who will continue at his post until the beginning of the second term, when Prof. Jackson will begin active duty. Prof. Jackson was born in Kennet Square, Pa., in 1865. In 1885 he was graduated from the Pennsylvania State College, and continued his studies further in a two years' graduate course in electrical engineering at Cornell. For two years he was vice-president of the Western Engineering Company, of Lincoln, Neb. Then he became affiliated with the Edison Company's interests as assistant chief engineer of the Sprague Electric Railway & Motor Company. Later he became chief engineer of the central district of the Edison General Electric Company. During this period he designed, built and operated many of the largest electric railway and lighting plants in the West. He is now advising engineer for several large corporations. He was a member of the international jury of the World's Columbian Exposition in 1893, and was also a member of the Association of Scientists at the Pan-American Exposition in 1901. He is a member of the American Society of Civil Engineers, of the American Society of Mechanical Engineers, of the American Institute of Electrical Engineers, of the Société Internationale des Electriciens, and of many other scientific societies.

TABLE OF OPERATING STATISTICS

Notice.—These statistics will be carefully revised from month to month, upon information received from the companies direct, or from official sources. The table should be used in connection with our Financial Supplement "American Street Railway Investments," which contains the annual operating reports to the ends of the various financial years. Similar statistics in regard to roads not reporting are solicited by the editors. * Including taxes. † Deficit.

Company.	Period.	Total Gross Earnings.	Operating Expenses.	Net Earnings.	Deductions From Income.	Net Income, Amount Available for Dividends.
AKRON, O. Northern Ohio Tr. & Light Co	1 m., Aug., '06	109,492	53,189	56,303	22,667	33,636
	1 " " '05	102,717	50,210	52,508	23,267	29,241
	8 " " '06	675,002	361,281	313,721	181,696	132,025
	8 " " '05	628,245	336,151	292,094	184,136	107,958
CHAMPAIGN, ILL. Illinois Traction Co	1 m., Aug., '06	270,869	*140,055	130,814	.....	.....
	1 " " '05	217,934	*106,600	111,334	.....	.....
	8 " " '06	1,896,464	*1,053,206	843,258	.....	.....
	8 " " '05	1,535,665	*836,062	699,603	.....	.....
CHARLESTON, S. C. Charleston Cons. Ry. Gas & Elec. Co	1 m., Aug., '06	56,290	36,147	20,143	13,017	7,126
	1 " " '05	51,585	31,540	20,045	13,267	6,778
	6 " " '06	328,504	198,855	129,649	77,950	51,699
	6 " " '05	306,502	179,756	126,746	78,350	48,396
CHICAGO, ILL. Aurora, Elgin & Chicago Ry. Co	1 m., July., '06	135,798	64,971	70,826	24,939	45,887
	1 " " '05	122,336	55,479	66,857	24,304	42,553
	4 " " '06	441,465	232,492	208,972	99,756	109,216
	4 " " '05	391,382	203,974	187,408	97,199	90,208
Chicago & Milwaukee Elec. R. R. Co	1 m., Aug., '06	107,089	35,615	71,474	.....	.....
	1 " " '05	67,838	25,181	42,657	.....	.....
	8 " " '06	536,387	212,894	323,493	.....	.....
	8 " " '05	347,074	150,069	197,005	.....	.....
CLEVELAND, O. Cleveland, Painesville & Eastern R. R. Co	1 m., Aug., '06	31,707	*13,749	17,958	.....	.....
	1 " " '05	29,554	*15,990	13,563	.....	.....
	8 " " '06	178,225	*95,626	82,600	.....	.....
	8 " " '05	159,623	*93,722	65,901	.....	.....
Cleveland & Southwestern Traction Co	1 m., Aug., '06	64,850	33,848	31,502	.....	.....
	1 " " '05	55,540	29,282	26,258	.....	.....
	8 " " '06	418,263	239,298	178,965	.....	.....
	8 " " '05	347,738	206,478	141,260	.....	.....
Lake Shore Electric	1 m., July, '06	97,124	*45,780	51,343	20,428	30,915
	1 " " '05	87,645	*40,786	46,863	20,404	26,459
	7 " " '06	473,312	*272,018	201,293	142,852	58,441
	7 " " '05	414,275	*238,917	175,358	142,828	32,530
DAVENPORT, IA. Tri City Ry. & Lt. Co	1 m., Aug., '06	143,057	83,765	59,292	.....	.....
	1 " " '05	116,545	70,872	45,673	.....	.....
	5 " " '06	659,023	410,887	248,136	.....	.....
	5 " " '05	583,837	370,522	213,315	.....	.....
DETROIT, MICH. Detroit United Ry	1 m., Aug., '06	576,813	*327,836	248,977	96,708	152,269
	1 " " '05	511,942	*281,865	230,077	92,395	137,682
	8 " " '06	3,819,754	*2,252,795	1,566,959	756,206	810,753
	8 " " '05	3,365,011	*2,001,572	1,363,439	736,211	627,228
DULUTH, MINN. Duluth St. Ry. Co	1 m., July, '06	75,470	32,990	42,480	17,876	24,603
	1 " " '05	64,461	30,037	34,424	17,361	17,063
	7 " " '06	431,708	224,466	207,242	122,930	84,313
	7 " " '05	369,203	197,502	171,701	117,940	53,761
EAST ST. LOUIS, ILL. East St. Louis & Suburban Co	1 m., July, '06	101,827	46,267	55,561	.....	.....
	1 " " '05	87,287	36,139	51,147	.....	.....
	7 " " '06	619,126	324,512	294,613	.....	.....
	7 " " '05	567,421	258,397	309,024	.....	.....
FT. WAYNE, IND. Ft. Wayne & Wabash Valley Tr. Co	1 m., July, '06	106,898	67,111	39,788	.....	.....
	1 " " '05	93,855	59,322	34,534	.....	.....
	7 " " '06	604,146	379,563	224,583	.....	.....
	7 " " '05	520,014	326,826	193,189	.....	.....
FT. WORTH, TEX. Northern Texas Tr. Co	1 m., July, '06	81,758	*48,210	33,549	9,942	23,607
	1 " " '05	59,874	*35,124	24,750	9,938	14,812
	12 " " '06	757,620	*467,450	290,170	119,279	170,891
	12 " " '05	615,949	*357,392	258,557	114,022	144,536
GALVESTON, TEX. Galveston Elec. Co	1 m., July, '06	33,441	*17,472	15,969	4,167	11,802
	1 " " '05	27,664	*15,248	12,417	4,167	8,250
	12 " " '06	292,390	*181,820	110,570	50,000	60,570
	12 " " '05	260,829	*190,535	70,294	35,000	35,294
GREENSBURG, PA. Pittsburg, McKeesport & Greensburg Ry. Co	1 m., Aug., '06	26,324	12,030	14,294	.....	.....
	1 " " '05	23,160	10,758	12,402	.....	.....
	8 " " '06	149,422	64,495	84,928	.....	.....
	8 " " '05	123,487	65,348	58,140	.....	.....
HANCOCK, MICH. Houghton County St. Ry. Co	1 m., July, '06	22,901	*12,913	9,988	3,910	6,079
	1 " " '05	21,391	*13,083	8,308	3,732	4,576
	12 " " '06	212,707	*144,454	68,253	46,123	22,130
	12 " " '05	166,349	*164,196	2,153	41,985	†39,833
HARRISBURG, PA. Central Penn. Tr. Co	1 m., Aug., '06	65,205	50,253	14,952	.....	.....
	1 " " '05	57,431	40,637	16,794	.....	.....
	8 " " '06	449,014	386,411	62,603	.....	.....
	8 " " '05	383,167	316,131	67,036	.....	.....
HOUSTON, TEX. Houston Electric Co.	1 m., July, '06	51,166	*32,489	18,677	7,692	10,985
	1 " " '05	47,903	*26,822	21,080	8,783	12,297
	12 " " '06	561,564	*352,315	209,252	99,274	109,977
	12 " " '05	459,130	*286,495	172,636	102,055	70,580
KANSAS CITY, MO. Kansas City Ry. & Lt. Co	1 m., Aug., '06	469,922	*267,910	202,006	.....	.....
	1 " " '05	433,072	*241,584	192,090	.....	.....
	3 " " '06	1,395,883	*820,711	575,173	.....	.....
	3 " " '05	1,268,055	*737,480	530,575	.....	.....
LEECHBURG, PA. Pittsburg & Alleghany Valley Ry. Co	1 m., Aug., '06	5,081	2,218	2,863	2,285	578
	5 " " '06	24,413	13,236	11,177	10,055	1,122
MILWAUKEE, WIS. Milwaukee Elec. Ry. & Lt. Co	1 m., Aug., '06	325,342	150,008	175,334	93,273	82,061
	1 " " '05	277,813	124,960	152,853	79,677	73,176
	8 " " '06	2,302,683	1,137,037	1,165,646	697,868	467,778
	8 " " '05	2,106,708	1,034,355	1,072,353	609,004	463,349
Milwaukee Lt., Ht. & Tr. Co	1 m., Aug., '06	80,038	27,971	52,067	31,163	20,904
	1 " " '05	69,724	24,265	45,459	23,636	21,823
	8 " " '06	454,958	177,801	277,157	207,834	69,323
	8 " " '05	379,207	170,746	226,461	165,409	61,052
MINNEAPOLIS, MIN. Twin City R. T. Co	1 m., July, '06	522,950	236,118	286,832	114,619	172,213
	1 " " '05	435,105	187,053	248,052	103,208	144,844
	7 " " '06	3,077,558	1,450,500	1,627,059	774,630	852,422
	7 " " '05	2,606,575	1,226,580	1,379,995	690,592	689,403
MONTREAL, CAN. Montreal St. Ry. Co	1 m., Aug., '06	300,278	158,415	141,863	59,430	82,435
	1 " " '05	262,009	136,199	125,810	35,469	90,341
	11 " " '06	2,794,948	1,686,769	1,108,179	434,240	673,939
	11 " " '05	2,443,829	1,531,038	912,790	267,389	645,401
NEW ORLEANS, LA. New Orleans Ry. & Lt. Co	1 m., Aug., '06	433,457	251,831	181,626	163,617	18,009
	1 " " '05	358,375	215,070	143,305	.....	.....
	8 " " '06	3,776,377	2,056,984	1,719,393	1,241,353	478,040
PEEKSKILL, N. Y. Peekskill Lt. & R.R. Co	1 m., Aug., '06	14,831	6,612	8,219	.....	.....
	1 " " '05	12,157	6,137	6,020	.....	.....
	8 " " '06	95,265	49,538	45,727	.....	.....
	8 " " '05	80,968	46,385	34,583	.....	.....
PHILA., PA. American Rys. Co	1 m., Aug., '06	274,005	.....	.....	.....	.....
	1 " " '05	245,475	.....	.....	.....	.....
	2 " " '06	550,280	.....	.....	.....	.....
	2 " " '05	500,311	.....	.....	.....	.....
ST. LOUIS, MO. United Railways Co. of St. Louis	1 m., Aug., '06	796,561	*493,226	303,335	198,026	105,309
	1 " " '05	751,810	*447,915	303,895	198,840	105,055
	8 " " '06	5,991,049	*3,711,270	2,279,779	1,585,374	694,405
	8 " " '05	5,524,759	*3,598,768	1,925,991	1,593,017	332,974
SAVANNAH, GA. Savannah Electric Co.	1 m., July, '06	60,528	*33,678	26,850	11,523	15,327
	1 " " '05	56,411	*30,037	26,374	10,554	15,820
	12 " " '06	618,897	*373,330	245,567	131,311	114,256
	12 " " '05	570,911	*330,687	240,224	126,934	113,291
TERRE HAUTE, IND. Terre Haute Tr. & Lt. Co	1 m., July, '06	76,110	*37,401	38,709	14,266	24,443
	1 " " '05	55,991	*35,051	20,941	10,747	10,194
	12 " " '06	723,963	*436,800	287,163	144,369	142,795
	12 " " '05	598,224	*391,125	207,099	115,811	91,288
TOLEDO, O. Toledo Rys. & Lt. Co.	1 m., July, '06	180,969	*89,646	91,323	42,785	48,538
	1 " " '05	171,994	*84,873	87,121	43,106	44,015
	7 " " '06	1,143,471	*598,492	544,979	296,506	248,473
	7 " " '05	1,067,788	*548,610	519,178	296,921	222,257