Street Railway Journal

VOL. XXII. NEW YORK, SATURDAY, OCTOBER 24, 1903 No. 17.

PUBLISHED EVERY SATURDAY BY THE
McGRAW PUBLISHING COMPANY

MAIN OFFICE:
NEW YORK, ENGINEERING BUILDING, 114 LIBERTY STREET.

BRANCH OFFICES:
Chicago: Monadnock Block.
Philadelphia: 929 Chestnut Street.
Cleveland: Cuyahoga Building.
London: Hastings House, Norfolk Street, Strand.

Cable Address, "Stryjourn, New York,"—Lieber's Code used.

TERMS OF SUBSCRIPTION.

In the United States, Canada and Mexico.....$4.00 per annum
Single copies, first issue of each month, 25 cents; other issues, 10 cents.

To all Countries outside of the United States, Canada and Mexico.... $6.00 £1-5s M 25 Fr. 31

Single copies, first issue of each month, 40 cents; other issues, 15 cents.
Subscriptions payable in advance, by check or money order. Remittances for foreign subscriptions may be made through our European office.

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

EDITORIAL NOTICE

Street railway news, and all information regarding changes of officers, new equipments, extensions, financial changes and new enterprises will be greatly appreciated for use in these columns.

All matter intended for publication must be received at our office not later than Tuesday morning of each week, in order to secure insertion in the current issue.

Address all communications to

THE STREET RAILWAY JOURNAL,
114 Liberty Street, New York.

Chicago Franchise Matters

We have announced so many times to our readers that negotiations for the renewal of the franchises of the Chicago city railway companies were again in progress, that we fear some may have taken it as a standing joke. Tedious these negotiations have been in the extreme, but it is not to be expected that such important matters could be settled in a few days. Whatever may be said regarding the obstructive policy of some of the city officials of Chicago, notably Mayor Harrison, there is no doubt that the local transportation committee of the Chicago City Council, which has had immediate charge of the franchise negotiations, has been painstaking and honest in its work. The Arnold report, which was arranged for by that committee, is but one example of the thoroughness with which it has attempted to do its work. It is but natural that this committee should attempt, in driving a bargain with the companies, to get as favorable terms and as high compensation for franchises as possible. However, it is to be hoped that in their zeal to drive a good bargain for the city these gentlemen will not place such burdens upon the companies in the way of compensation that the local transportation business will be crippled in Chicago for the next twenty years. Such an event would be nothing short of a great public calamity. That there is some danger of this just now there can be no doubt. The committee is now at work on a franchise for the Chicago City Railway Company, and it is understood that most of the details have been arranged, with the exception of the clause which provides for the proportion of the gross receipts which are to go to the city. What proportion will finally be agreed on no one knows at present, but it is practically certain that it will be higher than has yet been required in any city in the United States.

For those who have not followed the progress of the franchise negotiations in Chicago, we may say that the situation at present is, briefly, as follows: The franchise of the two principal companies, the Chicago City Railway Company and the Chicago Union Traction Company, on the principal streets of Chicago, are claimed by the city to have expired July last. There is considerable doubt as to whether these franchises really did expire on that date, as an act, commonly called the "Ninety-nine-year act," passed by the State Legislature many years ago might be construed in such a manner as to give the companies ninety-nine-year franchises. The validity of the franchises under this act has never been passed upon by the courts, and the result, consequently, is entirely problematical. The general proposition which is being embraced in the new franchise extension ordinances is that the companies waive all rights that they might have under the ninety-nine-year act, and accept in exchange for these rights a franchise giving them a clear title to all the streets upon which they are at present operating, together with some needed extensions, for twenty years. In addition to this it is proposed that the companies pay a proportion of their gross receipts to the city. At the end of twenty years the physical property must be purchased of the companies by the city or a renewed franchise must be given.

Relations of Employers and Workmen

An interesting and instructive document is reproduced on another page of this issue in the form of a letter written by George F. Chapman, general manager of the United Railways of San Francisco, and intended for the guidance of newly-employed platform men on that system. It is a straightforward statement of the relations between the employees and the company, defining the duties of the men and the attitude of their employer. Honesty, courteous treatment of patrons, conservative operation and strict observance of the general rules are the main requisites, and in return the men are assured regular employment, promotion according to relative merit and fitness, and the support of the management. There is nothing more conducive to good service than a sense of security among employees, and nothing so harmful as lack of it. It is impossible to maintain discipline where influential friends are of more importance in holding a position than efficient service, but the motorman or conductor who has the general manager's word that if he is honest, patient and polite, careful and obedient, that he will not be unjustly deprived of his position that promotion is for him, and that any specially meritorious acts he may perform will be fully recognized, will soon realize that his position is a valuable one, and that the best way to retain it is by strict attendance to duty. In general the terms set forth in Mr. Chapman's letter are the same as those which are generally understood to form the basis of employment, but they have not always been lived up to in some parts of the country, and for that reason an explicit understanding is desirable.

Stokers—Human and Other

The "Question Box" of the Pennsylvania Street Railway Association, which we give in part in this issue, contains much information suggestive of comment, but nothing more pertinent than the discussion of mechanical stokers, their merits and demerits. The question is one that is emphatically a familiar and well-worn one, to which, perhaps, no final answer need be expected, but the experience brought out in this instance was more instructive than usual. Stoker men in general may be divided into two classes—those who like mechanical firing and those who do not, and as a rule opinions on the subject may be impolite and irrelevant, but they do not lack variety or definiteness.

Four questions on stoking were asked, the first relating to the minimum size of plant for which an automatic stoker was to be considered. As touching this point, the opinions expressed were practically to the effect that after a plant was too large to be handled by a single fireman the automatic stoker was worth looking into, the corresponding horse-power being, say, 1000 to 1600.

The basis of this conclusion seemed to be that since a man was necessary anyhow to look after the mechanical stokers, he might as well be shovelling coal as doing work of supervision. There are two criticisms to be made on opposite sides of this judgment. It is held by some that the mechanical stoker will do enough better work than a fireman to justify its use in almost any case. On the other hand, interest and repairs on the machine must not be forgotten, and if these, for the sake of argument, equal a fireman's wages, then there will be no saving until a considerably larger size is reached. The answer really hinges on that pertaining to the next question in the box, which dealt with the relative economy, including operation and maintenance, as between hand-firing and automatic stokers.

Here there cropped out very radical differences of opinion, ranging from a claim of 30 per cent saving in coal down to the story of the automatic stoker squarely defeated by hand-firing. Some figures given in course of the discussion as to cost and the maintenance of automatic stokers are decidedly instructive. Figures from several Edison stations, while giving a material saving in cost of handling by the use of mechanical stokers, reported the extra repairs to be from 25 cents to $1 per horse power per annum.. Taking the installation cost of the stokers at $3.50 per horse power, the maintenance account would seem to lie between about 7 and 25 per cent, with an average of 17 per cent or so. This looks high, and if true requires a very good showing in economy of coal to justify the expense. In one answer an efficiency of 11.25 lbs. of water from and at 212 degrees was claimed for run-of-mine coal costing $2.35 per ton in the bin. This is stated to have been a result about 30 per cent better than was given by hand-firing, which evidently must have been rather poor. On the next two questions, as to whether the same automatic stoker could handle both soft and hard coal, and whether one could force the output of the boiler as well as with hand-firing, the answer dealt in flat contradictions as to fact, and, as usual, when statements are contradictory, they failed to be illuminating. In fact, the sum total of all the answers does not greatly add to the chances of elucidating the subject. It is, however, an interesting and pertinent one, which is well worth study.

The fact is, that taking all available sources of information together, there seems to be a very wide difference of opinion as to the relative value of the two rival modes of firing. Some excellent engineers uniformly recommend automatic stokers, while others as consistently prefer hand-firing. And undoubtedly these differences of practice and opinion spring from real differences in experience. Each man derives his ideas from the conditions under which he has personally worked; thus one whose natural fuel has been a low grade of Western soft coal will reach very different conclusions from one who regularly uses the best anthracite. On general principles, the better the fuel, or the less fuel that has to be handled, in any given case, the easier it is for a skillful fireman to compete with an automatic stoker. In plants where the fuel handled is only 2 or 2¼ lbs. per horse-power hour, one fireman can take care of 1000 horse power with ease. In several of the auxiliary stations of the Boston Elevated Railway Company, two men per shift, a fireman and a coal passer, take care of 2000 kilowatts without difficulty, and the total fuel bill for the year is so moderate that the charge for maintenance of mechanical stokers would have to be very much lower than the figures here quoted to give the slightest chance for economy. On the other hand, it is easy to see that in cases where the fuel to be handled rises to 4 or 5 lbs. per horse-power hour, a single fireman can take care of only a very moderate capacity, and will have to work hard to do that. Then he is likely to get careless, and the evaporative efficiency of his efforts falls off.

This much is certain, however, that while good fuel gains little or nothing from mechanical stoking, year by year, the world must learn to make the best of low-grade fuel. Almost the best opportunity for economy in steam generation lies in the study of the utilization of coals of low evaporative power. Good fuel will yearly get dearer, and furnaces and boilers must be planned to make the best of what is available. Here there is a great future before the mechanical stoker. Its task is to handle large quantities of fuel so uniformly and cheaply that although intrinsically poor, the economic result will be good. If one knows how to make the best of automatic stoking with low-grade fuel he has found the secret of cheap power.

The Confusion of Fusion

The gentlemen in charge of the literary bureau of the Citizens' Union are getting mixed in their dates and lame as to facts. Here is an abstract from a recent pronunciamento:

"The Metropolitan Street Railroad has made haste under the Fusion administration to effect great improvements in its equipment, substituting electrical for horse-power on all its cross-town lines."

While the street railway management has been eager all along to effect the improvements indicated it has not been able to secure the necessary legal consent, and we do not recall any assistance that has been offered by the Fusion administration, or any other for that matter, toward increasing the transportation facilities. The company has been obliged to solve the problems itself, and if it were permitted to do so unhampered it would be satisfied, but when certain measures were before the Legislature at Albany last winter, intended to enable the street railway companies of the State to effect improvements and extensions, Mayor Low opposed their enactment, and, according to his own statement, secured their defeat. It would seem, therefore, that whatever improvements in the street railway service of Manhattan have been made were accomplished in spite of the Fusion administration and not through its good offices. But the most remarkable exhibition of borrowed plumage that has been displayed before the admiring gaze of this constituency in many a day is this:

"The Manhattan Elevated Railway system has availed itself of the progressive attitude of this administration to make ex-

tensive improvements upon its lines, the most conspicuous being the change of motive power from steam to electricity."

Mayor Low's term of office began Jan. 1, 1902, and the Manhattan company had at that time not only completed its arrangements for changing over the elevated system from steam to electricity, but it had actually begun to operate trains by the new motive power. We do not recall any remarkable display of activity, intelligence or comprehension of the situation by the present city administration during the agitation last winter over the subject of transportation. Whatever may have been the merits of Mayor Low's administration, and in many respects it has been admirable, the least said about his "transportation record," under the circumstances, will serve the best purpose for Fusion.

A New Competitor

Many of our readers will probably agree with us that while the description of the new German single-phase electric railway system, given by our foreign correspondent in the last issue of this paper, was not so complete in all its details as might be wished, nevertheless, the account furnishes a great deal of food for thought. Our correspondent is not yet able to state definitely the character of the motor from which the results were obtained, though, of course, it looks like a series-wound proposition, but the results themselves are somewhat startling, particularly the efficiency of the regulation. To be sure, the work so far has been purely experimental, and we do not in the least know what snags the workers may have struck, but they certainly have developed a single-phase motor which, in some respects, is very remarkable. We have steadily been disposed to discount somewhat reports concerning single-phase traction motors on the ground that no single-phase motors have yet been put into ordinary commercial work which have anything like as good properties as those attributed to the experimental traction motors. And the common stationary motor is a very much easier proposition than the traction motor, both in its smaller demand for weight efficiency and in its freedom from the requirements of a large air gap. Yet we are bound to say that the Union Elektricitäts-Gesellschaft, like the Westinghouse Company in this country, cannot fairly be suspected of an unlimited bluff, and we shall be vastly interested in the inevitable show-down. The results, so far publishable from the Union Elektricitäts-Gesellschaft road, are certainly enough to whet curiosity as well as to provoke a certain feeling of lurking uneasiness. The foreign experiments on polyphase traction, which we have often described and commented upon, have promised a special, rather than a general, solution of the alternating-current traction problem, and have, therefore, been of indirect rather than of direct importance. But a successful single-phase motor is a cat of quite another color, for it is easily applicable to general traction purposes.

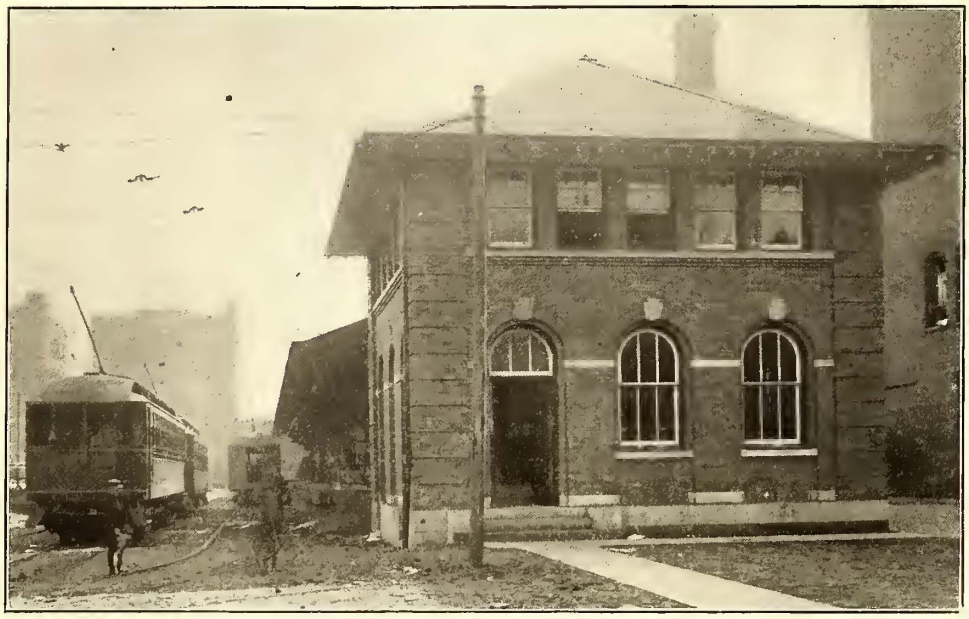
In this case the contact arrangements are simple enough, and there is no good reason why the motor should not be applicable to urban and suburban lines as well as to the long-distance roads for which some sort of alternating motor is especially desirable. For ordinary street railways an alternating motor has in itself no particular advantage. The usual direct-current railway motors are wonderfully reliable and efficient machines. The commutator troubles have been so far reduced that they are of relatively little moment, and are quite certainly much less than would be encountered in an alternating motor of the commutating persuasion. But on long suburban and interurban lines the advantages of a motor drawing its current from alternating-current working conductors are very great, indeed, in the matter of cheap and efficient distribution. So long, however, as the alternating system cannot conveniently be used in the urban part of the general system, alternating current is inconvenient in the outlying portions. The double-conductor system demanded by polyphase motors works against their general use, for the experience with double trolley systems of any kind is very far from encouraging. A single-phase motor requiring but a single-working conductor can obviously be used as conveniently as any other motor if its other properties are good. We have been awaiting with great interest the equipment of the promised American single-phase roads, but the Union Elektricitäts-Gesellschaft work shows plainly that our German friends have been far from idle, and are prepared to give us a run for our money in this as in other directions. We cannot afford to be outdone on this side of the water, and if we are to retain supremacy in the supply of electrical apparatus it is high time to be up and doing. A really good single-phase traction motor will stir up the art most surprisingly when it really comes, and will cause a sudden revision of the present methods of distribution. With the present tendency toward the construction of long and widespread networks of electric roads the possession of such a motor is a very valuable and important thing, and however skeptical one may be disposed to be as to the facts it will pay to remain open to conviction. We hope ere long to give to our readers a further description of the Union Elektricitäts-Gesellschaft methods.

Freight Delivery in Chicago

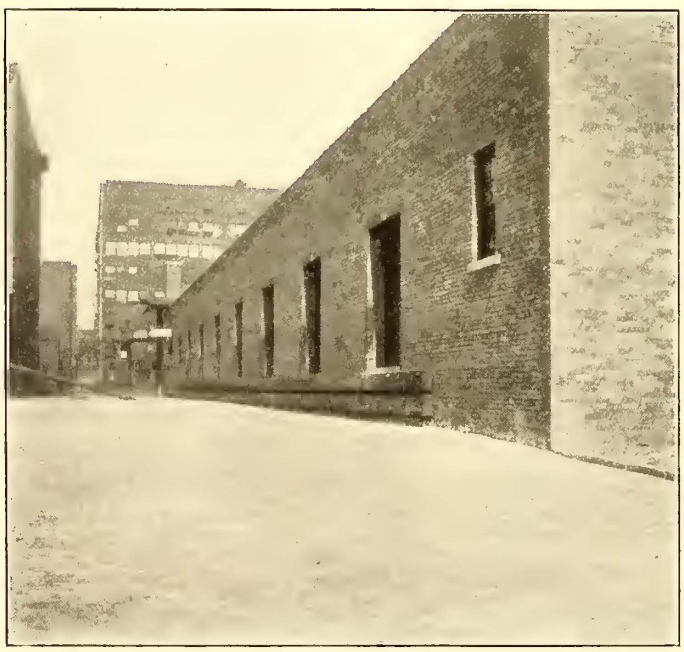
An important movement in connection with local transportation is to be inaugurated in Chicago when the Illinois Telephone & Telegraph Company begins its freight delivery service through its system of underground tunnels. This company, instead of building the ordinary conduits to take the wires for its new independent automatic telephone exchange, has gone 26 ft. below the surface of streets and has constructed a set of deep tunnels under the principal streets. These tunnels are of sufficient size not only to accommodate the telephone cables but to permit of the operation of small freight cars for delivering goods from railroad depots and warehouses to various buildings in the down-town center. The tunnels are of concrete, arch construction, 12½ ft. wide by 14 ft. high. The top is 26 ft. below the street level. Lateral branches enter the basements of the principal buildings. This freight delivery service ought to relieve the streets of considerable team traffic and result in a cheapening of the cost of delivery, as well as an improvement in surface transportation service. A single-track narrow-gage railway is to be operated in the tunnels. The cars will be small, to permit of the turning of the short curves and so that they can be easily handled, after the manner of mine cars. That electricity will be the motive power goes without saying, and in this connection come some interesting problems for the electric railway engineer. That some method of relieving the congestion of drays and coal wagons on the streets of our largest cities is needed is painfully evident, but the company which built the Chicago tunnels has been the first to have the financial courage to prepare an underground system at enormous cost to take care of the freight business, though, of course, in this case the chance of using the tunnel space for dozens of other purposes reduced the financial risk to practically nothing.

INTERURBAN FREIGHT AND EXPRESS

The Electric Package Company of Cleveland, which operates the express and baggage departments of the Lake Shore Electric Railway, the Cleveland & Southwestern Traction Company, The Northern Ohio Traction & Light Company and the Cleveland, Painesville & Eastern Railway, is now occupying its newly completed Cleveland station. The property is owned by the Electric Depot Company, an organization formed by the several interurban roads for the purpose of building the station. Each of the interurban roads mentioned has one share in the company, while the Cleveland Electric Railway, over whose lines the interurbans operate into the city, holds two shares.



OFFICES AND WAREHOUSE



WAGON SIDE OF STATION

The Electric Package Company, which, as a matter of fact, is not an incorporated body, but simply a representative working arrangement under which the express business of the several companies is handled, leases the station. Barney Mahler, formerly president of the Lake Shore Electric Railway, is president of the Electric Depot Company, and is also general manager of the business of the Electric Package Company. C. A. Kenworthy is general superintendent of the affairs of the Electric Package Company, while D. L. Ingham is local agent in charge of the Cleveland station.

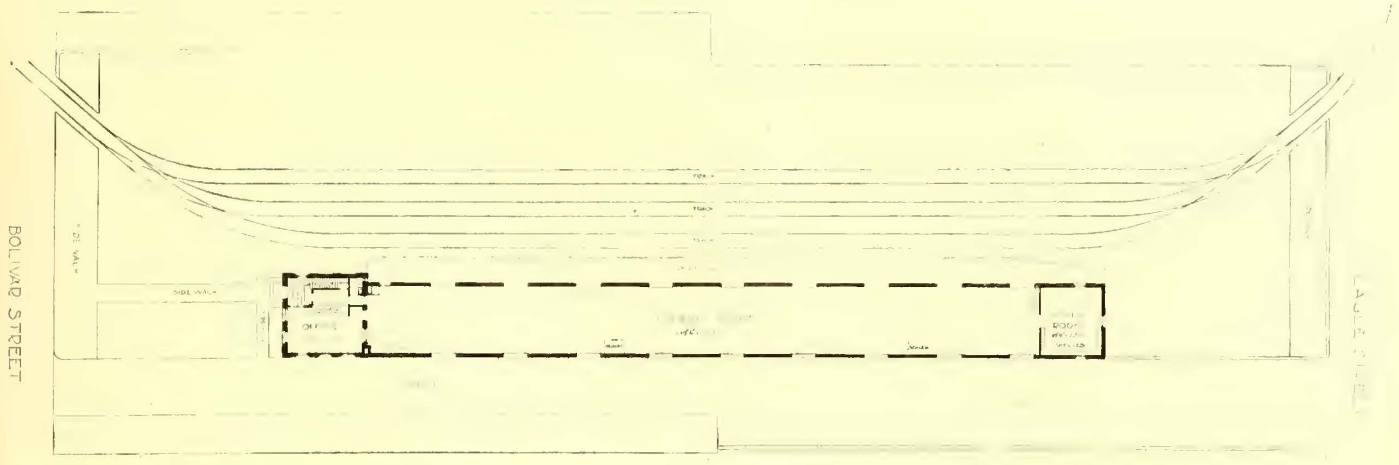
The business of the Electric Package Company is not an experiment, but has been in successful operation for several years. During the last two or three years the development of the business has been seriously handicapped owing to the poor terminal facilities in Cleveland. Up to the time of the completion of the new station the company had as its headquarters a store room on one of the business streets, and the goods had to be loaded and unloaded from the street, there being neither sidings nor platforms.

More than three years ago the companies realized that the business could not be developed under these conditions, and accordingly the Electric Depot Company was formed for the purpose of building a large station which should be designed for both passenger and express traffic. The committee in charge went so far as to purchase a tract of land extending from Eagle Street to Bolivar Street, adjoining Erie Street, and plans were prepared for the station and tracks were laid through the property. Then came the Everett-Moore embarrassment, which put a quietus upon all plans for improvements for the Cleveland properties. Lately it became imperative for the express company to secure better facilities, and arrangements were completed for financing the depot project on somewhat modified plans.

TRAIN SIDE AND LOADING PLATFORM

The present station occupies only about one-half of the company's property, and it is quite probable that before many years a passenger station and additional express facilities will be provided. The location of the station, while perhaps not an ideal one from the standpoint of the public, which has been accustomed to seeing both freight and passenger business centered at the public square in the heart of the business district,

possesses many advantages which would not be possible were the site nearer the centre of the city. The new station adjoins Erie Street, the first north and south thoroughfare east from the square, and it is in the district known as the "New Center," which within the last five or six years has made tremendous strides as an office building and shopping center. At the present time only one city line traverses the portion of Erie Street nearest the station, so that the interurban cars are not held up by the congested traffic that they would have to encounter down town. The lines running east and south from the city may reach the station without passing through the congested district, and by slightly changing the routes of the other lines it will be possible for them to enjoy the same advantages. This feature makes the location especially desirable for passenger service, and the property is laid out with three through tracks, so that it will be convenient for cars to lay up while loading and unloading passengers without interfering with city traffic. The Cleveland managers believe it is of great advantage to have a starting point for cars—a place where they lay over any desired length of time. Formerly the interurban cars were permitted to lay over on a siding at the public square, but a change of city routes has deprived them of this privilege. For some months the Lake Shore Electric Railway has utilized the tracks on the depot site as a laying-over point, and nearly every car has laid over one trip. This gives time for cleaning and inspection, besides making it possible for every outgoing car to leave promptly on time. It is probable that other roads will follow this practice, although, as before stated, it is improbable that a passenger station will be erected for some time to come.



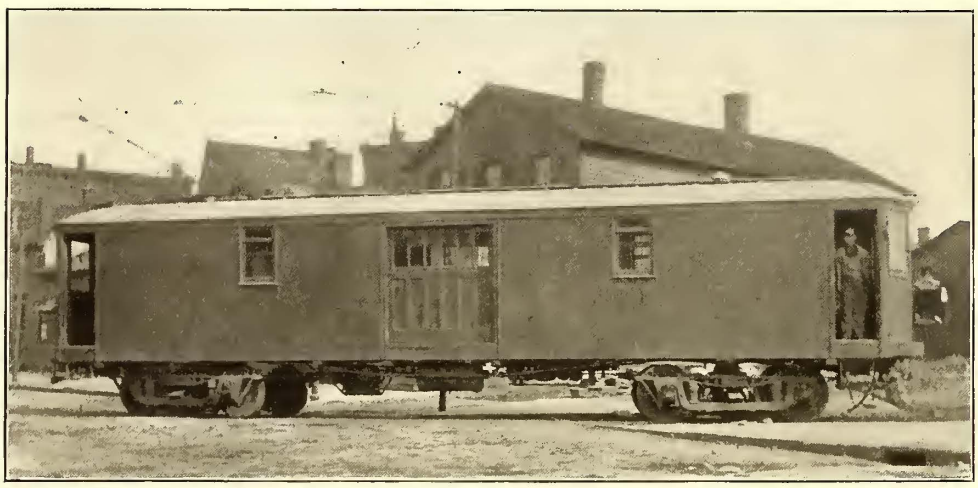
FREIGHT HOUSE, LOADING PLATFORMS AND YARDS

BAGGAGE DEPARTMENT

The new station building occupies only about one-third of the depot property, and is located to the west of the three tracks running through the property. It has an outside measurement of 255 ft. x 32 ft., including the platform on the track side, which

GENERAL INTERIOR VIEW

is about 9 ft. wide. To the west of the building is a paved driveway 20 ft. wide for teams. The freight shed proper is one-story high and is built of hard brick, while the office building in front is two stories high, and is built of pressed brick with sandstone trimmings. It has an ornamental front and is built in the most substantial manner. As shown in the plan, the greater portion of the ground floor of the office building is utilized as the agents' receiving room. A corner is allotted to the agent in charge of the station, which is fitted up as headquarters, and there is a desk for the cashier. The second floor is divided into three rooms, two of which are for the bookkeepers, stenographers and auditor, and the third is a large private office for the superintendent of the package company. The interior finish is Georgia pine, and the general appointments, while not elaborate, are neat and substantial. The office building has a basement in which is built a furnace for heating.

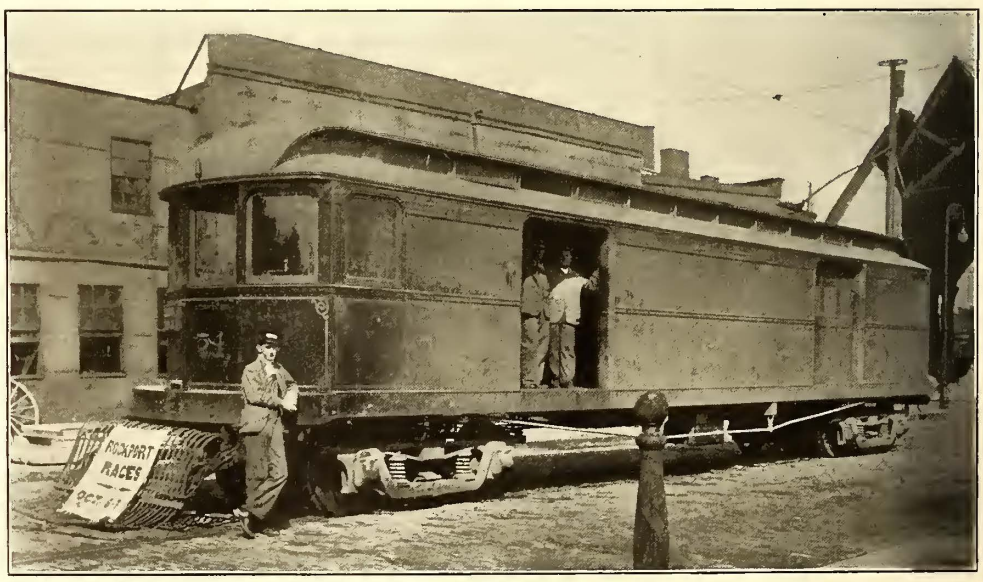


EXPRESS CAR ON LAKE SHORE ELECTRIC ROUTE

The express shed proper is 249.6 ft. long by 22.6 ft. wide. The end adjoining the office building is fenced off, forming a baggage room 25 ft. long. This is provided with a counter and shelves for packages; also racks for bicycles, which are handled as baggage under a State law. This room may be reached without entering the main express room, and there is a separate door from the driveway for delivering baggage into the baggage room. The south end of the building is partitioned off as a supply room and "old hoss" room, the appellation given unclaimed express and baggage, which, by the way, accumulates rapidly. Adjoining this room are a number of lockers for drivers and other employees. The express room proper is nearly 200 ft. long. On each side are nine doors, 8 ft. wide, provided with metal rolling shutters. At either end of the room are 2-ton platform scales, and at one side of the room on the platform side is a "coop" for the caller and bill clerk. This will be heated in winter by a stove, since, of course, it will be impractical and undesirable to heat the entire room. The doors on the team side are designated by a driver's number, while those on the track side are designed by the names of the several interurban routes. All goods intended for delivery by any driver or for shipment by a certain route are gathered at the proper place, so that there is no delay or confusion in handling. A small overhead crane will be installed for handling heavy articles. The flooring of the express shed and platform is double, being 2 in. x 4 in. planking on end, with matched flooring above. The roofing is corrugated sheet iron, with tarred paper and gravel roofing above, and there are peaked skylights at frequent intervals, making the room very light, which is heightened by white finish throughout. There are numerous clusters of incandescent lights and the platform is well illuminated in the same manner. The platform has a covering, and it is the intention to erect a similar covering on the drive side of the building. The station was designed by and erected under the supervision of Searles & Hirsh, architects, Cleveland.

The force at present employed in handling the business at the station includes two porters, one head porter and caller, one baggageman, one bill clerk, two night men, one cashier and one counter clerk and telephone man, in addition to the agent. At the present time there are nine single and double teams operating from Cleveland. The drivers are paid by the day, and, of course, they assist in loading and unloading their express. Each car has a messenger and a motorman.

The improved terminal facilities will, of course, aid greatly in the development of the business, and many plans are already being placed in operation which will speedily show returns. It is the intention to go after the market produce business, and it is believed that by offering improved facilities to the produce farmers in this district more of them may be induced to ship their goods to Cleveland.

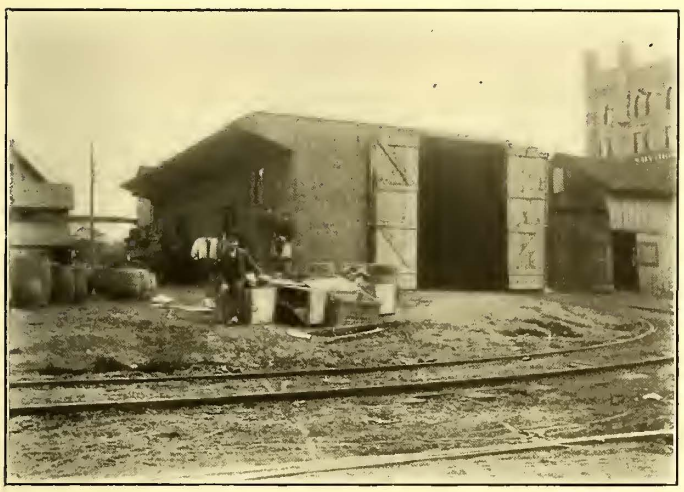


CLEVELAND & SOUTHWESTERN CAR

A short time ago the company perfected traffic arrangements with the Canton & Akron Railway and the Canton & New Philadelphia Railway, so that goods are now shipped from Dennison, New Philadelphia and Canal Dover direct into Cleveland, connection being made with the Northern Ohio Traction & Light Company at Akron. Another arrangement which is of great advantage to shippers is one made with the Cleveland & Detroit and Cleveland & Toledo boat lines. Goods are transferred by the company's wagons in Cleveland and it is possible to ship direct from points as far south as New Phil-

adelphia to Detroit, and even to distant points in Michigan, through connection with the freight cars of the Detroit United Railway. In fact, a shipment is possible by this company between points that will necessitate transportation over 300 miles. Within the last two weeks the service has been extended to Sandusky and Toledo on the Lake Shore Electric system. As has already been outlined in these columns, the Toledo end of the Lake Shore business has always been conducted on a freight basis. This gives a continuous express run of 119 miles, said to be the longest electric express run in the country. The Cleveland-Toledo run has a schedule of seven hours, and stops are made for loading and unloading in all towns. The new arrangement makes it possible to ship goods from New Philadelphia and Canton and have them delivered in Toledo the same day, the distance from New Philadelphia being over 200 miles.

At the present time the company maintains agents and teams in twenty-five towns. All of these employes are on a salary basis. In some of the smallest towns the company makes arrangements with teamsters on a monthly basis, but in the large



FREIGHT STATION OF EASTERN OHIO ADJOINING ELECTRIC PACKAGE DEPOT

majority of cases the teams are owned by the company itself. There are nine teams in Cleveland; Toledo has four, Akron three and Sandusky two.

The rates charged by the Electric Package Company are practically the same as those charged by the old line express companies and the methods of handling are almost identically the same. A special rate, generally 10 cents, less than the regular rate, is made for fruit, poultry, eggs and produce. Milk delivered to hotels is also handled at a special rate, but the Electric Package Company has nothing to do with the milk handled in bulk by the several roads, this being hauled in separate milk cars and delivered to milk wagons at the city limits.

All of the Cleveland roads now use express cars exclusively, and the use of combination cars has practically been abandoned except on the spur lines.

The time of departure for the cars of the several roads and the towns where agents are maintained, together with the distances and special and regular rates are shown in the accompanying table.

It will be remembered by those who have read the articles published in the STREET RAILWAY JOURNAL relative to the freight business of the Eastern Ohio Traction Company, that it has no connection with the business of the Electric Package Company. The Eastern Ohio Company serves a farming district practically untraversed by steam roads. The company has found it advantageous to handle a heavier class of goods than is taken care of by the Electric Package Company, and the business is conducted strictly on a freight basis.

Believing it would be of advantage to centralize the interurban business, the company some months ago secured a site adjoining that of the Electric Depot Company. A residence was fitted up for general offices, and in the rear of this was erected a small freight station, which is reached by the same tracks that serve the depot site. A spur runs into the Eastern Ohio station. The arrangement makes it convenient for transferring goods from one station to the other and enables the two systems to co-operate.

Route	Name	Distance from Cleveland. Miles	Special Rate Per Cwt.	Regular Rate Per Cwt.	Time of Departure From Cleveland	
					a m.	p.m.
Lake Shore Elec ...	Lorain	27	30	40	7.00 10.30	2.00 7 30
	Sandusky	57	40	50	10.30	7.30
	Norwalk	57	40	50	7.00	2.00
	Monroeville	63	40	50	7.00	2.00
	Bellevue	70	50	60	7.00	2.00
	Clyde	77	50	60	7.00	2.00
	Fremont	84	50	60	7.00	2.00
	Toledo	119	60	75	7.00	2.00
Cleveland & South-Western	Elyria	27	30	40	5.30 9.00	12.30 3.00
	N. Amherst	32	30	40	5.30 9.00	12.30 3.00
	Lorain	37	30	40	5.30 9.00	12.30 3.00
	Grafton	34	30	40	5.30 9.00	12.30 3.00
	Oberlin	38	30	40	5.30 9.00	12.30 3.00
	Wellington	47	30	40	5.30 9.00	12.30 3.00
	Norwalk	57	40	50	5.30 9.00	12.30 3.00
	Berea	14	30	40	8.45	2.15 7.15
	Medina	33	30	40	8.45	2.15
	Seville	45	40	50	8.45	2.15
	Creston	48	50	60	8.45	2.15
	Wooster	60	50	60	8.45	2.15
Cleveland, Painesville & Eastern...	Willoughby	20	30	40	6.30 9.00	1.30 4.30
	Painesville	30	30	40	6.30	1.30
North'rn Ohio Traction & Light Co ..	Bedford	12	30	40	9.00	2.00 9.00
	Cuyahoga Falls	30	30	40	9.00	2.00 9.00
	Kent	35	30	40	9.00	2.00 9.00
	Ravenna	43	40	50	9.00	2.00 9.00
	Akron	37	30	40	9.00	2.00 9.00
	Barberton	42	40	50	9.00	2.00 9.00
North'rn Ohio Traction & Light Co., via Canton & Akron Ry.....	Canton	63	40	50	9.00	2.00
	Massillon	73	40	50	9.00	2.00
	Canal Dover	91	50	60	9.00	2.00
	New Philadelphia	95	50	60	9.00	2.00

OPEN COMPARTMENTS IN WINTER

In these columns recently attention was called to the present attempts to provide rolling stock which will accommodate those who wish to ride outside during the greater portion of the year, as exemplified by long platforms and the half-open compartments to be found in some cities. In that article a certain street railway man was quoted as being of the opinion that people were seeking open-air seats more than formerly. Of course, public habits in one city do not necessarily correspond with those in another having a different climate. General Manager Robert McCulloch, of the Chicago City Railway Company, says that while in the early days of cable traction in Chicago seats on the open grip car were taken in cold weather, the present tendency is to "hug the top of the stove" as soon as the weather turns cool. He considers a compartment car worthless for use the year around in that climate.

"Prominent among the good things that have come to Honolulu with the asurance of stable government is the passenger service of the Honolulu Rapid Transit & Land Company, which operates more than eighteen miles of car track. * * * The company is extending its lines constantly and expects to attain the Pali, the top of Tantalus and Moanalua within the next two years, as well as to gridiron the city with its rails. * * * It has been only two years since Honolulans were given the privilege of riding in electric cars. The old horse and mule system held a monopoly of the streets that could not legally be set aside for a long time. Honolulu was probably the last American community of any size to adopt electricity as a means of rapid street transit, and when it did modernize itself in this particular there were hardly enough cars to carry people."—Paradise of the Pacific.

ROADBED CONSTRUCTION FOR WORLD'S FAIR INTRAMURAL RAILWAY

Work on the construction of the intramural railway at the World's Fair grounds in St. Louis has progressed sufficiently to give some idea of the character and extent of the enterprise. It will comprise a scenic route, 6 miles long, double tracked throughout, and so arranged that visitors next year may take a car at any of the entrances, or at any one of the seventeen stations distributed at intervals along the route, and make an entire circuit of the grounds. A general view of all the big exhibit palaces can be obtained on such a trip, and one may thus reach a point within easy walking distance of any important building.

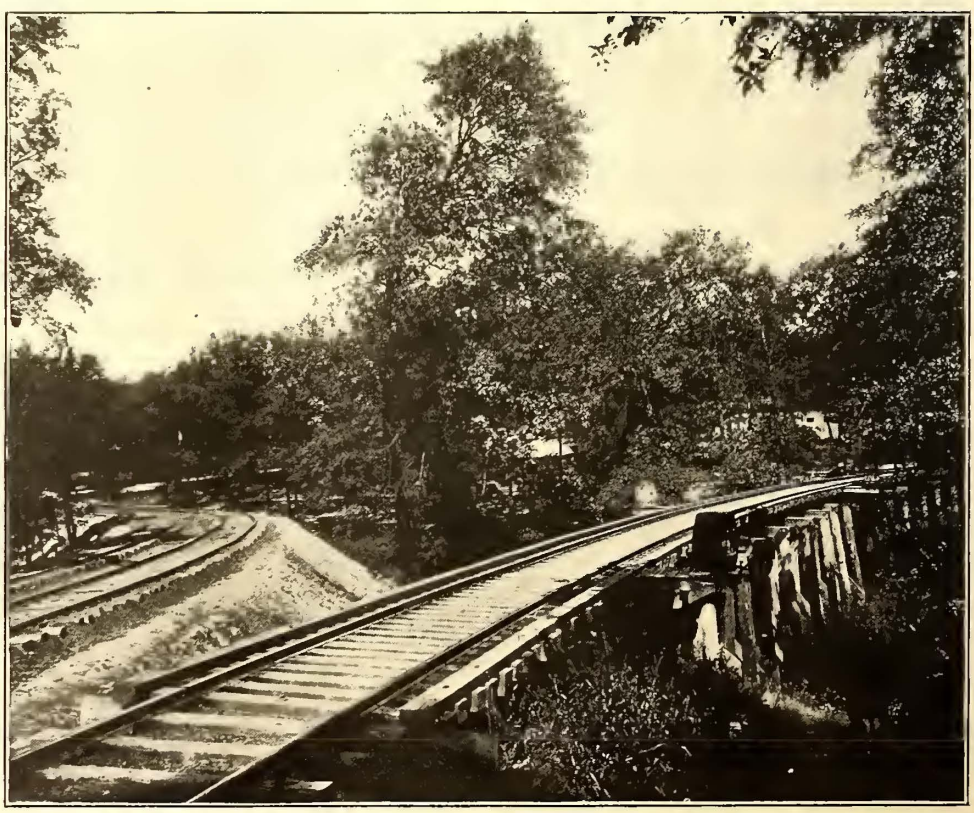
RAILWAY BRIDGE CROSSING RAVINE

In the construction of the intramural 5 miles of the 12 miles of track to be laid are completed, and work on the remainder is being pushed rapidly. The maximum grade is 3 per cent, and the maximum curvature 20 degs., except the loop curves at the terminals, which have a radius of 75 ft. Three hundred men are now engaged in constructing the trestles, grading and laying the tracks. The road is perfectly graded throughout except for a short distance in the western part of the grounds, where work is still in progress. Work is being pushed on the trestle which will carry the road down Government Hill, close to the eastern fence. This trestle will be 2100 ft. long, and will be built on piling of heavy double-deck structures, 30 ft. high. A truss bridge, which will carry the road over the World's Fair terminal surface tracks, is now being erected. This bridge has a length of 112 ft., consisting of two 56-ft. spans.

The intramural tracks will be used for transporting building material and exhibits during the pre-exposition period, and they are now used to a limited extent for this purpose, as shown in the cuts. The tracks throughout are standard gage, 4 ft. 8½ ins., which is the gage of both the intramural and steam railway equipment. The construction of the entire line will be heavy enough to run the largest switch engine over it without danger, and steam cars may be handled on the tracks of the intramural road at all times.

Installation of the poles for carrying the feeder wires is progressing as rapidly as the tracks are laid. The poles are 30 ft. long and of white pine. They set 6 ft. in the ground, so that the trolley wire will be 18 ft. above the top of the rails. Center-pole construction has been adopted, and the wires will be supported on brackets attached to the poles.

The cars for the intramural are now being built at the St. Louis Car shops. There will be seventeen trains, each consisting of two motor cars and a trailer. A few open cars will be used, but most of the cars will be



TRESTLE WORK AND HIGH EMBANKMENT ACROSS GULCH AT HEAVIEST GRADE ON LINE.

closed. Each car will have four 40-hp motors, and the "multiple-unit control system" will be employed. A 500-volt current will be used, and the system will be sectionalized so that one section may be cut out at any time without impairing the operation on the rest of the road.

An interesting feature of the roadbed construction is the time and labor-saving method employed in ballasting the roadbed with cinders. A large cinder dump-car, used by the street railways of the city, was run onto a flat car on which rails had been laid. It was impossible to run the electric car over the intramural tracks on account of the difference in the gage, but it was utilized by running the flat car close to an embankment the exact height of the car. On the embankment a spur of the street railway tracks was laid with a trolley wire extending a car's length beyond it. The spur and the rails on the flat car made perfect connection, enabling the electric car to be transferred with ease and safety. To the flat car is then coupled a locomotive, and as the car is drawn slowly over the system the cinders are distributed along the tracks, where they are afterwards leveled. It is estimated that $10 is saved on each carload of cinders dumped, or about $2,500 in all. It takes about fifteen minutes to distribute a carload by this method, where by the old way it took four hours.

LAYING CONNECTION ON INTRAMURAL IN SOUTHERN PART OF GROUNDS

ELECTRIC DUMP-CAR MOUNTED ON FLAT-CAR AND DRAWN BY LOCOMOTIVE FOR DISTRIBUTING CINDERS IN ROADBED CONSTRUCTION

THE RESULTS OF NEWSPAPER ADVERTISING OF THE TRENTON, N. J., LINES

The experiments in newspaper advertising, both paid and free, which have been tried by several street railway companies entering Trenton, N. J., prove conclusively that this kind of advertising, as a means of increasing traffic, does pay. Actual comparative figures as to the results are not available, because the companies have not yet operated two seasons, but evidence of the increased returns is strikingly apparent.

The Trenton, Lawrenceville & Princeton Railroad was the first company entering the city to pay cash for advertising time-tables. A few months ago, when the Yardley, Morrisville & Trenton Street Railway was completed to Newtown, Pa., the New Jersey & Pennsylvania Traction Company, which controls both lines, began running special advertising in the local newspapers. Before the Newtown road was open a week it was overloaded with business, and at times could not begin to handle the crowds that gathered at the Trenton terminals. Two fares, or 10 cents, are collected for the 12 miles between Trenton and Newtown, and two semi-convertible 40-ft. cars are run every 40 minutes, each making a single trip in 35 minutes. A small tripper runs between Trenton and Morrisville, just across the Delaware River, and these three cars, on a single day, recorded more than 10,000 fares. For several days before, the company had been running small reading notices in the two morning papers, telling of the line and the connections it made, and without some sort of newspaper publicity the public could scarcely have known that the road was in operation. The cars started, at that time, from

HANDLING FREIGHT IN STEAM CARS OVER INTRAMURAL ROADBED

an obscure point on Calhoun Street, Trenton, one block west of the State Capitol, and it was here that people blocked the street from early morning until late at night, on the Sunday in question. All through the summer the traffic was heavy each day, and on Sunday every car was filled to the doors. The advertising was varied slightly from week to week, but had for its object the booming of the Newtown line and connections. This line carried on a certain day just five times as many passengers (counting fares) as another line, with far better facilities and just as interesting a trip, which did not advertise. No other reason can apparently be given for the wide difference in travel.

The Trenton & New Brunswick Railroad, running from the Inter-State Fair Grounds, Trenton, to Milltown Junction, 25 miles, and New Brunswick, 28 miles, was placed in operation less than a year ago, with a traffic which was very light. During the winter only a single car was operated, on a 3-hour headway, as this was all the traffic warranted. There are no intermediate towns or villages adjacent to the line, and it must depend almost entirely upon the through travel. Traffic increased slightly during the spring months, and cars were operated every hour. For months the newspapers had been a trifle reticent in "booming" the line, because of the uncertainty as to its purpose. About this time, however, the company began advertising in the newspapers, and a little later took a party of local newspaper writers and editors over the line in a special car, and banquetted them at New Brunswick. This aroused the newspapers to an active interest in the line, and advertising the special features caused the traffic to jump to two or three times what it had been. On a single Sunday the road carried more than 2000 passengers, of whom about 85 per cent went all the way through from terminus to terminus. This is remarkable when it is considered that the single fare from the center of Trenton (by ticket only) to New Brunswick is 45 cents, or 80 cents return. Of course, most of the people who went one way returned again, but this is included in the figures. In other words, more than 2000 passengers were on the cars during the day. This traffic has held up remarkably well, and from 500 to 700 are carried every weekday, with three cars in operation, and so arranged that practically only three crews are needed.

As previously stated, no comparisons with a previous year are possible, because neither line has been in operation a year. The great increase in traffic is undeniable, however, and upon neither line is there any sign of an abatement. Some of the pleasure traffic has fallen off, of course, but the regular traffic very nearly makes up for it. Most of this regular traffic has been newly built up by the companies, too.

Because the Trenton Street Railway Company is largely a local company, it has never gone into newspaper advertising to any extent. The newspapers are all on friendly terms with it, however, and anything new which it has to offer is exploited at length in the local press. The company has, at various times, advertised Spring Lake Park, which it owns.

Free advertising, which offers great possibilities, was worked by the Trenton companies to a considerable extent. During the last three years, at a rough estimate, the electric railways have been advertised through favorable articles to the extent of thousands of dollars worth of space. An open policy with the newspapers has been largely responsible for this. There is not an electric railway line running into Trenton to-day that does not treat the newspaper men with courtesy, and all of them are very liberal in answering questions, either by telephone or in person.

The first outside line to enter Trenton was the Camden & Trenton Railway, and this company placed every facility in the way of the newspapers for obtaining the news. Every movement of the company was chronicled in the press, and the placing of a switch or siding was considered sufficient excuse for printing a column of news concerning the line. The road has enjoyed a large patronage, and has won public sympathy largely through the fact that the newspapers give every possible item of information concerning it.

The Yardley, Morrisville & Trenton Street Railway was the next line to enter the city, and its doings were followed with a care which would have almost appeared ludicrous to an outsider had he been acquainted with the details. One stormy night, after midnight, a local newspaper man walked 2 miles to measure some rails and ties. If they measured a certain number of inches they would be for the use of the company in question; or if not, they would be used for another purpose. The officials of the company were expecting them, but even they did not know that they had arrived during the evening. They measured right, and the next morning at least one of the newspapers of the city printed nearly a column descriptive of what would be done, using the arrival of the supplies as a basis. This effort would never have been put forth had not the company kept in close touch with the newspapers and engendered a friendly feeling. It was free advertising of the best kind, and kept public interest alive.

The Trenton, Lawrenceville & Prineeton Railroad received as great or greater attention than the Yardley, Morrisville & Trenton, if possible. Both were and are under the same management. The Trenton, Lawrenceville & Princeton Railroad was longer building and being put in operation, and it afforded better opportunities for news. Every incident connected with its early operation was faithfully portrayed.

An instance of the good that results from this cordiality of feeling between the companies and the newspapers is shown by the statement of an editor in regard to a certain company, whose manager made it his business to give the facts to the papers. This editor said that he always tried to use the utmost care in handling accident reports of this particular line, because the officials always supplied him with the details promptly, and he never had to watch them for fear they would disappoint him. That road received thousands of dollars worth of free advertising, and no fault could be found with the publicity from the manager's standpoint.

DETAILS OF THE UNDERGROUND RAILWAY ACCIDENT IN PARIS

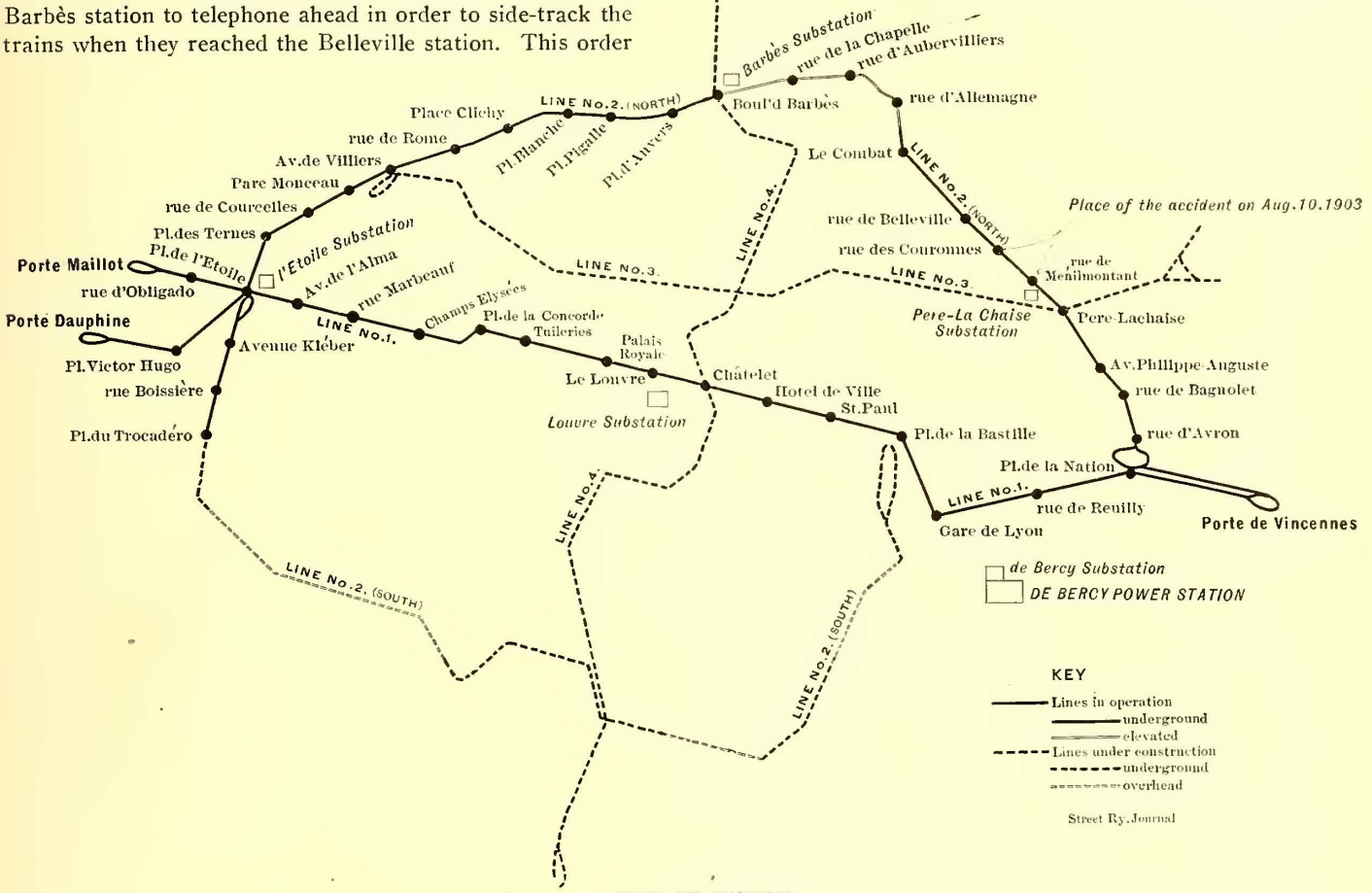
Some details of the accident on the Metropolitan Underground Railway, of Paris, which occurred Aug. 10, and which resulted in a large loss of life, have been brought out during the last month by the official investigation. In view of the number of underground electric railways now in operation in different cities, and those which are proposed, some particulars adduced at the inquest may be of considerable interest.

The accident occurred on Line No. 2, north, as shown by the accompanying map, in a part of the tunnel very near Menilmontant station. Soon after a crowded train of eight cars left the Dauphine station, running toward the Nation station, and at the foot of the grade which connects the underground portion of the line with the elevated, the motorman noticed trouble in the electrical equipment of the front motor car in which he was stationed. It was probably a short circuit in one of the motors, and was possibly caused by excessive friction of the brake-shoes on the wheels, as the motorman noticed, on leaving the Dauphine station, that the brakes were working badly. Nevertheless, the facts on this point are not very clear. Whatever may have been the cause the trouble appeared insignificant to the motorman, who started off with his train and mounted the 4 per cent grade up to the neighboring Barbès station on the elevated line. At this moment the motor in question began to behave worse. The motorman, believing that his train was disabled, discharged his passengers at Barbès station, according

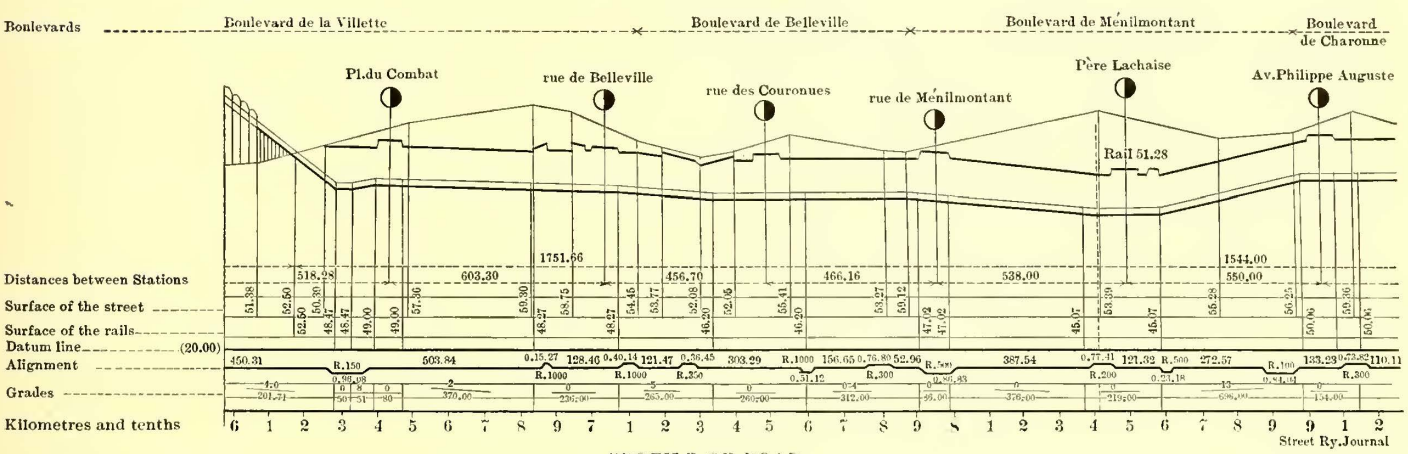
to the rules, and asked to be pushed by the following train. This second train, which had four cars, discharged its passengers in its turn and commenced to push train No. 1.

According to the evidence, it seems that the motorman neglected the precaution of raising the third-rail shoes connected to the disabled motor car and of opening the motor cut-out switches in the controller.

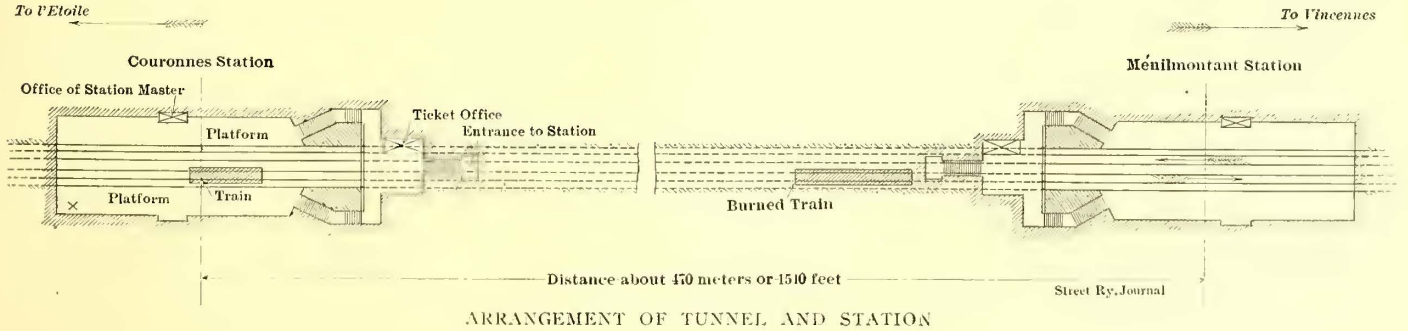
The double train, consisting now of twelve empty cars, left the station at high speed to prevent a block, after one of the conductors of train No. 2 had asked the station master at Barbès station to telephone ahead in order to side-track the trains when they reached the Belleville station. This order seems to have been transmitted. The double train ran the entire distance of the elevated structure without stopping, and it was only at the Combat station, the first station on the underground road, that the employees noticed that the head motor car was smoking. By the use of water and patent extinguishers they succeeded, as they thought, in putting out the fire, which seems to have started at Barbès and to have been brought to a blaze by the current of air on the elevated structure. Even at this time the employees on the train evidently considered the train to be in no danger, but it



MAP OF SYSTEM



PROFILE OF ROAD



ARRANGEMENT OF TUNNEL AND STATION

seems that the liquid acids in the patent extinguishers and the water used to put out the fire affected the insulation of the cables, particularly those which connect the shoes with the controller. It should be remembered that these shoes had not been raised, and that the defective motor had not been cut out. The double train finally arrived at the Belleville siding.

The versions are conflicting from this point. The station master at Belleville affirms that he was ready at the switch to have run the train onto a siding. This, however, would have been useless, as it should have been taken directly to the Nation station without blocking the line. The double train went through the Belleville station at full speed. When the Couronnes station was reached the station master saw flames in the head car, and made the signal to stop, which was probably not understood by the crew, who were not aware of any trouble, and the train continued toward Menilmontant. When within about 150 ft. of this station a violent explosion brought the train to a standstill, and it was seen that the head motor car and the first trail car were on fire. The bodies of these cars were made of green pitch pine, and do not seem to have been fireproofed. A second attempt was made to extinguish the fire, but the smoke became suffocating and the employees were obliged to retreat.

At the time the short circuit occurred the breakers in the nearest sub-station, and which is near the Père Lachaise station, opened. But as the third rail of Line No. 2 is not sectionalized in the sub-stations by separate switches, it is extremely probable that the sub-stations at the Place de l' Etoile and at Barbès, which are run in parallel with the Père Lachaise substation, were not disconnected by the short circuit. The resistance of the third rails and of the track combined was sufficient to keep the current less than that for which the circuit breakers were adjusted. As the third-rail shoes of the motor car had not been raised, an arc was maintained under the car, and naturally prevented the employees from being able to extinguish the fire, and, finally, the entire train soon became a prey to the flames. The fire itself created a draft in the tunnel in the direction of Couronnes station, and the employees were obliged to retire with difficulty.

The only loss would have been the destruction of several cars by fire if, at this time, a very unfortunate combination of circumstances had not occurred. The heat caused by the fire soon destroyed the light and telephone cables, and the tunnel was plunged in darkness.

In order to understand what now occurred it is necessary to go back and follow the movements of the train which was coming in the rear of the burning train. This train took on at the Barbès station the passengers who had been traveling in the first two trains, descended the grade and continued its trip, finding the track free. On arriving at the Couronnes station the signal showed red and the train stopped, the employees believing that it was simply a case of blocked traffic. The wait being prolonged, the station master attempted to telephone to the Menilmontant station in order to find out the cause of the trouble, but was not able to obtain any reply. The wait lasted about twenty minutes. A certain number of passengers becoming impatient left the train and blocked the ticket office, demanding a return of the money for the tickets. The others in the train waited patiently for the train to start, when all at once quantities of black and acrid smoke appeared in the tunnel, coming from the direction of Menilmontant. The passengers complained but the employees advised them not to be afraid, not imagining that there was any danger. The smoke came rapidly, thick and suffocating. The passengers climbed out of the cars and ran to the exit pell-mell, when all of a sudden the lights went out and the tunnel was plunged in complete darkness. Those who found themselves at the side of the staircase appeared to have escaped with great trouble in view of the confusion. The means of access to the station soon became cut off, or, at least, invisible, on account of the heat, smoke and darkness, and it was not until the following day that the firemen were able to penetrate into the tunnel. It was then seen that eighty-four passengers, being deceived in the direction which they should have taken by the obscurity, had been helplessly suffocated against a wall of the station which did not have any exit.

While it is not difficult to derive from the detailed report of this disaster some very conspicuous lessons, it should be said that during the last three years of operation of the Metropolitan over 200,000,000 passengers were carried without accident. The present instance proves, however, the absolute importance of a reliable despatching system and proper protection against fire, the necessity of having the lighting and telephone circuits unaffected by accidents to trains, and the dangers of blind exits in railroad stations.

NEW PRESIDENT OF THE NEW HAVEN

The selection of C. S. Mellen as president of the New York, New Haven & Hudson River Railroad Company is particularly interesting to the electrical industry, not only because of the network of electric roads which now form an important part of the New Haven system, but because of the plans which had been made for extensions and improvements in this branch of the service, and the well-known antipathy of Mr. Mellen to electric traction when he was formerly connected with the company. The question naturally arises, will Mr. Mellen, as president, modify the opinions he entertained when vice-president or will the plans and policy of the New Haven in this matter be altered so as to coincide with those of its new president?

Mr. Mellen is an "operating" man, and he is essentially a steam railroad man, so that under ordinary circumstances little favor might be expected from him for the electric service, but the extent and importance of this branch of the New Haven system has reached a point where it cannot be disregarded. This condition is recognized by steam railway men, and the situation is attracting much attention, because, as stated by the "Railroad Gazette," of the "exceptional nature of the questions which now arise in its administration and development."

It is pointed out, for instance, that the New Haven system includes at least 180 miles of electric railroad, single track, in nine widely separated localities and under quite divergent conditions. The electric lines comprise old trolleys bought up to ward off electric rivalry and still operated as trolleys; former steam lines electrified both by trolley and third rail; and, in one case, an extensive trolley system—the Worcester & Connecticut Eastern—created both by new construction and by purchase to thwart threatened competition by the novel expedient of self-parallelism of the company's steam road. The annual receipts of all these electric lines amounted last year to $772,666.

It is not to be wondered, therefore, that much interest is felt in steam railroad circles regarding the policy to be followed by the new administration. The "Gazette" says:

> When formerly connected as vice-president with the New Haven Company, Mr. Mellen was stoutly opposed to electric experiment and expansion. But he now inherits an electric policy with its concrete outlays, and the question of his own policy becomes one of acute interest both to his stockholders and the public. Will he expand or will he contract the plans of his predecessors? Will he meet electric rivalry or ignore it? Will he drop such unprofitable electric lines as the Nantasket branch or try to develop them further? Will he modify operation of apparently profitable branches like the Hartford-Bristol third rail line? Will he favor third rail, or trolley, or neither? Will he approve or veto, for example, an old plan of Presidents Hall and Clark of third-railing the New Haven-Derby branch, now that electric rivalry is imminent? Will he develop the Boston suburban electric system with its projected terminal and loop under the South Station, or will he let it remain quiescent. And, in broader aspects, what will be his legislative policy toward competitive electric projects, especially in Connecticut and Massachusetts?

TESTS OF STEEL FOR ELECTRIC CONDUCTIVITY, WITH SPECIAL REFERENCE TO CONDUCTOR-RAILS*

BY J. A. CAPP

For certain classes of electric railways a steel conductor is preferable to the older and more commonly used overhead trolley wire. The third rail presents a rather better appearance, because of the absence of an overhead structure; it is easily installed, cheaply maintained, presents a large area for conducting and collecting the current, and is particularly well adapted for high speed and heavy service. With costs calculated on the basis of equal conductivity in rail and trolley wire, the third rail construction is cheaper than the overhead trolley. But the average interurban road will use a trolley wire of considerably less conductivity than would be obtained with the smallest size steel rail (about 60 lbs. per yard) that would ordinarily be used, and here the first cost of trolley construction would generally be less than that of the third rail. While no third-rail installation has yet been in operation long enough to give figures or value, it would appear that the cost of maintenance of the third-rail construction should be less than that of the overhead trolley. This consideration, together with that of sightliness and adaptability (particularly in the case of terminals, yards and very heavy or high-speed service), will frequently offset the higher cost of the third-rail construction and make it the preferable means of conducting the current from the generator to the car motor.

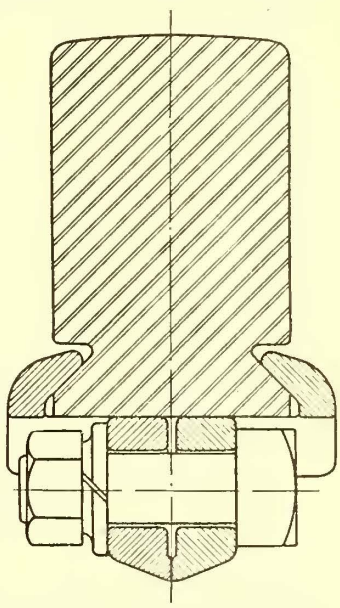
For the first third-rail installations, old track rails were used when obtainable, and these old rails were supplemented with new rails of standard T-section and composition. With the coming of the very heavy, high-speed service during the last few years, the resistance of these old and new standard T-rails was found to be so high that they would not carry the high currents necessary without too great a drop in the line potential. The rails would, therefore, have to be supplemented with additional copper feeders, but as this would be an expensive way to overcome the trouble, rails of higher specific electric conductivity were sought.

Because of the lack of specific data on the relation between conductivity and composition of mild steels, specifications for conductor rails have usually been based on the fact that the conductivity of a metal is generally more or less directly in proportion to its purity. In most cases the purity of the iron specified for such rails has been so high that not only was it difficult to obtain, but the iron was also correspondingly of high price. One of the factors governing the choice between a third rail and a trolley wire is the relative price of steel and copper, allowance being made for the difference in conductivity. Hence, a balance must be struck between high conductivity (which is equivalent to saying a high degree of purity or freedom from the usual metalloids associated with iron) and the cost of producing the steel of the composition necessary for the conductivity required.

With the object of drafting a rational specification for such third-rail steels, a series of tests was started last spring, in the testing laboratory of the General Electric Company, on steels of as wide a range of composition as could be obtained from the steel makers, the results of these tests forming the basis of this paper.

When entering the market with an order for rails of special composition, difficulty was encountered in interesting rail makers, and the reason became apparent. The mills which make the standard T-rails, or standard rails of other sections (such as the girder and grooved rails), have generally been designed with the object of making such rails only, and practice throughout has been standardized to the greatest possible extent, both in the manipulation of the steel and in its manufacture in the furnace or converter. Hence, an order, even of considerable extent, for rails of special composition, has so upset the routine work that it was considered a nuisance to be endured, rather than a desirable business to be sought for. Obviously, then, recourse must be had to mills where such special compositions can be handled economically.

The T-section of rail was the outcome of designs intended to present the greatest life and strength of the section, with the least weight of the metal, conditions necessarily to be met in a running rail. But the conditions for the third or conductor rail are different; here, there must be provided sufficient surface for the collection of the current, and cross section ample to carry the current without an undue drop in the line potential. The strength of the section is of little moment, and any section which is easily installed in an insulator is satisfactory. This permits the use of sections rectangular, or nearly so, which may be rolled easily in any mill equipped for the rolling of merchant-bar shapes of reasonably heavy weight, without any change in equipment or practice beyond the provision of grooved rails of the necessary shape. Mills rolling merchant-bar or structural steel, to-day, are generally equipped to make steel in the open-hearth furnace, which readily lends itself to the making of steel of the special composition demanded by the electrical engineers for the third or conductor rail.



CROSS-SECTION OF NEW CONDUCTOR RAIL, 2.5-INS. WIDE, 4-INS. HIGH AND 98 LBS. PER YARD

Having these facts in mind, a section of a conductor rail has been designed by W. B. Potter, chief engineer of the railway department of the General Electric Company, which, when 2.5 ins. wide by 4 ins. high, will weigh about 98 lbs. to the yard. This shape may be easily rolled in any merchant-bar mill heavy enough to attempt sections of this weight. A dove-tail at the bottom provides an easy means of securing the rails by fish-plates of special forms, and any of the common forms of bond may easily be applied. Ordered in lots of 1000 tons or more, such a rail should cost no more than a plain rectangle of equal weight.

To provide steels of sufficient range to give some indication of the relation between conductivity and composition, we obtained from as many of the steel makers as we could interest samples representing all of their common products. Some of the makers kindly provided us also with samples of special steels made in crucible charges. The samples were mainly forged or rolled bars of from 1 in. to 2.5 in. in diameter, and from them were turned bars of 0.75 in. in diameter, or 1 in. in diameter by 24 ins. in length, on which resistivity was determined. The chips from the finishing cuts were collected and these furnished the samples for analysis. Also, we cut similar bars from the heads of T-rails which were to be found in the yard tracks.

Table I states the electrical resistance and the chemical composition of forty-five samples of steel, and Table II similar data on seven samples of wrought, or refined, iron, together with results on three samples of iron reported by Barrett, Brown and Hadfield in a paper referred to later in this article. The samples were numbered serially in the order of their resistance, No. 1 being of the highest resistance. Samples

* Read at the New York meeting of the American Institute of Mining Engineers, Oct. 15, 1903.

Nos. 1, 2, 4, 7, 11 and 12 are standard T-rails from several well-known makers, while Nos. 24 and 25 are cut from the 100-lb. T-rail used for the conductor on the Aurora, Elgin & Chicago Railroad. No. 45 is a T-rail used by the Underground Electric Railways Company, of London, and ordered from a steel maker in Westphalia. Samples Nos. 46, 47 and 48 are ordinary refined bar-iron, while Nos. 49 and 50 are special

TABLE I.—RESISTANCE AND COMPOSITION OF STEEL

Serial Number	Specific Resistance: Microhms Cm Per Cm²	Specific Resistance: Temp. °C.	Conductivity: Matthiessen Standard	Resistance: Cu.=1	Percentage Composition: C.	Mn.	P.	S.	Si.	Total. Not Fe.	P. + S. + Si.
1	22.72	19	7.58	13.20	0.33	1.27	0,09	0.05	0,05	1.79	0.19
2	20 90	20	8,27	12.12	0.17	1.09	0.09	0.05	0.004	1.404	0.144
3	21.29	25	8 27	12.09	1.40	0.222	0.01	0.020	0 082	1.734	0.112
4	19 87	19	8.65	11.55	0.20	0.95	0.10	0.08	0.05	1 38	0.23
5	19,80	19	8,68	11.51	0.43	0.77	0.10	0,04	0.066	1.406	0.205
6	19,80	19	8,69	11.51	0.36	0.80	0 10	0.04	0.047	1.347	0.187
7	19.81	20	8 69	11.51	0.22	1.08	0.10	0.05	0.06	1.510	0.210
8	19.69	19	8.73	11.44	0.74	0.58	0 043	0.036	0.20	1.599	0.279
9	18.95	25	9 29	10.76	1.61	0.147	0.015	0.018	0.092	1.882	0.125
10	18.17	19	9.46	10.56	0.41	0.72	0.039	0.041	0.11	1.32	0 190
11	17,27	19	9.96	10.04	0.36	0.87	0 08	0.09	0.04	1.44	0.21
12	17.10	19	10.06	9.94	0.37	0.73	0.09	0.04	0.06	1.29	0.19
13	17.10	19.5	10.06	9.94	0.23	0.80	0.046	0.033	0.016	1.095	0.065
14	16.96	19	10.14	9.86	0.30	0.95	0.063	0.01	0.01	1.333	0.083
15	16.95	19.5	10.14	9 86	0.29	0.99	0.084	0.01	0.01	1.384	0.104
16	16,32	19	10.55	9.48	0,23	0.89	0.058	0.01	0.005	1.193	0.073
17	16,25	19.5	10.59	9.44	0 26	0.83	0.053	0.01	0.004	1.157	0.067
18	16.21	20	10.62	9.42	0.38	0.65	0.083	0 06	0.05	1.123	0.193
19	16.09	19	10.60	9.36	0.22	0.68	0,07	0.07	0.05	1.097	0.197
20	16.09	19	10,69	9.36	0.16	0.66	0.074	0.030	0.014	0.938	0.118
21	15 32	19	11.24	8.90	0 33	0.49	0 068	0.05	0.02	0.958	0.138
22	14.57	19.5	11.82	8.46	0.31	0.45	0,10	0.04	0.026	0.926	0.166
23	14.49	20	11.88	8.42	0.25	0.41	0.10	0.04	0.03	0.83	0.17
24	14.73	23.5	11.88	8.42	0.144	0.46	0.09	0.08	tr.	0.774	0.17
25	14.62	23.5	11.96	8.36	0.188	0.48	0.09	0.08	tr.	0.83	0.17
26	14.15	19	12.17	8.22	0 22	0.56	0.024	0.34	tr.	0.838	0.058
27	14.03	19	12.26	8.16	0.192	0.57	0 024	0.34	tr.	0.82	0'058
28	13.86	19	12.41	8.06	0.16	0.48	0.091	0.04	0.01	0.781	0.141
29	13.83	19.5	12.44	8.04	0.10	0.55	0.08	0 05	0.024	0.804	0.154
30	13 80	19	12.57	8.02	0.14	0.41	0.11	0 05	0.009	0.719	0.169
31	13.67	19	12.58	7.95	0.23	0.48	0 024	0.01	0 025	0.767	0.057
32	13.64	19	12.61	7.93	0.24	0.57	0 029	0 01	0.003	0.850	0.042
33	13 90	24	12.63	7.92	0.10	0.25	0 04	0.02	0.05	0.46	0.11
34	13.31	19	12.92	7.74	0.25	0.37	0,04	0.02	0.018	0.708	0.088
35	13.30	19.5	12.94	7.73	0 23	0 49	0 024	tr.	0.004	0.748	0.048
36	13 27	19	12.97	7.71	0.19	0.37	0.09	0 05	0.01	0.71	0 15
37	13.25	19	12.99	7.70	0.27	0.41	0.024	0.01	0 001	0.715	0.035
38	13.18	19	13 05	7.66	0.28	0.28	0.027	0.034	0.01	0.661	0.111
39	13.18	19	13.05	7.66	0.07	0.40	0.08	0.07	0.013	0.633	0.163
40	13.07	19	13.16	7.60	0.28	0.42	0.022	0.04	0 008	0.770	0.070
41	12.87	20	13.27	7.48	0.16	0.38	0.08	0.04	0.009	0.669	0.129
42	12.73	20	13.52	7.40	0 15	0 45	0.011	0.033	tr.	0.644	0.044
43	12.69	19	13.55	7.38	0.19	0.21	0.025	0.04	0.034	0.499	0.099
44	12.53	19	13.74	7.28	0.215	0.22	0.051	0.113	----	0.599	0.164
45	11.01	19	15.63	6.40	0.05	0.19	0.054	0.059	0.03	0.383	0 143

TABLE II.—RESISTANCE AND COMPOSITION OF IRON

Serial Number	Specific Resistance: Microhms Cm Per Cm²	Specific Resistance: Temp., °C.	Conductivity: Matthiessen Standard	Resistance: Cu.=1	Percentage Composition: C.	Mn.	P.	S.	Si.	Total. Not Fe.	P. + S. + Si.
46	13.80	25.5	12.78	7.82	0 15	0.068	0.13	0.02	0.15	0.518	0 30
47	13.82	26	13.37	7.48	0.15	0.064	0.036	0.02	0.13	0.400	0.186
48	13.10	26	13.50	7.41	0.16	0.074	0.12	0.027	0.10	0.481	0.247
49	12.54	25.5	14.07	7.11	0.08	nil	0.13	0,008	0.024	0.242	0.162
50	11.92	25.5	14.80	6.76	0.17	0 027	0 074	0.022	0.077	0.370	0.173
51	10.82	24	16.21	6 17	0.058	0.10	0 014	tr.	0 012	0.184	0.026
52	10.80	25.5	16.34	6.12	0.16	0.618	0.049	0 011	0.015	0.252	0.075
LSS	11.40	17	15.00	6.68	0,050	0.180	0.013	0.011	0.02	0.274	0.044
B	11.00	17	15.57	6.44	0.030	0 036	0.065	0 016	0.14	0.287	0.221
SCI	10.35	17	16.55	6.06	0.028	tr.	0.004	0.005	0.07	0.107	0.079

TABLE III.—RESISTANCE OF STEEL. VARIATION WITH MANGANESE
(Carbon from 0.17 to 0.23 Per Cent)

Sample Number	Manganese	Resistance	Carbon	P. + S. + Si.
	Per Cent		Per Cent	Per Cent
2	1.09	12.12	0.17	0.144
4	0 95	11.55	0.2C	0.23
7	1.08	11.51	0.22	0.210
13	0.80	9.94	0.23	0.065
16	0.89	9.48	0.23	0.073
19	0.68	9.36	0.22	0.197
25	0.48	8.36	0.188	0.17
26	0.56	8.22	0.22	0.058
27	0.57	8.16	0.192	0.058
31	0.48	7.95	0.23	0.057
35	0.49	7.73	0.23	0.028
36	0.37	7.71	0.19	0.15
43	0.21	7.38	0.19	0.099
44	0.22	7.28	0.215	0.164

TABLE IV.—RESISTANCE OF STEEL. VARIATION WITH MANGANESE
(Carbon from 0.27 to 0.33 Per Cent)

Sample Number	Manganese	Resistance	Carbon	P. + S. + Si.
	Per Cent		Per Cent	Per Cent
1	1.27	13.20	0.33	0.19
14	0.95	9.86	0.30	0.083
15	0.99	9.86	0.29	0.104
18	0.65	9.42	0.28	0.193
21	0.49	8.90	0.33	0.138
22	0.45	8.46	0.31	0.166
37	0.41	7.70	0.27	0.035
38	0.28	7.66	0.28	0.111
40	0.42	7.60	0.28	0.070

TABLE V. RESISTANCE OF STEEL. VARIATION WITH CARBON
(Manganese from 0.15 to 0.30 Per Cent)

Sample Number	Carbon	Resistance	Manganese	P. + S. + Si.
	Per Cent		Per Cent	
3	1.40	12.09	0.222	0.112
9	1.61	10.76	0.147	0.125
33	0.10	7.92	0.25	0,11
38	0.28	7.66	0.28	0.111
43	0.19	7.38	0.21	0.099
44	0.215	7.28	0.22	0.164
45	0.05	6.40	0.19	0'143

TABLE VI.—RESISTANCE OF STEEL. VARIATION WITH CARBON
(Manganese from 0.4 to 0.5 Per Cent)

Sample Number	Carbon	Resistance	Manganese	P. + S. + Si.
	Per Cent		Per Cent	Per Cent
21	0.33	8.90	0.49	0.138
22	0.31	8.46	0.45	0.166
23	0.25	8.42	0.41	0.17
24	0.144	8.42	0.46	0.17
25	0.188	8.36	0.48	0.17
28	0.16	8.06	0.48	0.144
30	0.14	8.02	0.41	0.169
31	0.23	7.95	0.48	0.057
35	0.23	7.73	0.49	0.028
37	0.27	7.70	0.41	0.035
39	0.07	7.66	0.40	0.163
40	0.28	7.60	0.42	0.070
42	0.15	7.40	0.45	0.044

TABLE VII.—RESISTANCE OF STEEL. INFLUENCE OF CARBON
(Results of M. Le Chatelier)

Resistance: Microhms	Resistance: Cu. = 1	Composition: C.	Mn.	Si.
		Per Cent	Per Cent	Per Cent
10	5.78	0.06	0.13	0.05
12.5	7.22	0.20	0.15	0.08
14	8.10	0.49	0.24	0.05
16	9.25	0.84	0.24	0.13
18	10.40	1.21	0.21	0.11
18.4	10.64	1.40	0.14	0.09
19	11.00	1.61	0.13	0.08

TABLE VIII.—RESISTANCE OF STEEL. VARIATION WITH CARBON
(Results of Barrett, Brown and Hadfield. Temperature 17° C.)

Sample Mark	Resistrnce: Microhms	Resistrnce: Cu. = 1	Composition: Carbon	Manganese	Silicon
			Per Cent	Per Cent	Per Cent
1392G	19.1	11.19	1.23	0.14	0.12
1392L	17.6	10.31	1.09	0.32	0.17
1392A	17.9	10.49	0.85	0.32	0.17
1392B	17.2	10.07	0.84	0.18	0.20
1392I	16.7	9.78	0.83	0.25	0.06
1392H	16.4	9.43	0.78	0.10	0.10
1166A	13.4	7.85	0.14	....	0.08

brands of refined bar-iron sold for use in staybolts and similar work. Nos. 51 and 52 are Swedish and Norway irons, respectively.

The resistance is expressed in the three ways in which such results are frequently stated. The first column gives the specific resistance or resistivity of a section 1 sq. cm in cross-section and 1 cm long, expressed in microhms (ohms x 10^{-6}) and at the temperature given in the second column. In the third column is given the conductivity (on the basis of Matthiessen's determination of the resistivity of pure copper), i. e., the ratio of the resistivity of copper to that of the sample, expressed as a percentage. The fourth column gives the resistance of the samples compared with Matthiessen's copper as unity (the figures in the fourth column are the reciprocals of those in the third column multiplied by 100). The second half of the table gives the percentages of the usual elements to be found in steel or iron, the total percentage of these elements and the sum of the percentages of phosphorus, sulphur and silicon.

The coefficient of change of resistance with change of temperatures is practically the same for copper and for ordinary steel and iron, hence, even though resistivities are determined at different temperatures, the conductivities or comparative resistances derived therefrom are directly comparable within limits close enough for the purpose of this discussion, without actual determinations of the temperature coefficient in each case, and the reduction of results to a basis of common temperatures. Therefore, in all succeeding reference to results the resistance will be expressed as in the fourth column, i. e., the ratio of resistivity of sample to that of Matthiessen's copper.

By the selection of samples of a composition varying in one element only, an attempt was made to define separately the influence of the several elements upon the resistance of steels. In Table III are listed those samples having carbon between 0.17 per cent and 0.23 per cent, manganese being the principal variable; and in Table IV are listed samples with manganese variable and carbon constant at from 0.27 per cent to 0.33 per cent. These results show that the effect of manganese in increasing resistance gradually increases with the percentage of manganese present, within the limits represented by these samples.

Messrs. Barrett, Brown and Hadfield,* in the study of the influence of manganese on resistance, used steels containing from 0.5 per cent to 18.5 per cent manganese, and found the resistance to increase at first very rapidly, with constantly increasing percentage of manganese, then more and more slowly, until 7 per cent manganese, after which a further increase in the percentage of manganese produces little or no increase in resistance. Le Chatelier* also gives figures showing the influence of manganese on resistance, but he has reported five samples only, and these are of such high carbon content as to be of no service to us in the study of steels available for conductor rails.

To determine the influence of carbon we have selected, in Table V, those steels with manganese constant at from 0.15 per cent to 0.30 per cent, with carbon as the principal variable. In Table VII we have stated results given by Le Chatelier in the paper previously mentioned, and in Table VIII the results of Barrett, Brown and Hadfield taken from the paper previously quoted. With uniformly increasing carbon, the resistance at first rises very rapidly, but the rate of increase gradually drops until it reaches a straight line at about 0.2 per cent C, which continues up to limits of the carbon listed. In all cases the steel is supposed to be unhardened, as it has been shown by Barus and by Le Chatelier that hardened steels may have double or even treble the resistance found in the annealed state. Table VI selects samples, with manganese constant at from 0.4 per cent to 0.5 per cent and carbon variable.

The elements phosphorus, sulphur and silicon were not present in sufficient quantity in any of the samples tested to permit us to draw any curves showing their influence upon the resistance. In both the papers previously quoted the influence of silicon, when present in large quantity, is studied, but the number of samples tested is too small to warrant any conclusions that are really definite. In commercial steels the percentages of all three of these elements is so small that their effect on resistance may generally be neglected.

A study of the several tables given in the paper shows that manganese preponderates in influencing the resistance of steels, and that for lowest resistivity, this element must be present in very small quantity, much smaller than is usual in merchant or structural steels. While all the other elements must be present only in very small percentages, so great is the preponderance of the influence of manganese, that they may be tolerated in quantities which the steel makers would consider reasonable, without unduly increasing the resistance.

For a satisfactory third rail the lowest possible resistance (from 6 times to 6.5 times that of copper?) is not necessary; and the great cost of making such extremely pure steel is not warranted. In fact, such extremely pure steels would probably be so soft that the frictional wear of the collecting shoe would be excessive and the life of the rail in service unduly short. Assuming, then, that a rail made from steel having a resistance not greater than eight times that of copper (13.8 microhms at 20 degs. C.) would be desirable for conductor rails, the figures tabulated would seem to indicate that the following extreme composition would be permissible:

	Per Cent
Carbon up to	0.2
Manganese up to	0.4
Phosphorus up to	0.06
Sulphur up to	0.06
Silicon up to	0.05

This composition, however, would be extreme, and any overstepping of bounds might result in too great resistance; therefore, for resistance up to eight times that of copper, the specified analysis should be:

	Per Cent
Carbon not to exceed	0.15
Manganese not to exceed	0.30
Phorphorus not to exceed	0.06
Sulphur not to exceed	0.06
Silicon not to exceed	0.05

This latter composition is one which could be made easily in any open-hearth furnace and it should present no difficulty in rolling to a shape suitable for conductor rails. In fact, steel of this composition has been successfully rolled into sheets as thin as 0.014 in., a size which was for a long time a standard product of a large sheet mill.

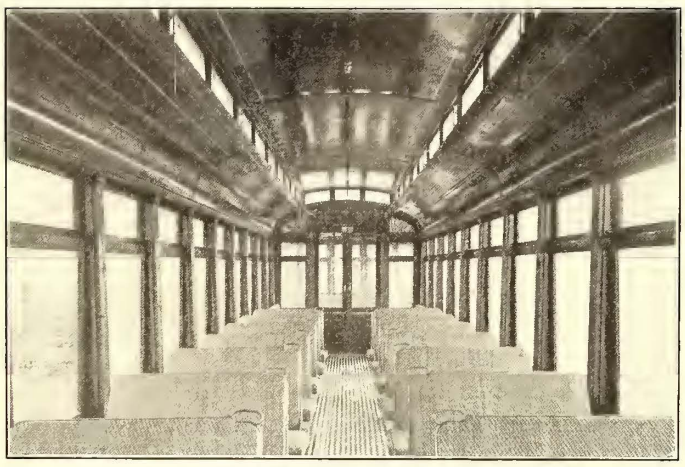
To street railway companies whose employees are "afflicted" with kleptomania, either mild or violent, the following item from the Lahore (Hindustan) "Tribune" may be of interest: "Many wandering gypsies employ a very simple method to check dishonesty on the part of the member of their band of musicians who has to make the collection. They give him a plate to hold in his right hand and a live fly, which he has to keep imprisoned in his left, as he goes round collecting the money."

* "On the Electrical Conductivity and Magnetic Permeability of Various Alloys of Iron," by W. F. Barrett, W. Brown and R. A. Hadfield, in "Transactions of the Royal Dublin Society," vol. vii., series 2, Part IV.

* "Sur le Resistance Electriques des Alliages," par M. H. Le Chatelier, in "Contribution a L'Etude des Alliages," published by the committee on alloys of the Société d'Encouragement pour L'Industrie Nationale.

LARGE CARS FOR COLUMBUS, OHIO

The American Car Company, of St. Louis, has lately completed and shipped two large straight-side cars to the Columbus Street Railway Company, of Columbus, Ohio. The absence of grades and the uniformly wide streets of Columbus permit the running of such cars into the heart of the city. One of the especially interesting features of the cars consists of a

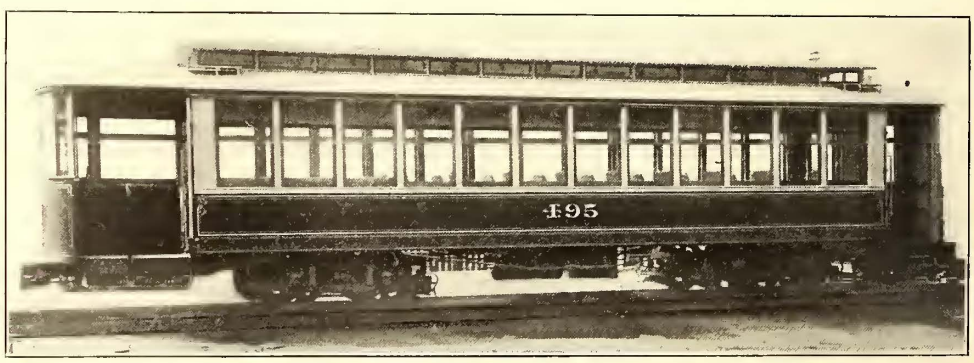


INTERIOR OF COLUMBUS CAR

vestibule at the forward end, which has no door between the vestibule post and the car corner post.

The accompanying illustration gives an idea of the general arrangement. A partition is extended from the vestibule corner post, at an angle with the platform, and is met by a door hung to the inside post of the car door, which door is situated at the right side of the car end, and is of the single sliding type. The rear platform is of Detroit type, and provided with portable vestibule. The car doors at this end are of the twin type. The seating capacity of each car is forty-six. The seats are placed transversely, and are of spring cane with stationary backs. At the rear end seats for six persons on each side are placed longitudinally. The transverse seats are 34 ins. long, leaving the aisles 20 ins. wide. The interiors are finished in mahogany, handsomely carved and decorated, with ceilings of the same.

The general dimensions of the car are as follows: Length over end panels, 34 ft.; length over crown pieces, 45 ft.; from panel over crown piece at front end, 5 ft., and at rear end, 6 ft.; width over sills, including sheathing, 8 ft.; center of posts, 2 ft. 8 ins.; thickness of corner posts, 3¾ ins., and of side posts, 3¼ ins. The side sills are double, each 2¾ ins. x 7¾ ins., with space between to allow room for the large sashes. Sill plates on the outside are ⅝ in. x 8 ins. The center sills are composed of 7-in. I-beams, end sills are 4¾ ins. x 7¾ ins. Both upper and lower trusses are used. Height of platform step, 18 ins.; from step to platform, 14½ ins. The platform knees are reinforced with angle-iron, and angle-iron bumpers of Brill patented type protect and strengthen the platforms. The cars are mounted on the Brill 27-F E-1 trucks, with 33-in. wheels, and equipped with four 38-hp motors per car.

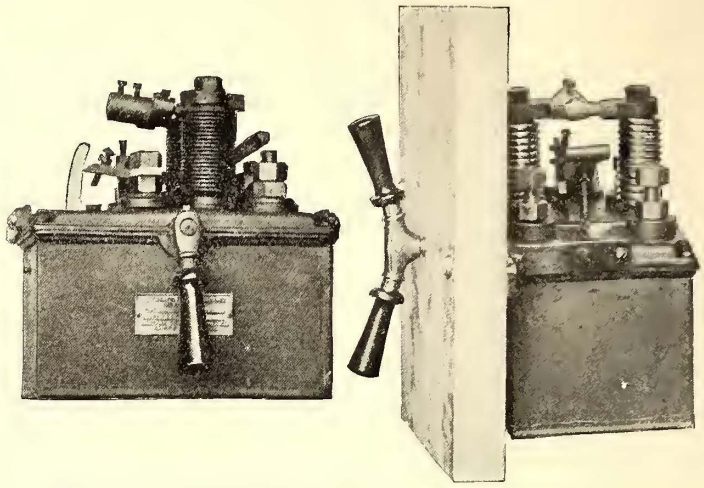


EXTERIOR OF COLUMBUS CAR

Emperor William has telegraphed his congratulations to the company engaged in the electrical experiments on the Marienfelde-Zossen Railroad, on attaining a speed of 125 4-5 m. p. h.

RAILWAY CIRCUIT BREAKERS

It has been the standard practice until recently to protect railway motor equipments by fuses. This method has been satisfactory only to a limited degree, as the fuse frequently fails to blow at the proper time, causing severe damage to the motor equipment. The delay caused by stopping a car to replace a



FIGS. 1 AND 2.—CAR AND SWITCHBOARD TYPES OF OIL CIRCUIT BREAKER

blown-out fuse is another serious objection to this method.

The automatic oil-car circuit breaker, manufactured by the Hartman Circuit Breaker Company, of Mansfield, Ohio, is designed to take the place of the fuse block and hood-switch on the car. It operates automatically upon an overload, and, at the same time, can be thrown by hand as readily as the ordinary hood-switch. It is said to be practically noiseless in operation—only a faint "click" being heard when the breaker opens even on the severest overload. The manufacturer believes that this feature will be appreciated where car circuit breakers with magnetic blow-out have been used.

The switch contacts are of the laminated type, to ensure perfect electrical connection, and also to prevent "freezing" of the switch at critical periods. The arc is ruptured in oil upon auxiliary contacts. Of these there are four, connected in series, giving a quadruple break.

The circuit breaker shown in Fig. 1 has a capacity for continuous duty of 400 amps., and any desired overload adjustment can be secured from 100 amps. to 900 amps.

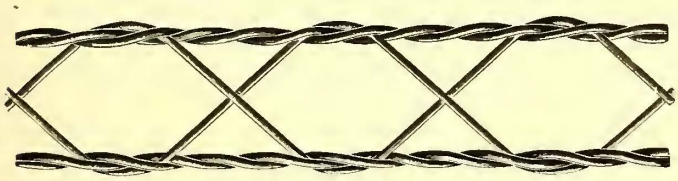
Fig. 2 represents the Hartman circuit breaker mounted for switchboard use. This circuit breaker is especially adapted for the protection of railway feeder circuits where the conditions are peculiarly exacting. The breaker cannot be thrown in while an overload exists, and thus dispenses with the necessity for using an additional switch on the circuit. As a hand switch it is stated to be as reliable as the ordinary knife switch but much safer to operate.

NEW TYPE OF RAILWAY FENCE

The Truss & Cable Fence Company, of Cleveland, Ohio, is manufacturing a wire fence that it believes will appeal to interurban railway builders as possessing a number of advantages. As shown in the accompanying illustration, it is a strand fence erected one strand at a time like a board fence, using as many strands as desired. This feature makes it frequently possible to effect a great saving in the amount of fencing used on a right of way, for in passing pasturage, timber land or grain fields it is not necessary to use as many strands as would be required where small animals are being confined.

Each strand is composed of six galvanized wires, the strength of each strand being equal to the combined tensile strength of all the wires. The six wires form two cables and a double truss, and it is claimed that there is no other way in which wires can be combined to give as great strength. In manufacturing the strands there are no short or abrupt twists, so that the galvanizing of the wire is not broken in any place, thus reducing the chances of rust. Each strand is independent of the others, so that if one strand is broken the remainder of the fence is not injured. It is constructed so that it can be fastened to a post in a way to prevent its stretching, and if a strand is cut or broken between two posts the fencing on either side of the posts will remain as rigid as before. It is claimed that it is impossible for a strand to unweave, and that the fence will not sag.

This type of fencing is especially adapted for rough and uneven country, because it follows the ground line, and there is no chance of its bagging or sagging when the fence changes its direction up and down. The fence is put up in small compact coils weighing about 100 lbs. each, making it convenient for handling and storing. In erecting, it is claimed that fewer posts are required than with ordinary woven wire

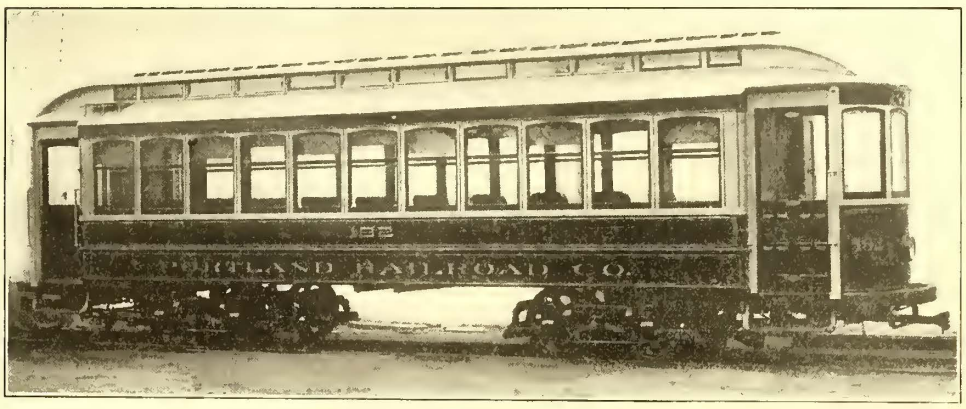


TRUSS AND CABLE FENCE

fences, and that any ordinary laborer can string this fence, as only a simple stretcher is used, which is fastened with ordinary staples. The cost of maintenance of a fence of this type is, of course, very low, as short sections of single strands may be inserted at any time, without the necessity of replacing entire sections. Two different widths are furnished, and for certain service the company advocates combining the two. Truss and cable fences are used by several leading steam railroads, among them the Pennsylvania, Erie and Atlantic Coast Line, and it has recently been adopted by several electric railways.

SEMI-CONVERTIBLE CARS FOR PORTLAND, MAINE

The Portland Railroad Company, of Portland, Maine, has lately received from the J. G. Brill Company three semi-convertible cars like that shown in the illustration. This type has been in considerable use on the lines in Portland for several years. The manner in which the city is laid out, the distance of the principal steam railroad station from the business portion of the city and the numerous suburban towns with which the electric lines connect renders it particularly well suited. In the summer Portland has a large transient population, composed of travelers going to summer resorts and requiring to make changes at that point. The city itself is a popular place in summer, being beautifully located at the head of a bay filled with islands, and within easy access to many popular resorts. The railway owns and operates several amusement parks, and



EXTERIOR OF PORTLAND CAR

the system extends over 90 miles of track, a large part of which is outside of the city proper.

It will be noticed that the cars have steam car roofs and substantial vestibules with folding doors. The windows, when not in use, are raised into roof pockets by the well-known method of this type. Plush upholstered, reversible-back seats are placed transversely with the car, and seat forty-four passengers. Length of the cars over end panels is 30 ft. 8 ins.; over vestibules, 40 ft. 1 in.; from panel over vestibules, 4 ft. 8½ ins.; width over sills, 7 ft. 8½ ins.; over post belt, 8 ft.; size of side sills, 4 ins. x 7¾ ins., ⅜-in. x 12-in. plates on the inside. The end sills are 5¼ ins. x 6⅞ ins.; thickness of corner posts, 3¾ ins., and the side posts, 3¼ ins.

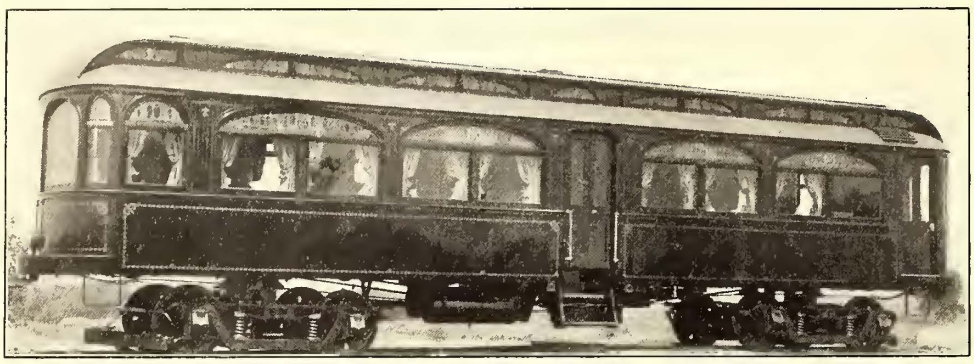
Included with this shipment were two closed cars for winter service, 28 ft. over end panels and 37 ft. 5 ins. over vestibules; width over sills, 7 ft. 4 ins.; over post at belt, 7 ft. 7½ ins.; sweep of posts, 1¾ ins. The side sills are 4¾ ins. x 6¾ ins., with ½-in. x 6-in. plates. Among the patented specialties with which each car is equipped are the following: Track scrapers, "Dedenda" alarm gongs, "Dumpit" sand boxes and radial drawbars. All the cars are mounted on Brill 27-G trucks with 4-ft. wheel base, 33-in. wheels and 4¼-in. axles. Each car is equipped with four 38-hp motors.

PROSPERITY OF BRAZILIAN TRAMWAY COMPANY

The Sao Paulo Tramway Company, of Sao Paulo, Brazil, which was organized by F. S. Pearson, has made a satisfactory record of earnings since its organization two years ago. At that time $6,000,000 of 5 per cent bonds were sold largely to Toronto interests at 90, with a 100 per cent bonus in stock, and such investment now shows 90 per cent profit, the bonds selling at 95 and the stock at 85. At the top of the Toronto boom the stock sold as high as 118. Earnings have just been published for the first six months of this year. They show net receipts of $436,949, compared with $326,787 for the same period of 1902, a gain of $110,162, or 34 per cent. During the six months operating expenses were reduced $20,000, or 9 per cent. Earnings of the Sao Paulo Company now equal 8½ per cent on the $7,000,000 of capital stock ($1,000,000 of new stock having been issued last year at par $100).

THE PRIVATE CAR PALATINE

A very handsome private electric railway car was recently finished by the St. Louis Car Company, and is now in use at St. Louis. It is seldom that such a magnificent stock of African mahogany is available as the St. Louis Car Company had to draw from in the construction of this car. Unfortunately, the beauty of this mahogany finish cannot be reproduced, but the general appearance and furnishings of the car may be appreciated from an examination of the accompanying engraving of the interior. The car has two compartments, a smoker and parlor. At each end of the car is a double observation room. To make these observation rooms possible the entrance is at the center. The buffet is in the smoking compartment of the car. The settee which adorns the center of the parlor, as well as the other furniture, is upholstered in the finest quality of fabrics. The African mahogany finish is inlaid with artistic designs of marquetry. The car can carry a large supply of water, which is stored in a tank under the car, and forced into the toilets by compressed air. As can be seen the lighting is by St. Louis Car Company interior arc lamps. Incandescent lamps are also provided. The lower window sashes have polished beveled-edge plate-glass. The upper sashes are filled with cut plate-glass with an opalescent art glass in the center. This car has been placed on St. Louis Car Company No. 23-A trucks, and is equipped with that company's arc headlights. Charles H. Ledlie, consulting engineer of St. Louis, general manager of the Union Electric Light & Power Company, is the owner of this car.



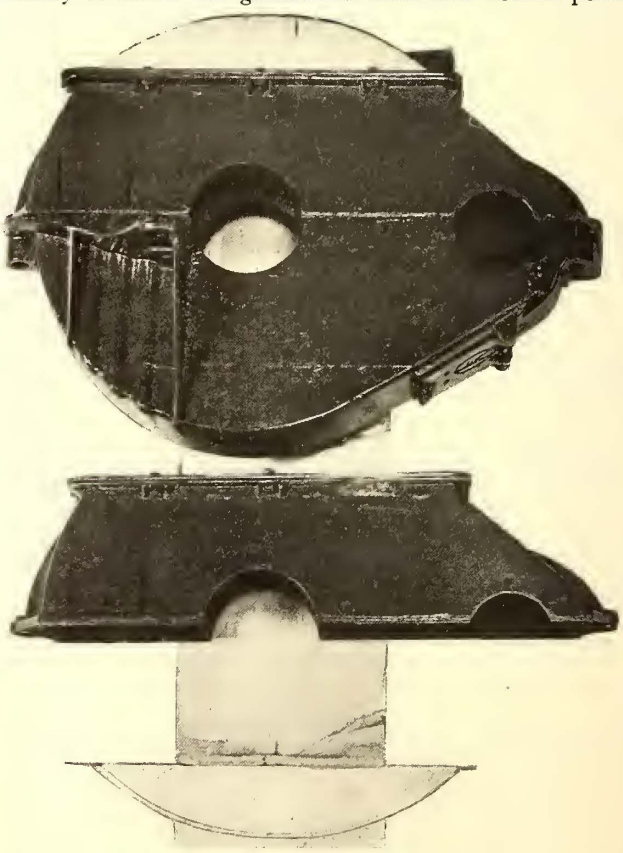
EXTERIOR OF PRIVATE CAR "PALATINE"

INTERIOR OF PRIVATE CAR "PALATINE"

GEAR CASES AT MILWAUKEE

In a discussion at the Saratoga Convention of the American Railway Mechanical and Electrical Association, Edwin W. Olds, superintendent of rolling stock of the Milwaukee Electric Railway & Light Company, described a gear case of rather novel construction which his company has used for about two years. An illustration of one of these cases is shown herewith. As will be seen, the bottom of the gear case is of galvanized iron, so that when obstructions on the street hit the case it does not wreck the whole casting, but simply makes a dent in the galvanized iron portion. The upper part of the gear case is of malleable cast-iron. The bottom part is No. 20 sheet-iron.

As stated by Mr. Olds in the discussion, none of these gear cases has been broken in service, although it is frequently necessary to renew the galvanized sheet-iron bottom portion.



SPECIAL GEAR CASE FOR MILWAUKEE

This goes to show that the company properly diagnosed the matter when it concluded that if blows from street obstructions could be cushioned the breakage of gear cases would be avoided.

The rapid extension of trolley lines connecting small towns in Indiana has greatly stimulated amusement enterprises. Medium-sized theatrical troupes now appear in such towns, and small theaters and opera houses are springing up rapidly.

QUESTION BOX OF PENNSYLVANIA STREET RAILWAY ASSOCIATION—I.

An innovation was introduced at the twelfth annual convention of the Pennsylvania Street Railway Association, held at Williamsport this year, in the form of a "Question Box," which consisted of a series of practical questions on all branches of railway operation and management. Copies of the list were mailed to members of the organization some time in advance of the meeting, and the questions, together with the answers received, were then printed in pamphlet form as a part of the official proceedings of the convention, thus making a very valuable contribution, indeed. The matter was divided under the following headings:

Power House Department.
Operation and Maintenance of Equipment.
Track and Roadway Department.
Bonding Department.
Overhead Line Department.
Management.

An abstract is presented herewith, covering the questions pertaining to power house machinery and practice, and will be followed in subsequent issues by abstracts from other parts of the document. The plan was received with universal favor by the members of the association.

POWER HOUSE DEPARTMENT

1. In boiler pumps for handling hot water, 200 deg. F. and hotter, what results have been obtained by using ball valves instead of usual flat valves, composition or otherwise?

It is my experience that any pump, handling hot water 200 deg. F. or higher, can be profitably changed over to use ball valves throughout on the water end. The space available for valves may make such change impossible, but in the Dean pump, which is used in our Edison plant, complete equipment of ball valves, with necessary cages, replaced the regular spring controlled disc valves. With the old disc valves, there was always more or less hammering, and valves were refaced or renewed regularly every few months. Since ball valves are used, the action of the pump is smooth and there is no evidence of wear on either ball or seat. The balls and seats, ground to fit, were purchased from a local firm. These with a brass casting for cage and a cast-iron bushing for old valve seat, represented our entire bill of material. The fitting and lathe work was done by the power house employees. The cost for material was approximately $1.25 per valve for 2-in. ball system.—Paul A. Hess.

Have always used flat valves, which have given satisfaction.—H.

In making this change, it is essential that the balls be absolutely true and balanced, and of ample weight to keep their shape under heavy service. Above 2 ins., hollow brass balls are recommended. Use bronze flat valves and find them satisfactory.—A.

With a properly proportioned and balanced ball, it is only necessary to provide a seat ground to fit the ball, and some sort of cage over the ball, rounded up inside at top to the same shape as the seat below, so that ball in rising will meet with a surface similar to its own shape, and of height sufficient to give proper life to ball.—Editor.

2. What type of boiler feed pumps has given satisfactory service with water 200 deg. F. to 210 deg. F.? What is the minimum head of hot water supply above pump suction for reliable pumping service?

Our experience has been that the Knowles double pump works very satisfactorily with water up to 200 deg. F. to 210 deg. F. Three feet head meets all requirements for hot water—F. B. Musser.

Knowles and Blake pumps.—H.

Brass lined outside packed, plunger type of pumps. A head of 4 ft. or 5 ft. is desirable.—M.

The Worthington Admiralty type. Three feet of head with a short and direct connection of ample size; but with a long pipe or several bends in run, the head should be greater.—A.

3. What is the most economical and reliable method for handling drips and condensation from various classes of steam piping?

The steam loop and Holly gravity return system will accomplish this work with the minimum operating and maintenance costs. This system, modified to suit special plant conditions has been installed in practically all modern, high-grade plants.—E. H. Sniffen.

Holly gravity return system. In a recent complete efficiency test of a 1000-kw modern plant, in which almost exactly 200,000 lbs. were evaporated in twenty-four hours, the Holly system required 2300 lbs. of steam in twenty-four hours—slightly over 1 per cent of steam generated.—Editor.

4. Is there any type of steam trap which can be depended on for high-pressure steam lines?

I understand the Flinn mercurial trap works very satisfactorily on high-pressure lines.—E. H. Foster.

The T. K. Kiely trap gives reliable service.—F. B. Musser.

Not only has my experience with steam traps been bad, but I can find practically no engineers who have obtained satisfactory results with reasonable care.—J. O'Toole.

We have found none entirely reliable or satisfactory.—H.

The Pennsylvania Railroad report reliable service from a special open pan float trap, built and guaranteed by one of their steam piping contractors. This trap does not return condensation to boilers, but is generally discharged into an open heater.—Editor.

5. What are relative merits of extra heavy iron and brass for hot feed water piping?

Iron and steel pipe on hot water feed piping is very unreliable, as the hot water corrodes and eats through the pipe from the inside, and also clogs up the feed pipe entering boiler. Brass, on the other hand, is not affected by hot water.—F. B. Musser.

Brass is, in our experience, best for permanent construction. —H.

Brass is preferable where condensed water is used (as iron will pit in a few years); and where there is considerable expansion in short connections.—A.

6. What advantage or economy is obtained by the use of automatic boiler feeding devices?

The use of automatic boiler feeding devices secures a uniform level of water in the boiler, thereby preventing uneven expansion and contraction. Such device also makes boiler steam more uniformly.—F. B. Musser.

We find it best to use regular water tenders to better provide for emergencies.—H.

Inquiry among plants which have used such devices for some years brought out the following statements: "No trouble, better quality of steam, and saving in fuel over our previous results of 5 per cent to 10 per cent," and "A good investment absolutely reliable and practically no repairs necessary. Stops the fireman from filling up the boiler every time steam pressure raises up or blows off. Makes the fireman coal more carefully, and watch the draft in order to maintain even steam line."—J. O'Toole.

No economy in labor except in a very large boiler room, but better regulation. They are also advantageous, provided with a high and low water alarm to give notice of danger.—A.

7. Is there a damper regulator which will control steam pressure within 2 per cent or 3 per cent of normal under railway load conditions?

After thorough trial of several well-known damper regulators, we found none that would control steam pressure closer than 5 lbs. on either side of normal. The damper regulator which gave the closest regulation was one which either entirely closed or opened damper when steam pressure was above or below normal.—J. O'Toole.

Any of the well-known standard makes will accomplish this result, provided fluctuations are reasonable in extent.—H.

Locke damper regulator controls within 2 per cent or 3 per cent under ordinary conditions.—F. B. Musser.

8. What is the best arrangement of valves on individual boiler feed lines in order to regulate water supply, and to permit independent separation of any boiler feed from main supply lines?

Taking valves in order from main feed water line, and assuming 2-in. line to each boiler: (a) Globe or Gate valve, (b) Globe valve, metal seat, for regulating supply, (c) Ball check, and (d) Globe or Gate valve. With this combination the only valve subjected to cutting or serious wear can be repaired or replaced without affecting other boilers.—Paul A. Hess.

Loop feeder water mains, with valves in same to cut out individual boilers.—H.

Duplicate mains provided so that sections of mains and pipes to individual boilers can be cut out.—A.

9. What is the smallest size of boiler plant, or minimum coal consumption, which warrants the use of automatic stokers?

From the labor-saving side of the question, a boiler plant will warrant the use of stokers as soon as it reaches a size requiring the attention of more than one fireman. The fuel saving by the use of a good stoker will be a certain percentage over hand-firing; consequently the size of the boiler plant has little bearing on the question of fuel economy. The labor required for operating the boiler plant is, therefore, the most important question in determining how small a plant will warrant the use of mechanical stokers, and I would say as soon as the plant reaches a size requiring more than one man for hand-firing, stokers would then be a profitable investment.—E. H. Sniffin.

When the plant requires 1600 hp in boilers for regular service, corresponding to an annual coal consumption approximating 16,000 tons.—H.

A plant using about 40 tons of coal on a single 10-hour shift is the dividing line.—A.

The statement of a number of the large lighting stations, using both automatic stoking and hand-firing is that automatic stokers offer no especial advantage where plants are burning less than 1½ tons of coal per hour and able to obtain fair steam coal at a reasonable price. The handling of 1½ tons of coal per hour seems to be regarded as the limit for one fireman with hand-firing furnaces, and it would require one fireman to look after a stoker.—Editor.

10. What is the comparative economy, including operation and maintenance, of automatic stokers and hand firing?

The comparative economy of automatic stokers and hand-firing will be so much affected by local conditions, such as size of plant, kind of fuel, hours per day under full service, etc., that it is difficult to make a definite statement. It is, however, a fair estimate that under average street railway conditions, with the average size of boiler plant, a properly designed and operated stoker should show an economy, including operation and maintenance of 10 per cent and upwards over average hand-firing.—E. H. Sniffin.

Last week we made tests in our boiler house which will interest you. As you know we have put on one of our boilers ——— stoker, and these people guaranteed us a saving in coal of 10 per cent against the best hand-firing. At first we made a test of eight hours, the stoker people getting a saving in coal of a little more than 5 per cent. When we stated then to the representative that he had several advantages against our hand-feeding at this test, he requested to have another test of twenty-four hours. We allowed this after he had signed an agreement in which we gave our conditions. And one of them was that this test should be considered final.

After this test was finished, we saw that we not only worked with the same success with our hand-firing, but had saved 1 per cent more than the stoker man. The man left my office with the words, "I am a sad buried man." As a reason for his defeat, he claims that besides the good fireman we placed against him, our chimney draft was too good. He stated then that with their stoker they got good results only by using Western coal, and where the chimney draft was not so good.—M. E.

The cost of firing boilers by hand or by automatic stokers will at the end of the year be practically equal when the cost of maintenance plus labor is equated, for the stokers against the cost of labor plus maintenance of hand-fired grates.—H. S. N. Y.

Practically no difference in total costs, when all repairs, etc., are included.—H.

In one instance, the boiler room cost for hand-firing, including unloading coal, handling ashes, firing and tending water, was 35 cents per ton; and with stokers, 17 cents per ton. The additional cost for repairs to stokers over hand-fired furnaces was 3 cents per ton.—A.

The figures furnished by a number of the Edison stations, in the matter of hand-firing versus automatic stoking, are as follows: Hand-fired furnaces 25 cents to 32 cents a ton to charge the coal under the boilers. Automatic stokers, in connection with overhead coal bins, 6 cents to 7 cents a ton to charge the furnaces. Repairs are reported from 25 cents to $1 per horse-power per annum more with automatic stokers than with hand-fired furnaces.

In addition the following data was submitted by G. B. Leland: Plant consisting of four 250 hp Babcock & Wilcox boilers, equipped with American stokers, with induced draft, we found the saving over hand-firing to be approximately 30 per cent, using run of mine coal, which cost $2.35 in the bin, from which we were enabled to obtain the equivalent of 11.25 lbs. from and at 212 deg. The cost of renewals and repairs to the stoker was equal to 25.8 lbs. of castings per horse-power per year. The stokers consumed approximately 2 per cent of the steam generated to operate them. On an overload test they would run up to 100 per cent over their rated loads without unsatisfactory results. The stokers cost approximately $3.50 per B. H. P. installed.—Editor.

11. Are there any automatic stokers which are equally adapted for burning bituminous and small sizes of anthracite coal?

The Roney mechanical stoker has been in operation for the past five years at the power station of the Metropolitan Street Railway Company, in New York City, and in other street railway power houses burning both bituminous and anthracite coal.—E. H. Sniffin.

No.—H.

12. Can a boiler be forced as hard with automatic stokers as with hand firing?

With suitable draft and fuel, it is possible with a mechanical stoker to maintain a higher percentage of overload capacity than with the average hand-firing. Boilers have been fired with the Roney mechanical stoker 200 per cent, or three times their rated capacity, and it is a common occurrence for boilers fitted with this stoker to run as high as 70 per cent above rating continuously for twenty-four hours with good bituminous coal.—E. H. Sniffin.

No.—H.

No. The fireman is unable to work his fires with an automatic stoker.—F. B. Musser.

Yes, if forced draft is used.—A.

13. Is there any rapid, simple and easily manipulated apparatus for testing flue gases?

Either the Econometer or the Orsatt apparatus.—A.

The only apparatus which has been tested in power house service and reasonable in cost, is a modified balance type, the Arndt Econometer. This instrument has been tested in power house service by the Chicago Edison Company, and their reports indicate a sufficient commercial accuracy for station purposes. As arranged by them, samples of flue gases can be taken from any boiler during operation by pipe connecting each uptake with test room and the efficiency of the firing is continuously shown by the position of the balance pointer on the attached scale of percentages, the per cent of carbonic acid gas present. This same instrument was carefully examined into on behalf of the Steam Users' Association by R. S. Hale, and his tests and report on this instrument show it to be reliable and a valuable adjunct to the testing equipment of any power house.—Editor.

14. Is there any hot water meter which can be run continuously and maintain reasonable accuracy?

Our experience with hot water meters in the high pressure feed line has been unsatisfactory. The meter seemed to be subject to variable errors, and it was impossible to depend on same for continuous records. The meters we tested were run at low loads, but there were frequent breakages of parts and the meters were thrown out of service.—J. O'Toole.

Some impulse meters have given good results.—A.

Meter manufacturers generally decline to make any guarantees as to continued accuracy of their hot water meters when operated continuously on high pressure boiler-feed lines. Their advice is to arrange by-pass and only cut-in meter for periodical test runs. If so used, the accuracy claimed is within 5 per cent. This applies to meters of both the displacement and impulse types and is in harmony with the observations of R. S. Hale on European hot water meters.—Editor.

15. Has the Venturi meter been applied to measuring feed supply to boiler? If so, what results have been obtained?

The Venturi meter has been used on boilers and the results are expected to be satisfactory.—A.

16. Is it easier for the firemen to handle coal from the floor with a long-handled shovel or from a charging car with a short-handled shovel?

From the floor with a long-handled shovel.—H.

The fireman can handle coal from the floor with a long-handled shovel easier, because he can put his weight on the shovel more advantageously.—F. B. Musser.

The practice in the matter seems to be largely one of local customs. The firemen in a plant where method of handling coal was changed from floor dump to charging car states that at first it was much harder to work the short-handled shovel in connection with charging car; but after a little practice this opinion changed. The knack of swinging shovel secured, the convenience of having all coal grouped in cars in front of furnaces at a distance requiring practically no additional work beyond filling the shovel and throwing into the fire, made this arrangement preferable to the men.—J. O'Toole.

17. What is the boiler room labor cost per ton fired, to cover coal and ash handling?

57.2 cents per ton of coal used.—F. B. Musser.

About 40.9 cents per net ton.—H.

Total labor cost, including dumping from cars, firing into furnaces, and wheeling out ashes, 21 cents per short ton. Coal—run-of-mine bituminous and high in ash.—J. O'Toole.

Our coal, anthracite No. 3 buckwheat, is delivered by carts close to the fire room. Average cost per long ton for firing and wheeling ashes about 150 ft. is 37 cents.—Paul A. Hess.

18. Which is the better or more economical method of increasing boiler capacity during heavy peak loads—forced or induced draft?

This question must be determined largely by the question of the coal used. With the smallest size of anthracite coal, the best results can be obtained by maintaining a reasonable pressure in the ash pit; while with bituminous coal, induced draft is the more economical method of increasing boiler capacity under heavy peak loads. The combination of induced and forced draft with small anthracite coal has been found very effective. There are some large street railway power plants provided with chimneys of sufficient heights to carry the average load and fitted with induced draft fans, arranged by means of dampers, to take care of

the peak of the load, and in effect increase the height of the chimney in accordance with the demands for steam. These fans act as boosters for the draft, and are very effective when thus used.—E. H. Sniffin.

Forced draft, because induced draft increases leakage through settings.—A.

19. Under what conditions is it more advisable to use mechanical instead of natural draft in the regular operation of a plant?

Experience thus far has shown that small or moderate-sized boiler plants are benefited by the use of mechanical draft, for the reason that their economy is more affected by a fluctuating load than are large plants where the variations in the load are distributed over a large number of boilers. It is also advisable to use mechanical induced draft in the place of natural draft when economizers are used, to overcome the loss in draft both by the cooling of the gases and by the mechanical interference with their flow. If natural draft is used, a very tall chimney is required, whereas induced draft will overcome the effect of the economizers and at the same time take care of the peak of the load by increasing the speed of the fans at the time of the greatest demand for steam. There are many railroad plants equipped with economizers and induced draft, where the engines operating the fans are fitted with automatic valve on the steam line, which regulates the speed of the fans according to the boiler pressure and the demand for steam. This is accomplished without any increase of attention by the fireman.—E. H. Sniffin.

Natural draft is preferable.—H.

A large Western street railway company recently substituted natural for induced draft, as it was found that the coal required to drive the fan engines for the latter system would pay for the chimney in a short time.

The plant should have sufficient natural draft for ordinary conditions and be supplemented by forced draft for emergencies.—A.

20. Is there any financial economy in lining steel stacks with brick? If so, to what height should lining be carried and what kind of brick used?

The Bethlehem Steel Company is reported as having a steel stack, completely lined with fire brick and yet corroded badly.—M. E.

21. What is relative cost of regular brick, special custodis, and self-supporting brick-lined steel stacks from 160 ft. to 200 ft. high?

In competition we find custodis chimneys are about 10 per cent cheaper than well designed common brick chimneys, besides being lighter and requiring less costly foundations. As compared with lined steel stacks, custodis type is generally cheaper, but there is no way of giving average comparison.—William L. Greeley.

22. Is there any way to protect the interior of brick stacks against cracking and disintegration when boilers are forced and stack temperature is approximately 650 deg. F.?

We presume this refers to the cracking noticeable in the inner core of common brick chimneys as ordinarily designed, and where the core usually has a thin wall of considerable height with consequent pressure. The material used in the custodis chimneys is specially prepared for the purpose, and will not crack at temperatures up to 650 deg. F. Where the temperatures are likely to be much higher and where explosions occur, a sectional lining is used. By so dividing the lining, the expansion is similarly reduced, preventing the lining from cracking. In case lower sections of lining are burned out, these can be replaced without disturbing the upper.—William L. Greeley.

We have experienced no trouble with cracking at 650 deg. F.—H.

23. Is there any reliable method of testing soils in order to ensure brick chimney against cracks and other defects, due to irregular settling of foundation?

The most reliable method of testing soil to ascertain its carrying capacity is to impose loads on it, either with dead weight or by a system of levers and observing the actual settlement. In case foundation is liable to settlement, it should be built of concrete with a grill work of iron rails or expanded metal.—William L. Greeley.

The best plan is to consult and contract with experienced chimney constructing firms, who will examine soil and erect chimney under suitable guarantees covering settling, etc.—H.

24. What difficulties have been experienced with superheaters?

With highly superheated steam, the difficulties are liability of superheated tubes to burn out, and engine lubrication, unless special valve system, like poppet type, is used. Inquiry concerning superheater at a large mill in Philadelphia developed the fact that superheater had been burned out after comparatively short service.—M. E.

Experience with superheaters, heating steam up to 800 deg. F., and in service for considerable period of time, indicates that no troubles are experienced other than those due to gross carelessness in management, and the ordinary wear and tear of settings and furnaces. In one case a superheater was damaged by building a fierce fire under it and subjecting it to this severe heat for several hours with no steam passing through. This same superheater has repeatedly had the flow of steam stopped for half an hour at a time, with no damage whatever. With ordinary care, the superheater is easier to handle than a boiler, and fully as durable. I have seen temperatures of 940 deg. and over realized in a separate superheater, for short periods, without damage to engine or superheater.—Richard H. Rice.

With reasonable care, there is no difficulty with gridiron valves, using steam superheated 100 deg. F. to 105 deg. F., and steam pressure 160 lbs.—H.

25. With moderate superheating, not over 150 deg. F., in plant of 1000 B. H. P., is it more economical or advantegous to install one separately fired superheater or an individual superheater for each boiler?

It is probably more advantageous to install individual superheaters for each boiler within the setting because of the greater economy of burning fuel in large quantities and also in the diminished radiation.—E. H. Foster.

Separately fired.—H.

With moderate superheating, up to 150 deg. F., it is desirable to install a separately fired superheater, because with the individual superheater connected with each boiler the temperature of the steam is highest when the boilers are being forced and load is heaviest, and least when the load is lightest—exactly the reverse of the conditions called for by the engine when operating under the safest and most economical conditions. When an engine is operating with early cut-off and light load the tendency to cylinder condensation is greatest and consequently a high degree of superheating is advisable to overcome this tendency. On the other hand, at late cut-off, a high degree of superheat would be liable to cause damage to the engine, since on account of the diminished tendency to cylinder condensation at the late cut-off, less superheat is used up in overcoming such tendency, and the mean temperature in the cylinder during admission and expansion is therefore higher. For best economy, the temperature of the steam should vary inversely as the load; while the boiler superheater varies it directly as the load. This latter condition forces the use of the lower average temperature than is possible with the independent superheater, and therefore makes it impossible to secure the maximum benefit from superheating. The independent superheater also permits the temperature to be exactly regulated at will, involves less complication of piping and valves and can be more readily repaired and kept in order.—Richard H. Rice.

26. To what extent can superheating be carried safely in plants operating engines with Corliss, gridiron, or usual types of valves?

To a temperature of 500 deg. F., corresponding to a superheat of about 150 deg. above the normal temperature of steam at usual pressures.—E. H. Foster.

The Boston Edison Company use Babcock & Wilcox superheater, and with 100 deg. superheat experience no difficulty in the operation of gridiron valves. Practically all first-class engine builders will guarantee the operation of their valve system and engines to be entirely satisfactory using steam up to 500 deg. F. With steam temperatures in excess of 500 deg. F., poppet valves are recommended.—P.

With 160 lbs. steam pressure, superheating 100 deg. F. is safe.—H.

Not over 50 deg. F. with Corliss or other unbalanced valves.—A.

The extent to which superheating can be safely carried with usual types of valves, depends somewhat upon the nature of the service as to variability of load, and upon the type of superheater. With cut-off at about one-fourth stroke and a steady load, 480 deg. to 500 deg. temperature of steam at the cylinder is permissible; but if the cut-off goes to one-half stroke, a reduction of temperature is necessary. With the varying loads of street railway service and boiler superheaters, 450 deg. to 460 deg. is the highest safe average temperature of steam. If, however, compound engines, fitted with ordinary types of valves, are supplied with a Schmidt reheater receiver, 550 deg. to 600 deg. steam can be safely utilized. The function of this device is to reduce the temperature of the steam passing into the high pressure cylinder when the load on the engine increases, and to increase the temperature when the load falls off. This is performed by using more or less of the steam in the main steam pipe to superheat to a greater or less degree the steam entering the low pressure cylinder. The heat abstracted from the steam entering the high pressure cylinder is therefore not lost, but used to increase the efficiency of the low pressure cylinder; and the action of the apparatus is to preserve the best conditions in each cylinder for all conditions of load, and to maintain the cylinder temperature within safe limits. This per-

mits of the use of a maximum temperature of superheat at all times.—Richard H. Rice.

27. What is net gain in coal economy by the use of either moderately or highly superheated steam?

Net gain in coal economy has been frequently reported at from 8 per cent to 40 per cent. The more wasteful steam engines show the greater percentage of saving. With an ordinary cross-compound Corliss engine, it is safe to count on a coal saving from 8 per cent to 15 per cent, steam superheated 150 deg. F.—E. H. Foster.

A conservative estimate of the saving due to moderate superheating is 10 per cent.—H.

Compared with engines using saturated steam, the use of 150 deg. superheat will save roughly 12 per cent to 14 per cent of steam, and 8 per cent to 9 per cent of fuel; while 300 deg. superheat means a saving of 25 per cent to 30 per cent of steam and 16 per cent to 20 per cent of fuel. These figures are based on actual results. The use of superheat renders beneficial also the use of a high vacuum, the increase of temperature range in the cylinder with superheated steam not involving any increase in cylinder condensation. Curves of steam and heat consumption obtained from various types of engines tested under varying degrees of superheating show that the gain due to the superheat increases more rapidly than the temperature; and it is therefore advisable to carry superheating as high as possible without appearance of superheat in the exhaust. With 140 lbs. to 150 lbs. boiler pressure, engines on the Schmidt system can use steam at a temperature of 750 deg. to 800 deg. with safety and without superheating the exhaust; and under these conditions and a vacuum of 27 ins. to 28 ins. these engines develop a horse-power from 8.9 lbs. to 9 lbs. steam, at rated load; while the variation of economy is less than with saturated steam, under varying load.—Richard H. Rice.

The following data were obtained concerning the economy of the steam plant of Milbourne Mills, Philadelphia, Pa., equipped with separately fired Schmidt superheater and Rice & Sargent engines:

Temperature of steam, approximately, 700 deg. F.

Coal consumption per day, using steam at above temperature, 23,000 lbs.

Coal consumption per day, using saturated steam, superheater cut out, 32,000 lbs.

Approximate net saving due to the use of highly superheated steam, 9000 lbs. coal, or 28 per cent.—Editor.

28. What precautions are necessary to avoid trouble with cylinder and valve lubrication with superheated steam?

Use ordinarily good oil and lubricate positively, or, in obstinate cases, lubricate the cylinder direct.—E. H. Foster.

No trouble if good grade cylinder oil is used and positive feed be used.—H.

The best quality cylinder oil must be used, and fed positively as by oil pump.—A.

The only precautions necessary to avoid trouble with cylinder and valve lubrication with superheated steam, are, first, to use oil having a very small percentage of animal or vegetable constituents; that is, to have the oil as nearly as possible a pure mineral oil, and to have the flash point of the oil regulated in proportion to the amount of superheat which is being used. The higher superheats requiring a flash point of 600 deg. to 650 deg. in air, corresponding to about 700 deg. to 750 deg. under pressure of 140 lbs. per square inch. It is also necessary to avoid the use of springs in the piston packing and to arrange the stuffing boxes with cast-iron rings instead of bronze or soft metal. With highly superheated steam it is necessary to keep the stuffing boxes well away from the high temperatures existing in the cylinders, and in some cases to water-jacket the packings to protect them from the superheat. With this steam it is also necessary to use poppet or piston valves, and to design the cylinder so that the barrel is free from ribs or passages. Lubrication should be by positive oil pumps, rather than displacement cups; and brass, bronze, composition, copper or other similar materials should be kept away from the action of the steam, under which they rapidly deteriorate. All pipes and cylinders should be covered with not less than 3 ins. thickness of non-conducting material of the best quality; and it may not be out of place to mention that recent experimens indicate that this same thickness is economical for saturated steam and pays a handsome return on the investment.—Richard H. Rice.

29. Does the use of superheated steam require a different ratio of high and low pressure cylinders than for saturated steam?

With superheated steam, a higher ratio between the two cylinders may be used because of the elimination of cylinder condensation.—E. H. Foster.

No. Same engines have been used with saturated and superheated system.—H.

30. What type of gasket is best to use in superheated steam mains?

Corrugated brass gaskets have been found to give excellent results. Also woven wire and asbestos gaskets.—E. H. Foster.

Corrugated copper gaskets.—H.

Either ground joints or copper gaskets. No rubber or fiber.—A.

The best gasket for use in superheated steam mains is an asbestos gasket made as thin as possible, and with just sufficient rubber or other binding material to hold the asbestos together and prevent access of moisture to the fibers during the time when saturated steam is passing through the mains.—Richard H. Rice.

We are using corrugated copper gaskets in one of our plants, equipped for moderately superheated steam. This choice was largely due to the experience of the Boston Edison Company with similar gaskets on their superheated steam lines.—Editor.

DISCUSSION ON QUESTIONS 24 TO 30, INCLUSIVE, ON SUPERHEATED STEAM

Mr. Wendle—What changes, if any, are necessary in the present piping systems in the smaller stations?

Mr. Rice—It would likely be necessary to change gaskets and put on a greater thickness of covering. The flanges should be covered after it is certain that the joints are tight. Precautions would have to be taken in regard to increased expansion in the steam lines. I think it would be necessary to remove all the brass or bronze rods. We find a rapid deterioration of such rods takes place.

President Davis—Within your own experience, what has been the effect of 100 deg. superheat in old plants?

Mr. Rice—Where plants have been adapted to the new conditions, no trouble has been experienced.

President Davis—Does the saving amount to 10 per cent under ordinary commercial conditions?

Mr. Rice—I do not think there is any question about it—the actual percentage depends on the degree of superheat.

Mr. Wendle—In connection with an engine proposition, where the guarantees covered saturated and highly superheated steam, there was a difference of 3 lbs. of steam per ihp per hour. The question then was, how much coal per ihp was required to operate the superheater, not only under full load, but under average load conditions obtaining in railway service? Can Mr. Rice state how much this amounts to—banking and all other items included?

Mr. Rice—We have made some tests, but owing to the illness of Professor Jacobus, we have not received the final results. In general, about .15 lb. of coal is required to superheat 1 lb. of steam 250 deg. This would cover full load conditions, and our experience is that superheater efficiency if fairly maintained through a wide range.

Mr. Wendle—If the superheater furnace is operated similarly to boiler fires, then, as the load varied or fell off, the superheater fire required would not fall off in proportion. Suppose the average load on a railway engine is 30 per cent of the full load, and that the superheating requires .15 lb. of coal per ihp at full load, amounting to, say, 14 per cent of coal consumption of engine, what variation would there be in the .15 lb. and in the percentage of coal required by superheater, as compared to total engine consumption, under average load conditions?

Mr. Rice—It would be a smaller percentage of the actual coal used with light load than with full load, because your engine economy is decreasing with decreased load and the superheater economy remains more nearly constant.

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31. In 500-kw units, what are the relative merits of steam turbines and modern compound condensing engines in total first cost and operating economy?

The steam turbine is less in original cost than the corresponding size of steam engine when the latter is put upon the same basis of economy and capacity. Aside from being lower in first cost, it requires a comparatively inexpensive foundation, and there is also frequently much saved in the way of space that would be valuable for other purposes.—E. H. Sniffin.

Actual results with modern compound condensing engines, 160 lbs. steam pressure and 26 seconds vacuum:

One-half load, 14.25 lbs. steam per ihp.

Three-fourths load, 13.4 lbs. steam per ihp.

Full load, 12.5 lbs. to 12.75 lbs. steam per ihp.—H.

Comparison between the 500-kw turbo-generator set, running at 1800 r.p.m., and a modern compound-condensing 500-kw engine unit, running at 125 r.p.m., shows a saving in first cost of about 25 per cent to 30 per cent. This comparison covers the steam prime mover, the electric generator, and all auxiliary machinery, with the exception of the condensing apparatus. In addition, there will be a large saving in first cost for—(A) real estate, (B) buildings, (C) foundations, and (D) smaller items due to decrease in floor space needed, weight, and to the steady revolving motion

of turbine. The operating economy will also be better for the turbine, on account of—(A) higher thermal efficiency of the turbine, (B) reduction in cost of maintenance, due to simplicity of turbine construction, (C) reduction in cost for attendance (all oiling being automatic), (D) saving in oil, and (E) saving in boiler feed-water by use of surface condensers. The lubrication is done by a circulating oil pump, and one-half barrel of oil is about sufficient for a 500-kw set. This oil can be used over and over again until deteriorated. As oil cannot come in contact with steam, no precautions are required in using condensing water for boiler supply.—R. E. Moore.

The operating economy of the turbine unit, erected ready for piping, is given unofficially to the editor as practically 10 per cent less than a high-grade compound condensing Corliss engine.

The operating economy of the turbine unit, considered by itself, is better than the compound condensing Corliss unit; but where direct current is the entire output and direct distribution is possible, there is considerable doubt whether the generating cost, including fixed charges, is not more with the turbine unit and necessary rotaries, etc., than with compound condensing Corliss engines.

32. What overload can be carried by a steam turbine under the control of the governor and without opening bypass or turning on additional nozzles by hand?

The steam turbine should be rated at its greatest capacity, for at that point it gives its best efficiency, and then by means of a bypass it is able to carry 50 per cent overload; or it would give the full rating non-condensing.—E. H. Sniffin.

The DeLaval practically limits the economical range under governor control to 10 per cent above rating.

The Parsons to about 25 per cent, as per tests.

The Curtis does not furnish this information.

On any of the above turbines, extreme overloads up to 50 per cent are taken care of by opening additional nozzles or a bypass. —W.

We build our steam turbines to stand, as a whole, a somewhat larger overload than first-class reciprocating engines. Generally the overload capacity will be determined by the generator capacity, which will usually allow 50 per cent overload for two hours. Our turbine has no by-passes.—R. E. Moore.

33. Does a steam turbine require a special or more expensive condensing equipment than reciprocating engines?

The steam turbine does not require a more expensive condensing equipment than reciprocating engines. To obtain high vacuum, like 27 seconds or 28 seconds, of course requires more expensive condensing apparatus than the lower vacuums, but it requires simply to capitalize the difference in efficiency to prove or disprove the desirability of the extra expense. Usually, high vacuum will be found to pay.—E. H. Sniffin.

From statements of turbine and condenser manufacturers, the general demand is for 28 ins. vacuum, using surface condensers, with two stage air pumps, and every refinement to increase this performance. The condenser manufacturers seem unwilling to furnish any actual figures, but advise that the cost of high vacuum equipment is considerably in excess of that usually supplied for reciprocating engines and giving 26 ins. to 27 ins. vacuum.—J. O'Toole.

It does not require a more expensive equipment; but a high vacuum gives a better efficiency in a turbine than in a reciprocating engine.—A.

An examination of curves, deduced by Mr. Emmett, shows clearly the rapid increase in efficiency of the turbine with high vacuum, and therefore the advisability, in most cases, of the best possible condensing equipment.—R. E. Moore.

34. What is best type of condensing equipment for steam turbines?

There is no particular type of condenser equipment specially adapted to the steam turbine. The type of condenser depends upon the conditions, and in steam turbine practice there are no characteristic limitations.—E. H. Sniffin.

It is our standard practice to use surface condensing equipments, the reasons being higher vacuum and possibility of again reusing boiler feed-water.—R. E. Moore.

An examination of a number of the latest steam turbine installations indicates a special preference for—(a) surface condensers placed as close to the turbine as permissible; (b) centrifugal circulating pumps, operating in connection with a syphon system of water piping, and (c) air pumps of either the Edwards or two stage dry air type.

An equipment of this type, with the amount of piping required, was estimated, by a large steam piping and plant contractor, to cost not less than four times as much as a modern central condensing system suitable for a first-class reciprocating engine plant. —Editor.

35. What vacuum is regularly obtained at the engine cylinder in plants equipped with central condensing system?

Twenty-five inches is good.—A.

Twenty-five and one-half inches with central condensing system, and 26½ ins. with surface condenser near engines.—H.

36. What is the relative cost of fan and natural draft cooling towers for condensing systems? What vacuum can be obtained with their use?

Cooling towers cost about $6 per hp, basing hp rating on Corliss engine performance; vacuum obtainable, 24-ins. to 26-ins., depending on atmospheric conditions.—H. C. Reagan.

37. What is best form of automatic atmospheric exhaust valve for use in condensing plants?

Schutte automatic exhause valve is entirely reliable.—F. B. Musser.

W. H. Gullison Company, of Boston, Mass., makes a satisfactory one.—H.

38. What is relative value of run-of-mine bituminous and the small sizes of anthracite coal in regular plant service, including banking, etc.?

With the grades of bituminous and anthracite coal furnished in our market, we can afford to pay 15 per cent more for a short ton of run-of-mine bituminous coal than for a long ton of anthracite coal No. 3 buckwheat.—Paul A. Hess.

If both coals are clean, there is little difference in the heating power. Any difference in results is due to the method of firing.—A.

39. What is the cost per ton, exclusive of fixed charges on equipment, for handling coal from car to boiler room bins with modern coal and ash conveying machinery, assuming an annual coal consumption of 6000 tons to 10,000 tons?

With such a small annual consumption, it is questionable whether the maintenance and fixed charges on any conveying system would not amount to more than cartage. A modern coal and ash conveying equipment, suitable for handling coal for storage, conveying to boiler room bins and for taking out ashes, would probably cost $15,000 to $20,000, and the relatively low interest and depreciation charge of 10 per cent would make the costs of any such system prohibitive, even if the actual operating cost nothing.—W.

Shoveling coal off car, 5 cents a ton; conveying, 1 cent a ton; and handling ashes, 2 cents per ton of coal.—A.

40. What is the cheapest method for handling ashes in plants of 1000 B. H. P. to 1500 B. H. P.?

Dump directly into conveyer.—A.

Ash cars or barrows would probably be the only method at a reasonable cost.—W.

41. Are economizers a profitable investment in a 1000-hp condensing plant?

We consider they are decidedly. In a plant of 1000 hp we would very conservatively say an economizer will save 10 per cent in fuel. Records show over this. The cost of such an economizer installed and bricked in ready for work would be about $5,200. Taking 3.70 lbs. of coal burned per B. H. P. on boilers for 365 days in the year, and coal at $3 on the grates, an electric plant would consume about $18,000 of coal per annum. Ten per cent of this would make a saving of $1,800.

Allowing 5 per cent for borrowed money on $5,200	$260
Allowing 6 per cent for depreciation on $5,200	312
Allowing 1 per cent for maintenance and repairs	78
Allowing 1½ per cent taxes and insurance	78
Total charges against economizer	$728
Ten per cent saving	1,806
Net gain (20 per cent)	$1,078

This, you will see after borrowing money, will pay 20 per cent on the investment, making all fair allowances and being very conservative. In actual practice it would probably be larger. One of the great advantages of economizers on electrical plants is certainly the large reserve power when sudden demands are made for steam, which item it is very difficult to get any figures on, and only those that have experience realize. The fireman will have no difficulty in keeping up steam during heavy peaks of the load when using the economizer, having about an hour's supply of hot feed water. They do not use this up before the peak of the load is off, and even what water is coming in to replace that which is used has the benefit of the gases when the boilers are being worked to their full capacity. Managers of electric power plants know how the steam begins to drop when very heavy loads suddenly come on the boilers and during the period having to rush a lot of cool water into the boilers makes the work harder for the fireman. An economizer overcomes that. Then again, the de-

positing of sediment in the economizer and the saving in repairs to boilers, it is difficult to estimate or get figures on, but both are important advantages in addition to the saving in fuel. With an economizer of the capacity of your boiler plant, you do not have to keep so many boilers partly banked ready for sudden emergencies, as the economizer increases the steam capacity of your plant 10 per cent. The fact also has to be realized that your men have 10 per cent less coal to handle and proportional amount of ash.—Green Fuel Economizer Company.

No.—H.

None, unless you have an excessively high temperature of flue gases.—A.

In answer to inquiries among plants about this size, using economizers, the consensus of opinion was as follows: In an existing boiler plant, the advisibility of adding an economizer was entirely a question of finance and plant conditions, available draft, etc. The fuel saving against fixed charges and maintenance. If a new plant was proposed, then the almost unanimous opinion was the economizer should be considered in connection with boilers in distributing the heating surface to be provided. The general experience being that of the total heating surface required, 70 per cent should be boiler and 30 per cent economizer.—Editor.

42. What is the maintenance cost and a fair depreciation rate on economizers?

The maintenance cost of economizers in the last fifteen years to twenty years has been proven to be under 1 per cent of the original cost of the machine, and a fair depreciation we consider is 6 per cent, as a machine will last with ordinary attention over twenty years. We can show any number of records of machines that we sold over twenty years ago that are working to-day very satisfactorily.—Green Fuel Economizer Company.

43. Have any power houses been heated by hot water supplied from a special section of the economizer run at low pressure? If so, what difficulties have been experienced?

We do not know of any electric power houses that have been heated by hot water from our economizer, but we are heating a number of mills quite satisfactorily by this system.

We have also recently sold economizers, part of which will be used for heating the power house, to the Canadian Pacific Railway Company shops in Canada. There is no reason that we can see, if we can heat mills satisfactorily, which have to be kept at high temperature, why the hot water cannot be used for heating power houses. The way we do this is, we take the cool end of the economizer furthest away from the entering of the hot gases, and use a portion of that for heating the building, by making a constant circulation of the water through it.—Green Fuel Economizer Company.

44. What is the saving in coal when storage batteries are kept floating on the line?

The coal saving depends upon the class of service for which the battery is installed, and is brought about principally by shutting down engines and generators at the power house and improving the load factor. If a battery is installed on the line at a distance from the power house, for saving copper and improving voltage, it will generally affect only a very small portion of the total load, and may have but little effect on the power house operation and economy. If, however, the battery is installed at the power house and is adjusted to take the fluctuations of load off the machine so that the latter can be operated continuously under a steady load equal to their full rated capacity, instead of under a widely fluctuating load whose average is perhaps under 50 per cent of the rated capacity, about half of the machinery required before the battery was installed, can be shut down, thus saving all the constant losses from friction and radiation involved in operating these machines, and the other half will be run at a point of maximum economy. The saving in fuel thus accomplished would probably range from 15 per cent to 25 per cent. The saving will be greater where the units are few in number and the fluctuations excessive, and will be less where the fluctuations of load are small and the number and size of units such that they can be readily adapted to the load.—E. L. Reynolds.

About 15 per cent.—W. S. B.

45. Does the storage battery require any extra or special labor?

In the great majority of cases, the very reasonable amount of attention required to keep a battery in the best condition is secured without the necessity of employing additional or special labor. With a battery of ordinary size, the time that should be spent on it should not exceed four hours or five hours each week. It has very generally been found practicable to detail an employee who is in the service of the company for this battery work without materially interfering with his other duties.—E. L. Reynolds.

A man carefully selected and properly instructed should be placed in charge of battery, and the battery made his first and most important duty.—L.

Requires only a small amount of labor, but the work done should be done thoroughly, care being taken not to neglect even the smallest details. The most important point in the care of battery is that the man who is in charge of the battery must be able to discover and remedy the slightest trouble in the cells before it grows so large that it affects the good working condition of the battery.—G. G.

Yes, it requires an attendant to take gravity and temperature readings and to fill the cells to a uniform level as the water evaporates. This man is, however, able to perform other duties, as the battery only requires his attention about one-third of the day.—F. B. Musser.

46. What records are essential in order to obtain a low maintenance cost on batteries?

In order to keep a battery in the best condition and obtain a minimum maintenance cost, it should be looked after in the following manner:

In the daily workings of a battery, hydrometer readings of a single cell, usually termed the "pilot cell," should be taken hourly, or as frequently as possible, if the battery is so situated that it is impracticable to take the hourly readings (from one minute to two minutes only is required for taking these readings). When a battery is situated at or near a power house or rotary sub-station where an attendant is present, there should be no difficulty in arranging for the hourly readings to be taken. In the case of line batteries where there is no regular attendant, it can usually be found practicable to have at least four of these readings taken in each twenty-four hours. In any case, one reading a day must be taken. In addition to the pilot cell hydrometer readings, the recording voltmeter records must be carefully observed, and the working of the battery as indicated by these charts and pilot cell readings, kept in proper adjustment.

Once a week, when what is termed the "weekly overcharge" is given a specific gravity reading of each cell in the battery should be taken just before the charge is started. If the charging current can be kept constant, a complete set of voltage readings should also be taken; these at the completion of the charge and just before the current is cut off. If the current cannot be kept constant during this part of the charge, then these voltage readings are not of sufficient value to warrant their being taken, and in their stead, another set of gravity readings should be taken as a check on those taken before the charge is started. In all cases, pilot cell gravity readings should be taken at the end of this charge, as well as at the beginning, and as frequently during the charge as possible.—E. L. Reynolds.

There should be a recording voltmeter to record the hourly gravity readings.—F. B. Musser.

Accurate records covering—(A) Specific gravity of acid, (B) recording voltmeter charts, and (C) Input and output of battery. The first two are essential and should cover both charge and discharge.—L.

47. What is a fair maintenance and depreciation charge on batteries, under railway conditions and floating continually on the line?

The maintenance and depreciation charge of such batteries normally operated and properly looked after should not exceed 5 per cent or 6 per cent annually of the original cost of the battery.

The amount of work that a battery does is a factor that should always be taken into consideration when the question of maintenance charge comes up.—E. L. Reynolds.

Based on the experience with large lighting batteries, which are completely charged and discharged regularly, and with which 7 per cent to 7½ per cent of original cost of battery must be set aside for maintenance and renewals, the annual charge against railway batteries, constantly floating on line, should not exceed 5 per cent of original cost, provided proper care is given battery and sufficient capacity is provided.—E.

For floating batteries, 4 per cent to 5 per cent of the original cost should be set aside annually to cover renewal of plates and an additional amount to cover renewal of lead tanks in ten years.—G. G.

48. Is the differential booster system the best mode of controlling charge and discharge in railway service?

This depends also on the character of service in question. In a small plant where the fluctuations of load are rapid and the battery is installed at the power house, the differential booster is the best method of automatic control that has yet been put into practical service. Where the total output of the plant is large and the battery is used principally for peak work, a compound booster is often more satisfactory and less expensive. Where a battery is installed on a line at a distance from the power house, a plain shunt booster at the power house is preferable.—E. L. Reynolds.

Yes, the differential booster is considered the best mode of con-

trol for the charge and discharge or railway service.—F. B. Musser.

49. What precautions are necessary in cutting out batteries and dynamos in case of line troubles or excessive overloads; and also in cutting in batteries and dynamos after disconnection?

In the case of excessive overloads the circuit breakers on the battery and dynamos should open simultaneously if properly adjusted. It is preferable, of course, to have the feeder circuit open rather than throw the entire plant out, but this is not always possible. Where a booster is in operation with a battery, an interlocking device is installed between the circuit breakers of the battery and the booster motor, so that in case the latter opens first, it will trip the former.

In cutting in batteries and dynamos after disconnection, no special precautions are necessary other than to see that the circuit breakers are operating properly and that the voltage is properly adjusted before throwing switches.—E. L. Reynolds.

When cutting out a battery try and get the battery at or as near zero as possible. When cutting in a battery get voltage equalized same as when cutting in a generator.—F. B. Musser.

50. How often must the acid be removed and renewed?

Unless some extraordinary impurity gets into the battery cells, it is not necessary to consider removing or renewing the battery acid or electrolyte. In the use of the battery, there is some slight loss of the acid in the electroyte, but this is so slight that the cost of replacing is almost negligible.—E. L. Reynolds.

Not more than once a year and likely once in two years. Keep the specific gravity of the acid right.—L.

51. What is the best method of removing and replacing the acid in batteries?

As it is not necessary to remove the acid, means for doing this need not be considered. In replacing the slight loss of acid referred to in the answer to question 50, this can be done without special cost by adding new acid to the cells at the usual time for replacing the evaporation by water.—E. L. Reynolds.

For batteries of fair size, either the syphoning or pumping method is generally the most satisfactory. If battery room has been properly designed, the syphoning method is most economical.—W. E.

Syphon with a rubber hose or pump out.—L.

52. Is there any method, within the resources of the ordinary central station, by which the condition of a battery can be determined accurately?

The condition of a battery can always be gaged by an observation of the cell readings and the physical condition of the plates.—E. L. Reynolds.

By keeping careful records of charges and discharges, in connection with the color of the plates and detailed tests.—L.

53. Is there any difficulty with overcharging a floating battery?

Overcharging is extremely bad in any kind of service, in that depreciation of the plates is increased much beyond what it would be if the battery were properly operated. Continually overcharging a battery, frequently overdischarging it or allowing it to stand for long periods completely discharged are very objectionable.—E. L. Reynolds.

DISCUSSION ON QUESTIONS 44 TO 53, INCLUSIVE, ON STORAGE BATTERIES

Mr. Musser—We have an old-time station, very much overloaded, which we expected to supersede with an entirely modern plant. Somewhat over a year ago, additional capacity had to be provided, and it was a question whether a new steam unit or a storage battery be selected to help us out. After going over the matter very carefully, we concluded to put in the battery, because we could install it more quickly and at less expense. We have been running the battery about fifteen months successfully, and thus far with absolutely no expense except a part of the time of one man. The battery has worked regularly, and unless a good deal of deterioration takes place shortly, we do not expect to spend any money on it for some time to come. We have never made any calculation as to just what the battery has saved us, as we are working at a disadvantage. So far, it has met with all our expectations, taking care of the peak of the load during the rush hours, with practically no care or expense.

Mr. Wendle—When we took up the question of labor costs with some of the large battery users, we were strongly advised that it was the best policy to have one man to look after the battery properly. This statement is the result of considerable experience in paying the maintenance expenses under different modes of caring for the battery, and indicates that saving in labor and inspection means increased maintenance costs, not necessarily at once, but ultimately. From the answer made by Mr. Reynolds and the statement of Mr. Musser, the labor item is regarded as an incidental. Is this condition peculiar to a floating battery or railway conditions?

As to depreciation, the large users of lightning batteries have settled on 7 per cent of the total cost of the battery as the proper rate. Their experts reduce this to 5 per cent for a floating battery. Both of these figures are based on giving the best care possible to the battery. With improper attention or unskilled care, the actual maintenance costs have been much higher. In view of these facts, it would be advantageous to hear from any gentleman who has had a battery in service more than six or seven years, and given it the incidental attention implied by the answers received.

Mr. Reynolds—Most of the Edison Companies have very large batteries. In New York there are 30 batteries distributed over the city. The aggregate amount of labor on these batteries is hardly to the point. Take the average street railway; they have one battery or two, one at each station along the line. You cannot keep a man busy watching these batteries. Half an hour during the day will easily cover the work; but it must be good, honest, intelligent attention. Where the battery is in the power station, the engineer generally looks after it. I will be pleased to refer to a large number of stations, operating their batteries in this way, which have had batteries in service five or six years.

Mr. Wendle—The Storage Battery Company has, by reason of supplying most of the repairs, etc., special facilities for learning the exact maintenance costs. Would it be a fair question to ask what, in the experience of your company, is a reasonable depreciation on floating batteries?

Mr. Reynolds—We consider that 5 per cent ought to be ample. It depends altogether upon the man who is running the plant; given the right sort of attention, there is no reason why the percentage should not be lower.

Mr. Wendle—All the percentages have been based on the total cost of battery. In order to put the matter clearly, what would be the percentage based on the cost of plates only?

Mr. Reynolds—I have never figured it out that way.

President Davis—Mr. Reynolds, will you explain how the acid is taken from the tanks in practice?

Mr. Reynolds—The acid is never removed from the battery unless you have a tank that leaks, or are taking a battery out of commission. The simplest method of removing acid is by a rubber hose syphon. It is not necessary to remove the acid in making repairs to plates. This is done while the battery is working. As a matter of fact, we could renew an entire battery, put in an entirely new set of plates, and keep the battery working all the time. If the number of tanks to be repaired is small, say 5 or 6, these batteries could be cut out and repairs made without effecting the battery as a whole.

Mr. Wendle—In answering question 53, Mr. Reynolds states that overcharging is bad. The question is, is there any danger of overcharging, and how is that to be prevented? The overcharging is generally admitted to be bad; but does trouble of this kind occur?

Mr. Reynolds—There is liable to be trouble on this account through careless supervision; it should be easily determined and stopped. We recommend that every plant be equipped with a recording voltmeter, and it is a simple matter for anyone, with proper instruction or experience, to determine the conditions of charge and discharge of the battery from the records. Further, we are desirous that operating companies send us these voltmeter records once or twice a week. This enables us to notice any overcharging and promptly advise the operating company.

The practical adjustment to prevent overcharging is simple. If your battery is on the line, say, 7 miles or 8 miles from the power house, you adjust the shunt booster to give the proper increase of voltage on the feeder supplying battery; in case no booster is used, the main generator voltage is adjusted until overcharging stops. Where battery is at the power house, adjustment of the differential booster will stop trouble, or a few cells may be added to bring up battery voltage.

President Davis—What provisions are necessary for ventilating and what kind of flooring do you recommend for battery rooms?

Mr. Reynolds—The best flooring is vitrified brick. It is slightly more expensive than cement, but is best for permanent construction.

For ventilation, we do not require any expensive or special methods; but simply want a good circulation. In some cases, ventilators are put in the roof; but if a room is well ventilated for ordinary purposes, it will generally meet all requirements. It is essential to guard against having the room temperature too high.

President Davis—What is the effect of too low a temperature?

Mr. Reynolds—A low temperature is better. With ordinary low temperatures, the only effect is to lower the available capacity of the battery; but with a high temperature, the deterioration of the plates increases.

President Davis—How about the side walls and roof construction in a battery room?

Mr. Reynolds—Iron should be kept out of it as much as pos-

sible; ordinary wood construction is satisfactory. If you must use iron on the sides or in the roof, be sure to have it well painted with acid-proof paint.

57. What is the best practice in regard to circuit breakers on high potential generators?

Use oil switches.—H.

The General Electric Company has long advocated the use of oil break circuit breakers for opening or disrupting high potential power circuits. This type of circuit breaker is not only more positive and reliable in action than the air break switch, but the nature of the break is such as to produce much less resonance effect, with attendant decrease in strain upon the insulation. The oil switch is also more compact in form and may be located at points most convenient and suitable for simplicity in wiring and control. In very large installations, the oil switch is the only safe and reliable means of disrupting the circuit.—R. E. Moore.

58. Are time limit circuit breakers satisfactory?

Yes.—H.

59. In railway sub-stations, is it advisable to connect both the A. C. and D. C. sides of rotaries in multiple?

Not in my judgment.—H.

When rotary converters are connected together at both the alternating current and direct current sides, local interchange of current will take place between the machines unless the brushes of all the machines are set in exactly the same position. On high frequency rotary converters a variation of 1-16-in. in the setting of the brushes may set up local currents between the machines exceeding their rated capacity. The only effect of such local currents is to cause excessive heating. We have seen cases where the temperature had been more than doubled due to this cause, and of such degree as to seriously threaten the life of the insulation. It is a very simple matter to avoid metallic connections between collector rings, either by having a separate bank of transformers for each rotary converter, or else providing a separate secondary winding for each rotary in case a number of machines are run from a single group of transformers.—R. E. Moore.

60. In a complete transmission system, what is the best method for automatically disconnecting main generators, rotaries, etc., in case of line or apparatus trouble?

Oil switches in connection with circuit breakers.—H.

The General Electric Company's practice is to install automatic oil switches with instantaneous overload relay in alternating current rotary converter circuits and in-coming lines at the sub-stations. Time limit relays are placed on the automatic oil switches controlling the outgoing lines from the main station, and oil switches for generators are made non-automatic. With this arrangement a momentary short circuit will only disconnect the rotary converters in the sub-station affected. If the short circuit hangs for a length of time exceeding that for which the time limit relay is set, the line switches at the power station will open. If the trouble continues and is likely to injure the generators, the main generator switches may be opened by the attendant.—R. E. Moore.

61. For combined railway and lighting plants, using 60 cycles main generators, is it better to use rotaries or motor generators for the lighting service?

Use motor-generator sets, consisting of synchronous A. C. motor direct coupled to D. C. or A. C. generator. By this means voltage fluctuations in main generators, due to railway load, are not carried into the lighting system as with rotaries. With synchronous motor and D. C. generator, the fluctuations will be due to change of frequency, which can be kept within limits of good practice. There is also a great advantage in the independent regulation of lighting generators by simple field regulation.—W.

Our practice is to use 25 cycles for combined lighting and railway plans. This frequency is better suited to the design and operation of rotary converters. While 60-cycle rotaries may be built to give satisfactory shop tests and to even operate satisfactorily under service conditions favorable to their use, their necessarily high commutator speeds make them inherently more sensitive than 25-cycle rotaries. In practice, a 25-cycle rotary will respond successfully to demands considerably in excess of its guaranteed capacity without injury and with minimum attention, while a 60-cycle machine must be given skilled and careful attention if subject to heavy fluctuations, as railway loads are usually very fluctuating, it is advisable to use motor-generator sets for the lighting service in order to secure satisfactory regulation on the lights.—R. E. Moore.

62. Are 60-cycle double-current generators commercially satisfactory for combined railway and lighting service?

It is doubtful whether the service is entirely satisfactory.—H.

Regarding the successful operation of 60-cycle generators in combined railway and lighting service, it may be said that with the steam turbine this is easily accomplished and is being done successfully.—E. H. Sniffin.

We do not consider the 60-cycle double current generator satisfactory for this service, due to the impossibility of securing satisfactory regulation where the load is at all variable.—R. E. Moore.

63. In a 500-kw to 1000-kw plant, using compound-condensing Corliss engines and direct-connected generators, what is a good monthly average steam consumption or coal cost per kilowatt-hour?

Large modern plants are operating on 24 lbs. of steam per kilowatt-hour, with total generating cost .556 cent per kilowatt-hour. In a comparatively small station, 500 kw to 1000 kw, 30 lbs. to 32 lbs. of steam per kilowatt-hour, and a total cost of 8-10 c per kilowatt-hour would be good.—H.

RAILWAY EMPLOYEES' DUTIES AND REWARDS

Following is the text of a letter prepared by George F. Chapman, general manager United Railroads of San Francisco, for the instruction of applicants for positions and newly-employed platform men on that company's system. Copies of this letter have just been circulated among recent employees, as a basis for them to work upon:

To Applicants and Employees—The chief requisites necessary to obtain employment and to retain your position with the United Railroads of San Francisco are these:

First. You must be honest. The dishonest man cannot continue long in any service.

Second. You must be patient and polite to the public. The company realizes that frequently passengers may be unreasonable in their demands or exasperating in their manner, and that at times it will require an effort on the part of the employee to refrain from resenting what appears to be an insult or a lesser imposition. But the ability to control your own temper is one of the very necessary qualifications of the service.

Third. You must never lose sight of the fact that your recklessness, your carelessness, or your negligence may render you responsible for the loss of a human life. Never take a chance.

Fourth. Observe strictly the general rules of the company. They have been carefully drawn to protect life and property, and to give the public the best possible service.

The United Railroads of San Francisco pays to its motormen, gripmen, drivers and conductors the highest scale of wages paid to men in similar employment on any system of similar size in the United States. The employee who observes the four cardinal rules above set out may feel assured:

First. That he may have continuous employment with this company. That he is as much a part of the company as are any of its officers.

Second. That no political or outside influence can unjustly deprive him of his position.

Third. That in making promotions the company will give preference to its most faithful and competent men where it is possible to do so. The highest position in the gift of the company is open to the qualified employee.

Fourth. Special meritorious acts by men with a good record will always be recognized.

The new employee on entering the service may find men who do not come up to the standard set out above, and he may believe that such delinquents are successfully deluding the company. The man who indulges this thought deceives no one but himself. The great majority of our employees are honest, capable, industrious men. There are some, as a matter of course, who are indifferent, but the new employee will discover that such men seldom last long.

The company is more than willing to deal fairly with its employees, and it demands in return that employees deal fairly by it. When the company takes you into its employ it is reposing special trust and confidence in you and those who have endorsed and stood sponsor for you, a trust which I hope the future will more than justify, and that you may ever stand on our records as honest, faithful, careful employees.

G. F. Chapman, General Manager.

The Northern Ohio Traction & Light Company has ordered ten new interurban cars and will install a limited service between Cleveland and Akron. Other Cleveland roads are figuring on adopting this plan, which has been developed with great success by the Cleveland, Painesville & Eastern Railway.

FINANCIAL INTELLIGENCE

Wall Street, Oct. 21, 1903

The Money Market

The general features of the money market remain substantially the same as a week ago. The usual autumn demands from the interior continue to be withheld in a truly astonishing manner. In explaining this singular situation, some account must now be taken of the slackening trade activity throughout the country, which means, of course, a diminished pressure upon banking capital. Without much doubt this is a partial explanation for the small movement of currency out of this city. But the main reason must still be found in the exceptional backwardness of the crop-moving, which has the effect of postponing the customary drawing down of New York deposit balances by the interior banks. Last week net shipments of currency out of town were estimated at less than $1,000,000—considerably less than in either of the two weeks before. Meanwhile payments by banks to the Treasury are reflecting the falling off in customs revenue, due to the shrinkage in the volume of our merchandise imports, which, according to the latest statement, were $5,800,000 less in September than in the same month of 1902. Contrary to all precedent at this season the Treasury's disbursements, in this city at least, are steadily falling behind its collections, and the result is that the banks have been able for the last few weeks to add materially to their cash holdings from their operations with the government. With holdings of specie and legal tenders increasing rather than decreasing, and with loans contracting under the influence of Stock Exchange liquidation, the movement of surplus reserve continues to be highly favorable. Last Saturday found a further gain in this item of $850,000, and the account now stands at the highest level of the season in recent years. The strong position of the banks has naturally made itself felt in lower rates for money. Call money has for some time past been purely nominal; it is quoted in Wall Street at 2 per cent and 2¼ per cent. The more important fact is the lowering of time money rates, which for sixty-day loans have fallen since the middle of September from 5½ per cent to 4½ per cent. It is perfectly easy now to obtain accommodation on good collateral at 5 per cent and under over the first of the year. So long as speculative demands continue as light as they are at present, so long as mercantile requirements are curtailed, and so long as the banks continue to discourage the placing of new loans by the railways and other corporations, the money problem, as it was understood and feared six months ago, may be said to have disappeared. Nor is the foreign exchange position a matter of such solicitude as it was a short while ago, for there is no need of gold imports from Europe when the supply of money at home is so plainly sufficient for all ordinary purposes.

The Stock Market

A sharp and general recovery has occurred in the course of the week's trading on the Stock Exchange. The only interruption to the movement came on Monday, when the failure of two important Baltimore trust companies was announced. But yesterday, after it had been ascertained that these suspensions were due entirely to local causes, and that there was small probability of the difficulties spreading, prices resumed their upward tendency with some enthusiasm. The explanation for the week's improvement lies chiefly in the oversold condition of the market, especially in the railroad share list—a fact which has been patent to close observers for some time past. It is evident, in the first place, that the absorption of stocks by strong interests has gone on with its usual secrecy, and that, as always happens, the majority of onlookers have entirely underestimated its actual extent. It is equally plain that the forced liquidation which played so large a part in the demoralized condition of July and August, and which appeared again a fortnight ago confining itself to the industrial shares, has run its course. And in the third place, a short interest of considerable dimensions developed, which has found it difficult after the reduction in the available supply of stocks from the other two causes mentioned, to beat an orderly retreat. These simple technical conditions afford a sufficient explanation for the sharp recovery which has been witnessed during the past week. So far as they relate to the outside situation, they point very clearly to the belief in higher financial circles that the decline in the standard stocks had gone as far as was called for by the extraordinary depressing influences of the past twelve months, and that in view of the successful crop season, the assured prosperity of the agricultural regions and the favorable outlook for railroad earnings, particularly in the West and South, there was abundant warrant for a higher level of prices. No conservative person expects a much further advance for the present. The uncertain position of trade, the possibility of fresh irruptions of the labor party, and the sensitive state of the money market are all firmly opposed to any new speculation for the rise. But financial sentiment naturally finds sufficient reason for cheerfulness in the recent proofs that the market as a whole has turned the corner after its long decline.

There is not much to be said concerning the movement of the local traction stocks beyond what has already been said concerning the course of the general market. All these stocks have simply drifted with the tide. They rose as fast as any during the general recovery at the end of last week, and fell off as rapidly as any when the general market turned weak on Monday. The bear party has devoted a good deal of attention to Brooklyn Rapid Transit, on the theory that the speculative interests particularly identified with the stock are in no position to give it very energetic support. Gossip is still very free with the names of certain street railway capitalists who are supposed to have dropped an enormous sum during the recent break. The notion that these persons have been forced to part with some of their investment holdings and that they are unable to afford much protection against speculative attacks on their properties, accounts for the persistent pressure which is being kept upon Metropolitan shares. Manhattan Elevated, as usual, has acted the best of the traction group. Specialists bear continual witness to the steady investment absorption of the stock, which, they say, is fast reducing the floating supply in the market to insignificant dimensions.

Philadelphia

The only reflection which the financial disturbances at other cities had in the market for Philadelphia street railway stocks, was a further sharp decline in Philadelphia Company shares. This issue is held more or less extensively in both Baltimore and Pittsburg. It was liquidation rather from Baltimore which caused the drop in the common stock Monday from 37¼ to 35⅛. This latter figure repeated the low record made several weeks ago. Philadelphia preferred suffered less, losing ¾ to 43. In yesterday's general recovery the common went back to 36½. Among the other traction specialties, the week's movement took uniformly the direction of the general market; prices rose on Friday and Saturday, dropped back on Monday, and rose again yesterday. Union Traction went from 42½ to 43, then down to 42½, then up to 42⅞; Philadelphia Rapid Transit sold as low as 11⅛ and as high as 11⅞; Philadelphia Traction ranged between 93½ and 94, and American Railways between 41¾ and 42. Scattering sales were also reported in Consolidated of New Jersey at 60, and Hestonville Passenger preferred at 72⅛.

Chicago

The interesting but complicated game between the city and the street railroad companies, in which a liberal franchise extension is the stake, goes on apace. Moves and countermoves, proposals and counter-proposals have been made during the week, but so far as the public knows anything to the contrary, the negotiations are no nearer their termination than they were a week ago. If the market for the traction stocks was a sign of anything in this connection the absolute cessation of all trading which has recently been witnessed, might be interpreted as an indication that the investing public have become apathetic toward the franchise muddle, and have left this part of the investment field in disgust. Not a sale is recorded in any of the surface line securities since a week ago Wednesday. A few trades have been reported in Metropolitan Elevated at 18, and two single transactions, one in South Side Elevated at 91, the other in Lake Street at 4⅛. With these exceptions the week has been a total blank.

Other Traction Securities

Baltimore has been the center of interest among the outside markets this week, on account of the troubles which led to the suspension, on Monday, of two of the leading trust companies of that city. All the securities having their home market on the Baltimore Exchange suffered severely. United Railways stock

and bonds were the only traction issues which come within that category, and they were the only ones accordingly to feel the force of the financial storm. The common stock sold down to 8, and the income bonds to 57¾, both of which were new low records for the year. The general 4s were not as weak, declining only from 90½ to 89¾. All three securities rallied rather sharply in yesterday's trading. Other Baltimore sales for the week included Atlanta Consolidated 5s at 103, City & Suburban (Baltimore) 5s at 110¼, Charleston Street Railway 5s at 104, and Anacostia & Potomac 5s at 90. Nothing of particular consequence has happened in the week's dealings in Boston. Massachusetts Electric, on a small volume of business, sold as low as 18 and as high as 20, ending yesterday at 19¼. The preferred sold between 77¼ and 78. West End common dropped from 91 to 90, the preferred sold at 109, and Boston Elevated between 136½ and 138. On the New York curb Interborough Rapid Transit, after touching a new low record at 80½, rallied sharply to 83, then fell again to 81, on the news received yesterday that the motormen on the elevated lines will probably go on strike. Washington Traction common lost a point to 8, and Brooklyn Rapid Transit 4s sold at 77½. This was all there was to the week's traction dealings, so far as the local curb market was concerned.

Compared with the business of recent weeks there was what might be called quite a run on Detroit United on the Cincinnati Exchange. Following the quotations from New York the stock opened the week at around 60, and declined steadily to 54¾. Around this point it came into pronounced demand, and some 1500 shares changed hands, the buyers being bargain hunters who were anxious to pick up a stable 4 per cent security at such prices. As the result of this demand the quotation rose steadily, and closed the week at 60½. Toledo Railway & Light sold to the extent of several hundred shares at 19 and 20, the lowest figure in many months. Cincinnati Street Railway was firm at around 128½, sales being small scattering lots. A small lot of Miami & Erie Canal changed hands at 6¼, which is a slight advance over previous figures. The future of this company remains clouded in doubt. Several lots of Cincinnati, Dayton & Toledo 5s sold at 82.

At Cleveland, Northern Ohio Traction & Light was the leading issue, about 500 shares selling at 15 to 15½, which is considered a very low figure. Cleveland Electric ranged from 64½ to 67, sales being 380 shares. During the previous week the stock made a low record of 63. It is believed that large local holders are tendering their support on this stock in order to protect stocks put up against loans in local banks. Northern Texas Traction sold at 30, a decline of two points. A sale of Lake Shore Electric common at 5 attracted some attention, and there were plenty of bidders around 6, but no further offerings within range. This property is making on an average of a 35 per cent gain in earnings during the last few months.

Security Quotations.

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

	Closing Bid	
	Oct. 13	Oct. 20
American Railways	41	41¾
Aurora, Elgin & Chicago	—	—
Boston Elevated	136½	137
Brooklyn Rapid Transit	31⅞	32½
Chicago City	170	170
Chicago Union Traction (common)	4	3½
Chicago Union Traction (preferred)	30	25
Cleveland Electric	65½	65
Consolidated Traction of New Jersey	59	60
Consolidated Traction of New Jersey 5s	103	103¾
Detroit United	55	55
Elgin, Aurora & Southern	a56	a45
Lake Shore Electric	a5	5¾
Lake Street Elevated	4	4
Manhattan Railway	130	130¼
Massachusetts Electric Cos. (common)	18	18¾
Massachusetts Electric Cos. (preferred)	77½	77
Metropolitan Elevated, Chicago (common)	17	18
Metropolitan Elevated, Chicago (preferred)	53	55
Metropolitan Street	103	109½
New Orleans (common)	7	7½
New Orleans Railways (preferred)	a30½	28
North American	72	73¾
Northern Ohio Traction & Light	13	15⅛
Philadelphia Rapid Transit	11¾	11¾
Philadelphia Traction	93½	93⅝
St. Louis Transit (common)	13¼	14½
South Side Elevated (Chicago)	91	90¼
Syracuse Rapid Transit	a30	—
Syracuse Rapid Transit (preferred)	73¾	73¾
Third Avenue	100	103
Toledo Railway & Light	a20	17½
Twin City, Minneapolis (common)	80½	83
Union Traction (Philadelphia)	42¼	42⅞
United Railways, St. Louis (preferred)	61	51

a Asked.

Iron and Steel

"The Iron Age" blast furnace statistics for September showed production to have been less than in August, but by a trifling amount only. The September total was 1,556,717 tons, against a total of 1,571,126 tons for August. It is, however, to be recollected that the concerted efforts to restrict the output of pig-iron were not begun until after the first of October; consequently, the present production is undoubtedly considerably less than it was, according to the latest investigations of the "Iron Age." With this reflection the fact that stocks of iron on hand again increased by 85,000 tons during the month of September, is not as serious as it would otherwise have been. In the finished iron and steel branch there is a fairly encouraging demand for steel rails for next year's delivery, and also for merchant pipe and wire products. But in sheet steel and tin plate, as well as in structural material, business is decidedly slack. Quotations are as follows: Bessemer pig-iron, $15.85 a ton; Bessemer steel, $27, and steel rails, $28.

Metals

Quotations for the leading metals are as follows: Copper, lake, 13⅛ cents; tin, 25½ cents; lead, 4½ cents, and spelter, 6 cents.

REFERENDUM FOR CHICAGO

At the meeting of the Chicago City Council, Monday, Oct. 19, an ordinance was passed to submit the Mueller municipal ownership law to a vote of the people at the election next spring. The Mueller law is the law passed by the last Illinois Legislature empowering cities to own and operate street railways. It becomes a law as regards any city only after it has been voted upon and carried by the people of that city at an election. The submission to the voters at the election next spring will probably result in its adoption as a law for Chicago, if the result of the ballot held two years ago is any indication. The adoption of the law by Chicago does not have any immediate bearing on the settlement of franchise matters in Chicago, as there is no likelihood that the city will take advantage of its power to own and operate street railways for some years to come. The present companies will probably be given renewed franchises for twenty years, and it will be left for the city at the end of that period to decide whether to take over the street railway properties or to grant franchises again.

NEW RAPID TRANSIT SCHEME FOR NEW YORK BRIDGES

Plans for connecting the transportation systems of Manhattan and Brooklyn by extending elevated and surface lines over the four East River bridges have been submitted to Mayor Low by Bridge Commissioner Lindenthal. Three extensions of Long Island lines to Manhattan are proposed, the first to run over Manhattan Bridge from Canal Street, thus crossing all north and south lines. From the Williamsburg Bridge the Brooklyn Rapid Transit system is to be extended along Delancey Street to the Bowery or to Elm Street, in Manhattan. A third branch of the Long Island lines is proposed over the Blackwell's Island Bridge to a plaza 100 ft. wide, extending from Sixtieth Street to Fifty-seventh Street and parallel with Second Avenue, Manhattan. Mr. Lindenthal advises two extensions of the Brooklyn Rapid Transit elevated over the Manhattan Bridge. It is recommended that all these extensions should be constructed by the city and leased to the Brooklyn Rapid Transit Company. The Mayor will present the plan to the Rapid Transit Commission for its consideration.

The Springfield Street Railway Employees Relief Association, of Springfield, Mass., has a membership of 340. It received during the year $2,839.75 and paid benefits amounting to $2,830. The association has $509.75 in its treasury.

ANNUAL REPORT OF THE METROPOLITAN ELEVATED OF CHICAGO

The annual report of the Metropolitan West Side Elevated Railroad, of Chicago, for the year ending June 30, 1903, was filed at Springfield last week. As compared with the preceding year it shows an increase of $266,056, or 14½ per cent, in gross earnings. But operating expenses increased $256,971, absorbing practically all the gain in gross. Comparing expenses in detail, maintenance charges show an increase of $85,127, while cost of conducting transportation increased $157,962, or 28 per cent. The cost of conducting transportation per passenger carried was 1.75 cents this year, against 1.57 cents last year, due to higher wages, increased cost of material, etc. Charges were some $64,000 greater than the year before, due mainly to increase in bond interest paid, thus the net amount available for dividends was equal to only about 2 per cent on the outstanding preferred stock. It should be noticed that the items in this report which cut down the surplus—that is, high operating cost and increased interest charges—were met in the last annual report, covering the fiscal year ending Feb. 28. Hence the next annual report may be expected to make a much better comparison with its predecessor than this June 30 report makes with the one before it. The detailed statement of the earnings follows:

Year ending June 30—

	1903	1902
Whole number passengers	40,551,301	35,372,909
Daily average	111,099	96,912
Earnings—		
From passengers	$2,025,837	$1,768,525
Miscellaneous	68,171	59,428
	$2,094,008	$1,827,953
Operating expenses—		
Maintaining way	60,964	49,787
Maintaining equipment	162,467	88,517
Conducting transportation	716,055	558,093
General	97,695	84,813
Total operations	$1,037,181	$781,210
Net earnings	1,056,828	1,046,743
Other income	10,462	5,678
Total income	$1,067,290	$1,052,421
Charges—		
Interest	467,153	406,569
Rental	235,351	209,461
Taxes	140,870	175,334
Miscellaneous	58,269	46,653
Totals	$901,643	$837,817
Balance of stock	165,646	214,604
	(3%)	(3%)
Preferred dividend	261,243	261,243
Surplus for year	*$95,597	*$46,639
Per cent op. to gross	49.5	42.8

* Deficit

BALANCE SHEET, JUNE 30.

ASSETS

	1903	1902
Cost of road and equipment	$29,078,580	$28,087,071
Securities of company owned	483,900	483,900
Cash	197,817	258,227
Current assets	163,570	75,783
Miscellaneous accounts	16,235	34,452
	$29,940,102	$28,939,434

LIABILITIES

Capital stock	$16,500,000	$16,500,000
Bonds outstanding	13,000,000	11,500,000
Interest accrued	223,467	163,467
Rent accrued	8,350	8,350
Taxes accrued	32,508	31,901
Unpaid coupons	8,634	38,870
Loans	.....	400,000
Accounts payable	118,915	155,455
Reserve accounts	5,147	2,714
Profit and loss	43,079	138,677
	$29,940,102	$28,939,434

ADDITIONAL TIME FOR EVERETT-MOORE SYNDICATE

A meeting of the creditors of the Everett-Moore syndicate and the bankers in charge of the syndicate's affairs was held last week, and an agreement was reached by which the creditors have granted a further extension of time to April 1, 1905, in order to give the syndicate that much additional time to clear up all outstanding indebtedness. The tightening of the money market and the general depression in all stocks made it impossible for the syndicate to float its securities in time to meet all the obligations devolving upon it by the time specified—July 1, 1903. This condition has been known for some time by the bankers' committee, and it was thought best that the opinion of all the creditors should be obtained as to what should be done. This action was hastened by the fact that one or two of the creditors of the Federal Telephone Company had been pressing matters, and one of them recently obtained a judgment against the company.

It developed at the meeting that since the bankers' committee took charge of the syndicate's affairs, Jan. 1, 1902, more than $12,000,000 of obligations have been paid off, and in addition, about $2,000,000 of new money has been put into the various concerns. The traction properties have been entirely cleared up, and the telephone properties are in a fair way to right themselves. There still remain about $3,500,000 of obligations outstanding, nearly all against the telephone properties. Several plans had been proposed for refinancing the Federal Telephone Company, but owing to the stringency of the money market these plans had been interfered with, hence the necessity for the extension.

To facilitate administrative action a committee, composed of H. R. Newcomb, representing the bankers; Frederick Dickson, representing the Federal Telephone Company, and H. A. Everett, representing the Everett-Moore syndicate, was appointed to act for the bankers' committee and the syndicate in all matters pertaining to the different properties. The bankers' committee remains in existence for consultation purposes, and it will continue to act in such cases of emergency as are beyond the scope or power of the special committee. The status of the various traction properties controlled by the Everett-Moore syndicate was fully outlined in the STREET RAILWAY JOURNAL of May 2, 1903, and there have been no material changes since that time.

REPORT OF THE ACCOUNTANTS' ASSOCIATION

The verbatim report of the Saratoga Convention of the Street Railway Accountants' Association of America has just been received, and will be welcomed by all those who follow the important work accomplished by this Association at its annual meetings. The papers and discussions are printed in full. In addition the volume contains a list of the attendants at the Convention, constitution and by-laws, list of members, standard classification of accounts and form of report, a very valuable summary of the reports of previous meetings, and a handsome half-tone portrait of the president, Henry J. Davies, of Cleveland.

NEW TURBINE AND ALTERNATING CURRENT RAILWAY MOTOR PATENTS

Among the patents granted last week is one issued to E. H. Porter and B. Currier, of Philadelphia, on a combination of a steam turbine and a multiple phase generator, in which several interesting points are noticeable.

In previous practice it has been customary to have the steam turbine and generators two separate machines. The inventors of the present machine propose the electrical generation direct from the turbine blades at a comparatively low voltage. The patent issued describes a multiple set of rotors of an asynchronous induction generator carried on the turbine blades, all acting inductively on a stationary armature, no insulation being required except the fire and moisture proof insulation around the armature bars.

All the losses coincident with electric generation are in this machine returned to the steam itself. In fact, the machine is so designed as to materially increase in it the ordinary electrical losses, thus maintaining the turbine blades at a slightly increased temperature, thus avoiding losses due to the condensation of moisture at the turbine blades and thereby increasing the efficiency of the turbine. It is proposed to start the machine either as an induction motor, running in conjunction with other generators, then by applying full steam pressure to make it take its full share of the load, or it can be brought to approximate synchronism by the turbine and simply thrown in without accurate adjustment.

The same inventors have also been awarded a patent recently on a variable speed polyphase type railroad motor, in which the speed variation is secured by changing the number of poles instead of the insertion of resistances, as heretofore the practice.

The motor is designed for a low voltage current, and is either of the synchronous or induction type.

The winding of the stator consists of heavy copper bars, all connected and fed in multiple from the low-tension mains. By its multiple arrangement each bar or set of bars can be readily connected or disconnected from either phase of the low tension supply circuit, and according to the relative position of these bars with regard to the different phases, the number of bars per phase per pole, and therefore the number of poles can be varied.

It is proposed to operate these switches by compressed air, by means of a suitable controlling valve built in conjunction with the motor itself, and connected with the train line pipe.

If all the switches were thrown at one instant there would undoubtedly be serious burning at the contacts, but it is claimed by the designers that the transferring of any bar from one phase to another is accomplished without spark, owing to the large number of bars in multiple with it, at the time the bar is temporarily removed from the circuit, especially with the low frequency current for which the motor is designed. On account of the heavy stator bars and low voltage requiring comparatively light insulation, it is thought temporary variation of the number of bars from a uniform number to each pole and phase during the progressive change of speed, will have no injurious effect.

TROLLEY BEATS LOCOMOTIVE

That little stretch of the Mohawk Valley, N. Y., between Little Falls and Utica promises to enter the field now held almost exclusively by the Western steam and electric railway companies for the prize as the battle-ground for tests of speed between the two motive powers. Over the stretch of country just mentioned the Utica & Mohawk Valley Railway operates an electric line, and its tracks are paralleled by those of the New York Central Railroad. Although the rivalry between the engineers and the motormen is most keen, and the "try outs" between the powers have been more or less frequent, it was not until a few days ago that the opportunity was presented for a test that was perfectly fair. Simultaneously engine 945 of the Central, which used to draw the Empire State Express, and car No. 18 of the Utica & Mohawk line, capable of 60 miles an hour, pulled out of Little Falls. No formal declaration of hostilities was needed. The struggle was on at once. The locomotive soon was setting a hot pace, but the little trolley—little only by comparison with the train of seven cars—was not to be shaken. Indeed, when it seemed to those on board that it had reached the maximum of speed another link was suddenly let out, and the steam monster was slowly but surely passed. Then the little victor with its merry passengers—for they had enjoyed the run immensely—was compelled to slow up, for Small's Gulf suddenly loomed up and a stop had to be made there.

CHICAGO CITY RAILWAY LABOR MATTERS

In last week's issue the extravagant demands made by the union employees of the Chicago City Railway Company were published and General Manager McCulloch's answer thereto and refusal was given also. Since then the men held a meeting and voted to appeal the matter to President D. G. Hamilton and the directors, and in the event of failure to secure concessions, to take a vote of all the union employees as to whether to strike or not. As might be expected, President Hamilton refused in advance to entertain any such propositions, and in an interview in the Chicago "Record-Herald," immediately following the meeting of the employees, stated the company's position very clearly. He said:

"We cannot give higher wages and have the company continue as a paying concern, and we certainly will not run ourselves into bankruptcy. A year ago we increased the men's wages 4 cents an hour, from 20 cents to 24 cents. Now they want 28 cents. The raise given last year has meant an added output of $400,000, while our coal bill increased $300,000. The receipts from additional passengers carried, in other words, the increase in our business, was not enough to pay for the additional wages alone.

"In addition to the increased wages the union demands a great many other things. One clause gives the union members complete control of the selection, employment, retention and discipline of all employees, while another provides for an arrangement of time-tables considering only the convenience of the operatives.

"To the principle of arbitration in a third clause the company has assented in the main. But to grant all the numerous minor demands made would be equivalent to turning over our whole organization, rolling stock and everything else, to division 260 of the Amalgamated Association of Street and Electric Railway Employees of America."

RECEIVER FOR CHICAGO MOTOR VEHICLE COMPANY

The Chicago Motor Vehicle Company, of Chicago, with a factory at Harvey, Ill., was placed in receiver's hands by Judge Kohlsaat on Oct. 13. Edwin C. Potter was appointed receiver. This company has manufactured gasoline automobiles for some time, and recently has started to make gasoline passenger coaches for railroad use, as previously mentioned in these columns.

STREET RAILWAY PATENTS

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

UNITED STATES PATENTS ISSUED OCT. 13, 1903

741,020. Pneumatic Safety Appliance for Street Cars, etc.; John Enright, Cleveland, Ohio. App. filed Dec. 19, 1902. Relates to means for removing obstructions from the car track by compressed air.

741,032. Car Seat; Henry S. Hale, Philadelphia, Pa. App. filed April 2, 1902. Details of construction of a reversible car seat.

741,033. Car Seat; Henry S. Hale, Philadelphia, Pa. App. filed Jan. 14, 1903. Details of a reversible car seat.

741,048. Track-Sanding Device for Tram Cars; Charles W. Angridge, Pueblo, Col. App. filed Dec. 10, 1902. Sand hoppers located beneath and at each side of the car platform provided with nozzles and valve openings, a transversely disposed rod, normally spring-elevated, and bent to limit its vertical movement, valves carried by the rod controlling the openings, and a branch extending above the platform and provided with a foot-rest.

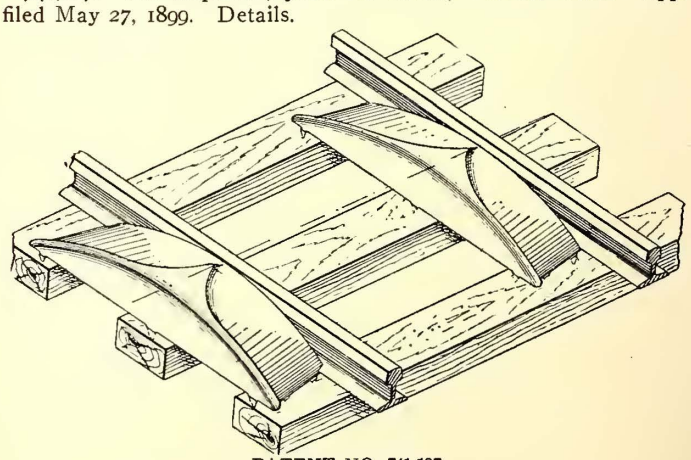
741,097. Street Railway Switch; Walter J. Bell, Los Angeles, Cal. App. filed Aug. 5, 1902. The switch is actuated by a pneumatic piston, an electro-magnetic valve controlling the air.

741,116. Track-Sanding Device; Murry A. De France, Newark, Ohio. App. filed April 22, 1903. A sand-box, a distributing pipe for connection with the sand-box, means for effecting the delivery of sand, and a perforated pipe passing through the sand-box and adapted to supply jets of air thereto for loosening the sand.

741,118. Means for Operating Railway Switches; Joseph O. Dimmick, Denver, Col. App. filed Jan. 21, 1903. An oscillatory shaft is made the core of an electro-magnet, the poles thereof being projected toward the switch point and then rotated, thereby causing the point to follow the poles by magnetic attraction.

741,123. Electrical Track Instrument; Taylor T. Fogel, Allentown, Pa. App. filed Aug. 8, 1902. The wheel of a passing car acts as an armature in the magnetic field of an iron core which is magnetized by an electro-magnet and causes the electro-magnet to oscillate in the direction of the car's course, whereby a signal is operated to indicate the direction of movement of the car.

741,127. Car Replacer; John D. Green, Toledo, Ohio. App. filed May 27, 1899. Details.



PATENT NO. 741,127

741,160. Brake-Operating Device; Michael O'Brien, Chicago, Ill. App. filed March 25, 1901. The brake handle has engagement with the brake-rod by means of a ratchet, whereby the brake may be applied by a to-and-fro movement of the handle.

741,171. Wheel Fender; Claud H. E. Schenck, Cleveland, Ohio. App. filed July 29, 1903. Details of construction.

741,433. Switch-Throwing Mechanism; Norval J. Anderson, Pittsburg, Pa. App. filed May 18, 1903. Two treads mounted in

a casing between the rails are connected with the switch point in such a manner that when one tread is depressed the switch will be thrown in one direction, and when the other is depressed the switch will be thrown in the opposite direction.

741,571. Railway Switch and Operating Means Therefor; Arthur J. Backer, Syracuse, N. Y. An electro-magnet is inclosed in a chamber in the switch point, the magnet being fixed with respect to the switch point and when energized attracts the latter and moves it.

ENGINEERING SOCIETY

The October meeting of the American Institute of Electrical Engineers has been assigned to the discussion of two papers on electric traction, namely, "The Conditions Governing the Rise of Temperature of Electric Railway Motors in Service," by Cary T. Hutchinson. Discussion will be participated in by John Balch Blood, Louis Duncan, A. H. Armstrong; and "A Graphic Recording Ammeter and Voltmeter," by A. H. Armstrong.

PERSONAL MENTION

MR. HOWARD B. RHOADS, general superintendent of the Columbia line of the Conestoga Traction Company, of Lancaster, Pa., has resigned. Mr. John G. Livingston is temporarily in charge of the line.

MR. J. P. CLARK, formerly manager of the Terre Haute Electric system for Stone & Webster, of Boston, and later representing the same interests at Dallas, Tex., is to become manager of the Indiana Union Traction Company's lines at Fort Wayne, Ind.

MR. LOUIS E. PELLISSIER has been elected treasurer of the Holyoke Street Railway Company, of Holyoke, Mass., to succeed Mr. William R. Hill, resigned. Mr. Pellissier has been with the company thirteen years, beginning work as a conductor and later becoming a bookkeeper.

MR. J. H. MERRILL, the retiring general manager of the Ohio Central Traction Company, was surprised a few evenings ago by a call from nearly all the employees of the company. As a token of their esteem the employees presented their former associate with a fine Morris chair. Mr. Merrill has become auditor of the Western Ohio Railway.

MR. J. W. BROWN, superintendent of the McKeesport lines of the Pittsburg, McKeesport & Connellsville Railway Company, has been appointed to succeed Mr. Thomas Elliott as general superintendent of the system, the latter going to England. Mr. Brown's headquarters will be in Connellsville. Mr. W. E. Moore will be general manager of the company.

MR. R. P. SCALES, formerly general manager of the Consolidated Car Heating Company, died last week. Mr. Scales had been identified with the Consolidated Car Heating Company for a number of years, having been the Chicago representative for five years, and general manager at Albany for two years. He retired from active participation in the selling branch of the company about a year ago. His death occurred in Boston.

MR. THOMAS FARMER, who recently resigned as superintendent of motive power of the Detroit United Railways Company, of Detroit, Mich., has become superintendent of the shops of the G. C. Kuhlman Car Company, of Cleveland, Ohio. Mr. Farmer was connected with the Detroit Company for a number of years, and was one of the organizers of the American Railway, Mechanical and Electrical Association, of which he was the first chief executive.

MR. H. A. NICHOLL, treasurer, general manager and purchasing agent of the Ithaca Street Railway Company, of Ithaca, N. Y., has accepted an offer to become general manager of the Cleveland & Southwester Traction Company's systems, with headquarters at Cleveland, Ohio, and will assume the position Nov. 1. Mr. Nicholl has been in the transportation business more than twenty years, and has had long experience on both steam and electric roads. He was connected with the Chicago & Northwestern and Illinois Central lines. From there he went East and became associated with several electric roads, a few years ago becoming manager of the Ithaca system. Mr. Nicholl succeeds Mr. F. T. Pomeroy, who was recently elected president of the system with the understanding that an operating man of efficiency should be employed to relieve him of the many arduous duties of management.

MR. W. O. WOOD, formerly general superintendent of the Rapid Railway System, of Detroit, Mich., which is the suburban system of the Detroit United Railway Company, has been appointed superintendent of the elevated division of the Brooklyn Rapid Transit Company, of Brooklyn, N. Y., succeeding Mr. Geo. W. Edwards, resigned. Mr. Wood has been connected with the Rapid Railway for some time and his experience extends as well to the operation of steam railroads. For ten years he was connected with the Illinois Central Railroad, as trainmaster and in other capacities, and was for several years secretary to Second Vice-President J. T. Harahan. His experience previous to this was gained with the Louisville & Nashville Railroad, with which he was connected for five years. Mr. Wood's first work in Brooklyn will be in perfecting and applying to the elevated lines the merit system of discipline recently adopted by the company, and in thoroughly working out for the elevated lines the system of train despatching recognized as standard by the leading steam railroads. Mr. Edwards, who is succeeded by Mr. Wood, has been connected with the elevated railways of Brooklyn intermittently since their beginning. For a long time he was assistant superintendent under General Manager Barton, of the Brooklyn Elevated Railway Company, and when the latter road was absorbed by the Brooklyn Rapid Transit Company he was made general superintendent of the entire system.

AN EXAMPLE of deserved promotion in recognition of ability and capacity is recorded in Mr. John A. Beeler, vice-president and general manager of the Denver City Tramway Company. Mr. Beeler has been in the street railway business since 1885, when he joined the Cincinnati Street Railway Company as rodman. In the summer of 1888 he went to Denver, Col., as assistant engineer for the Lane National Cable Railway Construction Company, in charge of construction of the Denver cable lines. On the completion of these lines in 1889, he joined the Denver Tramway Company as engineer in charge of civil engineering on the South Broadway overhead electric line. This was the first electric railway installed in Colorado, and was equipped with the Sprague system. Mr. Beeler continued as chief engineer of the Denver Tramway Company until 1891, when upon organization of the Metropolitan Railway Company to take over an opposition line, he was also appointed chief engineer for that company, and in that capacity built 35 miles of electric railway in Denver. Upon the organization of the Denver & Northwestern Railway Company he was appointed its chief consulting electrician, a position which he still holds. In 1902 Mr. Beeler was offered the position of general manager of the Denver City Tramway Company to assist President Curtis. The president's health failing soon afterward necessitated his retiring from the active management, and on the election of Mr. Wm. G. Evans to the presidency in the spring of 1902, Mr. Beeler was elected vice-president and general manager. In addition to these duties Mr. Beeler continues to act as chief engineer of the system. Mention should be made of the 72-lb. T-rail which he designed in 1892, for use on paved streets, a rail commonly known now as the "shanghai" section. In 1898 he found that the records of the track department did not show where the maintenance expense went, no record being kept of the work or of the distribution of the material used. He therefore prepared a system of daily reports, whereby the work of each foreman was tabulated, with separate accounts for each class of construction. From these reports weekly and monthly summaries were made. The result was that the foremen and even the men became personally interested in their work, as they were desirous of producing good reports, and a rivalry sprang up between the different gangs to do as much work as possible. To counteract the tendency to produce cheap work, a record was also kept of those who did the work, so that a piece of poor construction could be directly traced to the workman doing it. As a result of these daily reports, at the end of the first year, despite the fact that the men's wages were raised 16 per cent, the cost of doing all classes of work was reduced 45 per cent. The company was so well pleased with the system that it was gradually introduced into the various departments of the railway so far as practicable and has been in successful operation ever since.

J. A. BEELER

NEWS OF THE WEEK

CONSTRUCTION NOTES

EUFAULA, ALA.—At a regular meeting of the City Council a franchise was granted for a period of twenty years to the Eufaula Railroad Company. The company is composed of the following: J. P. Foy, B. B. McKenzie, R. A. Ballowe, C. A. Martin, H. C. Holleman and L. H. Brassell. It is proposed to construct a system of electric lines over the city and to extend it as far as Abbeville, and the Board of Revenue will be asked at its next meeting to grant the privilege of crossing the county. The project is meeting with every encouragement and is believed will be a success.

LOS ANGELES, CAL.—Petitions are being signed by property owners asking the City Council to advertise the sale of an electric railway franchise on Eleventh Street, from Main Street to Hoover Street.

LOS ANGELES, CAL.—The Clear Lake Electric Railway Company, incorporated last March, in which Los Angeles capital is interested, has been formally granted a franchise to run a 40-mile electric railway from Cloverdale, in Sonoma County, to Lakeport, in Lake County. This line will open up a country of rich resources which has been held back because now all products have to be hauled out by team. The directors are: Dr. W. P. Prather, W. C. Phillips, H. C. Healy, Robert M. Hartwell and H. R. Bingham.

SAN JOSE, CAL.—The Board of Supervisors has passed a resolution of intention to grant to George Tourney, representing the San Jose Street Railway Company, a franchise for an electric railway from San Jose to Campbell.

WOODLAND, CAL.—Attorney N. A. Hawkins has made application to the Board of Supervisors and the City Trustees for a franchise to build an electric railway through the city of Woodland and Yolo county. The proposed route passes through Woodland to the head of Capay Valley, and touches the Sacramento River at Elkhorn and Knight's Landing, with branches at Cacheville, Blacks and Winters. Mr. Hawkins is counsel for the Yolo County Consolidated Water Company, and it is believed that corporation is behind him. The company owns nearly all of the water rights of Cache Creek, on the headwaters of which the proposed power house will be located.

NEW LONDON, CONN.—Judge Wheeler has granted a certificate of public necessity to the Groton & Stonington Street Railway Company, which proposes to build an electric railway from Groton to Westerly. The hearing on the application of the company showed that the project is well in hand. All the stock has been taken, and the testimony of the engineers of the company showed that the plans for construction are well in hand.

TORRINGTON, CONN.—At the annual meeting of the Hartford-Torrington Tramway Company the following officers were elected: President, M. C. Webster, of New Britain; vice-president, Walter Holcomb; treasurer, N. E. Pierce, of Bristol; secretary, D. B. Mansfield, of Harwinton. The directors are these officers, with C. B. Strong, of Hartford; Samuel Knous, of Terryville; D. A. Grannis, of Hartford; D. W. Clark, of Torrington, and E. G. Gibbs, of Hartford. A large subscription is promised soon, and the outlook is very promising. The trolley line to Terryville is now nearly completed, and a trip can be made from that place to Hartford by trolley and third rail. Only 12 miles is needed to complete the connection with Torrington. The charter of the company has been extended two years.

CANTON, ILL.—Incorporation papers have been granted to the Illinois Central Electric Railway Company to construct a street railroad at Canton, and interurban roads branching from that city. The incorporators are: Joseph David, of Cleveland, Ohio; James H. Lawrence, James S. Hopkins, Fred. A. Dolph and David J. Peffers.

CHARLESTON, ILL.—M. C. Thomas, of Homer, says there is every reason to believe that the proposed electric railway from Charleston to Homer will be built. At Homer the new line will connect with a road from Ogden, promoted by the McKinley syndicate.

EAST ST. LOUIS, ILL.—The East St. Louis & Columbia Electric Railway Company has been incorporated with a capital stock of $2,500. The incorporators are: P. J. Meyers, John Keckhain and C. J. Gorla.

EVANSTON, ILL.—The Chicago & Milwaukee Electric Railroad Company has asked the City Council to grant a fifty-year franchise, so that the southern terminus of the road may be at the Chicago city limits. The road now runs north from the heart of Evanston. It is desired to extend it south through Evanston as far as the Chicago city limits. The route proposed is through the western part of Evanston.

MOUNT VERNON, ILL.—Isaac A. Smith, chief engineer for the Southern Illinois Electric Railway Company, has finished the drawings for the main power house of the road, which will be located at Irvington.

O'FALLON, ILL.—The East St. Louis, O'Fallon & Lebanon Electric Railway has been completed east of this city to the Willard Range Works, and cars will be placed in operation at once.

ROCKFORD, ILL.—The Inter-State Electric Railway Company, which was incorporated some weeks ago for the purpose of building a line from Rockford to Madison via Brodhead, has been formally organized at Rockford. President, M. A. Beal, manager, Rockford Edison Company; vice-president, N. F. Thompson, vice-president Manufacturers' Bank.

SPRINGFIELD, ILL.—The City Council has passed an ordinance granting to the Consolidated Railway Company a franchise to extend its tracks and build certain switches and turnouts in the streets of Springfield.

SPRINGFIELD, ILL.—The Kankakee Interurban River View Railroad Company, of Kankakee, has been chartered with a capital of $2,500. The incorporators are H. T. Bonfield, E. W. Bonfield, Gordon Hannah.

FORT WAYNE, IND.—Attorney W. S. O'Rourke has announced that all the franchises outside the city of Fort Wayne through territory over which the Fort Wayne & Northeastern Traction Company is to construct its electric line connecting Fort Wayne and Bryan, Ohio, have been secured. The last of these was the franchise through Bryan, which has just been passed by the Council there, upon conditions which are acceptable to the company. The projectors now hold franchises through Allen County, DeKalb County, Defiance County, Williams County, the town of Hickville and the city of Bryan. Mr. O'Rourke stated also that the securing of these franchises had been the only matter which was delaying the company, and that the construction work upon the road would be advertised and awarded within a few weeks, so that actual work will be commenced in the spring, or earlier.

FRANKLIN, IND.—J. I. Irwin, president of the Indianapolis, Columbus & Southern Traction Company, has purchased a site in this city at Main Street and Madison Street, and will erect at once a three-story traction office building, station and freight depot. The offices of the company, now at Greenwood, will be removed to Franklin.

FRANKFORT, IND.—The Indianapolis & Northwestern Traction Company has the road now completed between Lafayette and Dayton. Construction trains are now running back and forth. The connection between the interurban and the street car company's tracks will not be made for a few weeks.

INDIANAPOLIS, IND.—The Indianapolis, Shelbyville & Southeastern Traction Road has been sold by Fletcher Hines and Dr. R. C. Light to the traction interests headed by Charles L. Henry. New officers were elected, George A. Ball, of Muncie, who is associated with Mr. Henry, being made president. It is announced that the extension from Shelbyville to Greensburg will be pushed through, but it is also understood that the road will stop at that point and that Mr. Henry will push his Rushville line through to Cincinnati, making it the only Indianapolis-Cincinnati traction road.

INDIANAPOLIS, IND.—There is considerable speculation concerning the purposes of the Appleyard syndicate's invasion of Indiana. It has developed that the syndicate proposes to build from Troy, Ohio, to Winchester, Ind., and thence to Richmond, to connect with the line the syndicate is promoting between Richmond and Columbus. But the enterprise is not to stop here. A line will be built to Evansville from French Lick. The syndicate is said to have an interest in the Southern Indiana Traction Company, and will get into Louisville over that line. From Columbus the syndicate cars will reach Indianapolis over the Irvin system, and thence over the Indianapolis Northwestern to Lafayette, from whence a line will be built to Chicago. The company has deposited bonds in Columbus, Greensburg, Connersville and Richmond, where franchises have been granted, to be forfeited if work is not begun within a year and the road is not in operation in two years.

INDIANAPOLIS, IND.—The Central Indiana Traction Company has been incorporated by L. A. Bookwalter, V. J. Drayer, S. J. Rock, W. C. Teeter, Aaron Miller and N. A. Teeter, of Dayton, Ohio, to build an electric railway from Wabash to Warsaw, by the way of North Manchester and Winona Lake, and from Connersville to Liberty and the Ohio-Indiana State line. The company is capitalized at $50,000. The Appleyard syndicate is believed to be back of the new company.

MARTINSVILLE, IND.—The Martinsville Rapid Transit Company has made arrangements with the Big Four Railroad to use 5 miles of its track between this city and Taggart. This plan will enable the company to operate its Bloomington extension without having to drill a tunnel through several hundred feet of rock.

NEWCASTLE, IND.—After grading 15 miles of track between Anderson and Newcastle the Union Traction Company has suspended work. The company did not get all its right of way before beginning work, and the farmers near Newcastle have combined and are asking $1,000 an acre for their land. The company will now proceed to condemn the right of way.

RICHMOND, IND.—The City Council has taken the necessary steps to raise the C. C. & L. bridge to permit the opening of through travel on the electric railways between Indiana and Ohio, arrangements for which have been completed for some time.

SEYMOUR, IND.—The Indiana Central Railway Company, which proposes to build an electric railway from Seymour via Columbus to French Lick, is asking a subsidy from every township through which the road is to pass. If these subsidies are all voted, the contribution will amount to over $200,000.

CEDAR RAPIDS, IA.—The work of surveying the proposed line from Cedar Rapids to Waterloo, in which Colonel W. G. Dows and Isaac B. Smith, of this city, are interested, and which was mentioned in these columns recently, has commenced. The surveying party, under Chief Reynolds, started out a few days ago, and has surveyed a line as far north as Jubilee, a point near the east line of Black Hawk County, and about 12 miles southeast of Waterloo, the terminus of the proposed line. The route surveyed lies about half-way between the Decorah and the Minneapolis & St. Paul divisions of the Rock Island Railroad.