Street Railway Journal

VOL. XXIV. NEW YORK, SATURDAY, OCTOBER 29, 1904. No. 18.

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"; "Stryjourn, London"—Lieber's Code used.

ST. LOUIS HEADQUARTERS:
Section 1, Electricity Building, Louisiana Purchase Exposition.

TERMS OF SUBSCRIPTION

In the United States, Hawaii, Puerto Rico, Philippines, Cuba, Canada and Mexico.

Street Railway Journal (52 issues)..... $3.00 per annum

Combination Rate, with Electric Railway Directory and Buyer's Manual (3 issues—February, August and November) $4.00 per annum

Both of the above, in connection with American Street Railway Investments (The "Red Book"—Published annually in May; regular price, $5.00 per copy).....$6.50 per annum

Single copies, Street Railway Journal, first issue of each month, 20 cents; other issues, 10 cents.

To All Countries Other Than Those Mentioned Above:

Street Railway Journal (52 issues), postage prepaid..... $6.00
25 shillings. 25 marks. 31 francs.

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

STREET RAILWAY JOURNAL,
114 Liberty Street, New York.

Substitution of Electricity for Steam as a Motive Power

This subject received considerable attention at the recent Electrical Congress, and also was the subject of a very comprehensive paper by J. G. White, read at the International Engineering Congress and published in abstract in this issue. Having in mind the success attending the operation of electric motors upon various steam lines, it is natural that the electrical engineer should look for new fields to conquer, and should indulge in the hope that the important developments on the New York Central and Pennsylvania systems presage similar improvements on other steam roads. As pointed out by B. J. Arnold in his retiring address, the progress made in electric railway work during the past seventeen years has been enormous. While the progress has been largely in connection with the problem of catering to the urban and suburban passenger traffic, the difficulties overcome and the systems developed have educated the electrical engineer to deal with the larger problems arising in the electric work of the future.

Steam railway service can be divided into two broad classes—short-haul and long-haul traffic. This division holds equally good for passenger or freight work, and both Mr. White's paper and the following discussion dealt largely with the local or short-haul portion of the steam railway business. The success of the electric motor in this class of service was assured from the start, and while the passenger field has been developed first, the same success will attend the electrical operation of the local express or freight traffic. Both passenger and freight local service call for the same qualifications of motive power; subdivision of trains into small frequent units, single cars for the lighter service and trains of several cars equipped with multiple-unit control for the heavier service. The success of local service depends upon short headway, frequent stops and a high schedule, calling for such high rates of acceleration as can be secured only by equipping all, or nearly all, axles with driving motors. The steam locomotive with its large percentage of dead weight and insufficient tractive effort, is hopelessly outclassed in competition with the electric motor for such a class of work. Taken in connection with the poor efficiency of the steam locomotive when performing a service calling for rapid and frequent acceleration, the success of its electric rival was assured in the local field.

Electric traction has now reached the stage, however, where, having completed the conquest of the local traffic field, it pauses before taking up the struggle with the steam locomotive on its own ground, the long-haul or through-train service. The introduction of the electric motor has revolutionized steam locomotive methods of serving the local public, and has created a large increase in travel, due to the better service afforded. No corresponding increase in traffic can be looked for with the use of the electric locomotive hauling through trains, and their introduction in this field must be justified by lower operating expenses for the same service performed; this decrease being large enough also to pay fixed charges on the increased investment required.

In some cases secondary considerations may be sufficiently strong to warrant electrically equipping main steam lines, but such considerations are local in their extent, and no general changing over will be attempted until the electric locomotive has justified its financial right to supplant its steam rival.

The mountain grade problem is one of the most vulnerable points to attack. Not only is the steam locomotive very inefficient and expensive to maintain in this class of service, but its restricted output necessitates a subdivision of the trains hauled on the level portions of the road, while the concentrated weights on a limited number of drivers and the pounding of the steam locomotive require expensive trestles and a large expenditure for upkeep of rails and roadbed. The abundance of

water power along many of our mountain roads makes it possible for the electric locomotive to operate at a cost for power which will show an attractive reduction from the cost of coal used by the steam locomotive, which often works at nearly full stroke on such work.

The views of Messrs. White and Stillwell seem to conflict as regards the relative amount of fuel used by steam and electric locomotives for the same service. No fixed ratio of the amount of fuel used by the two types of motive power can be given that will apply to all classes of service. The losses in the electric system occur in the generation, distribution and the locomotive itself, but the percentage of these losses is about the same for all classes of service, hence a horse-power of work performed at the rim of the drivers will call for practically the same amount of coal burned at the generating station, whether the motors are running a train on level, grade or performing a local schedule. The steam locomotive on the contrary is a machine of very variable efficiency. Operated on a fixed load and speed, it can deliver a horse-power with a steam consumption of 28 lbs. to 30 lbs., but on grades, and especially in acceleration work, a horse-power of work performed will call for a steam consumption of 60 lbs. or more. These figures do not include any losses due to standing, and, moreover, a pound of coal produces but 6 lbs. to 8 lbs. of steam, while the stationary boiler in the generating station will do better than this.

About equal coal consumption for steam and electric operation, as claimed by Mr. White, would apply more nearly to main line through trains on a practically level track, a class of service where the steam locomotive shows to best advantage. Mr. Stillwell's claim of one-half to one-third the fuel used in the steam locomotive would easily be true for such service as the Manhattan, from which he draws his comparisons. While a steam locomotive under favorable conditions may run as low as 28 lbs. of steam per horse-power delivered, this figure applies only while the locomotive is in operation, and will be increased fully 20 per cent if the losses are added that occur during the time it is out of active commission, which is fully one-half the time. The saving in fuel consumption, passed over as unimportant by Mr. White, may therefore become a factor of considerable weight in grade or acceleration work.

The three main items of operation affected by the introduction of the electric locomotive—fuel, engine crews and maintenance—are each equal to about 10 per cent of the total operating cost of the road, but in special cases, such as grades or acceleration problems, their proportion to the total expense is larger, and it is in these special instances that the electric motor will make its best showing and first receive recognition. Its entrance into the main line movement of freight is perhaps to be deferred until operating figures on a large scale are obtained from such installations as the New York Central. While the use of such figures will be unfair to steam locomotive main line work, due to the character of the Central service, which includes considerable acceleration, the figures obtained will apply more nearly than the results from the Manhattan, where the acceleration losses place it in a class by itself.

The development of the single-phase railway motor will undoubtedly do much to hasten the introduction of electric locomotives on steam roads. Granted a more efficient and cheaper operation of the electric system, the burden of the heavy fixed charges of a d. c. rotary converter system often leaves no profit warranting a change from steam to electricity. The elimination of the rotary converter and the change from a protected third rail with heavy feeders to an inexpensive high-tension trolley have cut the cost of installing an electric system for heavy haulage work to a point demanding the careful consideration of steam railroad managements.

We are rather inclined to agree with Mr. White that future development in the alternating motor field will be along the lines of the single-phase commutator motor in preference to the three-phase induction motor. The induction motor is practically a synchronous motor, and undoubtedly has a field of usefulness, but it is one where constant speed at fairly constant loads is called for. Variable speed can only be secured by the introduction of dead resistance or by concatenation, both of which methods are not to be compared with the methods of control open to the single-phase commutator motor with its variable speed characteristics. While there is no great apparent advantage in using a. c. motors and high-tension trolley for local work, even should high potentials be allowed on local trolleys, the benefits secured with a high potential trolley in heavy freight haulage are such as to make it possible to consider the electrification of steam lines which were closed to the d. c. motor and rotary converter. With the reduction in fixed charges resulting from a cheaper construction, it is possible also to consider an infrequency of train service, which places many of our Western grade problems within the scope of possible electrification. Owing to our short acquaintance with the single-phase commutator motor itself, its possibilities have not yet been fully worked out, but it bids fair to become an important factor in the broad question of electrifying steam roads.

The steam locomotive and the induction motor are somewhat on a par as compared with the variable-speed series motor in general railway work. Neither shows the adaptability required in a motive power which shall meet the conditions imposed in traction work varying from frequent stop high-schedule service, demanding rapid acceleration and fractional speed running, grade haulage over an irregular profile at variable speed, and, finally, main line haulage at a fairly constant speed and constant output on a track that is fairly level. The demands upon the motive power are exacting, and are fairly well filled by the electric motor of the series type, that is, d. c. motors for local and a. c. motors for the heavy freight haulage work. While the d. c. series motor has pre-empted the local haulage field against the horse, cable, and steam locomotive, it is probable that the a. c. series motor will demand recognition in the long haulage field, with occasional instances where the frequency of train service and considerations of local traffic justify the retention of the d. c. motor. The reasons for adopting electricity in this class of steam haulage work must be largely financial, and the battle with the steam locomotive will be fought out on the balance sheet. The whole growth of electric traction is the outcome of seventeen years of development, and it is reasonable to suppose that continued development of the generating and distributing systems, together with the locomotive and motors themselves, will place the electric system in a position to be a formidable competitor of the steam locomotive upon even main line through haulage service.

Lubrication in Cold Weather

The discussion at the New York State Street Railway convention brought out some facts regarding car lubrication in cold weather in connection with storage of cars out doors. Some of these points, while not new, have not been touched upon for a number of years. At least two speakers in the discussion referred to spoke of the large amount of power re-

quired to propel cars after they have stood out doors in the cold over night. One speaker followed the line of argument that it would be cheaper to keep the bearings warm by steam used in a steam-heated car house than to warm them up by means of electrically transmitted energy used in the propulsion of the car. The question under discussion primarily was one of keeping cars in car houses as against storing them in open yards, but it incidentally brings up the further question of lubrication in winter. It has become fairly well established that the power required to operate cars in winter is somewhat greater than that required in summer under the same conditions, the difference being largely accounted for by the difference in lubrication. It is especially true with grease that as the thermometer falls to zero and below, it stiffens to a point where its value as a lubricant is much reduced. With oil there is not such an immense difference between summer and winter conditions. Judging from the testimony of master mechanics at conventions and elsewhere, oil lubrication is the coming plan for both large and small motors, as it has been for large motors for some time; but for those roads still using grease, it is well to remember that grease which may flow very well in warm weather may be of little value in cold weather. On roads where maximum traction trucks are in use, the journal friction on days when the thermometer is below zero has sometimes been such that with a little snow on the rail the small wheels of the truck would slide rather than revolve, even with the brakes perfectly free.

A Chapter of Accidents

We are no alarmists and take no ghoulish joy in the details of accidents even though we do sport a yellow cover, but when unusual causes are operative in producing accidents in spite of the most careful management, they are worth looking into. Last week the Bay State was treated within twenty-four hours to four electric car collisions of a character so far out of the ordinary that they must be classified as freaks. The happenings were in this wise: Saturday afternoon a crowded Boston & Worcester car was bowling through Newton on its way to the Hub, and stopped at the foot of a long and moderately steep grade to change crews with an out-bound car that was awaiting it. While the exchange was being made, another Boston-bound car started down the grade and ran away on the track, made slippery by slimy autumn leaves. Sand, brakes and reversal failed to check the runaway, and the result was a rear-end collision, occuring so suddenly that there was no chance to get out of the way. The passengers were more or less shaken up, but nobody seems to have been seriously injured, though there were some breaks and many bruises. This was unfortunate, but the excitement had hardly died away and the car had hardly been cleared, when a third Boston-bound car came over the hill, ran over the signal torpedoes and was, from all accounts, slackening up when a fourth car came down the grade on a runaway, and the two chased down hill and brought up against the pair already there, very fortunately hurting nobody. All the brakes seemed, it is reported, to be in good condition, the sand boxes were supplied and operative, and all hands were doing their level best to stop the cars.

Sunday morning a Worcester street car did a queerer stunt while going up a longish but not very steep grade in Westboro. Part way up, the wheels began to spin on the slimy leaves, and the car came backward down the grade with increasing speed, the wheels still clawing desperately at the track. Sand, brakes and motors alike were of no avail, and the runaway rounded a curve at the foot of the incline just in time to meet another car coming up. Nearly a score of passengers were injured, very happily none of the number seriously. The autumn leaf has been guilty of delaying traffic before, but never to our recollection with so unpleasant results. Steam trains in the mountains have been caught at various times, but never with others within striking distance. A wet fallen leaf is a little thing, but when it gets on a grade with plenty of companions there is trouble brewing. Leaves when moist are about as slippery as anything that can be imagined, and sanding them does precious little good, for the wheel may bite on the sand, but will still spin in the slippery mush of sodden leaves underneath. And as for the brakes, they merely allow the wheels to skid even if they can hold against the slimy treads. When once a car begins to run away, the conditions are such that it is likely to keep on. To all intents and purposes, a track might as well be greased as covered with wet leaves, and if the wheels start slipping they are likely to keep it up for a while. It is no easy matter to stop a heavy car coasting down a sharp incline, even when everything is in working order, and we think that in this instance the cars got off quite as easily as was to be expected. The managers have our sympathy. For accidents due to negligence we have nothing in the way of excuses, but when one gets up against such outrageous natural conditions as those responsible for these collisions, he needs the left hind foot of a graveyard rabbit instead of criticism.

On some of these long Northern lines, where deciduous trees are plenty, the leaf nuisance is really something to be taken into serious consideration. Generally speaking, the leaves on the track at any one time are few, and the wheels merely slip a bit and then take hold again. It is only when the leaves get thoroughly damp and cover the track pretty thickly that trouble begins, as it did in these cases. And this condition is so rare that it is not one of the things which would naturally be met by special preparations. Good brakes and full sand boxes will generally take care of a car, but when leaves are plenty and wet, sand, as we have just remarked, is rather ineffective. In this autumn weather the track is apt to be slippery from moisture at best. Possibly track brushes might be made useful at this season, as during periods of light snow, but if stiff enough to take off wet leaves with certainty, they would have to be adjustable so as to be pressed firmly upon the rails when necessary, and the average car has already as much rigging about it as can well be taken care of. Perhaps a wiser procedure is to remember the possibility of leaves at this season, and if necessary keep a man with a broom riding up and down troublesome grades and keeping the track clear. And beyond this, it is a wise thing, particularly on interurban lines running fast and heavy cars, to work off at odd times enough brake tests to determine what can be done at holding or stopping a car even under unfavorable circumstances. If one thinks of a moving car as always preceded by a dangerous space equal to the distance in which it can be brought to rest from that particular speed, he will quickly grasp the precautions that are needed in arranging permissible headway and speed. A down grade and a bad track lengthen the dangerous space, just as good track conditions and up grades shorten it. The important thing is to have a practical understanding of its actual length under working conditions. A series of braking tests could readily be accumulated quite sufficient to bring out the facts, and then all hands would know better when to take extreme precautions. At present the dangerous space is more or less guesswork as applied to any given road.

METHODS OF HANDLING PASSENGER AND FREIGHT TRAFFIC, AND OPERATING FEATURES OF THE OREGON WATER POWER & RAILWAY COMPANY—II

PASSENGER TRAFFIC AND RATES

Although Oregon City is the only competitive point on the system, the local fares on all of the lines are based on practically a rate of 2 cents a mile, while the fares on the steam roads are 3 cents and 4 cents a mile. For round trips a reduction of 10 per cent is made from double the local fare. Commutation tickets are also issued based on a rate of 1 cent per mile. These are usually issued in thirty-ride books. Monthly commutation books at a somewhat lower rate are also issued for Oregon City and Gresham. That the management's policy in making low passenger rates is a wise one has been demonstrated in a good many cases. One instance in particular serves to emphasize this point. What is known as the Mount Scott line, running from Portland to Lents, a distance of 7 miles, was originally operated as a steam dummy line with only a few trains a day, and it was never a paying proposition. The present owners took hold of the road, changed it for electric operation, reduced the fare from 10 cents to 5 cents over the whole line and put on a service to meet the demand, which now requires cars every twenty minutes. The results of these improvements, and of what is termed locally as the company's broad-gage policy, are very evident to anyone riding over the line. Where a year, or even six months, ago there was nothing but second-growth timber and a few open fields, one finds now the entire district between East Portland and Lents platted and being rapidly settled by a good class of citizens. Property can be purchased at very low rates here, and at little expense houses can be built which will at least serve as comfortable homes until the owners can pay for their property and improve or build permanent residences. From a sociological standpoint this has had a very beneficial effect on the people in general, because it has removed the necessity of their paying rather excessive rentals for close and cramped quarters in the city and given them a chance to own their property with sufficient room in most cases to raise their own garden produce and perhaps market what they don't need. Such signs as the following: "Ten cents a day pays for your home," and "$5 down and $5 a month" are seen throughout the whole district. A point which also shows the rapid growth of this district is that the school census has increased 80 per cent during the last year, and a new school house is now being erected to take care of 1000 children.

FIG. 29.—SCENE IN CANEMAH PARK

Another example of unexpected increase in passenger traffic has been evidenced on the Cazadero line. When this line was opened up for service practically the only town on it was Gresham, which had a population of 150. The management thought that one freight train a day with a passenger car connected would serve to handle all the passengers on the line. The history of other electric railways, where before they were built no passenger traffic existed and little could be anticipated, has been repeated, and now seven daily trains each way to Estacada, four of which run through to Cazadero and carry trailers, are hardly sufficient to handle the regular business. On Sundays this schedule is increased from 50 per cent to 100 per cent, or sufficiently to meet the demands of the travel. It may be said that practically all of this business has been developed naturally by reason of the low fares offered and with but little special advertising. Features that have helped in this passenger development have been the facts that the road is the only one that operates a long interurban line out of Portland and that the route is very picturesque and touches excellent fishing and hunting grounds.

The sociological effect of an electric railway is also noticed along the Cazadero line. This country is settled largely by the pioneers of Oregon, who crossed the mountains and settled in this section some fifty years ago. Without transportation facilities and a 25-mile to 30-mile haul necessary to market their goods, the advancement of these sturdy settlers has been slow as compared with that noticed in other parts of the West. It has taken the electric railway to wake them up, and its beneficial effect is evident on every hand. Fences have been improved, crops that were formerly fed to the hogs are now garnered and marketed, new barns and houses are being built,

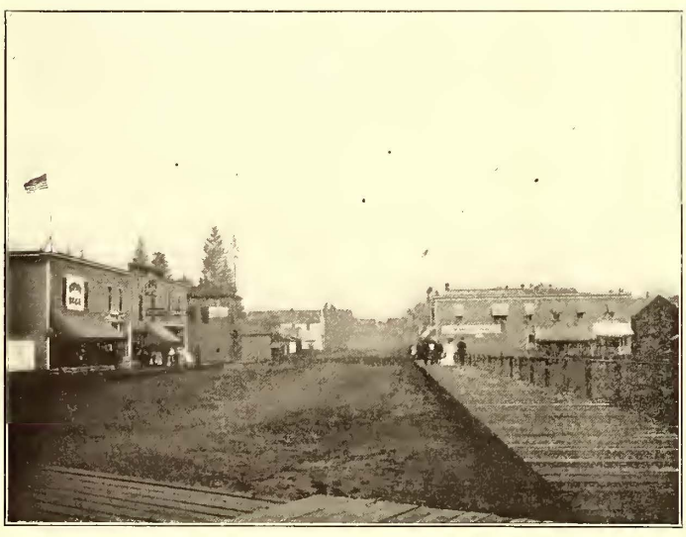


FIG. 30.—MAIN STREET IN ESTACADA, BUILT IN SIX MONTHS

FIG. 32.—DANCING PAVILION AT ESTACADA

land is being cleared and new crops planted, the towns are growing and new ones being started and a general enlightenment is seen everywhere.

All the passenger cars, including trailers, are equipped with the Ohmer recording-fare registers, with which all tickets, transfers and cash fares up to 25 cents are recorded. Duplex conductors' receipts are used for all fares in excess of 25 cents. Passengers are instructed to buy tickets at the stations whenever possible, and all fares are checked by means of slips, in accordance with steam-road practice. At present transfers are issued to the local lines of the Portland Railway Company.

PARKS AND PLEASURE RESORTS

The company owns and operates two parks —one at Canemah, the terminus of the Oregon City line; the other at Estacada, near the end of the Cazadero line and on the banks of the Clackamas River. The park at Canemah embraces some 38 acres and is situated on a high bluff overlooking Willamette Falls. Admission is free, and while no regular attractions are offered, an enclosed baseball park, a dancing pavilion, lunch stands, swings, etc. (Fig. 29), are provided for the use of special parties on week-days and for the general public on Sundays. The regular round-trip fare from Portland to Oregon City and Canemah is 45 cents, but this is reduced on Sundays to 25 cents, with privilege of going one way by boat. This reduction of fare for Sundays has proved a profitable one, as the regular forty-minute schedule has to be increased to a fifteen or twenty-minute service.

Estacada (Fig. 30) is a town of 300 or 400 people, with an excellent hotel, where six months ago there was nothing but a small farm and standing timber. Here the company owns 70 acres on both sides of the river, and, as at Canemah, it is covered with natural forest. A good proportion of the ground has been cleaned up and improved and a dancing pavilion has been built, while steps lead down to the river, which throughout this whole locality is very picturesque. Views of the park and river are shown in Figs. 31, 32 and 33. Eventually a bridge will be thrown across the river, and the land on the opposite bank opened up for campers and resorters.

The Hotel Estacada, which is shown in Figs. 34 and 35, is owned by the Oregon Water Power & Railway Company, and has been constructed with a view of providing accommodations for those desiring short and inexpensive outings within a reasonable distance from Portland. It is comfortably furnished throughout, with electric lights and good water, and is under the direct supervision of the company, its manager being employed on a salary and not a commission basis. The hotel has thirty rooms, and while at present its business is largely of a resort nature, it will eventually take care of a good commercial traffic. As a special inducement for Sunday traffic, a rate of 50 cents for the round trip is given to Estacada, instead of the week-day fare of $1.35. Another rate that is offered at any time is $1.50 to Estacada and return, the ticket including dinner at the hotel. While this hotel has only been in operation a short time, it is said to be already paying expenses. Fig. 36 shows a daily scene at Estacada.

FIG. 31.—PARK SCENE AT ESTACADA

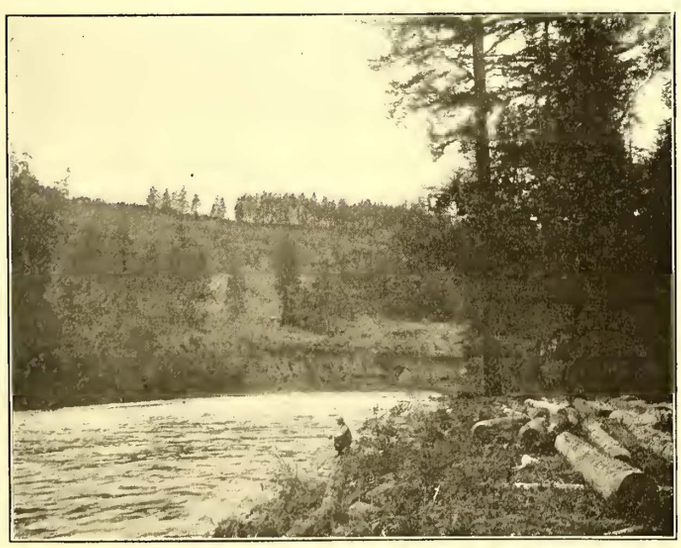


FIG. 33.—CLACKAMAS RIVER NEAR ESTACADA

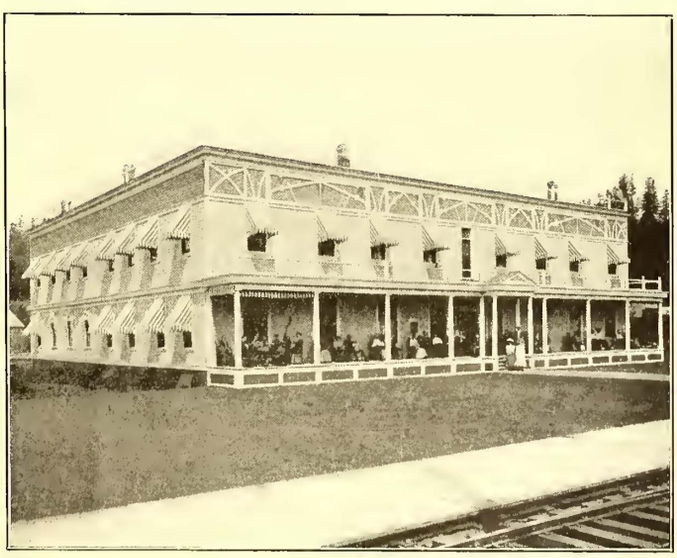


FIG. 34.—HOTEL ESTACADA

MAIL SERVICE

The company has contracts for carrying mail over all its lines. That on the Oregon City division is carried in pouches on the regular motor cars. On the Cazadero line the mail car makes two round trips a day between Portland and Cazadero, and carries a regular mail clerk. This mail service has proved to be of much benefit to the tributary country.

DESPATCHING SYSTEM

All the cars of the company—freights and specials, as well as passenger—are operated by a telephone despatching system.

FIG. 35.—THE OFFICE AND LOBBY OF THE HOTEL ESTACADA

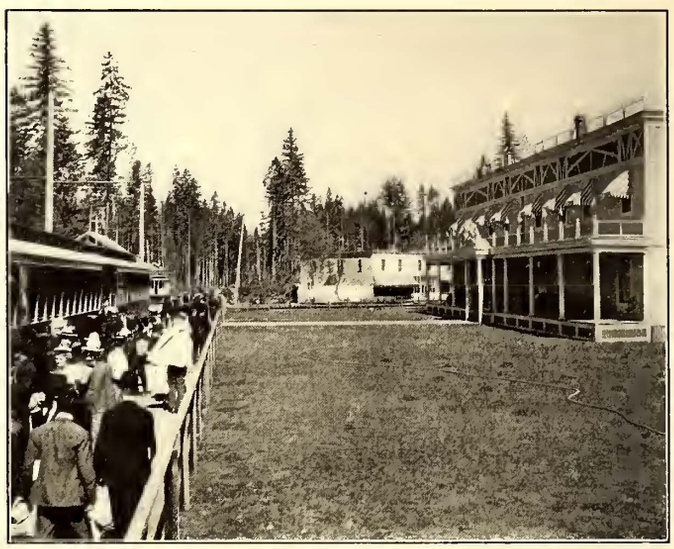


FIG. 36.—A DAILY SCENE AT ESTACADA

A despatcher is located in a tower supported 20 ft. above the ground on a large pole, as shown in Fig. 37, the tower being situated at the intersection of the company's line on Madison Street with the Southern Pacific tracks. Besides attending to his duties as despatcher, the attendant also acts as the signal man in giving the electric clearance over the steam railroad tracks. A rule of the company that is stringently enforced requires all cars approaching this crossing to come to a full stop, to signal the despatcher by means of the motorman's gong, and only to proceed when proper clearance is given by means of a semaphore arm on the tower. Another rule requires that all cars, as a precautionary measure, shall come to a full stop when descending the grade on the east side of the crossing if a steam train is seen or even heard.

The telephone system connects the despatcher's tower with the superintendent's office, the general offices, the freight house and all sidings and stations on the system, there being about thirty-five instruments installed at present. The Russell telephones are used. They are placed in heavy sheet-iron weatherproof boxes, fitted with Yale locks. Instead of the customary despatcher's sheet, there is in use at the despatcher's tower a table marked with a profile of the whole system, stations, sidings and distances. At each siding there is a hole, and small numbered pegs—one for each motor car on the system—are inserted to indicate the location of the cars. This system has proved equal to the demands made upon it, although it affords no permanent record of the movements of the cars. When a conductor calls up the despatcher he is required to repeat the order and write it down and hand it to the motorman.

DEVELOPMENT OF THE FREIGHT TRAFFIC

The company's freight traffic had its start on the original road to Oregon City. Between that city and Portland a small, but profitable, package freight business has been operated for several years, two round trips a day being made over the line with an electric freight motor car. Oregon City is a competitive point, the electric railway having to compete with a steam road and a boat line, and, although equal freight rates are charged by all lines, the electric railway controls the less-than-carload business. This has been due to the good terminal facilities and to the convenience offered the shippers in ordering.

A merchant in Oregon City, when he desires goods, telephones his order to the company's agent at that terminal and he transmits the order over the railway's private wires to the Portland freight terminal. The order is placed from there by public telephone, the goods are delivered at the freight house, and reach Oregon City the same day and frequently during the same forenoon. The freight house at Oregon City is on the main street and convenient to all business places. That this convenience in ordering is appreciated by the merchants is well evidenced by the large package business given to the company.

FIG. 37.—DESPATCHER'S TOWER AT SOUTHERN PACIFIC CROSSING

In connection with the Portland freight terminal, the company also operates three express wagons, which cover regular

routes in the wholesale district in Portland each day, picking up packages and freight wherever a card is hung out, as well as making special calls on telephone orders. This business is conducted in connection with the package freight traffic in a manner similar to that of the Wells Fargo Company, and has proved very profitable. The company has a unique mark for all its freight cars and wagons, consisting of a diagonal square with horizontal stripes of white and red.

A good business has recently been developed on the Oregon City line hauling carload lots of hides and pelts for the mills, and also cars of hogs, potatoes and cord-wood. Since the Spring Water division was opened up an interchange of cars with the steam road has gone into effect, and this is helping to build up the carload traffic.

The Cazadero line was built primarily for the purpose of tapping the large and excellent yellow fir region on the Upper Clackamas River. By reason of natural obstructions in the river channel below Cazadero, it has been impossible to float logs down the stream to the Willamette, and as the country is too steep and rugged for logging roads, and no other means of transportation were available, this large timber section, stretching back as far as the Cascade Range, necessarily has lain dormant for years. The large number of lumber mills in Portland do not own their timber, so the Oregon Water Power & Railway Company could safely figure on a profitable business in hauling this fir on the Upper Clackamas to market. As an additional investment, the company purchased 2000 acres of this timber land just above Cazadero.

The water-power development at Cazadero will play an important part in the handling of the timber. The lake to be formed by the dam will extend up the river for 7 miles, and can be easily utilized for rafting and hauling the logs to the dam. The river for 25 miles above the lake can also be logged. At the lower end the timber will be floated down the power canal and into the fore-bay reservoir; at that point the logs can be easily loaded onto cars and hauled over the electric railway directly to the mills of Portland or to the company's own booms on the Willamette River. It is thus seen that the water-power development will include all of the construction necessary outside of extending the railway from its present terminus on the east bank across the high bridge to the edge of the reservoir. As this will be necessary anyway for delivering the concrete for the dam and power house, the expense of providing for the handling of the timber may be said to be nominal. It is possible that a large saw-mill may be erected at Cazadero to work up some of the timber, and in that event the railway will haul the lumber to market instead of the logs.

As this large timber proposition necessarily could not be opened up at the outset, the officials of the road began an aggressive and systematic campaign to develop a freight business along the route of the new line. Mention has already been made that the road runs through a well-timbered section, portions of which have been cleared and developed into rich farms. The territory was thoroughly canvassed for freight business, and this, as in the case of the passenger traffic, has gone far ahead of what was anticipated. A package freight business is conducted with a car making a round trip a day, as on the Oregon City line, but the large proportion of the traffic is made up of carload lots, handled entirely at night after the regular passenger service is ended.

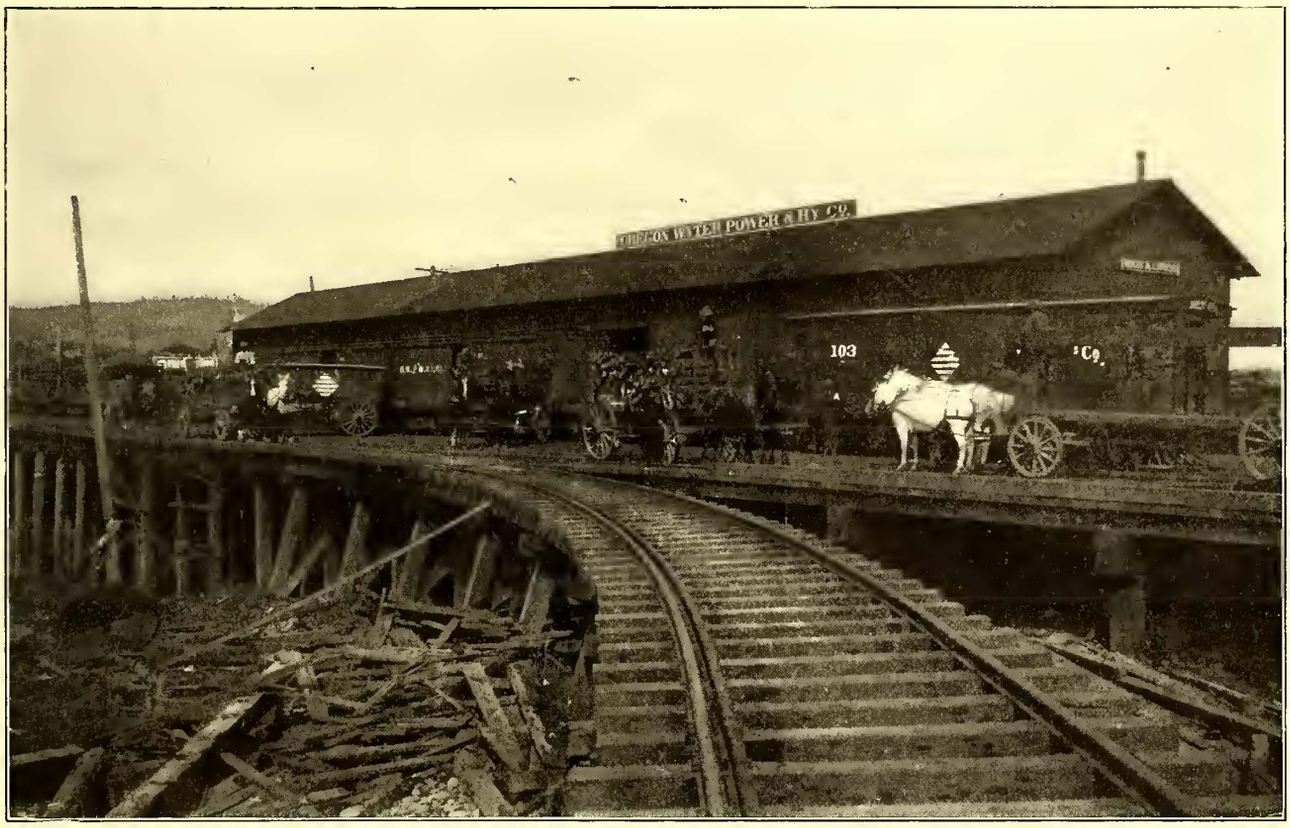


FIG. 38.—FREIGHT HOUSE AND SHIPPING SCENE AT EAST PORTLAND TERMINAL

Successful efforts were made to build up the cord-wood business, and this has grown so rapidly that the freight solicitor was long since called in, while the car equipment has been sorely taxed, although new cars are being added constantly. Portland burns wood almost exclusively for fuel, and uses from 200,000 cords to 300,000 cords annually. A conservative estimate before the opening of the road of the amount of such freight likely to be handled during the year placed the figure at from 25,000 cords to 30,000 cords. However, over 100,000 cords have already been hauled, and the season is not over yet.

The line is well supplied with side-tracks and the shippers are given twelve hours during the day in which to load the cars; then at night they are hauled to the city, and twelve hours are allowed for unloading the next day, the empty flats being hauled back at night. A 40-ft. flat car, with a capacity of 50,000 lbs., will carry 16 cords, and the rate charged ranges

from 60 cents to 85 cents per cord, according to the distance. Practically all the cord-wood is for local consumption in Portland, and is delivered at the terminal yards on the river front, or at a siding terminal on East Eighth Street. Such wood retails at $4.50 a cord.

The lumber business has also been built up to good proportions. Along the railway and directly tributary to it are thirty-seven saw-mills ranging in size from large mills to the small portable mills such as are used for sawing ties, and which are moved about as the timber is cut off. Several loads of these ties have been loaded on to steel gondola cars for the Oregon Railroad & Navigation Company and the Oregon Short Line, and transferred directly to their systems. A large amount of piling has also been shipped over the road, much of it for foreign consignment.

The rich agricultural land in the vicinity of Gresham, and also farther out on the line, is beginning to yield a large revenue by way of freight. As much as 150 cars of potatoes alone were hauled from one station last winter. On the upper half of the line above Boring are many old settlers, as already mentioned, who have been shut off from Portland by the narrow canyons of the streams and the long drive of 25 miles or 30 miles. These farmers have been accustomed to raise crops sufficient for their own use, fattening hogs on the oat and hay fields and then driving them the long distance to market. These settlers are now putting in large acreages to potatoes, which is decidedly profitable on account of easy shipments to Portland. The potatoes are shipped in carload lots, most of them being transferred to the Oregon Railroad & Navigation docks, where they are loaded on steamers for shipment to California. Other crops are beginning to be marketed, the first carload of wheat being shipped from Estacada only recently.

The company has adopted a schedule of very low freight rates to develop the business, and through its judicious management maintains very friendly relations with the shippers. As an indication of the growth of the company's business, it may be noted that its total net earnings for the four months ending with July showed an increase of 50 per cent over the average earnings of the first six months of complete operation of the present railway system.

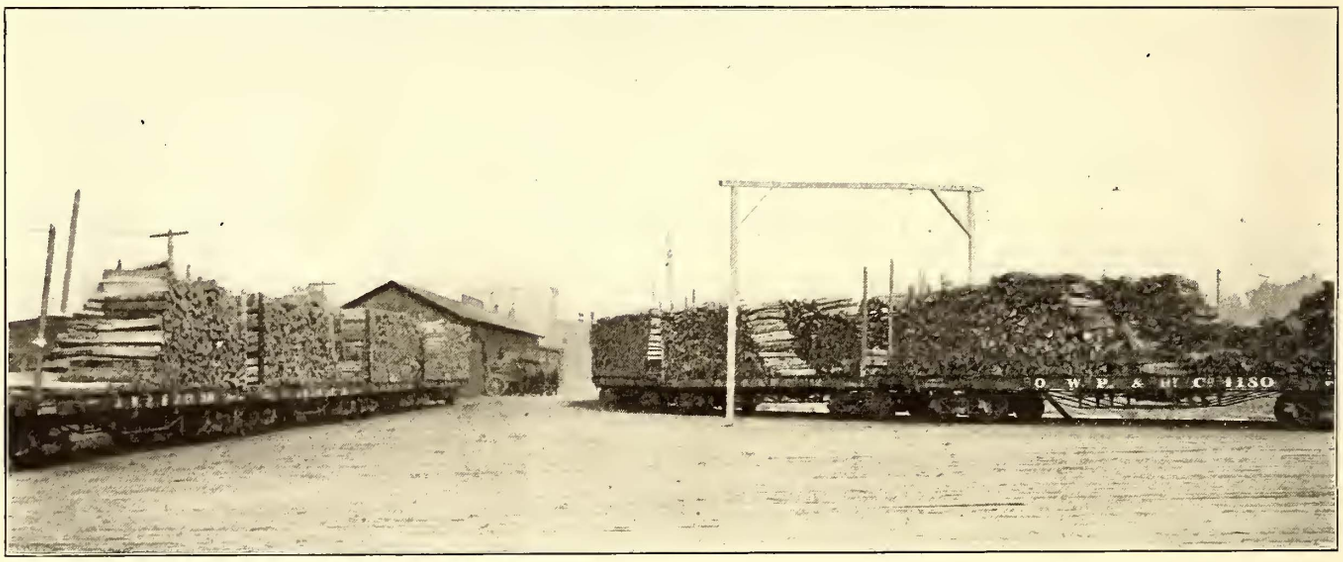


FIG. 39.—PART OF ONE NIGHT'S HAUL OF CORD WOOD AT EAST PORTLAND TERMINAL

TERMINAL FACILITIES AND TRAFFIC ARRANGEMENTS

The company owns very valuable terminal property in Portland which extends for 2 miles along the east bank of the Willamette River from the Madison Street Bridge south nearly to Sellwood.

There are over 400 acres in this tract, and on the northern portion of it are located the company's freight houses and yards, and here also will be erected in the near future shops, car houses, warehouses, etc. Figs. 38 and 39 illustrate scenes at the freight terminal. The remainder of the large acreage will afford ample room for the erection of manufacturing industries. The company's dock is 1648 ft. long and has a water frontage 25 ft. deep at low water, so that any ships which can reach the harbor of Portland can load and unload there. Thus the company's freight can be brought directly to the ships for shipment to any part of the Pacific Coast or the Orient if desired without the necessity of using the tracks of the larger railroads. At Canemah, above Willamette Falls, the company also owns docks where boats plying on the upper Willamette can make direct connection with the electric railway, thus avoiding the charges for passing through the locks at Oregon City. The company is also about to build a line north from Madison Street on East Water Street, which lies midway between the river and the Southern Pacific tracks. Excellent facilities will be provided along this new line for warehouses and wholesale establishments. It is thus seen that the Oregon Water Power & Railway Company has terminal facilities which not only meet the present demand, but are sufficiently large and convenient to handle a vast growth in the way of future business.

The company occupies a unique position among corporations operating electric railways, inasmuch as it has made arrangements for a complete interchange of freight traffic with some of the principal trans-continental railway systems of the country. This arrangement was brought about after considerable diplomatic negotiation, it being clearly demonstrated to the steam-road officials that it would be decidedly profitable to be a party to the arrangement. They were shown that considerable carload business from the electric railway could be shipped directly over their lines to eastern points and that this business would probably amount to more than what would come to the electric railway from foreign points. The agreement is with the Oregon Railroad & Navigation Company, the Oregon City Transportation Company and the Southern Pacific Railroad, all parts of the Harriman system, and, although no agreement exists with the Northern Pacific and other railroads, business is freely interchanged with them. The Oregon Water Power & Railway Company is a party to the per diem and demurrage associations, and to all intents and purposes operates as a steam railroad. The amount of freight business that is at present interchanged with the steam railroads amounts to about 10 per cent of the whole.

CRUSHED ROCK

Just beyond Cazadero the company owns a large and val-

uable rock quarry. Here it has erected a No. 5 Gates rock crusher, and arrangements have been made with a firm of contractors whereby it leases and operates the plant and ships all the rock to Portland over the company's railway. The rock is what is known as bull-granite, and has been found to serve excellently for street pavements, being superior to anything that has heretofore been used in the city. About ten cars a day of this rock are hauled over the line, and as the revenue is from $10 to $12 a car, the importance of the income from this source is considerable. Fig. 40 shows the crusher plant, and Fig. 41, the quarry.

OTHER POSSIBLE DEVELOPMENTS

In the way of latent resources the company has, besides its large timber holdings on the Upper Clackamas River, acquisitions which will be possible of a good development at the proper time. One of these is a large clay bank at Estacada, from which it has been found that an excellent quality of pressed building brick can be manufactured at a comparatively low cost. There is also said to be an extensive and very valuable coal field in the territory south of Cazadero, and as the supply of wood for fuel must necessarily be curtailed before

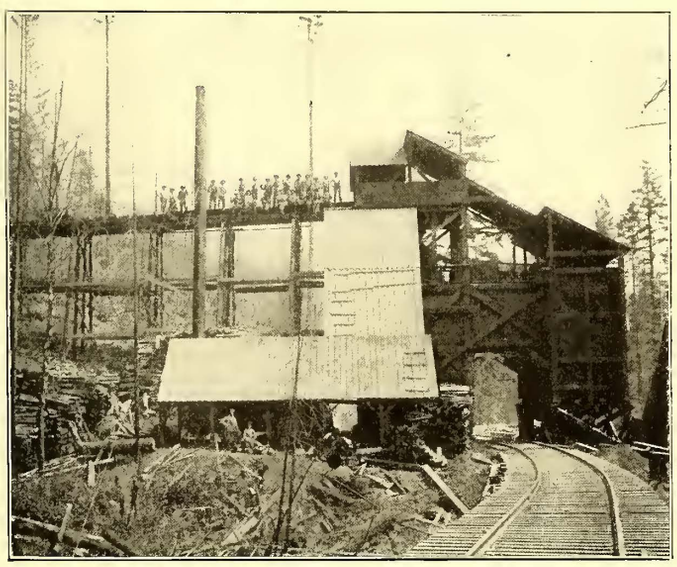


FIG. 40.—ROCK CRUSHER PLANT AT CAZADERO

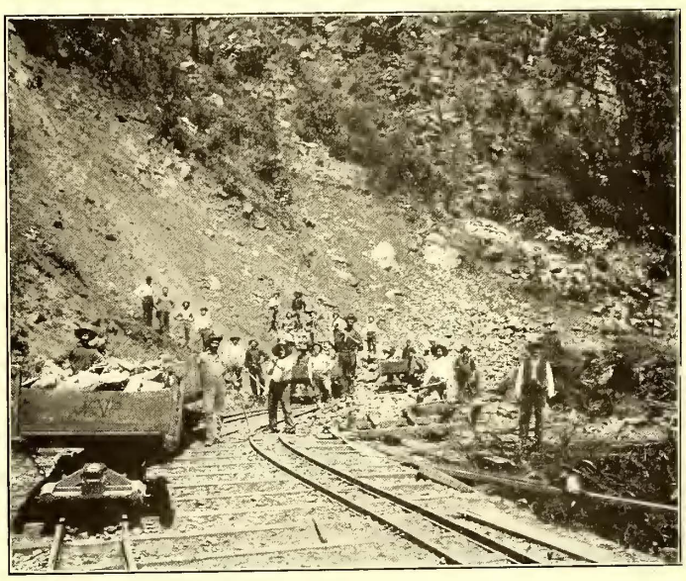


FIG. 41.—ROCK QUARRY AT CAZADERO

many years, this will offer a field for good investment and development. The railway company will profit from the brick plant and the coal fields by handling the freight. It is believed that the lake to be created above the dam at Cazadero can be made profitable for resort business, and near its upper end there are said to be some splendid hot springs, whose medicinal properties could easily be utilized for the establishment of a health resort.

REPAIR SHOPS AND CAR HOUSES

The repair shops and main car house of the railway company are located at Milwaukee. They are hardly capable of taking care of the repair work which the company now has to handle, as they were originally erected to serve only the Oregon City line. Now that the company's extensive track construction is nearing completion, plans are being formed for the erection of new shops at the terminal yard near the Madison Street Bridge, which will be equipped with the most modern appliances and will be amply large to take care of the company's equipment for some time to come. A good sized car house will also be erected at this point. In all probability arrangements will be made to build the company's passenger equipment, in addition to the rolling stock used by the freight department.

INSURANCE

All of the company's property is fully insured against fire by a blanket policy covering all car houses, shops and power houses, with their machinery and supplies; warehouses and depots, with their contents; all rolling stock in transit or housed, together with all trestles, bridges and docks.

A liability insurance is also carried by the company. The terms of this policy fully protect the corporation against any and all liability on account of accidents occurring to its employees while in its service.

ACCIDENT AND CLAIM DEPARTMENT

The accident and claim department conducted by the company is an excellent one, and that the methods followed are valuable is evidenced by the fact that the amount paid out for claims is exceedingly low. The secret of the success of this department of the company, which is under the direct supervision of the assistant superintendent, is largely due to the method of obtaining releases promptly and of always pursuing a courteous, diplomatic and kind treatment when interviewing the parties concerned. As the rules of the company in regard to accidents cover the methods used to a large extent, they are quoted verbatim:

Accidents—The conductor will use every possible precaution to avoid accidents. If an accident should occur he will

First. Stop the car immediately, ascertain the name, residence, and business address of the injured person, render all possible assistance; if necessary, taking him to a drug store, if one is near by, or summon an ambulance. Suburban cars will be provided with United States Army regulation "First aid to the injured" packages, which may be placed at the disposal of the injured person, or his friends or fellow passengers.

Second. In case the accident is at all serious, conductor will telephone immediately to the superintendent's office, stating place and nature of accident. The company's surgeon will be notified by the superintendent's office.

Third. He will ascertain the names, residences and business addresses of all passengers in car, and of all persons who witnessed the accident, and at end of trip make out a written report and send same at once to the superintendent, giving full and detailed report of the occurrence.

Fourth. The conductor will refrain from conversation or giving any information of any accident to any person other than the proper officials of the company. He will not accompany injured parties home, or call upon same, without consent of superintendent.

Note. The above rules regarding accidents are of the utmost importance and must be observed, no matter how slight the accident to person or property.

For Example—If a person falls in stepping from your car, even when the car is at a standstill and the accident is due entirely to the passenger's own carelessness, and passenger insists that he or she is not hurt, the name and address of such person, with witnesses, must be taken and reported to the superintendent. This is absolutely necessary for the protection of both company and conductor. Accident reports must be handed to proper officer at the first opportunity.

The "first aid to injured" package which is carried on each

car consists of a fibre box about 6 ins. x 6 ins. x 4 ins., and contains the following articles: Two packages absorbent cotton, two packages of absorbent gauze, two 2½-in. absorbent bandages, two 3-in. absorbent bandages, two rubber adhesive plasters and a card of safety pins. The strap of the box is sealed, and no conductor is allowed to carry a package unless this seal is intact. If part of the contents are used the box is returned at once to the superintendent's office and exchanged for a whole box.

Conductors are always required to have in their possession

Form 70. J-8-12-03-3M

The Oregon Water Power and Railway Co.

..... *Div.*

Emergency Accident Report

Date.....

Run No......, *Car No.*.....

Time....., *Route*.....

Conductor .....

Motorman .....

Exact Place.....

Cause of Accident.....

Party or Parties injured.....

.....

.....

.....

Names and addresses of witnesses

.....

.....

.....

.....

.....

.....

.....

.....

.....

FIG. 42.—EMERGENCY ACCIDENT REPORT

Form 18. 2-5-04-2M

ACCIDENT REPORT

THE OREGON WATER POWER AND RY. CO.

Accident No......

.....*190*..

Injury to.....

.....

of No......*Street*,

At .....

Car No.....

Conductor.....

.....

Motorman.....

Report received..... *M*.....*190*..

.....

.....

Superintendent

Report filed.....*M*.....*190*..

.....

Claim Agent

FIG. 43.—STANDARD ACCIDENT REPORT

while on duty copies of the emergency accident report blank, reproduced in Fig. 42. In case of accident this is filled out with the names and addresses of all passengers and persons in the immediate vicinity who may have witnessed the occurrence, and sent at once to the general office by the first car passing in how the accident occurred. This report is fastened inside of a cardboard folder convenient for filing, with blank spaces on the outside for the number of the accident, its location, the car number, date and the conductor's name. A copy of the rules given above is printed inside the folder, together with the names and addresses of the company's physicians. This report is handed in person to the assistant superintendent and is subscribed and sworn to before him as a notary public.

After this full report is received it is recorded in a ledger book in which the accidents are numbered consecutively. An alphabetical index in the front of the book contains the names of the persons injured, together with the number of the accident and the page number. The record includes an exact copy of the conductor's report and notation of how the case is settled.

All the conductors carry release blanks, Fig. 44, which are the same as the standard legal form, except that they are condensed. Whenever an accident occurs to a passenger (unless it be of a very serious nature) the conductor courteously asks the injured person to sign the release. For an accident which is due to the passenger's own carelessness a release of this sort is generally obtained on the spot, because he generally realizes that the train crew is not at fault and is willing to release the company from all claims and responsibilities, whereas an attempt to secure a release from the same party a day or two afterward would frequently be futile. The general office is invariably notified of an accident immediately after it occurs, and the assistant superintendent instantly drops whatever he is doing and makes all haste to reach the scene. If the conductor has not been successful in securing a release, the assistant superintendent generally succeeds in getting it. This form of quick release has proved to be of inestimable value, and it is said fully 90 per cent of the average accidents are settled in this way, and cost the company either nothing at all or a very nominal sum. The release ends the matter immediately, and does not give the injured party time to get "litigation symptoms," which might prove expensive to the company, even in case suit was brought by him and won by the company.

In cases where releases cannot be obtained immediately every assistance possible is rendered to the injured person, and if the injuries are at all serious he is taken to a hospital. Physical examination is at once made by the company's surgeons, and as the person improves and opportunity offers, a basis of settlement is generally arranged and the company released, frequently on the payment of the drug and physicians' bills, and

Form 11. J-6-4-04-5M.

Know all Men by these Presents, That I,.....

of.....in the County of.....State of.....

for and in consideration of the sum of ....Dollars, to me in hand paid by the **Oregon Water Power and Railway Co.**, a corporation, the receipt of which is hereby acknowledged, do, for myself, my heirs, executors and administrators, hereby release and forever discharge the said Oregon Water Power and Railway Co., its successors and assigns, its officers, agents and employes of and from all actions, causes of action, suits, controversies, claims, damages and demands of every name and nature, for and by reason of any matter, things or thing from the beginning of the world to this.....day of.....190..., and especially from all claims, damages and demands, accrued or hereafter to accrue, arising out of.....

.....

.....

.....

In Witness Whereof, I have hereunto set my hand and seal the day and date last above written.

Executed in presence of

.....

.....

.....[Seal]

RELEASE

—OF—

.....

—TO—

.....

Amount,$.....

In re.....

Date .....*190*....

Accident Report No......

FIG. 44.—RELEASE BLANKS CARRIED BY CONDUCTORS OF THE OREGON WATER POWER & RAILWAY COMPANY

that direction, or other opportunity. The reverse side of the blank is intended for remarks and full particulars of the accident. In addition to this emergency report, each conductor is required to fill out a standard accident report blank at the end of his run. In this report (Fig. 43) he also gives the names and addresses of the witnesses, damage to property, addresses of persons injured, with nature of injury and full details of possibly also for the damage to clothing and loss of time. The management is always liberal in settling such claims, because a few extra dollars will generally keep the good will of the party and head off any antagonistic feeling which might otherwise be costly to the company. When releases are not secured immediately the principal witnesses are visited as soon as possible, and their statements of the accident taken down in long-

hand and sworn to before the assistant superintendent, who carries with him a notary's seal for that purpose. This plan is found to work out better that when the statement is taken down in short-hand and afterward submitted to the witness in type-written form.

The assistant superintendent is given wide latitude in the settlement of claims, and only in cases of large amounts are the company's attorneys or other officers consulted. In addition to its own claims, the company's officials settle all claims for the accident insurance company in which the employees are insured.

EMPLOYEES

The company's officials maintain very pleasant relations with the other employees. There is no union among them, nor any benefit associations. Accident insurance is carried for the men with an established company, for which they pay a low rate. Each employee also pays to the company 50 cents a month for a hospital fund, which entitles him to free medical supplies and service and also to hospital attendance if necessary. In the way of discipline, the personal element of the superintendent enters largely, no merit or demerit system at present being in use. For slight infractions of the company's rules the men are disciplined by being put at the foot of the extra list for a few days.

When new men are employed they are first interviewed by the superintendent or his assistant, who questions them as to their past experience, examines their credentials, looks into their history and sizes them up in general. If they are deemed likely candidates they are put out with an instructor for two or three trips; if they then seem to take an interest in their work and are adjudged competent to discharge the duties, a deposit of $25 is required of them and their regular breaking-in is proceeded with. If, however, they do not show up satisfactorily at this stage, they are immediately dropped. The officials have a preference for a man who has had previous railway experience, and it has been found that on the average such a man will break in in about six days. Frequently during this period the superintendent boards the car upon which the man is being instructed and calls the attention of the instructor to any points which he deems necessary as to the man's work. After breaking-in the student is given a rigid oral examination covering the names of streets, transfers, collection of fares and his duties in general. Special attention is given to the performance in case of accident. He is then required to provide himself with a good watch and uniform and is put at the foot of the extra list for regular service. Each man is provided with a rule book, which in general follows the customary regulations used by most electric railway companies, with such special rules as are neded to meet the local conditions.

CONCLUSION

The Oregon Water Power & Railway Company is incorporated under the laws of Oregon, and has a capital stock, fully paid, of $2,000,000. Its present authorized bond issue amounts to $2,500,000, with an additional $500,000 retained by the trustees to retire outstanding bonds of the Portland City & Oregon Railway Company. This railway system has been self-sustaining from the first, and has now an established income substantially in excess of operating expenses and fixed charges upon the total bonded debt, which result has been accomplished before the lines have been in complete operation a full year and without any income from the water plant, which, as yet, is without earning power.

The officers of the Oregon Water Power & Railway Company are as follows: President, W. H. Hurlburt; vice-president, J. Frank Watson; secretary, Wm. T. Muir; treasurer, Frederick S. Morris; auditor, Daniel Grant; chief engineer, G. I. Brown; superintendent of construction, William Tiffany; superintendent of transportation, G. C. Fields; assistant superintendent and claim agent, B. S. Boynton; superintendent of power, E. C. Morrow; chief despatcher, A. R. Dimmick.

THE EFFECT OF CHANGING THE GEAR RATIO ON A SERIES RAILWAY MOTOR EQUIPMENT

BY J. C. HUFFMAN

With a given equipment,

What is the effect of changing the gear ratio on a railway motor?

What gear ratio will give the best results?

These questions can best be answered by considering a practical case. A quadruple equipment of 60-hp 500-volt motors and car having a total weight of 29 tons is used in this investigation. The ratio of gears on this equipment due to mechanical limitations is from 14:68 to 32:52.

In selecting a motor equipment where low schedule speeds are specified, and which requires low gear ratios, care should be taken not to have the gear ratio so low that while the car may be going at not more than normal speed, the revolutions of the

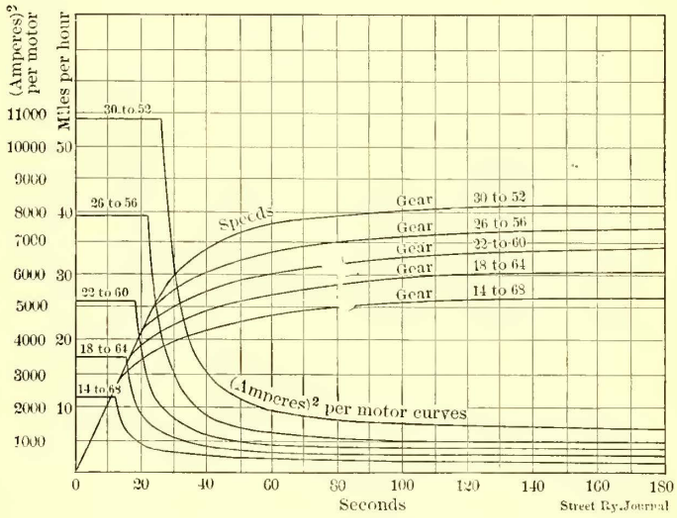


FIG. 1.—SPEED AND AMPERE SQUARE CURVES FOR GEAR RATIOS FROM 14:68 TO 30:52

armature will be in excess of the rated safe limit, and this becomes of special importance when cars are to operate on down grades.

The old method of rating a railway motor on the horse-power it will develop for one hour and not heat above 70 degs. C., is no longer adhered to by manufacturers except to furnish a comparison of motors and commutating possibilities. Motors are now rated on that root mean square value of current which, operating at such voltage as represents the average voltage in practice, will not give a temperature in excess of 70 degs. C. Such rating of motors is based on the heating due to copper loss, which is proportional to the square of the current; and to iron loss, which is a function of the voltage. The limit of the root mean square amperes for a railway motor in service is that value of current which, if running continuously under a pressure of 300 volts, will not cause the temperature to rise above 70 degs. C.

Time-speed and time-power curves are plotted for four gear ratios and for runs of ¼ mile, ½ mile, ¾ mile and 1 mile. An initial acceleration of 1 mile per hour per second is assumed in all runs, and a braking rate of 2 miles per hour per second; this being about the limit of braking rate that bodily comfort of passengers will permit. Also a ten-second stop is assumed in all cases.

Fig. 1 shows the increase of speed with the increase of gear ratio, this increase of speed being obtained at the expense of increased current. From the nature of series-motor characteristics, it follows that any condition which is imposed whereby the armature speed is reduced will be accompanied by increased current. It follows then that while the car attains a higher

maximum speed with increased gear ratio, the armature revolves at a lower rate for such change of gearing. A comparison of the heating effect—current square—is also shown in Fig. 1. This effect increases very rapidly with the increase of gear ratio, and especially so at starting. These curves serve to show why high-geared motors, such as are used in interurban service, should have a low initial acceleration, so as not to cause excessive drop on the line at starting, with its bad

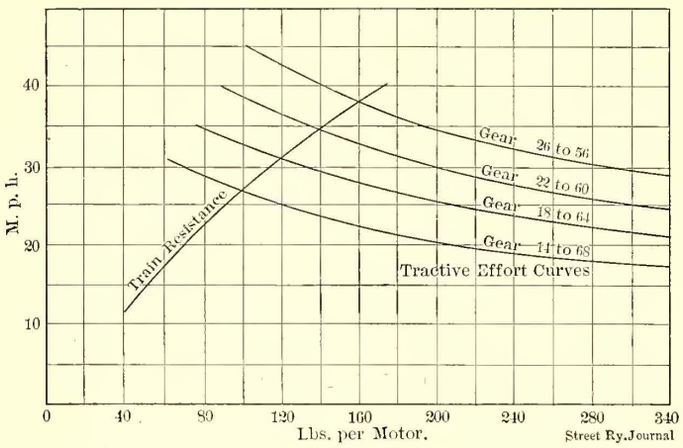


FIG. 2.—TRAIN RESISTANCE AND TRACTIVE EFFORT CURVES

effect on other cars running, and if on interurban lines the excessive maximum loads the rotaries are called on to supply, where the cars per sub-station are few in number.

In Fig. 2 are curves of train resistance and of tractive effort. The train resistance curve is in pounds per motor for a 29-ton car. The tractive-effort curves are also in pounds per motor. The latter differ in this respect from the usual custom where tractive effort is plotted against values of current. The method here used of plotting tractive effort against speed better shows

29 Ton Car. 4—60 H.P. Motors. Gear Ratio 14 to 68. Wheels 33."
Initial Acceleration 1 mile per hour per second. All stops 10 seconds.

Length of run — miles	¼	½	¾	1
Time of run — seconds	70	107	142	177
Schedule speed — m.p.h.	12.8	16.8	19	20.3
Average K.w. per car	40.7	40	39.3	38.1
Watt, hours per ton mile	110	82	71.4	65

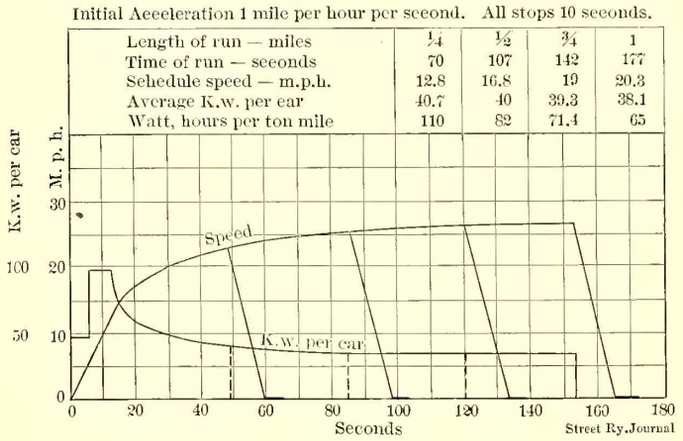


FIG. 3.—SPEED AND POWER CURVES

the effect on the relation of speed and tractive effort when the gearing is changed. These curves show that for a given car speed the tractive effort increases when the gear ratio is increased. At first thought this may seem paradoxical, and especially so in view of the fact that for a given value of current the speed increases proportionally with the gear ratio, while the tractive effort decreases proportionally with such change of gear or is inversely proportional to the change. The fact that the tractive effort does increase, however, with the increase of gear ratio for the same value of car speed, is accounted for by referring to Fig. 1 and noting the rapid increase of the current square values; torque in a series motor is almost directly proportional to the square of the current. Fig. 2 also furnishes a means of determining the maximum speeds available with different gear ratios. The points of intersection of the train-resistance curve with a tractive-effort curve of each gear ratio is the highest speed that can be made with that gear ratio—i. e., at the point of such intersection the tractive effort just balances the train resistance. Only partial tractive-effort curves are here shown because of the large scale used to show more clearly the maximum speeds available.

Figs. 3, 4, 5 and 6 are speed-time and power-time curves for

29 Ton Car. 4-60 H.P. Motors. Gear Ratio 18 to 64. Wheels 33."
Initial Acceleration 1 mile per hour per second. All stops 10 seconds.

Length of run — miles	¼	½	¾	1	¼	½	¾	1
Time of run — seconds	68	101	132	162	70	107	142	177
Schedule speed — m.p.h.	13.2	17.8	20.5	22.2	12.8	16.8	19	20.3
Average K.w. per car	49.6	50.2	48.4	47.1	35.2	33.6	32.6	32
Watt hours per ton mile	129	97.2	81	73.2	92	65.2	55	50

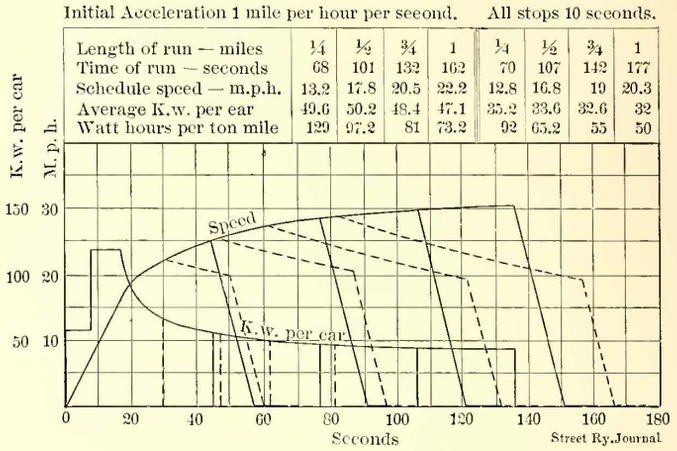


FIG. 4.—SPEED AND POWER CURVES

runs of ¼ mile, ½ mile, ¾ mile and 1 mile, with the different gear ratios specified. Two sets of curves are shown—solid and dotted. The dotted curves are for runs in which the same schedule speed is maintained for a given length of run with the different gear ratios, and will be taken up later.

The solid lines are speed and power curves, in which the motors are either worked to the continuous root mean square current limit or else to the limit of maximum available schedule speed. In the former class are the shorter runs of the higher

29 Ton Car. 4-60 H.P. Motors. Gear Ratio 22 to 60. Wheels 33."
Initial Acceleration 1 mile per hour per second. All stops 10 seconds.

Length of run — miles	¼	½	¾	1	¼	½	¾	1
Time of run — seconds	65	96	124	152	70	107	142	177
Schedule speed — m.p.h	13.8	18.8	21.8	23.7	12.8	16.8	19	20.3
Average K.w. per car	61	60.4	59.7	58.8	40	36	33.5	33.9
Watt hours per ton mile	152	111	94.5	84.3	99.6	66.2	53	49.4

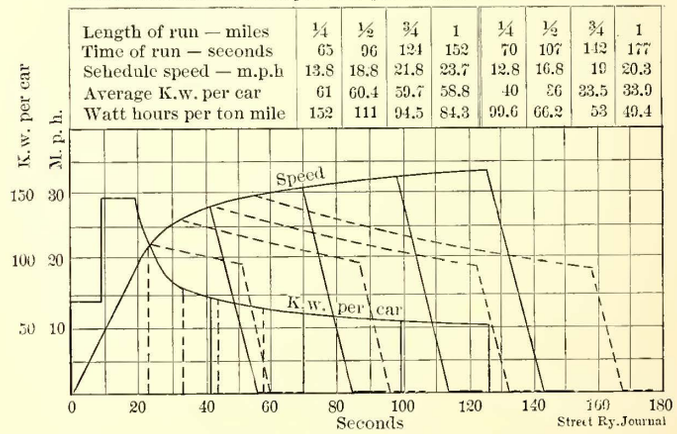


FIG. 5.—SPEED AND POWER CURVES

gear ratios. In these a higher schedule speed is available, but is not permissible if the motors are to be run continuously within the heating limit. To keep within this limit of heating on these runs it is necessary to have some coasting. In the latter class are all runs of the lower gear ratios, and in the longest runs of the higher ratios. In these the heating effect is well within the limit, while the schedule speed is the highest available; there being no coasting, the brakes being applied immediately on cutting off power.

Figs. 3, 4, 5 and 6 also show the change in power consumption from the time the motors start until the power is cut off. These kilowatt per car-time curves again enable us to see the amount of increased power that is required for the increased speed attained by increasing the gear ratio, and also the de-

cided increase of power at starting, due to increased gear ratio. From these curves are obtained the watt-hours per ton-mile. These values for the different length runs and gear ratios are given in the table. This table also contains the schedule speeds for the different runs and different gear ratios. It is fair to

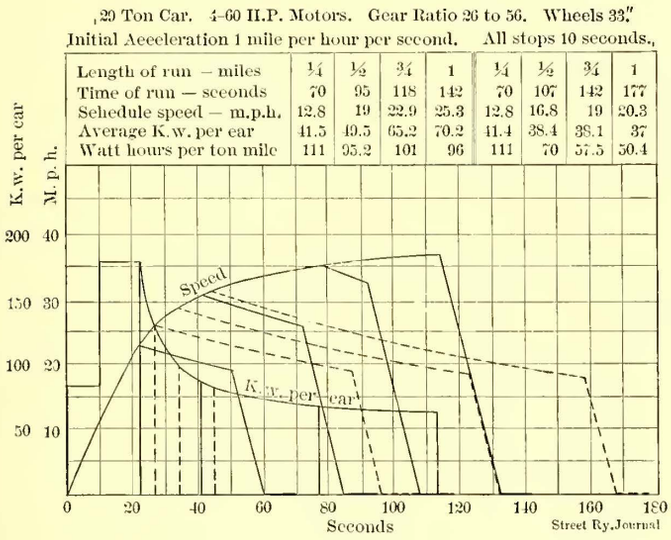


FIG. 6.—SPEED AND POWER CURVES

assume that intermediate runs will have schedule-speed and watt-hour per ton-mile values lying on curves connecting the above points.

Fig. 7 shows curves of schedule speeds for different gear ratios and different length runs. It is natural to suppose that for a given length run the schedule speed would increase as the gear ratio increased. This would follow if in each case braking began immediately on cutting off power and no coasting allowed, as in some of the above runs. Coasting, however, as has been stated before, is necessary on the short runs for the higher gear ratios in order to keep within the continuous limit of root mean square current, and to this is due the intersection of the schedule-speed curves instead of their having an increase for all values with an increase of gear ratio.

From the above values, watt-hours per ton-mile curves also have been plotted. The same cause holds for the intersection of these curves as for the curves of schedule speed. It will be noticed, however, that in runs having no drifting the schedule speed and the watt-hours per ton-mile increase when the gear ratio is increased.

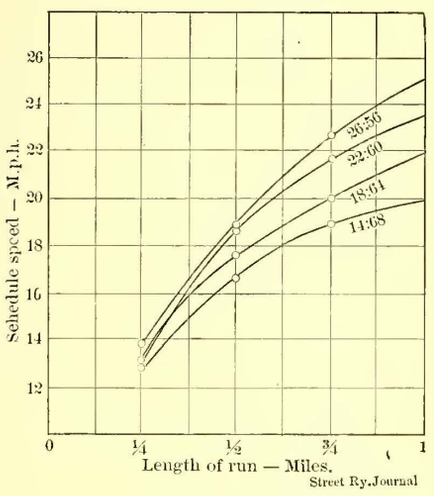


FIG. 7.—SCHEDULE SPEED CURVES

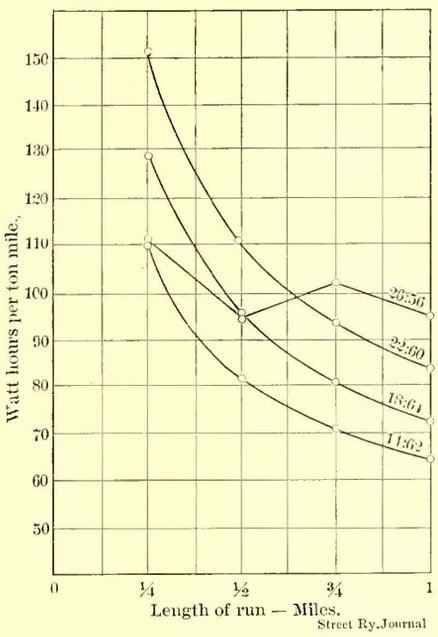


FIG. 8.—WATT-HOUR PER TON-MILE CURVES

The dotted curves of Figs. 3, 4, 5 and 6 furnish another basis of comparison of gear ratios. Here the highest schedule speed available with the lowest gear ratio is the schedule speed assumed for like runs with other gear ratios. The abnormal drift on the longer runs, and especially the longer runs of the higher gear ratios, are not in keeping with actual service curves. They are given here, however, as a means of comparing different gears making the same length run at the same schedule speed. The tables give the watt-hours per ton-mile for these runs, while Fig. 9 shows curves plotted from these tables.

The curves of Fig. 9 show generally lower values than do those in Fig. 8. From this it appears that runs made by the high gears and having a long coast are the most economical. This again brings in the question of that kind of running which for a short time at the starting of cars brings a hard jam on the power house or sub-stations, and if such running is justified by the economy it effects in power. This will be referred to in conclusion.

SUMMARY

The effect of changing the gear ratio on a car equipment is:

Increased car speed and a correspondingly decreased tractive effort for increased gear ratio for a given value of current.

Increased tractive effort for a given car speed with increased gear ratio.

Increased maximum speed available and an increased current attending this maximum speed which increases the motor heating for an increased gear ratio.

While a high ratio operating on runs having a long coast shows economy of power in its favor, the erratic load of such heavy pulls for a short time on the supplying station, and the telling effect on drop, car lights, and other cars running, more than offset any saving of power that shows to its advantage.

As a general proposition, then, it may be stated that the best gear ratio to use on a given equipment for a given schedule speed is the lowest gearing that with a fair margin will maintain the specified schedule.

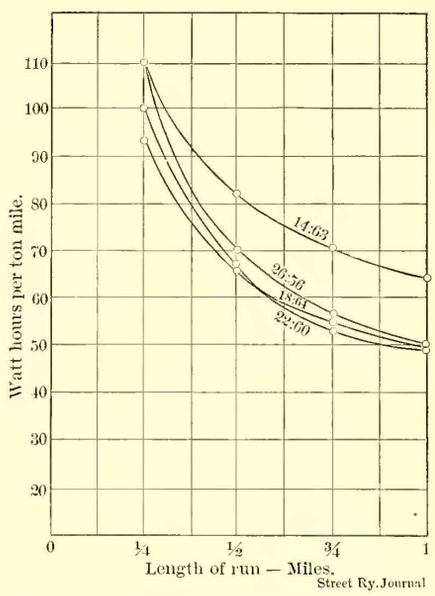


FIG. 9.—WATT-HOUR PER TON MILE CURVES (SAME SCHEDULE SPEED FOR GIVEN LENGTH RUN WITH DIFFERENT GEAR RATIOS)

Rendered uncontrollable because of leaves on the track, a car of the Boston & Worcester Street Railway slid down a steep hill in Boylston Street, Chestnut Hill District, Newton, Saturday afternoon, Oct. 22, and crashed into another car that was stalled at the bottom of the hill, wrecking both cars and causing painful injuries to eight passengers.

THE DUTIES OF THE CAR FORCE

BY E. B. CARLISLE

On many roads the duty of the conductor is to collect fares, ring them up on the register, issue transfers, attend the signal cord and trolley pole, and sometimes to give assistance to passengers who need it in getting on or off the car. In case of accidents the conductor is instructed to get a clear idea of what happened, and if damage has been done or persons injured, he is supposed to get the names of as many eye-witnesses as possible and report.

The motorman is expected to properly operate the controller and brake, and to keep the car on schedule time as nearly as it is possible for him to do so. If anything happens to the car equipment, causing the fuse to blow or the brakes to open, he is instructed to ascertain what motor is giving trouble, if it be a motor, and to manipulate the cut-out switches inside the controller so as to cut out the damaged motor or motors, and attempt to move the car with the others.

Now this is about all the crew are permitted to do. If they cannot move the car, as above, their instructions are to report to the office, by wire if possible, and wait for assistance. No tools or repair parts of any kind are carried on the car, and the crew are instructed not to make use of any, probably on the theory that men who are not supposed to understand the apparatus under their charge would only make matters worse if they attempted repairs.

It is a surprising fact that the management of many roads to-day believes that the above policy is good railroading. It is a common occurrence in some cities to see a disabled car in the street, and the crew standing about waiting for assistance, as much puzzled as to what has "gone up" as the passengers themselves. Again, it is inconceivable why the management apparently looks with indifference on the spectacle of an extra car, manned by repair men, sent from the house to tow the disabled car in! Of course, there are cases where the above method of procedure is inevitable, but its frequent repetition is a reflection upon the management in the eyes of the public, while the former appear only interested in the cause of the trouble instead of its rapid remedy.

It is not an exaggeration to say that in all probability the splicing together of a motor lead, the reattachment of a ground wire, or the adjustment of some controller fingers, would in 50 per cent of the cases make it possible to run the car to the house with one or more of its motors in use, and with a delay to the service of only five or ten minutes.

The rapid increase in the length of interurban roads has forced a change of policy. It was found that it would not do to tie up an interurban line for one or two hours while a disabled car waited for help, if there was a possibility of getting along without it. Here are some examples which are actual occurrences:

On an interurban run of about 25 miles the last car at night left one terminal bound for the power station and car house 17 miles away. Shortly after leaving, the booster at the power station was disabled by lightning, and the voltage became quite low. The car then descended into a deep hollow, with a heavy grade at each end, and repeated trials failed to make the car quite climb the further grade. After a delay of over an hour, during which there was no method of communicating with any one, the motorman suggested that the male passengers get out and push. This method easily succeeded, and shows the necessity of teaching the crew as much as possible about the apparatus under their charge and encouraging them to help themselves out of trouble.

On another interurban line the tension spring of the trolley stand of a single-ended car gave out, and a delay of an hour ensued, because it either did not occur to the conductor, or he had no instructions, to climb on the roof and hold the pole up, while the motorman ran the car slowly to a siding where they could transfer their passengers to another car and bring their own in.

To obviate most of these troubles, and thus secure better service, modern roads have greatly increased the duties of the crew, especially the motorman, in times of emergency. This has made necessary a preliminary education of the candidates for the position of motorman, and in some cases they are requested to work from one to three months in the car house, helping the repair men. They soon learn what ordinary troubles a car is subject to and how they are remedied. They are then "broken in" on the road. These men are generally able to discover what has happened to their car, and are in a position to know whether it is possible to make temporary repairs with the means at hand, or not. This relieves the situation of the element of doubt, and renders it possible to make the proper move in the matter. The motorman is also provided with some means to make repairs. A motorman's tool box is provided on the car, containing certain necessary tools and supplies, such as a hammer, a wrench, a pair of cutting pliers, a roll of tape, an extra trolley wheel and one or two carbon motor brushes. An extra trolley pole, all fitted up, is carried in suitable brackets on the roof. Sometimes there is carried on the car about 100 ft. of ½-in. rope for tying up broken trolley wire.

Besides the standard signal lamps, the car is provided with a pair of hand lanterns, with a red and a white globe, for flagging as well as for use under the car in making repairs at night. The motorman's tool box is frequently made a part of the car equipment, and each man given a key to it. On some roads, however, the box and its contents are issued to each motorman, and they are held responsible, taking it with them when relieved from duty for the day.

There are obvious arguments for and against the two methods, but one of the largest railway systems in the country uses the latter.

While the motorman is working in the car house, the master mechanic or foreman is expected to explain the apparatus and its working, and answer his questions. If there is a well-fitted-up instruction car or room this part of his education is more easily and thoroughly done. His experience in the house is likely to remove any fears he may have of getting "shocked," and to teach him the conditions which must exist when he does come in contact with the current, and he will then be able to properly protect himself when handling live wires or apparatus. A motorman who succeeds in bringing in a disabled car by means of some original idea in making repairs, where ordinarily success would appear doubtful, is deserving of commendation or a credit mark to his record.

A superintendent learns that certain of his men can be depended on in an emergency to do all that is possible, and knows that if help is sent for it is really necessary.

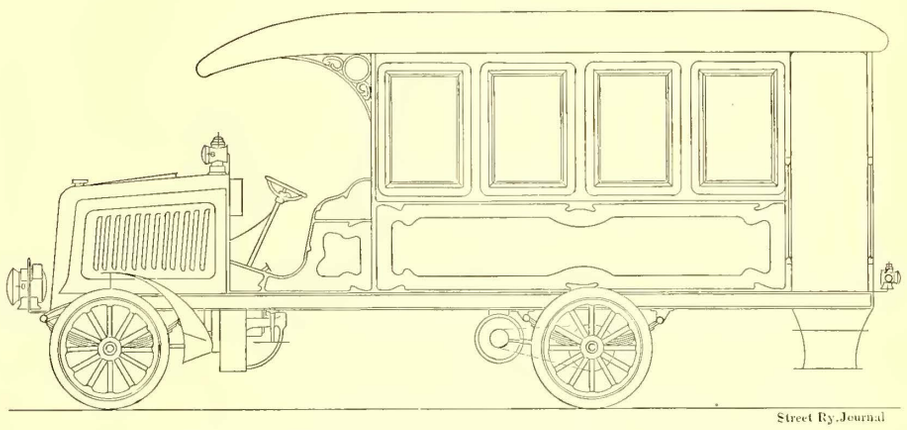
On many small roads "two-ended" men are very desirable. They are men who are competent either as motorman or conductor, and it is often very convenient to be able to shift them about temporarily. In the case of trouble with the equipment they are valuable, on the principle that "two heads are better than one," when both understand the mechanism.

The Schenectady Railway Company, of Schenectady, N. Y., has opened an evening school at the rooms of the Schenectady Railway Benefit Association for its employees. There are classes in mathematics, drawing and electricity. Already about seventy-five students have enrolled. The instruction in electricity will, of course, be kept to the line of electric railroading. The instructor of this class is J. G. Bankat, master mechanic of the company. The men have all entered in the work with the spirit of enthusiasm that presages good work, and it is expected that the competition will be keen for the prizes that are offered for good scholarship.

GASOLINE-ELECTRIC PASSENGER 'BUS

The improvements constantly being made in the construction of self-propelled vehicles for pleasure or business has led to serious investigations into the possibility of adapting them for regular passenger traffic in districts whose sparse population would not justify the installation of an electric railway. The comparatively low weight of gasoline per power-unit developed gives it quite an advantage over other methods, and has lead the General Electric Company to build gasoline-electric automobile 'busses of the style illustrated herewith.

The frame work of this 'bus is made up of angle irons bolted and riveted together, properly braced, thus insuring great rapidity with minimum weight. The engine and generator are suspended from the main frame under the hood in the extreme front of the car. The two motors which drive the car are mounted near the rear end and connected to the rear wheels by means of chains. The wheels are of standard artillery construction, equipped with solid rubber tires of sufficient cross-section to give long life without increasing materially the draw-bar pull. Semi-elliptic springs are used in front and full elliptics in the rear. The steering mechanism consists of the standard wheel construction, connected to the front wheels through an irreversible worm, thus rendering the steering easy on rough roads. The wheel base is long, thereby insuring easy riding on bad roads and reducing the tendency to skid to a minimum. The water and gasoline tanks are suspended from the frame work and located under the body of the car, the radiator being in front. The body of the car is arranged with seats running lengthwise. The entrances are from the sides at rear or car, thus eliminating the danger to passengers getting on or off the car. The inside of the car is lighted with acetylene gas, which also supplies the two searchlights on front of car.



A NEW GASOLINE-ELECTRIC 'BUS SEATING TWENTY PASSENGERS

The engine is of the four-cylinder, four-cycle type, having a capacity of 40 hp at a normal speed of 700 r. p. m., and can be speeded up to 1000 r. p. m. when required. It is direct connected to a generator which supplies energy to the motors. The generator is a six-pole, 6-kw multipolar machine, especially designed and built for automobile work. The demands for this class of service call for an extremely light machine, but one that is capable of carrying large overloads for short periods of time. The overloads which it will carry are as follows: 12 kw for one hour and 24 kw for fifteen minutes. It is wound for a normal voltage of 85 volts when the engine is running at 700 r. p. m., and by speeding up the engine this voltage can be increased considerably.

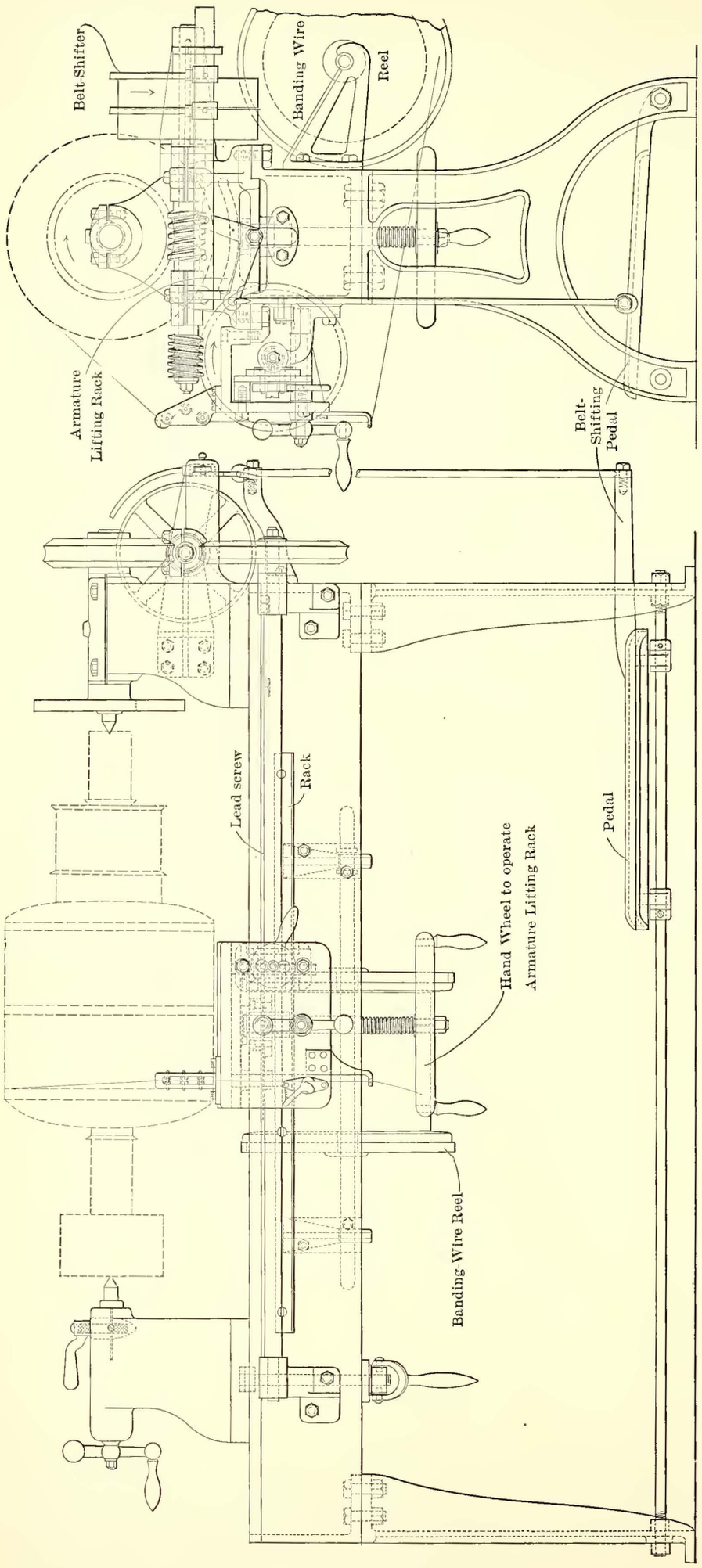
There are two G. E. automobile motors connected to and driving the rear wheels by means of chains, giving flexibility, efficiency and quiet running. Each has a continuous rating of 45 amps. at 85 volts, and an overload capacity of 120 amps. at 85 volts for short periods of time. Great care has been taken in laying out this line of motors, so that on overloads the greatest torque per ampere is obtained. The controller is of the automobile type, having two speeds forward and one reverse, with the addition of two electric brake points. These electric brake points are not to be used in regular service, but only in case of emergency. The connections of the controller are: First point, motors in series, therefore maximum torque for grade climbing and acceleration; second point, motors in multiple, which is maximum speed position. No resistance points are used, as the voltage of the generator is controlled by the speed of the engine. The control of the engine is really the main control of the car, as the connections of the motors from series to parallel, or vice versa, are only used when starting the car from rest or when climbing heavy grades. This control of the engine is accomplished by a single lever, actuated either by the hand or foot, and in turn controls the throttle and spark of the engine. At its off position the engine is throttled down and the spark retarded, so that it runs at such a low speed that the generator loses its excitation. By moving the lever from the off position, the engine speeds up, the e. m. f. of the generator picks up and delivers sufficient current to start the car. By opening the throttle still further, the engine speed is increased, the car speed thus being governed by the speed of the engine, and inversely the speed of the car will be reduced by throttling down the engine.

The efficiency of the above gasoline-electric combination for this class of service compares very favorably with any type of speed change gears, and, moreover, has the great advantages of large variations of speed, flexible drive, ease of control, minimum wear and tear, the acceleration and changes of speed being smooth and without jar or shock, which are ever present with any mechanical change speed gear. The speed of the twenty-passenger 'bus on good level macadam is 12 m. p. h., and the engine has power enough to drive car up a 10 per cent grade. The economy of this outfit on good level macadam is between 15-ton and 20-ton-miles per gallon of gasoline. The weight of the 'bus loaded with twenty passengers is approximately 4.5 tons.

A NOVEL SPECIAL TRAIN

A train on the Northwestern Elevated Railroad, of Chicago, carried a queer assortment of passengers a few evenings ago. The North Shore Congregational Church conceived the idea of running an "immigration special" over the elevated line in connection with a church entertainment. Those participating were dressed as immigrants in their native garb. The special train made a round trip from Wilson Avenue over the down-town loop, after which it was abandoned for a supper and vaudeville entertainment at a neighboring hall.

In preparing for its winter schedule, which will give through cars from Cleveland to Toledo on two hourly headway, instead of hourly as at present, the Lake Shore Electric Railway is planning to run its limiteds in trains of two or more coaches to take care of the additional traffic. The limited cars are equipped with the G. E. multiple-train control system, and the air brake and couplers are being arranged so that this plan can be adopted if found desirable. It will probably be necessary to separate the cars at the city limits of Cleveland and Toledo and run them into these cities singly.



A NEW AUTOMATIC-FEED ARMATURE BANDING LATHE—DESIGNED AND BUILT BY THE HARTFORD STREET RAILWAY COMPANY

A NOVEL ARMATURE BANDING LATHE

Many attempts have been made in the past to perfect an automatic armature banding machine which would facilitate this difficult task in repairing armatures. One of the most interesting and successful is that which has recently been built by the Hartford Street Railway Company, of Hartford, Conn., for use in its electrical repair shops. The banding of armatures was formerly accomplished there by the usual method of winding on the banding wire in an ordinary engine lathe, the tension being given the banding wire by makeshift braking methods, with the difficulties attendant. The new banding lathe, which has been recently designed and built for this purpose, is arranged not only to provide the necessary tension in winding, but also automatically to feed the wire axially along the lathe bed as it is wound upon the core.

The new design is illustrated in the accompanying drawing. As may be noted, it is an adaptation of a plain speed lathe with a 6-ft. bed, which has been provided with a special carriage and screw feed and a special worm-gear driven headstock; the tail stock was retained without change, as is also the case with the bed. A foot pedal has been added, with the necessary connections to a shifter upon the belt-drive, by means of which the machine may be started and stopped with the utmost facility by the operator. The changes which have been made to the lathe are not difficult, and are such as may easily be made upon any speed or light engine lathe of ordinarily strong construction.

As may be noted from the drawing, the scheme of the machine is that of mounting the armature between the lathe centers, as shown by the dotted lines, then revolving it slowly and smoothly by means of the worm-gear drive, and feeding the band wire through the special tension sheaves upon the front of the carriage and on to the armature as required, the carriage being fed along the lathe bed as the wire is wound on, in order that it shall lie smooth and tight. The machine is driven by pulleys upon a driving shaft at right angles to the lathe bed, at the right end, as shown. This shaft carries two worms, one of which drives the gear upon the headstock and the other the larger gear upon the feed screw in front of the bed. The machine is started and stopped by means of a belt shifter mechanism, tight and loose pulleys being provided upon the driving shaft. The belt is

shifted by a foot pedal connection which operates the shifting slide through a bell-crank, as shown. The headstock is equipped with a plain face plate of ordinary type, from which the armature shaft is driven through dogs in the usual manner.

The banding wire is carried upon a reel mounted at the rear of the bed and revolving freely upon a stationary shaft, so as to move axially, as required in winding the banding wire upon different portions of the armature. The banding wire is fed off from the reel beneath the bed, through a guide, and thence vertically upward to the tension sheaves, which are mounted in a special casting upon top of the apron, so as to deliver directly to the armature. The carriage feeding mechanism has been designed to give the very slight amount of feed which is necessary in winding the wire of the size used; in other words, the carriage is arranged to be fed axially with every revolution of the armature, through a distance corresponding to the thickness of the wire. The feed is thrown in or out upon the carriage by the usual split nut method, so common in lathe practice; it is also provided with a hand traverse for facility in locating it upon the carriage.

Another feature of interest is the provision upon the carriage of a spring operated "come-along" wire grip, by means of which the banding wire is automatically held in position ready for use after cutting off, when it would ordinarily tend to pull or spring back. In winding the band wire upon the armature, it normally feeds easily through the wire grip, but when it is cut off next to the armature, after completely winding on, so that it would tend to fly back, the grip automatically closes upon it and prevents it from pulling back through the tension sheaves and necessitating rethreading for further use.

An interesting provision for facilitating the mounting of armatures between the lathe centers has been provided in the form of a lifting frame, operating by a hand wheel beneath the bed for raising the armatures for centering. The frame is supported upon the inner ways of the bed and carries a lifting screw, operated by the hand wheel beneath, which terminates in a concave top in which the armature rests nicely when dropped upon it by the crane. After that it is an easy matter to raise or lower it by adjusting the hand wheel until its shaft is in line with the lathe centers.

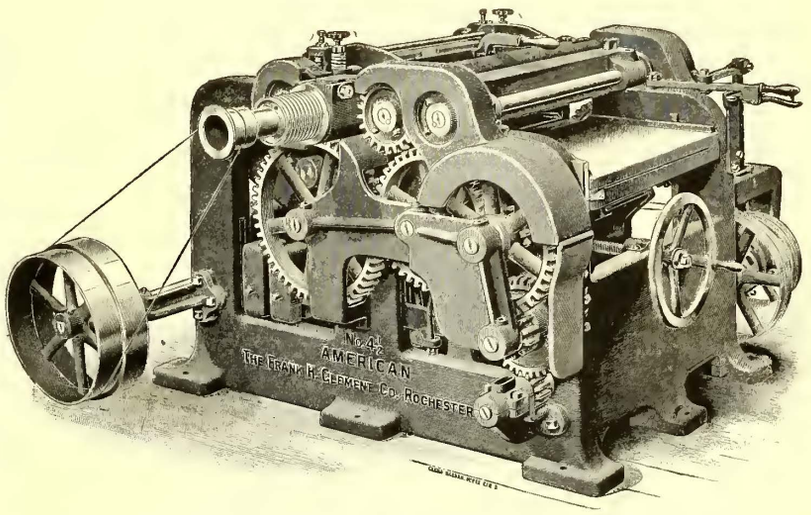
This has proven a very ingenious design for this work, and may be seen to be of a very practical nature. It has been worked out with care as a result of the experience in banding armatures at the shops, and will, it is thought, prove a great time saver. This machine was designed by Frank Caum, superintendent of the Hartford Street Railway Company, by whom this interesting information was furnished.

SINGLE FURNITURE PLANER

The machine shown in the accompanying illustration is an unusually rigid and well constructed single furniture planer, and embodies all of the latest improvements designed by the F. H. Clement Company branch of the American Wood Working Machinery Company, of New York and Chicago.

The main frame is deep and heavy, and the entire machine rests mainly on the two central foot flanges under the cylinder, the flanges in the front and rear cross-bars acting only as balancing or steadying points, and there is an unusually heavy body of iron around and under the cylinder boxes, extending to the floor; the result is a degree of solidity not before reached, both for the frame and bed and for the cylinder boxes. The cylinder is a solid steel forging, with bearings 2⅛ ins. in diameter and 10 ins. long, and carries two knives ordinarily. These journals are nicely ground and polished (not filed), and the boxes are accurately scraped to them. Thus the cylinder will start off at a high speed with close boxes without heating. It is belted at both ends, and may be driven from above or below, or horizontally; and the cylinder pulleys are secured by tapering, split sleeves, no nuts or keys.

The main boxes are made with patent side clamping flanges, finely fitted, whereby the adjusting is easily and accurately done; and the babbitt metal is rigidly secured by a new system of dovetails, causing it to shrink in tight. There are ample oil cells and a constant circulation of oil from center to end of the bearings with return channels. The bed is planed the whole length, and is raised and lowered on specially heavy and well fitted inclines, the lower or movable one sliding on tracks cast upon the framing. All these surfaces are carefully scraped to a bearing, and ample provision is made for oiling. The lower incline is moved by heavy square threaded screws worked together by cut gears on the wider machines, and operated by a large central hand wheel. The bed plate proper, or either out-



AN ADVANCED TYPE OF SINGLE FURNITURE PLANER

side section, may be removed for planing or facing without taking the machine apart.

The feed works are exceptionally heavy, well proportioned and powerful. The gears are 2-in. face all around, and their arrangement is the most simple and compact yet devised, reducing the number of the parts and bearings, and conveying power directly to the rolls. All rolls are driven, and every gear is in even mesh at all times; intermediates are arranged to adjust with the adjustable roll gears, and they are swung on shafts which have bearings on both sides of the gears. The upper forward roll is geared at both ends. The rates of feed are from 16 lineal ft. to 50 ft., in four gradations, two of which are instantaneously available by means of the variable feed lever, and the other two by shifting the first feed belt. The roll boxes are babbitted on a new plan, preventing looseness even after long wear. The roller shafts are of steel pressed in. The pressure bars are very carefully fitted and hang about 2½ ins. apart when working, whereby pieces as short as 3½ ins. may be surfaced perfectly true. The chip-breaker swings concentrically with the cylinder, within the limits of the cut.

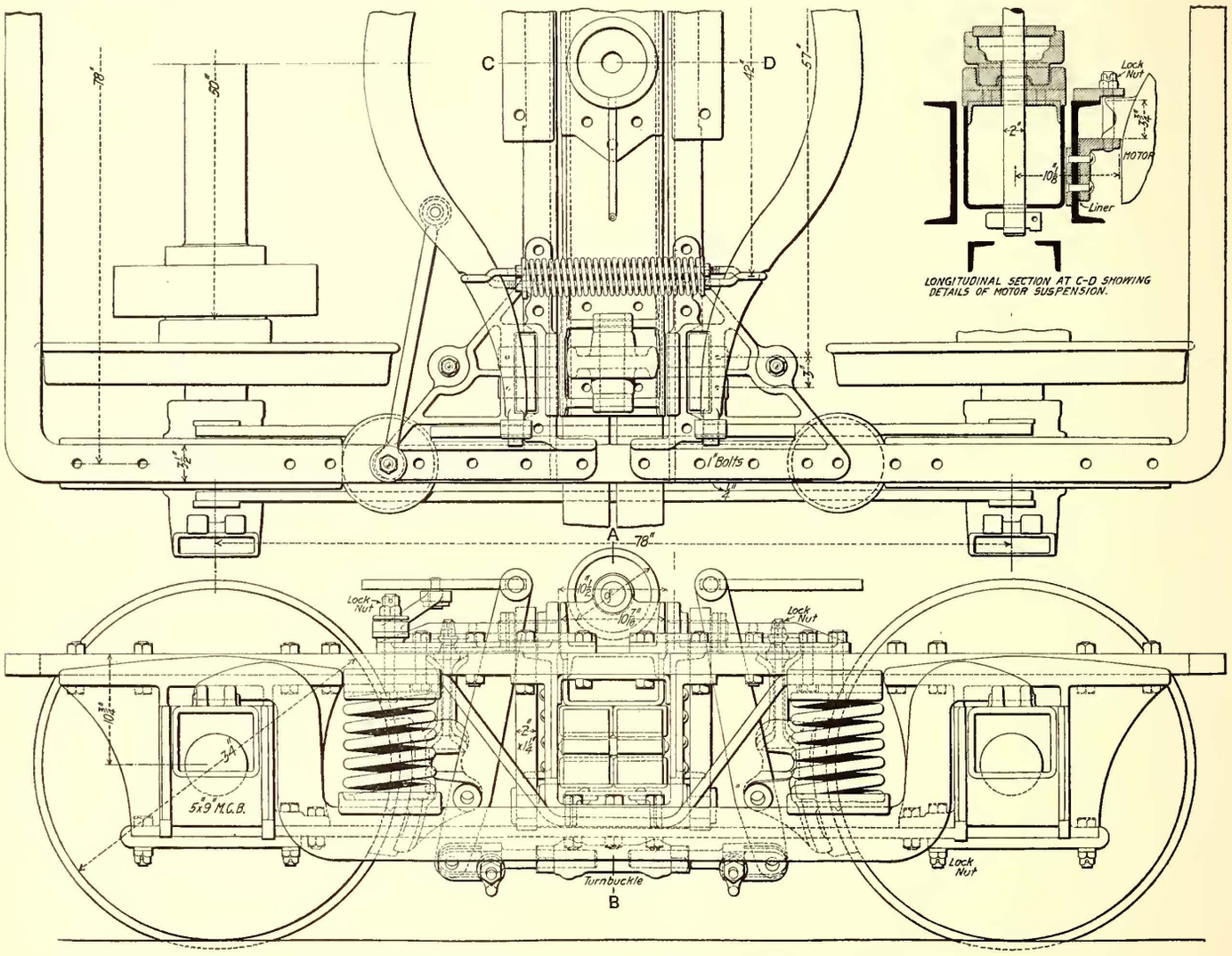
Large housings are provided to cover the gearing on both sides of the machine. These may be lifted off by slacking two screws. The countershaft has T. & L. pulleys 12 ins. x 7¼ ins. (with self-oiling loose pulley), and should run about 850, giving the cylinder 4200. Three heavy hangers and necessary shifter attachments are furnished.

The in-feed roll can be made in sections, usually 2 ins. long, when ordered. Four widths are made: 24 ins., 27 ins., 30 ins. and 36 ins. Double surfacers are made from same patterns in all widths, with or without divided rolls.

A NEW DESIGN OF STEEL MOTOR TRUCK FOR HEAVY ELECTRIC TRACTION SERVICE

The field of high-speed interurban electric traction has made extraordinary demands upon the builders of car trucks for trucks which shall be so designed as to not only withstand the racking, pounding and other extreme conditions of high-speed electric operation, but also at the same time furnish the important desiderata of easy riding qualities, serviceability and safety. The history of electric railway truck design has shown that, for high-speed interurban service, while an early departure was made from ordinary street railway methods to fulfil the requirements of high-speed interurban operation, still the adaptation of the general principles developed in steam railroad operation was extremely difficult owing to the lack of similar operating conditions, not only as to roadbeds operated over, but also to the motive power. The question of design in the case of a truck for heavy passenger cars in steam railroad operation is exceedingly simple as compared with that in the case of heavy interurban and elevated electric railways, where, in addition to carrying the weight of the heavy passenger car, the truck must also carry the weight of two large motors and also be capable of withstanding the shocks and blows made in transmitting the force exerted by the motors in accelerating the car body.

The new design of truck which is illustrated in this article is an example of a most successful application of the principles of truck construction, as developed for modern heavy passenger traffic conditions upon steam railroads, to the peculiar conditions met in heavy high-speed electric railway operation. The American Locomotive Company, appreciating the demand for a truck to fulfil these requirements, has made a careful study of the subject from both standpoints, and has succeeded in this design in producing a truck which will eliminate many of the difficulties that have been encountered in various other truck designs. The valuable past experience of this company in the construction of steam locomotives and passenger and freight trucks has enabled it to adapt the most approved principles of steam railroad truck design to the requirements of electrical operation, with the certainty of securing not only strength and durability, but also easy riding qualities and safety under the extreme conditions of rough track, worn special work, etc., usually met on interurban lines. This new truck is herewith illustrated both by drawings and photographs, which show the features of departure from usual principles of truck construction.

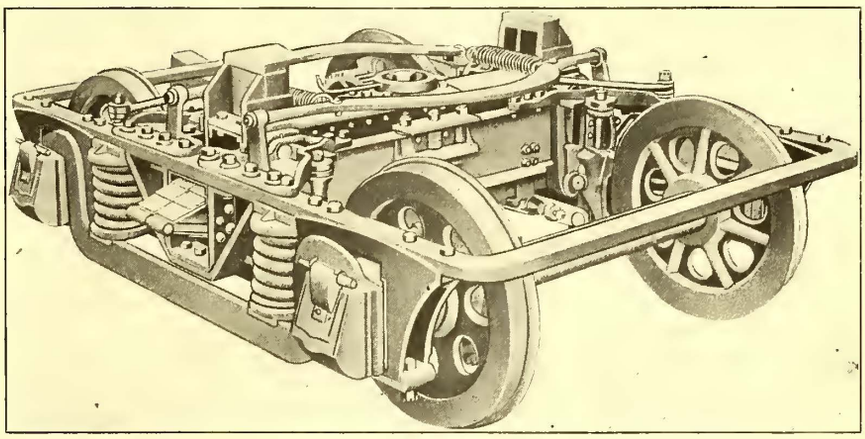


DETAILS OF NEW STEEL MOTOR TRUCK, SHOWING NOVEL SWING LINK AND SIDE BEARING CONSTRUCTION

It will be noticed by reference to the drawings that the Master Car Builders' standards of truck construction are adhered to in the general design of this new truck, in the use of equalizers and swing link bolster construction. The top frame is made all in one forging of bar steel, 2 ins. x 3½ ins. in section. The transoms are of 12-in. channels, with their connections to the frame stiffened by cast-steel corner plates, as is clearly shown in the engravings. The truck bolster is made of ⅜-in. steel plate, flanged into a trough-shaped girder, and tied across at the top by a 9-in. channel riveted within the plate, and thus acting as a cover plate; this is clearly shown in section A-B. The edges of the trough plate are kept below the top side of the channel so that both the center plate and the side bearing castings may be lipped over the edges of the channel,

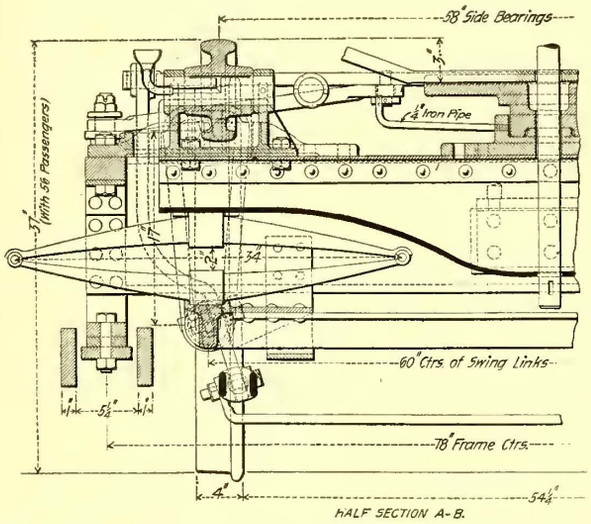
and thereby take the driving strain off of the fastening bolts.

The side-bearing castings are made with large vertical face areas, which bear against corresponding special faces on the cast-steel corner brackets above referred to, so as to transmit the driving strain from the motors to the king bolt without racking the bolster and cramping it between the transoms; these thrust bearings project above the center plates, and, in connection with the wearing plates riveted to the sides of the bolster near the bottom, take all of the driving stresses from the motors. The side bearings themselves may be flat or of the roller type, as may be desired. The photograph shows the use of the flat side bearings of the usual type, while in the drawings is shown a type of roller bearing. This roller type of side bearing embodies the use of a single chilled-iron wheel at each side, which is mounted with ample bearing surfaces upon an axle, and so arranged that the bearing surface may be oiled from the center of the axle, as shown, in order to prevent the entrance of dirt, which would in any other case be unavoidable.



THE NEW STEEL MOTOR TRUCK FOR HEAVY ELECTRIC TRACTION SERVICE

The links which carry the bolster rest on two pins at the top instead of one, thus giving the steady riding advantages of the spring-controlled bolster without the use of springs. This

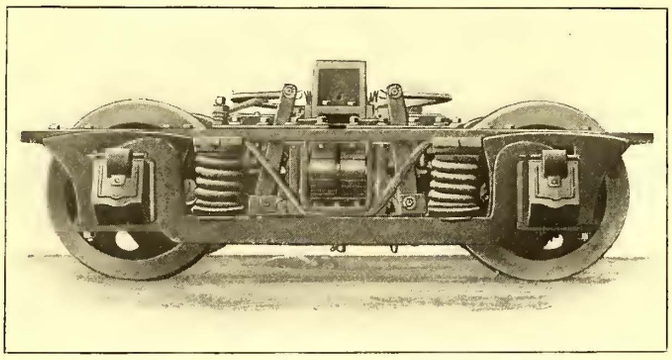


HALF CROSS SECTION, TO SHOW BOLSTER AND SWING LINK CONSTRUCTION

construction also takes the pendulum motion from the car, as the bolster cannot tip down on either end, but must always remain level when swinging from side to side. The links are so made as to lift from one pin when swinging.

The brake rigging circles are placed near the center of the truck, as shown, and all side strains on them when the truck is on the curve are resisted by a radius bar, which makes it impossible for the circle to travel in any way but parallel with the center line of the truck; this is an important factor in taking wear from the brake levers, as is the case when they are alone depended upon to constrain the circle to its proper longitudinal movement. Release springs of the compression type are used upon the brake rigging circles, as shown; the method of construction in this case is interesting, as both case of adjustment and extreme compactness are thereby secured. Two circles are applied to the truck when it is to be used in connection with the system of brake rigging which the American Locomotive Company has designed especially for electric railway service.

This system of brake rigging is especially adapted for use upon heavy high-speed railway cars, its most important features being that of extreme reliability for use upon steep grades and also its effectiveness. The purpose of this new design is in particular to keep the air-brake system of levers and rods entirely independent of the hand-brake system. This is provided for, as shown in the plan drawing of a car thus equipped, by the use of one air-brake system and two hand-brake systems, all of which are entirely independent of each other, and any one of which is capable of applying full braking power to all wheels of the car, even though the other two should happen to become disabled.



SIDE ELEVATION OF THE STEEL TRUCK

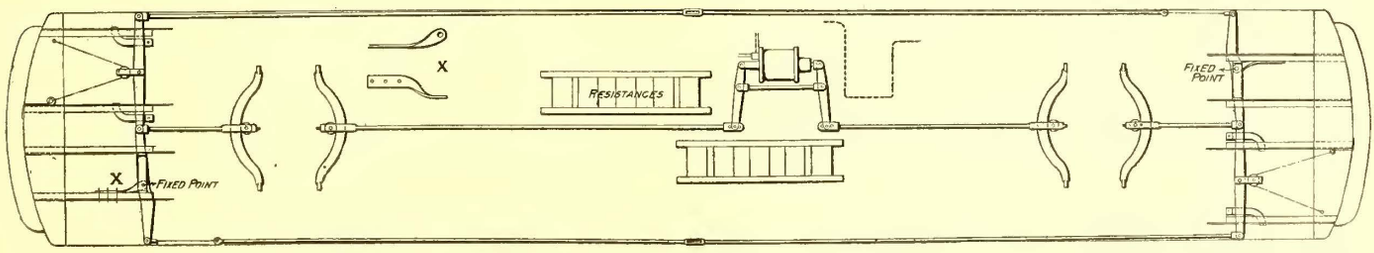


DIAGRAM OF NEW ARRANGEMENT OF BRAKE RIGGING TO ENSURE INDEPENDENCE OF HAND AND AIR-BRAKE SYSTEMS

As may be seen from the brake lever diagram, the hand brake at either end is attached to a floating lever, one end of which is coupled with the circle of the nearest truck and the other end to the truck at the opposite end of the car through the rod

running along the side; the motion of the latter rod is reversed by a lever so pivoted as to make its motion coincide with that of the floating lever at that end of the car. In this way it may be seen that the two hand-brake systems are thus identical in construction and in action. The air-brake system, of course, operates in the usual way, although with this construction the brake rigging under the body of the car is greatly simplified, which permits more easy access to the resistances, air compressor and other apparatus that may be installed there.

With this construction of brake rigging, the failure of one rod or any part of any one of the three braking systems does not in any way affect the operation of the two others. With usual systems, the failure of any rod or any part of any one of the three systems will render both air and hand brakes useless, so that the car can be stopped only by reversing the motor. It so often happens in reversing a motor in an emergency that the main power circuit fuse is blown, which would, in connection with a broken brake rod, make it impossible to stop the car. This feature of the new brake system is extremely valuable, as it provides against possible serious results in such a case.

The heavy standard journal box is used upon the truck, the design being such that the weight is applied at the center of the brass. The disposition of the loading upon the journal is made in accordance with the Master Car Builders' adopted standards, so that the bearing loads do not exceed the safe limits which have been established by practice. The truck weighs 11,400 lbs., and is designed for electric cars weighing from 75,000 lbs. to 80,000 lbs., to be run at speeds as high as 60 to 70 miles per hour.

WORLD'S FAIR EXHIBIT OF THE FRANKLIN RAILWAY SUPPLY COMPANY

The accompanying illustration shows the Franklin Railway Supply Company's exhibit of car-heating material at the Louisiana Purchase Exposition. It is located in the Transportation Building, Aisle D, Post 52, in charge of the company's St. Louis representative, William H. Davis.

The Western car heater is shown piped as it would appear in a passenger car, and demonstrates the small amount of space

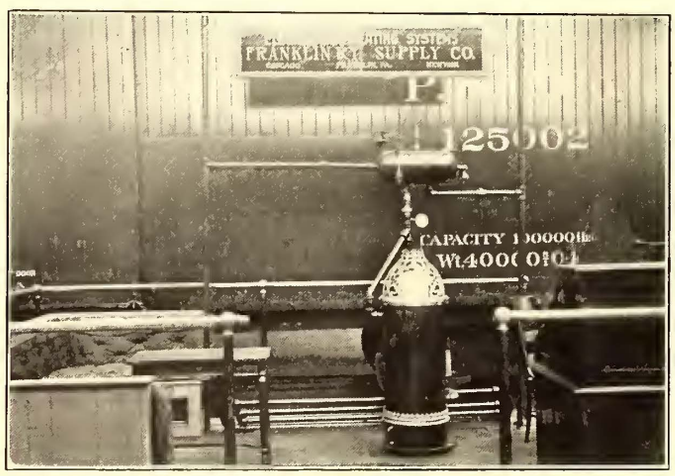


EXHIBIT OF THE FRANKLIN RAILWAY SUPPLY COMPANY

taken up by this equipment. This heater, as stated in the Oct. 8 issue, has been placed on the new cars of the Metropolitan West Side Elevated Railway, the Milwaukee Electric Railway, the Rochester Railway, the Syracuse Rapid Transit Railway and many others. Many of the street railway officials who visited the Fair did not fail to take advantage of the opportunity to examine this apparatus, and to see why the water-jacket heater has been so generally adopted during the past year,

EXHIBIT OF THE BRISTOL COMPANY AT THE ST. LOUIS EXPOSITION

The display of recording instruments for pressure, temperature and electricity made by the Bristol Company, of Waterbury, Conn., is located in the Electricity Building. The accompanying illustration shows the appearance of the booth,

THE BRISTOL COMPANY'S EXHIBIT

which is 22 ft. long x 12 ft. wide. The booth contains a large variety of recording instruments for pressure, temperature and electricity.

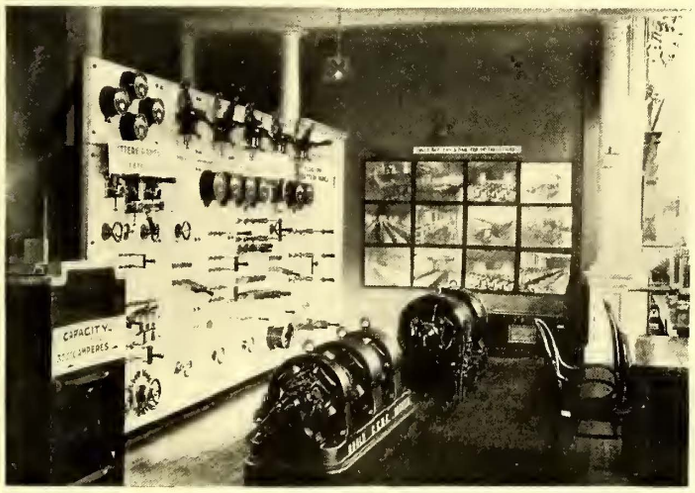
These instruments record continuously with ink upon graduated, revolving charts all changes that occur in pressure, temperature or electricity, so that a record of a period of twenty-four hours or more may be observed at a glance. Many of these instruments are in actual operation, and may be inspected by visitors to show the manner of construction and scientific principles upon which their operation depends, and the extreme sensitiveness and accuracy that it is possible to obtain in instruments of this character without rendering them too delicate for commercial application. Recording pressure gages are shown for ranges from full vacuum to 10,000 lbs. per square inch; recording thermometers and pyrometers for ranges from 60 degs. below zero to 1200 degs. F. The recording thermometers are made in many varieties of form to make them applicable to all industrial requirements, especially where it is desired to record temperatures at a distance from the source of heat. Recording voltmeters, ammeters and wattmeters for both alternating and direct current are shown, including a great variety of ranges suited to commercial demands for different voltages and currents in electric light, power and railway plants.

Recording water level gages are shown in operation, and also a new instrument designated as a thermometer-thermostat. This last instrument is so constructed that it may be used to give an alarm or set in operation temperature regulating apparatus at any predetermined point of temperature. A full line of sizes of Bristol's patented steel belt lacing is also exhibited, and includes styles and sizes of lacing for all varieties and thicknesses of belting.

THE GOULD STORAGE BATTERY COMPANY AT THE WORLD'S FAIR

The exhibit of the Gould Storage Battery Company occupies the northern portion of Section 16 of the Palace of Electricity at St. Louis. A space 80 ft. long x 21 ft. deep is occupied by the display of storage batteries, boosters, switchboards and other apparatus used in the operation of the batteries. Quite an elaborate display is made of batteries. These vary in size, from those measuring 3 ins. x 3 ins., the smallest manufactured by the company, to the largest, measuring 30½ ins. x 15½ ins.

A new size of plate which has been recently brought out by the Gould Company is exhibited. This measures 18½ ins. x 18½ ins., and is designed for use where floor space is valuable and where the deeper plates are not thought advisable. Three cells with this type of plate, which has been designated "Type U," are exhibited. Each contains forty-nine plates and has a rated capacity of 5700 amp.-hours. The largest cell shown is one holding 101 "T" plates, with rated capacity of 16,000 amp.-hours. This battery, it is said, has a momentary discharge capacity of 30,000 amps. Other cells are shown of the "B" and "O" types. In addition to the stationary cells, are shown portable ones and those designed particularly for railroad train lighting. Another part of the exhibit is composed of electric vehicle cells, showing the use of an electrochemical positive and pasted negative. The separators in the automobile cells are entirely of rubber, no wood being used. All of the stationary work shown is finished in polished oak, which gives a very handsome appearance. Large photographs of typical Gould plants are distributed about the booth. A set of cells for train lighting is shown in connection with the Gould car lighting system. A very handsome blue Vermont switchboard consisting of six



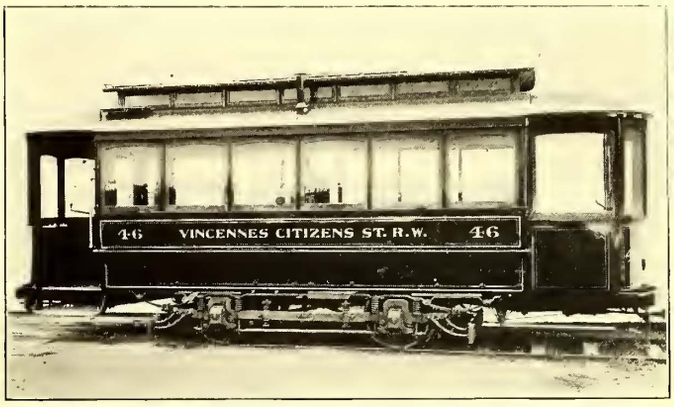
SWITCHBOARD AND COUNTER-E.M.F. BOOSTER

panels of blue Vermont marble has been erected to be used in connection with the various batteries, motors and generators in the exhibit. The separate panels show the standard switchboard sold by the Gould Company for floating railway batteries, booster regulating batteries, isolated charging plants and for the special features shown in connection with the plant. A motor-generator set taking current at 220 volts on the motor side and delivering 110 volts to the motor of the counter electromotive force booster set is also shown. The booster charges 60 cells of battery, and with it the method of applying the Gould booster system to the regulation of varying loads is demonstrated.

The Indianapolis & Northwestern and the Union Traction companies have just issued new folders with revised timetables of their lines. The folders are artistic and attractive, and contain maps and views of points on the lines.

VINCENNES STREET RAILWAY RECEIVES NEW CARS

The Vincennes Citizens' Street Railway has lately placed in commission three new vestibuled cars built by the American Car Company and mounted on Brill No. 21-E trucks. As will be seen by the interior illustration, the cars are without head-



SINGLE-TRUCK VESTIBULED CAR FOR THE VINCENNES STREET RAILWAY

linings and have longitudinally placed slat seats. The interiors are finished in cherry, and the carline finish is stained to the same color. The semi-accelerator doors, which are at either end, may also be seen, and used in conjunction with platforms closed at one side, aid considerably in facilitating egress and ingress.

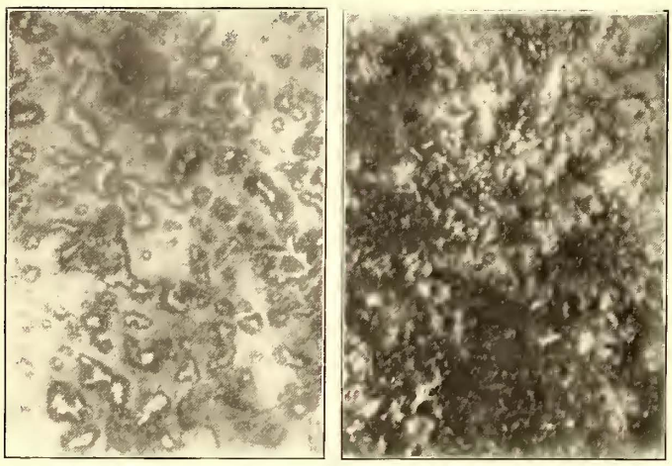
The length of the cars over the end panels is 18 ft., and over

INTERIOR OF THE VINCENNES CAR, SHOWING ACCELERATOR DOOR, VESTIBULE, SEATING ARRANGEMENT AND HEATER

the crown pieces, 27 ft., from the end panels over the crown pieces, 4 ft. 6 ins.; width over the sills, including panels, 6 ft. 3 ins., and over the posts at the belt, 7 ft. 6 ins. The sweep of the posts is 8 ins.; centers of posts, 2 ft. 11 ins. The side sills are 3¾ ins. x 7 ins., and the end sills are 3¾ ins. x 6 ins. The steps are 14 ins. from the rails, and from the steps to the platforms, 12 ins. The trucks have a wheel base of 7 ft., and the wheels are 33 ins. in diameter.

ARCTIC BEARING BRASSES

Of undoubted interest to electric railway men is the new process devised by the More-Jones Brass & Metal Company, of St. Louis, Mo., for the manufacture of brass journal bearings. For many years experiments have been made in different mixtures of bronze for bearing purposes, and while the company's product is not a new mixture, it is made by a novel method of casting any desired mixture. The accompanying reproductions from photographs are of cross-sections of bearings cast



FIGS. 1 AND 2.—BROKEN CROSS SECTIONS OF BEARINGS CAST BY OLD PROCESS, SHOWING OPEN GRAIN, AND BY NEW PROCESS, SHOWING CLOSE GRAIN

in the usual way, and by the special process of casting. Fig. 1 shows a broken cross-section of a bearing cast in the ordinary manner, while Fig. 2 is of a similar cross-section of a bearing made by the company's own process. The cut shows the grain to be much closer in Fig. 2. When the cross-sections themselves are compared, the grain in the metal cast by the new process appears not only closer but more fibrous.

The crushing and breaking strength of such a brass, it is claimed, is greatly increased by this process. A report from the St. Louis Sampling & Testing Works of some comparative tests upon metals of similar composition, but cast by the two methods, show the metal cast by the new process to be far superior in strength under both cross breaking and compression tests. The report is as follows:

CROSS BREAKING TESTS

	Breaking Load Lbs.	Modulus of Rupture
Cast by new process	5100	66,900
Cast in sand	3200	42,900

COMPRESSION TESTS

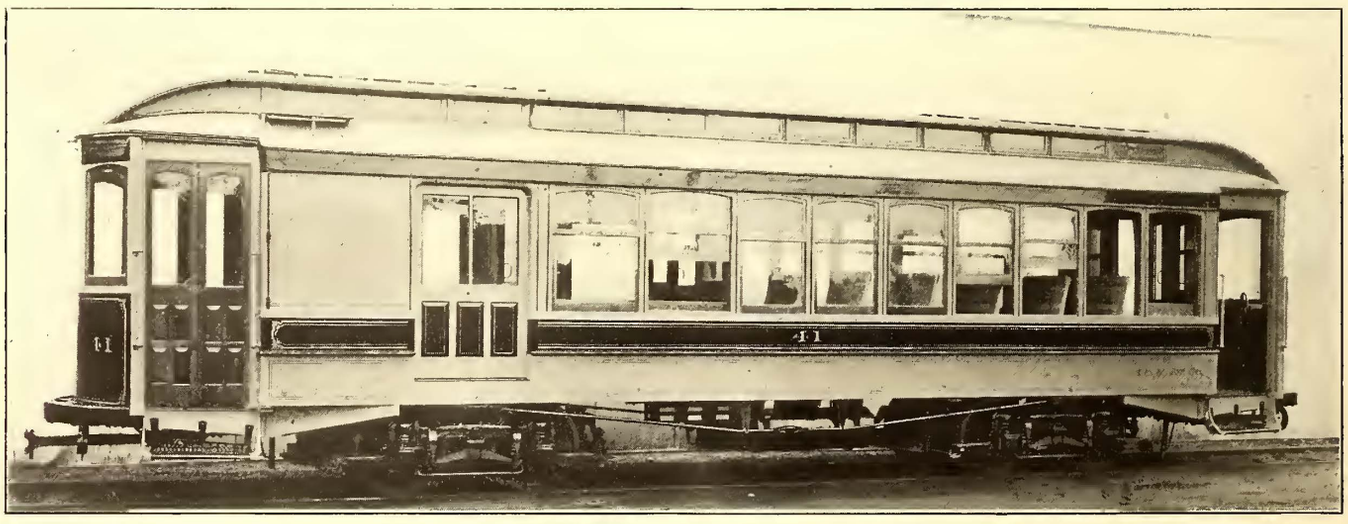
	Area Sq. In.	Maximum Load Lbs.	Maximum in Lbs. per Sq. In.
Cast by new process	56	66,200	118,214
Cast in sand	56	50,560	90,286

No tests to determine the wearing properties of the metal were made, but the company claims that longer wear would naturally be obtained from the closer grained and more fibrous metal. The "Arctic" bearing has been adopted recently by several electric railway lines, both for journal and motor axle bearings. The encouraging reports received by the firm leads it to believe the bearing is filling a long felt want.

SEMI-CONVERTIBLE CARS FOR HAGERSTOWN, MD.

The Hagerstown Railway Company has lately received two semi-convertible cars from the J. G. Brill Company which are particularly interesting on account of having three compartments—passenger, smoking and baggage—and yet measuring but 32 ft. over the end panels. The smoking compartment is only 6 ft. long, and has longitudinal seats with room for eighteen passengers, and there is standing room for as many more. This compartment is divided from the passenger compartment with hardwood partition and glass in the upper part and a single sliding door. The passenger compartment seats twenty-eight passengers, the seats being of the step-over type and having extra high backs. The seats are 35 ins. long and the aisle 32 ins. wide. The baggage compartment has folding seats, which may also be used by smokers when the floor space is not occupied by baggage.

The general dimensions of the cars are as follows: Length over the end panels, 32 ft., and over the vestibules, 41 ft. 5 ins.; length of the baggage compartment, 8 ft., of the smoking-compartment, 6 ft., and of the passenger compartment, 18 ft. The thickness of the corner posts is 3¾ ins., and of the side posts, 3¼ ins. The side sills are 4¾ ins. x 7¾ ins. in size, with sill plates on the inside, 12 ins. x ⅜ in. The end sills are 5¼ ins. x 6⅞ ins. The interior finish of the cars is in cherry, natural color, and the ceilings are of birch veneer, neatly decorated.



HAGERSTOWN RAILWAY COMPANY'S COMBINATION PASSENGER, SMOKING AND BAGGAGE SEMI-CONVERTIBLE CAR, 41 FT. 5 INS. LONG, INCLUDING VESTIBULES

Platform timbers are reinforced with angle iron, and the center knees are composed of angle irons, which extend well back of the body bolsters. The cars are mounted on No. 27-G trucks, having a 4-ft. wheel base.

The lines of the Hagerstown Railway Company and those of the Hagerstown & Boonsboro Railway Company, with which it has traffic arrangements, connect a number of the more important towns in the vicinity. They comprise in all about 25 miles of tracks. Hagerstown is the third largest city in the

State, and is situated in the northwestern part, and is an important railway center. The new cars are intended for use on the interurban divisions of the lines, and are capable of a speed of 35 miles per hour.

THE GOLDSCHMIDT THERMIT COMPANY AT THE ST. LOUIS FAIR

One of the most interesting exhibits at the St. Louis convention was in the Metal Pavilion, and consisted of the exhibit of the Goldschmidt Thermit Company, of New York. A short reference to this exhibit was published in the last issue, but a more extended description had to be postponed until this issue, owing to a delay in securing the illustrations.

The exhibit, which is a permanent one during the Fair, is designed to show the varied applications of "thermit" in the industrial world and the methods of using it. Cross sections of crucibles ready for pouring illustrate how the crucible is prepared. A tube butt-welded by the use of thermit, bent cold and hammered after welding, proves the strength of the weld. Cross sections of welds show no line of separation between the two parts joined, proving that the metal has thoroughly fused together.

Among other pieces of machinery exhibited which have been repaired by the use of thermit, is a gear wheel. One of the teeth, after being broken off, has been replaced by the thermit process. A large shaft is also shown which has been joined by thermit. As readers of this paper know, the thermit process is especially applicable to welding together rails of electric railways, and several forms of rails welded by the process are presented. Near the center of the exhibit is a case containing large drawings, showing some methods of employing thermit.

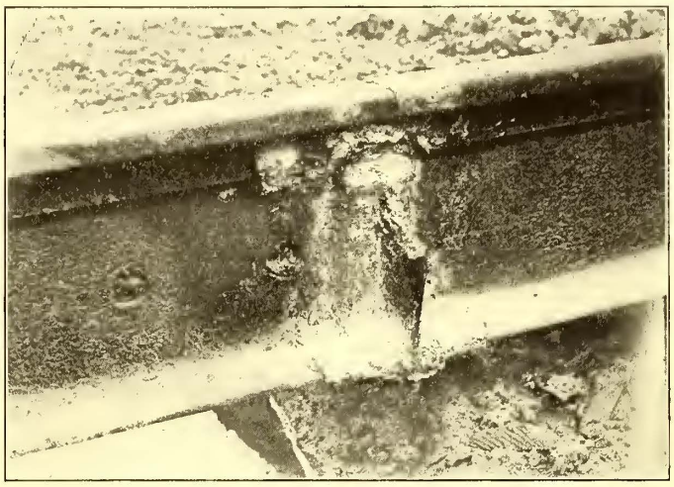
A very interesting feature of the exhibit is a mass of chromium weighing over 400 lbs. Another metal rarely seen lies nearby. This is a lump of manganese weighing 150 lbs. Both were reduced by the thermit process. In the reduction of metallic chromium by aluminum, a by-product, "corubin," is produced. This is used as an abrasive, and several grades, varying in fineness, are exhibited.

Just outside the building the use of thermit for welding was shown at 4 p. m. throughout convention week by actual demonstrations. Tubes were welded and molds of different forms, including rail joints, were poured. The demonstrations attracted great attention from all the delegates in attendance.

THE EXHIBIT IN THE METAL PAVILION

The fact that such a large amount of metal can be melted seemingly by the mere application of a match, mystified the lay spectators, but its convenience and practical value were evident to the railway managers who constituted the large audience which watched these tests daily.

During the recent International Electrical Congress, Dr. Hans Goldschmidt, inventor of the process, delivered a lecture on it and made demonstrations. The accompanying reproductions show a welded rail joint made before the audience and also the interior of the exhibit in the Metal Pavilion. The Goldschmidt Thermit Company was represented at its headquarters during the convention by Wm. M. Cole, and throughout the Fair by W. M. Carr. The exhibit has just been awarded a Grand Prize, the highest award given at St. Louis.



RAIL WELDED BY THE THERMIT PROCESS DURING DR. GOLDSCHMIDT'S LECTURE

SECURITY REGISTERS AT THE ST. LOUIS FAIR

The Security Register Company, of St. Louis, which is the successor of the old St. Louis Register Company, has an exhibit space in the Transportation Building at the World's Fair, at which visitors were made welcome during the recent street

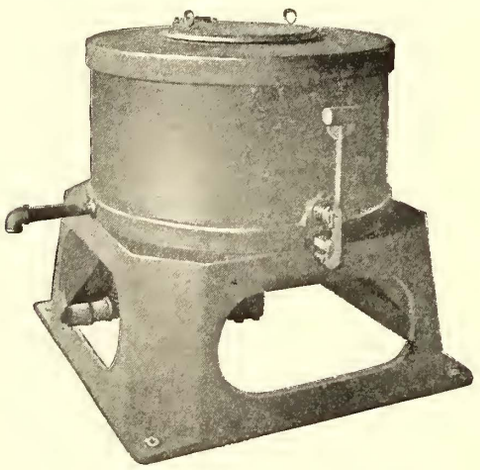
A VIEW OF THE SECURITY REGISTER COMPANY'S HANDSOME EXHIBIT

railway convention, and where some eight types of Security registers are shown. Of course, the most emphasized type of register is the self-recording register, which requires no clerical work on the part of the conductor. The company makes also registers of the regular kind without the self-recording device, which can be made into self-recording registers by small changes.

Besides the fare registers, a new station indicator for elevated and street railways is shown. This is intended to be placed in the end of the car, and contains a roll on which is printed the names of the streets, in their order, so that they appear in rotation, as a lever is pulled. This lever can be operated by a cord from any part of a car, or can be mechanically attached to the gate movement on an elevated car.

OIL AND WASTE-SAVING MACHINE

An indispensable item toward the economical operation of any power station is an efficient oil and waste-saving machine. The type illustrated herewith is made by the Oil & Waste Saving Machine Company, of Rochester and New York, N. Y., and is claimed to be capable of extracting 98 per cent of the oil or grease from waste or any other fabric in an easy, complete



OIL AND WASTE-SAVING MACHINE

and economical manner, so that the waste and oil can be saved and used over and over again.

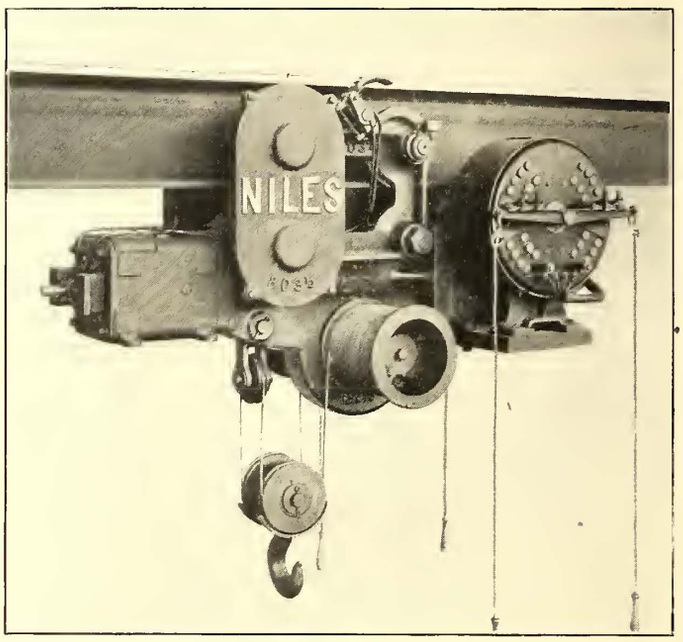
The oily waste is placed in a perforated metal basket surrounded by an outer casing and mounted on a vertical steel shaft, running in phosphor bronze bushings and on ball-bearing steps. Attached to the shaft and at the bottom of the basket is a series of turbine blades. A jet of live steam striking these blades causes the basket to revolve at the desired speed, after which the exhaust steam passes up into the basket, through the waste and out of an exhaust pipe. The exhaust steam from the turbine heats the waste and liquefies the oil, which is extracted by centrifugal force, and runs out of the bottom of the machine through a trap into any receptacle desired. The complete separation of the oil and waste is accomplished in less than thirty minutes with a steam consumption equal to 15 lbs. of water on a machine with 20-in. basket, and 30 lbs. of water with 36-in. basket. The machine is designed and built for long and constant service. It has no outside running gear, such as pulleys, belting and countershafts, no stuffing boxes, and requires no attendance except three minutes for loading and unloading.

Among the large railway power plants where this device is in active service is the Brooklyn Rapid Transit power station, Second Street and Third Avenue, Brooklyn, and the 8000-hp plant of the New York & Queens Light & Power Company at Astoria, L. I., where it has reduced the consumption of waste to 1 lb. per day. It has also shown similar results with other stations.

ELECTRIC TRAVELING HOISTS

Electric traveling hoists are rapidly coming into favor, and many of the more progressive electric railway shops are installing them in place of hand hoists. Besides the direct advantage of handling loads vastly quicker than the hand hoist, the electric traveling hoist has the indirect advantage of increasing the output of a shop by waking up the men. The hoist moves so rapidly that it compels the workman to be quick in his movements, and instinctively he does his regular work more quickly. On the other hand, if the workman is using a hand hoist, he is pretty well tired out after he has lifted a load, and does not return to his regular work with much vigor.

The illustration shows a new type of Niles hoist built by the Niles-Bement-Pond Company, of New York, in capacities of ¾ ton to 6 tons. It may be used either as a hoist, in which case it runs on an I-beam track, or when mounted on a traveling



TYPE OF ELECTRIC HOIST, BUILT IN CAPACITIES RANGING FROM ¾ TON TO 6 TONS

bridge it may be used as a small capacity crane. In the latter case, it is arranged to run between the two I-beams or channels of the bridge, and the controllers for raising and lowering the hook and operating the traversing mechanism may be placed either on the hoist, on the bridge and operated by cords from the floor, or in operator's cage attached to the bridge.

When used on an I-beam, the controllers are attached to the hoist and operated by cords from the floor. This hoist will run on straight and curved tracks, and is usually provided with a separate motor for traversing, but if desired, hand traverse may be furnished, or all the traversing mechanism may be omitted and the trolley moved along the track by pushing on the load. The increased service of the electric traverse, however, much more than compensates for the slight additional cost.

The hoist is self-contained in one heavy cast-iron frame, to which the motors are attached end on, and the power is transmitted directly from the armature shaft to the drum shaft through one train of worm and worm wheel gears. The traversing mechanism is also driven through one train of worm and worm wheel gears similar to the hoisting mechanism, except that when the trolley is arranged to run on a single I-beam, a double set of transmission gears is used to connect the worm gear shaft to the truck wheel shafts. All the mechanism is enclosed in oil and dust proof casings, and is absolutely noiseless in operation. In addition to the braking effect obtained by the use of the worm and worm wheel, a powerful electric brake is attached to the hoist motor.

ELECTRIC TRACTION AT THE INTERNATIONAL ENGINEERING CONGRESS AT ST. LOUIS.

Three papers presented at the International Engineering Congress, held in St. Louis, Oct. 3 to 8, 1904, discussed heavy electric traction, and are of particular interest to readers of this paper. Digests of these papers are given below:

THE SUBSTITUTION OF ELECTRICITY FOR STEAM AS A MOTIVE POWER. BY J. G. WHITE

The advisability of substituting electric traction for steam depends largely on the train frequency.

In general, as compared with steam, an electric railway will show a large increase in first cost, together with a considerable or large increase in gross receipts. Where very few trains are run, the operating expenses with same service will be increased, but where trains are frequent, operating expenses per car and ton-mile will be decreased.

The Chicago and New York elevated railways are excellent examples of where such a change is profitable, and all engineers, who have carefully studied the problem, agree that ordinary trunk-line steam railways, under present conditions, belong unquestionably to the class where it is not profitable.

The advantages and disadvantages of electric traction may be summed up under the following heads:

(A) General Comfort of Passengers.—Under this heading we may include cleanliness, particularly in tunnels, train sheds and other places where smoke is confined and soot collected, and better ventilation, lighting and heating. While costly, the electric heating of cars electrically propelled is not prohibitively expensive, and permits keeping the cars at almost any desired temperature.

(B) Speed.—Various contributing factors make a considerably higher speed possible with electric traction on all roads requiring frequent stops, and on others where a large expenditure is justified to secure such higher speeds. One of these is increased traction of rotary motors, due to uniform torque, so that there is no tendency to slip at particular points of the revolution. This increase is estimated by Messrs. Potter and Arnold to be as much as 10 per cent or 20 per cent. Another factor is the greater weight possible on driving wheels. On many steam railroads the weight on locomotive drivers is usually from 7 per cent to 10 per cent of the total weight of the train. With motors on all axles, 100 per cent of train weight is available for traction. With a multiple unit equipment, where half the cars are equipped with motors on each axle, approximately 55 per cent of the train weight rests on the driving wheels. If one-third the cars are equipped with motors on all axles, the figure is something more than 35 per cent, and if half the cars are equipped with two, instead of four, motors each, about 30 per cent. The two factors mentioned make possible higher rates of acceleration than with steam, hence higher average speed of trains making frequent stops. The value of this is shown in some tests made in the Liverpool Overhead Railway, where an increase of 56 per cent was secured in schedule speed, with an increase in power consumption per ton-mile of only 24½ per cent. Higher sustained speeds are also possible with electricity. Very high speeds will ordinarily be prohibited by the high resultant costs. Where, however, there are sufficient passengers who are willing to pay substantially to save time, the high speeds possible with electric traction may become important.

(C) More Frequent Service.—This develops the riding habit of the tributary population, hence the gross receipts. This has clearly been shown by some of the interurban trolley lines running out of such cities as Detroit, Cleveland and Indianapolis. Thus between Cleveland and Oberlin, 34 miles, the steam roads in 1895 carried 203,014 passengers. In 1902, after the construction of a competing electric road they carried 91,761 passengers, while during this same year the electric road carried about 3,000,000 passengers. Between Cleveland and Painesville and intermediate points the steam road in 1895 carried 199,292 passengers; in 1902 it carried only 28,708 passengers, while the electric system carried 1,537,754 passengers. Between Cleveland and Lorain, in 1895, the steam road carried 42,526 passengers, but in 1902 it carried only 9,795 passengers, the electric road in the same year carrying 3,886,902 passengers. Part of this newly developed passenger traffic is attributable to lower fares, and partly to a better and more frequent service. According to W. J. Clark, the electric roads, during the year ending June 30, 1902, did a business aggregating $14,086,711, which was taken from steam railroads, and also enjoyed a further $50,495,808 of newly created business.

(D) Increased Capacity of Lines.—In certain cases increased capacity of existing lines, as, for example, on roads having long tunnels, or at terminal stations, where real estate is enormously expensive, may be secured more cheaply by electrical equipment than otherwise. Such increased capacity may be due to increased average speeds already mentioned, greater ease in switching at terminals and the possibility of using more powerful locomotives. This latter was illustrated in the Berlin-Zossen experiments, where a single car, with a capacity of fifty passengers, was able to develop continuously 1000 hp, and a maximum of 3000 hp.

(E) Economies of Electric Traction.—For ordinary steam railroad conditions, probably the best data available as to cost are contained in a paper presented by Messrs. Arnold and Potter before the American Institute of Electrical Engineers, June, 1902 (see STREET RAILWAY JOURNAL June 28, 1902). In the experiments conducted to secure these data, similar trains of from one to six cars were hauled by a modern New York Central steam locomotive, having a total weight of about 207 tons, and a maximum tractive power of about 26,000 lbs., and also by two electric motor cars, each weighing about 35 tons, including electrical equipment. These two cars operated together as one locomotive, and hauled the same train of six cars, or parts thereof. The great increase in energy required at high speeds, especially with light trains, is fully set forth in an excellent paper presented by A. H. Armstrong before the American Institute of Electrical Engineers, June, 1903 (see STREET RAILWAY JOURNAL July 4, 1903), entitled "High Speed Electric Railway Problems." A number of interesting and useful curve sheets were presented with this paper, showing energy required at different speeds with single cars, trains of two cars and trains of a number of cars, each weighing about 40 tons. According to these curve sheets the power varied from 60 watt-hours per ton mile for a schedule speed of 30 miles per hour and two stops per mile with a multiple two-car train to 190 watt-hours per ton-mile for a single car at 60 miles per hour. The power consumption on the Manhattan Elevated Railway, with a six-car train, having a total weight of about 125 tons, exclusive of live load, and with comparatively low schedule speed, but high acceleration and frequent stops, is reported to be about 125 watt-hours per ton-mile. Including live load, this would be approximately 100 watt-hours per ton-mile. On the Central London Railway the power required is about 50 watt-hours, on the Lancashire & Yorkshire line it is about 80 watt-hours, and on the City & South London Railway it is reported to be 55.2 watt-hours per ton mile. The low results on the Central London are secured partly by the grade elevation of stations, which permits of acceleration being partly accomplished by gravity. In this case also the station distances are relatively great, and scheduled speed relatively low.

The cost of right of way, stations, signalling system, etc., will be practically the same for a railroad operated either by steam or electricity. The claim is frequently made that roadbed and tracks can be made lighter and less expensive for an electrically operated system than for a steam road, due to lighter maximum wheel weights and the lack of pounding due to reciprocating parts of steam locomotives. This, however, is questionable. With electric operations the speeds and service are generally increased, and consequently the tracks and roadways should be quite as heavy as formerly. The rolling stock of an electric road is somewhat more expensive than that required for steam operation. Motor car trucks will be materially more expensive, and the saving in the cost of locomotives will usually not quite balance the cost of the electric motors, resulting in an increased total cost for rolling stock of perhaps 5 per cent to 15 per cent. The cost of central station and distribution system must also be added, and is the principal charge against the electric equipment, and towards this the steam line has no offset. The central station will cost about $130 to $150 per kilowatt of capacity, including buildings and lands, although the development of the steam turbine is likely to make a saving of perhaps 25 per cent, including savings in buildings and foundations. The sub-stations will cost approximately $50 per kilowatt complete. The actual contact system may be either from overhead trolley of some form of third rail, the latter being in most cases cheaper. An improved contact system is very desirable.

General expenses and maintenance of way should not be materially affected whether a road is operated by steam or electricity. Maintenance of equipment should be materially lowered for electrical operation. For example, in 1903, on the Pennsylvania Railroad the cost of maintenance of locomotives averages about 20 per cent per annum on their first cost. The cost of motor repairs will not exceed one-half this, and may be under 25 per cent of such cost. Fuel account, under average conditions, should show little difference between the steam and electric operation. A steam locomotive will ordinarily consume from 30 to 80 lbs of steam, and burn 3.5 to 10 lbs. of coal per brake horsepower-hour. The electrical central station will produce power with a much smaller fuel consumption per ihp, but the losses in transmission and conversion are so great that the total efficiency will often be less than 50 per cent. Car heating should be considered in connec-

tion with the use of fuel, and on some suburban railroads the power consumed in electric heating ranges from 25 per cent to 50 per cent (Manhattan Elevated Railway power consumption per car-mile increases about 37 per cent in winter). The writer, however, believes that the resulting advantages of electric heating are sufficient to justify this increased cost. Wages on electrically operated trains for the same service as for steam should be materially lower, and, all things considered, may be readily reduced by from 20 per cent to 60 per cent for same train service. Other advantages are possibility of return of power to the lines on grades and in braking by the a. c. motor, possible use of cheap sources of power and possibility of combining a power and lighting business.

Statistics of South Side Elevated Railway and Manhattan Elevated Railway.

	S. S. El. Ry., Chicago	Manhattan E. Ry., N. Y.
Date of figures "before" electrification	1897	1900
Date of figures "after" electrification	1899	1904
Cost of electrical equipment, about	.....	$17,000,000
Increase in power consumption for heating, about	.....	37 %
Gross receipts "before" electrification	$695,287	$9,969,900
Gross receipts "after" electrification	1,170,381	14,529,188
Increase	475,094	4,559,288
Percentage increase	68 %	46 %
Operating expenses "before" (including taxes)	$562,258	$6,104,293
Operating expenses "after" (including taxes)	*669,933	†6,717,726
Increase	107,675	613,433
Train-miles run "before" (Manhattan five-car trains)	.....	10,740,183
Train-miles run "after" (Manhattan six-car trains)	.....	11,000,000
Total net earnings "before" (taxes and operating expenses deducted)	$133,029	$3,865,007
Total net earnings "after" (taxes and operating expenses deducted)	500,448	7,811,462
Increase	367,419	3,946,455
Percentage increase	276 %	102 %
Percentage excess earnings on cost equipment	.....	23.2 %
Per cent operating expense to gross receipts "before"	81 %	61 %
Per cent operating expense to gross receipts "after"	57 %	46 %
Saving per car-mile in operating expense	.....	9.6 %
Excess cost per car-mile in operating expense and fixed charge (interest and depreciation) calculated at 7 % on $17,000,000	.....	7 %

* Loop rental included as operating expense.
† Taxes for 1904 estimated to be the same as in 1900.

As regards relative reliability, the steam locomotive has the material advantage of being a self-contained unit. On the other hand, there is much less danger of a complete break-down with electric motors than with steam locomotives, and in a properly designed and constructed distribution system the probability of a total break-down is very small. With the use of a third-rail system there is greater danger of interruption to traffic, due principally to snow and sleet on the line, but this will undoubtedly be lessened with improvements in the protection of the rail and of contact devices. On the whole, we are safe in saying that the electric is already nearly as reliable as steam. With the same signaling appliances and conditions of operation, the safety of train operation by steam or electric systems should be the same, except in special cases, such as tunnel or underground roads; but it is possible with an electric system to increase safety by automatically controlling the trains by cutting off current if a train runs past its signal. Risks from fire have probably, up to date, been considerably greater with electric than with steam traction, but if proper safeguards are used, they should not be substantially greater with electric than with steam traction.

The roads on which electrification is clearly advisable include (1) Lines operating very frequent trains and having numerous stops. Excellent examples of this type are found in the elevated railways of Chicago, New York, Brooklyn, Boston and Liverpool. (2) Tunnel roads, where electrification is advisable for the sake of ventilation, irrespective of operating costs. (3) Terminals in large cities, especially if partly operated through tunnels. (4) Lines on which, from franchise or other conditions, the use of steam is not permissible.

That class in which electrification is at present inadvisable includes (1) All trunk lines operating under usual conditions and normal distribution of passenger and freight traffic. Generally it may be assumed that trunk lines operating trains at greater than thirty minutes headway cannot show sufficient economies and gains of traffic by electrification to cover the interest and depreciation on cost thereof. With trains operating more frequently than with thirty minutes headway individual cases may merit detailed study. (2) Branch lines depending largely or entirely on freight traffic and other branch lines on which a very substantial increase in passenger traffic cannot be developed by such more frequent service as electric equipment would make readily possible.

That class in which electrification is of doubtful value would include ordinary suburban traffic radiating from large cities, where distribution of population, posssible increase in passenger receipts by higher speeds, better and more frequent service, increased possible use of terminal facilities available and other factors must be carefully stated to determine the probable actual results; cases where increased capacity is required, and is possible only at large cost with steam operation; lines having infrequent steam service where passenger traffic can be largely increased by more frequent electric service, without greatly increasing operating costs, and high speed lines between large cities. Examples of this latter kind of road, which have been for some years discussed, are projected lines between Philadelphia and New York, Philadelphia and Atlantic City, Liverpool and Manchester, and Berlin and Hamburg.

In nearly all cases where electrical conversion is justified, direct-current motors alone deserve serious consideration. These should be supplied from direct-current generators, for compact systems operating within a radius of perhaps 6 miles from the generating station. With greater distances, current should be supplied from alternating generators through rotary transformers. If single-phase motors are as well developed as the manufacturing companies claim, they merit consideration where an infrequent service is operated, especially if at considerable distances from the power station. Assuming that accounts of the present development of the single-phase system are not too optimistic, three-phase or other systems will have practically no status in future conversion studies.

ELECTRICAL POWER, GENERATING STATIONS AND TRANSMISSION, BY L. B. STILLWELL

In this paper Mr. Stillwell discusses the subject under the heads of development of systems, progress in transmissions, overhead transmission, underground transmission, organization of circuits and storage batteries. In the first section of the paper a very interesting account is given of the development of electric traction, generating machinery and motor systems. It is shown that the development in power generators has led to radical changes in power station design, particularly in recent years. The last census report for the United States shows that the rated output of alternators constitutes more than 60 per cent of the total rated output of dynamos in central stations. The introduction of alternators has made a large increase in transmission voltage possible. The Zossen line used 12,000 volts, and the author sees no reason why in general 50,000 to 60,000 volts should not be used in transmission circuits. He then discussed the design and regulation of modern alternators, the adoption of standards and the changes in central station design resulting from the use of steam turbines. In the power station for the London Metropolitan underground road, for example, which is of 59,000 kw capacity, the ground space occupied is 1.44 square ft. per kw. The use of turbines does not necessarily imply an economy of floor space, however, as the Interborough reciprocating engine station occupies less area per kw than that of the Chicago Edison Company. This is due to the fact that the vertical reciprocating engine occupies but a small fraction of the total area of the plant; general features of plant organization being similar, the spacing of the boilers usually fixes the proper centers for the engines or turbines, and such advantages of the turbine as it possesses in respect to floor dimensions is partially, if not wholly offset by the increased size of the condensers. Under the head of transmission, the subject of installation, lightning arresters, steel towers, cables, conduits, etc., is discussed.

In conclusion, the author points out that while the last ten years have been characterized by material progress in the design and construction of electrical apparatus used for the generation and transmission of power, it would be quite erroneous to infer that electric apparatus is not to-day fairly comparable with other classes of mechanism used in the industrial arts with respect to stability and permanence of type.

It is true that the line insulators of 1894 are, with rare exceptions, no longer used, that lightning arresters during the last decade have been much improved, that oiled paper has largely superseded rubber as insulation for underground cables conveying high-potential circuits, that the switches now used for high-potential, alternating currents of large power are unlike anything thought of ten years ago, that dynamos and transformers, as now built, are more efficient and durable, and that in the best plants of to-day important features in the organization and connection of circuits and in the use of automatic circuit-breaking devices have been introduced which in 1894 were not conceived. But it is not true that a majority of electric apparatus essential to the generation and transmission of electric power is now in a stage of rapid development. On the contrary,

changes with respect to the specific apparatus just mentioned have been relatively slight during the last five years. They were much more radical in the first five years of the decade, and the opinion may be advanced, perhaps with safety, that dynamos, transformers, switches, measuring instruments, insulators, lightning arresters, cables, conduits, circuit-breaking devices, automatic and other, as now available on the market, have reached a reasonably stable condition in the evolution of the art, and with respect to these constituent parts of the electric systems for generation and transmission of power, no such rate of change, as has been observed during the last ten years, is likely to occur during the coming decade

THE SUBSTITUTION OF ELECTRICITY FOR STEAM AS A MOTIVE POWER, BY ALEXANDER SIEMENS

The paper by Mr. Siemens sketched the development of the electric motor from the electromagnet engine of Joseph Henry down to the latest single-phase types of traction motors. A brief account is given of the German high-speed electric traction experiments. Mr. Siemens considers that the results of those thus far conducted have justified the following conclusions:

1. Permanent way, constructed in accordance with the standard specifications for first-class main lines of the German Government railways, is sufficient for electric trains running at a speed of 125 miles an hour, but the radius of any curve should not be less than 660 ft.

2. The collector used in the Zossen experiments is well adapted for conveying electric energy at high tension and at high speeds from fixed conductors to cars.

3. The construction of the fixed conductor employed in the German high speed trials has been proven equal to the service.

4. The Zossen trials have demonstrated that high-tension current can be used direct without the intervention of transformers.

The paper summarizes the use of electric over steam traction, against which, however, should be balanced losses in electric traction caused by double transformation of energy and the interest on the additional capital expenditure. The final conclusion of the paper concerning the relative positions which the steam engine and electric motor occupy at present is that it is more correct to regard the one as the supplement of the other than to expect a complete substitution of electricity for steam as a motive power.

DISCUSSION

The paper by Mr. White was discussed in great detail by Mr. L. B. Stillwell. Mr. Stillwell referred to the ambiguity of the word "depreciation," which is sometimes used as synonymous with maintenance or upkeep, and sometimes to cover the amortisation charges which should always be made to cover the probable renewals of the entire plant, due not only to wear, but to changes in the art. Referring to the class of steam lines on which it would not pay to substitute electric traction, he suggested as a criterion that might apply that electric traction is not applicable to service of which the traffic per day does not exceed 10,000 ton-miles per mile of double track. He dwelt upon the importance of the factors of cleanliness, ventilation, lighting and heating, the first mentioned being of particular importance with respect to cities through which the railway pass. The increase of speed has a two-fold importance, first with respect to doing a given business with a rolling stock equipment decreased in proportion to the increase in speed; and second, the public is enormously attracted by higher speed which enables them to get from point to point in less time. Referring to single-car and the multiple-car trains, it is stated that the greater amount of power required for the single-cars does not cut a very large figure in the total expenses. For example, if on the Manhattan the cost of power were doubled the total cost of operation would only be increased from 10 to 11 cents per car-mile. Referring to the power per ton-mile on the Manhattan, which Mr. White gave in his paper as about 125 watt-hours, Mr. Stillwell said that this actually was about 82 watt-hours per ton-mile at the power house and 70 watt-hours per ton-mile at the third rail. He referred to the adaptability of electric motors for heavy grades—grades of from 6 to 10 per cent, not being obstacles. Such grades would be safe for electric traction owing to the very perfect braking arrangements of which it admits.

Referring to a statement by Mr. White that the cost of an electric power station and distributing station system would be about $130 to $150 per kw capacity, including buildings and land, Mr. Stillwell pointed out that these figures apply only to stations of average size and that they refer to rated capacity. Some stations of 40,000 to 50,000 kw have been built complete for about $110 per kw capacity, and it is important to bear in mind that the output can be safely increased 40 per cent over this during rush hours. As to the relative weight of the turbine and reciprocating engine units, the larger sizes of the latter weigh about one and one-half times the former. In the case of a 500-kw unit this weight is only one-eighth that of the corresponding reciprocating engine unit.

Mr. Stillwell expressed the opinion that maintenance of way would be a lesser charge with electric traction owing to the elimination of the unbalanced parts of the steam locomotive, and the less weight required for a given draw-bar pull. He contested the statement that there would be no saving in fuel consumption with electric traction. The New York Manhattan road is operating on 2.6 lbs. of coal per kw-hour, or 4.3 lbs. at the draw-bar, while 3.5 lbs. per hp-hour is a very low figure for steam locomotives. The average throughout the United States is nearer 6 lbs. to 8 lbs. Sixty per cent he considers a fair figure for total efficiency of the electrical plant at full load. He considers that with electric traction not more than one-half the fuel will be required, and it may be nearer a half than a third. The New York Central could save half and perhaps two-thirds of its coal bill, amounting at present to four or five million dollars per year. The cost of power on the Manhattan, he said, is about 6 mills per kw-hour, or including capital charges, about 9 or 10 mills. Electric traction permits the use of the most economical generating apparatus, such as gas engines, which promise to produce a hp-hour on 1 lb. of coal.

Mr. Stillwell considered that the third rail is one of the great objections to electric traction, and he favored the use, where practicable, of the suspended trolley conductor. He pointed out with respect to relative reliability, that on the Manhattan the delays in traffic with electric power were less than 40 per cent as numerous as when steam power was used. He referred to the effect of cold weather on steam traction, which would not be the case with electric traction. He did not approve a suggestion for cutting off power if a train passes its signals, but favored means for applying the brake. He did not see that any good object would be served by a rule prohibiting the carrying from one car to another of wires carrying heavy currents, as such wires can adequately be protected. As to dividing the contact system into short sections, this he believed would merely complicate matters and result in increased risk with no corresponding benefit. He recommended the testing at regular intervals of car equipments with a voltage three or four times the normal voltage. To such tests he ascribed the immunity of the Manhattan equipment from accidents.

Referring to a statement that the total loss with alternating current is about 17 per cent, and 24 per cent with direct current, Mr. Stillwell said that within the limits of the proper application of direct current to electric traction, the loss does not exceed 15 per cent. As to the superior torque of direct-current motors, he pointed out that the polyphase motor developed sufficient torque to skid the wheels, and therefore could not be considered defective with respect to torque. He stated that test recently made by the Ganz Company showed that polyphase motors can temporarily carry four times their load without falling off more than 7 or 8 per cent, and no direct-current motor can do more than this. As to the great weight of polyphase motors, this only follows when a large clearance is used. By a proper construction the Ganz Company produces such motors weighing no more than direct-current motors, and costing no more. American manufacturers have recently announced that single-phase motors need weigh no more than direct-current motors, and they have now got down their weight to about the same figure.

Mr. Stillwell challenged the statement that the return of energy to the track, using polyphase motors, involved complications rendering it inadvisable under usual conditions. He referred to a test of a week or more of the Ganz system, on a train of seven cars. In running down grades it was found that more than 70 per cent of the energy was restored to the line, and this figure would have been higher with steeper grades. The Ganz Company, in a specific case, guaranteed a restoration exceeding 20 per cent.

As to hours of service, the average for steam freight locomotives on the New York Central is but a little more than 75 miles per day, while with electric traction at least twice that mileage could easily be made, and therefore require half or less the number of locomotives. The maintenance and upkeep of electric locomotives may be placed at 2½ per cent per annum, while the rate for steam locomotives is 20 per cent. In conclusion, Mr. Stillwell said he could not agree that when electrical conversion is justified direct-current motors alone deserve consideration. On the contrary, he believes the time has arrived when not only the recently announced types of single-phase motors, but also polyphase motors, should be carefully considered with respect to each individual case presented to the attention of the engineer.

In the discussion of Mr. Siemens' paper, Mr. Stillwell said that the statement therein that "whereas direct-current motors are most suitable in cases where the speed of running has to be varied often and to a great extent, alternating-current motors are more efficient in cases where long runs at constant speed are required," represents the opinion of many engineers in this country. An interesting point is that the single-phase motor requires more weight on the driver than the polyphase motor for a given draw-

bar pull. The torque of the former varies with the frequency, and theoretically the average torque is one-half the maximum. In some tests made for Mr. Stillwell at Budapest this ratio was found to be actually 3 to 2. The polyphase motor has almost a uniform torque, while that of the single-phase is pulsating, and consequently the slip at the top of the pulsating torque and the average weight are much less than that for the effective draw-bar pull. The electric motor has a great advantage over the locomotive engine in applying the power developed. Both English and American tests have shown that only about 43 per cent of the power developed in the steam cylinder appears at the draw-bar.

CONVENTION AT LIVERPOOL OF THE MUNICIPAL TRAMWAYS ASSOCIATION OF GREAT BRITAIN

The third annual convention of the Municipal Tramways Association of Great Britain, was held Sept. 27 and 28, at Liverpool. Since the meeting at Glasgow last year, eleven city corporations and thirteen tramways officials have joined the association, which now includes fifty-six city corporations and seventy-one managers or their assistants, nearly all the municipal tramway undertakings in the country being allied with it. C. R. Bellamy, general manager of the Liverpool corporation tramways, was president for the past year, and the convention was attended by a hundred delegates.

Sir Charles Petrie, chairman of the Liverpool tramways committee, in welcoming the delegates, said he felt tramway undertakings throughout the kingdom were now a very important part of municipal work. When they looked back some ten years they wondered how in the world people in large cities got about. No doubt from time to time they had discovered many weak points in connection with the undertakings, and these were being corrected day by day with the experience they had gained. There was a suggestion to have a uniform way of keeping and rendering accounts of the various municipal undertakings. To his mind, that would be of very great benefit because from time to time they had discussions in the various councils as to how the price of electricity and power as charged in one town compared with another. He was afraid, however, no matter how the accounts were kept, there would be a great deal of difficulty, in comparing the various places, to arrive at a really proper comparison, as local conditions would have their effect upon this. At all events it would be satisfactory as far as possible to have a uniform statement of account showing under various headings the cost per car mile, and so forth, so that the councils of various cities would have the advantage of comparing notes with each other. He was sure, in all the deliberations that would take place, they were rendering a signal service to the great undertakings of electric traction, and he wished the conference every possible success.

PRESIDENT'S ADDRESS

Mr. Bellamy then took the chair, and his presidential address was read by Mr. M'Elroy, the secretary. After thanking the members of the association for electing him as its second president, Mr. Bellamy said the ideal which their association inculcated in its members was just that efficiency of administration and service which accounted for the greatest public benefit in the realm of street travel. It was needless for him to apologize for bringing before them, not as the critic, and certainly not as the dogmatist, but necessarily in a more or less cursory way, one or two of the topics affecting tramway interests, wide and general in their scope, which might form reasonable matter for careful thought. The standardization of tramway accounts, which was referred at the last conference to a joint committee of the Institute of Municipal Treasurers and Accountants and of their own association had been pushed forward with the vigor and care which the importance of the subject demanded. As a result of conferences held at Nottingham and Bradford, a form of accounts had been evolved which it was hoped would meet the requirement of enabling a fair comparison to be made of the working results of comparable undertakings. The initial difficulty appeared to be to bring into line for the purpose those undertakings which generate their own electricity with those purchasing from another source, chiefly owing to the impossibility of dealing with capital charges in the revenue account. The trouble had been overcome by providing a supplementary statement setting forth the total energy costs in the case of self-contained undertakings, which would be comparable with the purchase price of the others. The vexed question of differential depreciation had been left entirely open by carrying the balance from net revenue account to an appropriation account. The municipalization of British tramways was making steady progress, about 215 additional miles of tramways having been applied for during the past session under an estimated cost of over £5,000,000, and provisional orders had been granted for about 34 miles, the estimated expenditure amounting to £307,380. There was evidence of a better recognition of the principle underlying the early action of some of the large towns in arranging to acquire or operate the tramways of small adjacent authorities. In this connection the subject of through running became increasingly important, because where combination or absorption could not be arranged between adjoining districts, it would have to be considered. The convenience of the public must always be placed in the forefront of traffic considerations; and just as the railway companies had to arrange through running very early in their history, so it was becoming a necessity with the ever extending systems of tramways. In many cases where adjacent local authorities had failed to amalgamate for tramways purposes or link their systems, company promoters, recognizing the necessity, had stepped in to provide the required connections. Thus the South Lancashire Company had connected, or obtained authority for connecting, twenty-eight of the principal towns, bringing into one vast network Liverpool and Manchester, which in turn was rapidly linking itself with an equally important combination of the principal towns of Yorkshire. It was unfortunate that the municipalities concerned did not control all these lines. Under a system of joint municipal ownership and more centralized management, their usefulness would be enormously increased. The returns for last year disclosed the grave fact that nearly a dozen municipal undertakings ended the year with a deficit. It was probable that in most of these cases satisfactory results would have been obtained if routes, stages and fares had been arranged on a basis suitable to the particular district concerned, rather than framed in an attempt to imitate those of large towns where continuous streams of point to point traffic alone rendered them possible. In the large towns there were also signs of danger ahead. Great benefits had accrued under municipal control, routes, services and speed of cars had been largely increased, with a reduction in many cases to less than one-half the fares under horse traction. A few years ago a house in the suburbs was regarded as in an eligible position if it were within ten or twelve minutes walk of a railway station, with a quarter or half-hourly service. To-day the tramways were within a few minutes' walk of every one's door, with a practically continuous service at all times of the day, and nearly all night throughout the year, and prudence suggested that further concessions should be sparingly accorded until systems were consolidated and their financial stability finally secured. The halfpenny stage, the penny universal fare, the all night service, the season ticket, a multiplication of adjacent parallel routes, and lately farthing fares for scholars, were all questions of most serious importance, which, if carelessly dealt with, might at any time lead to disastrous results, and the obvious danger underlying them should suggest the advisability of increasing the sources of tramway revenue in directions less subject to popular attack. The Tramways Act, of 1870, provided for a general merchandise traffic, and while this class of business under company control had been practically ignored, it was probable that with interurban connections and joint municipal control it would become a very useful source of additional revenue as well as a great boon to important sections of the trade of the country.

For many years it had been apparent that some better method of collecting and carrying the agricultural and dairy produce of the districts surrounding large towns was necessary, beyond that provided by the railways. The only attempted solution of this problem was the effort to promote the construction of light railways, but the ever increasing network of municipal tramways, with their connecting links, might quickly provide the whole country with a system cheaper in operation than was contemplated under the light railways act. This subject was discussed at considerable length by Mr. Bellamy, who foresaw important benefits to the agricultural interests from an extension of interurban electric railways through their district.

STANDARD FORM OF ACCOUNT

The secretary, J. M. M'Elroy, of Manchester, presented a suggested standard form of tramway accounts.

This form was prepared by a joint committee of the Institute of Municipal Treasurers and Accountants, Inc., and the Municipal Tramways Association of Great Britain, and differs quite materially from that reported at the Glasgow convention on July 8 and 9, 1903, and published on page 179 of the Street Railway Journal for Aug. 1, 1903. The present form is somewhat similar to the American standard, from which it does not depart in any important particulars. At the same time there are so many differences in minor details that for purposes of comparison the two forms are useless.

The operating report in the British municipal report (which corresponds to schedules A and B, in the American report) is

entitled "Revenue Account." The operating expenses are divided into four main headings (instead of three as in the American report). These headings are as follows:

(1) "Traffic," which has nine sub-divisions. This account corresponds largely to the American "Transportation—Operation of Cars.," although the order of the items is different than in the American form.

(2) "General Expenses," with ten sub-divisions, which corresponds largely to the American "General," but with a different arrangement of accounts.

(3) "General Repairs and Maintenance," with seven sub-divisions, which corresponds largely to the American classification of "Maintenance," except that the power station charges are omitted.

(4) "Power Expenses," which corresponds largely to the American "Transportation—Operation of Power Plant," but which also includes the maintenance charges of the steam and electrical equipment in the power station, and also covers the maintenance charges of the feeder ducts and cables. In the British classification the maintenance of the overhead line is classified under "(3) General Repairs and Maintenance."

The Income Account in the British form is divided into two sub-accounts only, viz.: "Traffic Revenue" and "Sundry Revenue." The latter has only one sub-division, viz.: "Advertising on Cars."

In the Balance Sheet the assets column is entitled "Property, Assets and Outlay," and has the following items: (1) "Cost of Existing Works," with twelve sub-divisions; (2) "Investments"; (3) "Stores"; (4) "Sundry Debtors"; (5) "Unexpired Licenses," and (6) "Cash."

The liabilities are classified as follows: (1) "Loans," with two sub-divisions; (2) "Redemption of Debt," with only one sub-division; (3) "Sinking Fund"; (4) "Reserve or Renewals Fund"; (5) "Sundry Creditors."

The standard form also includes a statistical report in which, unlike the American form, certain of the figures given in the preceding report are repeated, as "Traffic Revenue," "Total Revenue," "Working Expenses," "Interest on Capital," "Sinking Fund" and "Net Balance." The statistical report has provision by which certain of the data can be averaged on the car-mile basis, but there is only one reference to the car-hour. This is the space calling for the "Average Car-Hours per Day."

In addition to the reports already mentioned, the standard form has accounts called "Net Revenue Account," "Appropriation Account," "Reserve or Renewals Fund Account," "Sinking Fund Account" and "Capital Account." The form presented at Liverpool concludes with a series of definitions of the different accounts covered by the report.

In the discussion, Mr. Dalrymple, of Glasgow, while not agreeing entirely with the scheme, hoped that by next year all tramway accounts would be put in the form suggested.

Councillor Smithson, of Leeds, speaking as an accountant, said that the proposed standardization of accounts was an immense advance on any previous attempt that had been made in arriving at a universal form of account, and if adopted generally it would give those comparisons which would be so exceedingly useful to all municipal bodies.

The secretary moved the adoption of the standard form suggested by the committee, and it was seconded by Mr. Hamilton, of Leeds.

This was carried, and it was agreed, on the motion of Alderman Stafford, of Brighton, that a copy of the resolution and of the suggested standard form should be forwarded to the Town Clerk of each municipality.

ECONOMIZING THE CURRENT

Peter Fisher, general manager Dundee City Tramways, read a paper on "Economy in Consumption of Current." Mr. Fisher pointed out that serious losses were caused through the voltage on the line dropping below what the tramway motors were wound for. It was important to train motormen in the economical use of the current. Some men operated their cars in a more intelligent and careful manner than others. A valuable system had been introduced in Blackburn. The general manager had determined that 1.87 B. of T. unit (or kw-hour) was the present average consumption, and he proposed that for every tenth of a unit reduction, 1 shilling per week bonus should be added to the wages of the motormen. On some systems special inspectors had been appointed for instructing motormen in using the current economically. With intelligent men so employed, the expenditure would be met many times over by the reduction in the amount of current used. It had been shown that the current used on the bogie or double-truck cars exceeded the consumption on single-truck cars by about 27 per cent.

A lengthy discussion followed the reading of the paper, in which reference was made to all the technical points brought out by Mr. Fisher. Several speakers alluded to the proposal to give a bonus to careful motormen, and difficulties were pointed out in ascertaining the exact effect of each man's operation. The majority of speakers stated that a great economy was effected if the rails were kept clean.

THE ARRANGEMENT OF MEN'S DUTIES

The paper on this subject was read by J. B. Hamilton, general manager of the Leeds City Tramways. The writer presented a table showing the wages paid in Leeds, which averaged from 5d. to 6d. for conductors, and from 6d. to 7d. for motormen per hour., for an average of sixty hours per week; also the excess overtime paid for in Leeds and in a number of other cities. At present in Leeds this is one-half hour, 69.4 per cent; one hour, 3.5 per cent; one and one-half hours 3.8 per cent; two hours, 26.7 per cent. In 1897, when the writer went to Leeds, the service was practically uniform from 4:30 a. m. to 12:30 a. m., and two shifts of men were employed, each working ten continuous hours. This was changed by the introduction of additional cars during the rush hours. The present day consists of ten hours in twelve, with one day off in seven, without pay. In addition, one week's holiday, with pay, is granted per year, and uniform and waterproof coats are provided.

Alfred Baker, general manager of the Birmingham Corporation Tramways, submitted an elaborate table showing the hours of labor and the rates of pay of the employees of the different municipal tramway undertakings in Great Britain.

Mr. Morley, of Burnley, said that with regard to the question of the risk of injury to the health of the motormen by exposure to the weather, he supposed he had had a few imitators in his system of placing the men within a vestibule. He was not sure that he could approve of the system of changing the men from car to car during the day.

A. L. C. Fell, of the London County Council Tramways, said that in London they had a rush load to the city in the morning and a similar rush back from the city in the evening, and nothing practically within those hours. If the men worked long hours on Saturdays, this was made up on Sundays. They were allowed to work swing runs on Sunday, and the hours were much shorter. At present they did not provide their men with seven days' holiday, but no doubt when the London tramways were in a more flourishing condition, like some municipal undertakings, they would be able to do it.

A. E. Fearnley, of Sheffield, said he would not, unless he was absolutely compelled, introduce a system of swing runs on any tramway he was working.

H. E. Blain, of West Ham, thought the ten hours' continuous duty was inhuman, imposing a strain on the motorman which might be dangerous to other street traffic.

The discussion was continued by Mr. Lancaster, of Blackpool; Mr. Le Rossignol, of Newcastle; Mr. McCombe, of Hull, and Mr. M'Elroy, of Manchester.

MIXED TRACTION

A. L. C. Fell, chief officer of the London County Council Tramways, read a paper on "Methods of Dealing with Mixed Systems of Traction." He said that nearly every manager of an electric tramway had had to consider the question of mixed traction. Some municipal authorities might think it advisable to permanently operate several different systems of traction, and under special circumstances this might be the best of policy to adopt, although as a general rule a uniform system was most easily and efficiently worked. In London, horse cable and electric traction had all been in operation at once, and for a short time the whole of these systems had been in operation on one route. The cable line had been abolished by the London County Council, and it was probable that in the future the Council would not hesitate to mix the overhead trolley system and the conduit system. The complications introduced presented no insurmountable difficulties to the management, as the method of changing from one system to the other was very simple. He hoped that they would soon materially decrease the cost of construction on the conduit system and also reduce the cost of operation, so that practically the whole of the London County Council's tramways might be on the conduit system. Local difficulties with regard to mixed traction might be easily dealt with.

EQUIPMENT AND MAINTENANCE

The paper on this subject was read by John Aldworth, general manager of the Nottingham Corporation Tramways. He believed that for traffic in the streets of large towns double-deck, single-truck cars carrying from fifty to fifty-six passengers are the most suitable, as they give quick service and are easily handled. For suburban lines, double-deck cars have certain advantages. The reversed staircase for reaching the upper deck is recommended. The chief drawback to it is that it obstructs the motorman's view of traffic on one side. The writer has overcome this difficulty by

inserting a small sheet of ¼-in. plate glass in the riser of the staircase, level with the motorman's head. For purposes of ventilation four corner side ventilating windows have been introduced into the Nottingham cars.

On the Nottingham system the commutators, brushes, and brush springs are examined nightly, and where any commutator shows signs of undue sparking or heating it is carefully examined by the night foreman, and if no cause for it can be discovered, it is cleaned and the car again put into service; instructions are given to the chief motor inspector to test the car on the road during the following day, and if then found to be working unsatisfactorily in any way, it is sent into the works to be thoroughly tested and the defect put right. Armature and motor bearings, with their lubricating boxes, are also examined nightly, and any defect discovered is reported to the night foreman, who in every case uses his discretion whether such can be efficiently dealt with by himself, or whether the car shall be kept in for it to be dealt with by the day staff.

Gun-metal bushings lined with white metal are used for the motor and armature bearings, and have a life of about 25,000 miles. The present metal used for lining is composed of three parts spelter and one part block tin, and while it has not been in use for very long it has given so far very satisfactory results.

The writer believes that considerable advantage would result from having commutators ground true instead of being turned up in the lathe, and is now experimenting in this direction. The condition of the armature bearings of each car is determined at least once a month by the night foreman, who tests the clearance between the armature and bottom fields, for which purpose he is provided with a set of steel feelers, numbered and varying in thickness from 3-16 in. to 1-32 in. The exact clearance of each armature is recorded and sent to the works superintendent, who decides when it is necessary for the bearings of a car to be renewed. Controllers are all examined at the end of each day's work; all contacts are cleaned and thinly coated with vaseline, also adjusted or renewed as found necessary.

All trolleys are examined daily, while the poles are also tested for tension, and adjusted if found necessary, once a month. Experiments have been made with several kinds of trolley wheel bushes, and one composed of solid graphite has been found to give the best results. The bush, wheel, and spindle, submitted for inspection at the meeting, had run 5762 car miles, and, although the wheel was nearly worn out, the bush and spindle were very little the worse for wear and could be put into and last the life of a second wheel. The cost of the bush is 1s. 2d., compared with 1s. paid for the metal cased graphite bush, of which two are required during the life of one wheel.

The writer is now experimenting with steel-tired wheels, but considerable difficulty has been experienced by the flanges becoming sharp. The average life of the chilled-iron wheels is 34,124 miles, and in only one case has a pair been reground. The equipment for a repair shop for a line of from 100 to 150 cars, using chilled wheels is as follows:

In the fitting shop: A 5-ton electric traveling crane, two lines of shafting—each belt driven by a 10-hp motor, 10-in. screw-cutting gap lathe, 6-in. screw-cutting lathe with universal chucks, vertical wheel boring machine, wheel grinding machine, hydraulic press, radial drilling machine, small sensitive drilling machine, universal shaping machine, power hack saw, screw machine, acme grinder, grindstone, moulding jigs for lining bearings, lifting jacks, and armature trucks, with various small tools as found necessary.

In the armature room: Armature stands, wire drums with tension brakes, furnace, formers, taping machine, drying oven, testing machine, and insulation testing set.

In the smith's shop: Two forges, anvils, swage blocks, set of levelling blocks, small power hammer, and blower driven by independent motor.

In the woodworking shop: Line of shafting driven by a 5-hp motor, circular saw bench fitted with boring apparatus, band saw, planing machine, mortising machine, and universal trimmer.

OVERHEAD EQUIPMENT

The paper on this subject was read by J. M. McElroy, general manager of the Manchester Corporation Tramways. In Manchester, both center and side-pole construction are used. Where the streets are 72 ft. wide the center-pole construction does not offer any material obstruction to traffic, but in streets of from 35 ft. to 40 ft. in width, the writer recommends side-pole construction. Practice differs as to whether to anchor section insulators. Very few towns have had any serious trouble, owing to the failure of line insulators. In Manchester, triple insulation is used throughout; in most other cities double insulation is employed. The adoption of a standard pole is recommended and specifications for light, medium and heavy poles are appended.

The average pressure for center-running trolleys is from 16 to 25 lbs.; for side-running trolleys from 18 to 32 lbs. The use of motor tower wagons in place of horse wagons for emergency work is gradually taking place. Considerable difficulty has been experienced in Manchester with the effect of the atmosphere on the span wires, especially in one district where there is a large number of chemical works. Vaseline, as well as other rust-preventing mixtures, has been used, but nothing so far has been effective. An elaborate table of statistics on overhead construction in different British cities was appended.

BANQUET

In the evening the delegates were entertained at a banquet at the Adelphi Hotel, tendered by the chairman, Sir Charles Petrie, and the members of the Liverpool Corporation Tramways Committee. Among the speakers were Sir Charles Petrie, of Liverpool; Bailie Paton, of Glasgow, and C. R. Bellamy, of Liverpool.

TROLLEY CARS ON THE NEW BRIDGE IN NEW YORK

The plan of operating surface cars over the new East River Bridge connecting New York and Brooklyn provides for the running of cars of the Brooklyn Rapid Transit Company and the Coney Island & Brooklyn Railroad, both of which systems are local to Brooklyn, over the bridge to New York, where they will loop as at the Brooklyn Bridge and return to Brooklyn; and for the operation of the cars of the New York City Railway Company, local to New York, to Brooklyn, where they will loop and return to New York. The Brooklyn Rapid Transit and the Coney Island & Brooklyn cars will both use the same tracks, equipped with the overhead trolley, while the New York City will have separate tracks, equipped with the underground system, to conform with its lines in New York. The work of installing these systems on the bridge has been in progress for some time, and the announcement is made that the operation of a limited service of cars from Brooklyn to New York over the structure will be begun Nov. 1. Owing to the more difficult construction involved in putting in the underground system, no date has as yet been set for the operation of cars from New York to Brooklyn.

The service that is about to be commenced is purely a concession on the part of the Brooklyn companies to a public now suffering greatly from lack of proper transit facilities from the great Williamsburg section of Brooklyn to the east side of New York. Suitable terminals will, of course, be built in Brooklyn and in New York to accommodate the cars, but for the present the Brooklyn companies will make use of a makeshift terminal in New York. In the temporary service about to be begun, only seven of the original thirteen lines selected to run over the bridge will be operated. These are the Broadway, Nostrand, Hamburg and Bushwick Avenue, Reid Avenue, Franklin Avenue and the Grand Street lines. The effort is thus to be made to serve the East New York, Bushwick and Greenpoint sections of the city. Shuttle cars also will go into operation with the running of these lines. As provision was made for separate runways for the surface cars as well as the elevated cars on the new bridge, there will be none of the vexatious delays from vehicle traffic to which the patrons of the surface lines crossing the Brooklyn Bridge are now almost daily subjected.

LEAVES ON TRACKS CAUSE ACCIDENTS

Slippery rails, due to the "sweating" of the tracks and the presence of the leaves, are the cause given for a rear end collision on the Boston & Worcester Street Railway near its terminus at Chestnut Hill, Brookline, Mass., Saturday afternoon, Oct. 22, and for a collision on the Marlboro & Westboro Street Railway at Westboro, the following day. In the former accident two passengers were seriously injured and a dozen others were slightly hurt. In the Westboro accident, although eighteen persons were injured, none of them were in such serious condition that they had to be taken to the hospital.

In the case of the Boston & Worcester accident, a heavily loaded car from Worcester, which had stopped about 500 ft. from the bottom of a sharp grade to change crews, was run into from the rear by its follower, which failed to respond to the brakes. The vestibules of both cars were smashed. The injured passengers were standing in the rear vestibule of the leading car.

The accident at Westboro was due to a disabled car sliding down a grade to be met at the bottom by a regular car. The vestibules were demolished, but the fact that the disabled car was empty probably prevented a serious accident.

Another accident attributed to the humidity and low temperature of the ground is reported from Stamford, Conn., where several persons are said to have been injured.

FINANCIAL INTELLIGENCE

Wall Street, Oct. 26, 1904.

The Money Market

The feature of the money market this week has been the decided strength in foreign exchange, rates for all classes of remittances advancing sharply, despite the extremely heavy offerings of bills against the shipment of cotton and other commodities. The advance in sterling amounts to nearly ¾ cent on the pound, prime demand bills selling as high as 4.8635, while proportionate gains were recorded in francs and reichmarks, owing to the sharp decline in rates for sterling at Paris and Berlin. Rates are now close to the point where gold can be exported profitably to either Paris or Berlin, but it is not considered at all likely that any substantial amount of the yellow metal will be shipped this week. Up to this time $1,250,000 in gold bars has been engaged for export to Paris, but the general belief in exchange circles is that the shipment is of a special nature, made regardless of the exchange situation. Otherwise the market has been an extremely dull and uninteresting affair. Money on call has been in abundant supply at rates ranging from 1½ to 2 per cent, with the average rate for the week about 1⅞ per cent. The time money market has been practically at a standstill despite the enormous dealings and advancing prices in the local securities market. Sixty-day funds were obtainable in considerable amount at 3 per cent, but the only business reported consisted of a few odd amounts. Bankers were more inclined to place their funds for the long periods, and offered freely at 3½ per cent for all over the year maturities, a reduction of 2¼ per cent from the rate prevailing at the close of a week ago. Even the reduction failed to stimulate the demand, borrowers generally being inclined to draw their requirements from the open market at the ruling low rates. Commercial paper has been more active, merchants being attracted by the low rates obtaining for prime material. The choicest names were readily discounted at 4 per cent, while for names not so well known 4½ per cent was charged. The bank statement published last Saturday made a favorable showing. There was an expansion in loans of $3,917,000, due probably to syndicate operation. Cash increased $3,535,000 and deposits increased $6,559,000. The reserves required increase $1,639,750. The surplus stood at $17,853,925 compared with $17,944,450 in the corresponding week of last year; $17,781,475 in 1902, $14,713,175 in 1901, and $6,031,825 in 1900.

The Stock Market

Transactions in the local securities market continue upon an enormous scale, and although the dealings were accompanied by more or less irregularity, the undertone displayed decided strength. Following the recession in values which marked the close of last week, prices renewed the upward trend, and in many instances new high records for the year were established. Subsequently there was considerable selling of stock to realize profits, but the ready absorption prevented any material reaction in prices. The opening of the current week was characterized by uncertainty owing to the Russian outrage in the North Sea, but the market quickly recovered and prices continued to advance on an extremely heavy volume of business. On Tuesday transactions reached the year's maximum, close on to 2,000,000 shares being dealt in. Interest centered in the railway issues, particularly in St. Paul and Union Pacific, the former rising to 175¼, the highest price attained in two years, while a sensational gain was also scored in Union Pacific. The sharp advance in these issues was accompanied by renewed talk of a settlement of the Northern Securities matter, but the only foundation for these reports was the offer to advance the dividends on Northern Securities stock to European stockholders. In other quarters of the market sympathetic advances were recorded, the Steel stocks and many of the less important industrials sharing in the general movement. At the close, however, prices broke sharply, and in most instances all the earlier gains were lost. St. Paul broke 3¼ points, and Union Pacific, after selling as high as 112, ran off to 109¾. Declines of 2 to 3 points were made in Atchison, Chicago, Great Western, Chicago & Northwestern, Louisville & Nashville, and in many of the other active issues. The closing was feverish and unsettled.

In the local traction issues Metropolitan Securities and Metropolitan Street Railway were conspicuously strong upon the renewal of the rumor of a combination of all the traction companies. Metropolitan Street Railway scored a net gain of 4¼ points on fairly active trading, while Metropolitan Securities scored a net gain of ¼. Brooklyn Rapid Transit was active and steady and an advance of 3½ points resulted from the dealings in Manhattan Railway.

Philadelphia

The interesting feature of the trading in the market was the activity and strength in Philadelphia Electric and United Gas Improvement stocks. The former opened at 1 3-16, as compared with the previous week's closing, and on the report of a deal of some kind, the price advanced sharply to 9 3-16. Toward the close there was considerable profit taking, but all stock offered was readily taken, the closing figure showing a net gain of 2⅛ points. About 135,000 shares were dealt in. United Gas & Improvement opened up at 97¾, and after a reaction to 97, moved up to 103 and closed at 102¾. Total transactions amounted to 37,000 shares. Consolidated Traction of New Jersey was quiet but steady, prices fluctuating between 74½ to 75. Philadelphia Rapid Transit was quiet but strong, the price advancing a full point to 16 despite the rumors that an assessment of $5 per share would be called before the end of the year. Philadelphia Company's stocks were quiet and prices ruled practically unchanged. The common sold from 43 down to 42½, but subsequently recovered nearly all the loss, the closing price being 42⅞. The preferred declined ½ a point, sales being reported at 46⅞ to 47. Philadelphia Traction sold in moderate amounts at 97⅝ to 98, and an odd lot of Fairmount Park Elevated brought 16¼. An odd lot of United Passenger Railway was exchanged at 237, and Union Traction held firm around 56¾ on moderate transactions.

Chicago

The trading in the market was generally quiet, but prices in several issues scored sharp gains. Chicago Passenger Railway was the feature in point of strength, the price advancing 3 points to 178, and closing at a net gain of 2⅞ points at 177⅞. Chicago & Oak Park Elevated also enjoyed a substantial rise of 1¾ points to 7⅞ on very light trading. The preferred sold at 25 for an odd lot. Metropolitan Elevated common sustained a loss of 1¼ to 22½ early in the week, but subsequently there was a rally to 23. The preferred closed unchanged at 66½ after selling as high as 67. South Side Elevated moved up 2 points to 94, but the 4½ per cent bonds, which displayed extreme activity last week, were dull, $30,000 selling at 103, an advance of 2⅛. Small amounts of North Chicago 5s brought 96, and odd lot of West Chicago brought 51.

Other Traction Securities

Very little interest was manifested in the traction issues at Boston, speculation this week being confined largely to other departments of the market. Trading was practically at a standstill, except in Massachusetts Electric common, which opened off 1½ points to 12½ points, and after a rally to 13, it reacted and closed at the low figure. The preferred was relatively strong, the price advancing ½ a point to 55½, and closing at the highest. Boston Elevated scored an early advance of ½ to 153½, but later lost it all and closed unchanged at 153. West End advanced ¼ to 91¾ and odd lots of the preferred brought 110 to 110½. United Railway issues were the feature of the trading at Baltimore, about 700 shares of the stock changing hands at from 8⅛ down to 7¾. The 4 per cent bonds were fairly active and strong at 90⅞ to 91, while the income bonds ruled at 47, about $13,000 of each issue changing hands at the above prices. Norfolk Railway & Light was extremely dull, odd lots bringing 10½. In the New York Curb market, Interborough Rapid Transit scored a sensational rise on unusually heavy dealings. During the fore part of the week transactions were made around 150, and on Friday of last week the price moved up to 162½, or 12½ points above the previous high record price. The advance was accompanied by renewed rumors of a deal to merge all the local traction interests, and although such a deal gained credence in some quarters, official confirmation was not forthcoming. It was also stated that the stock was to be put upon a 10 per cent basis. Subsequently the price reacted several points on realizing sales, but at the close there was a recovery to 160. In all, about 40,000 shares of the stock changed hands. Washington Electric Railway issues were

strong, particularly the common stock, which sold at 25, and the 4½ per cent bonds, which brought 83¾ and 84.

Detroit United showed pronounced activity at Cincinnati last week. It opened the week with a sale of 525 shares at 71⅞ and increased steadily during the week, advancing to 75¼. The total sales were about 2200 shares. Cincinnati Street Railway was firm at the old figures, 144½ to 145, sales about 775 shares. Cincinnati, Newport & Covington preferred sold at 92⅝ to 93½ on sales of 600 shares, while the common sold at 31½ to 31¾, sales 510 shares. A few small lots of Toledo Railways & Light moved up from 25 to 29 in sympathy with the demand from other Ohio centers.

Cleveland Electric was the most active issue at Cleveland. About 400 shares sold at an advance from 73½ to 75. Detroit United sold at 74⅝ to 75, about 2 points advance for the week, in sympathy with New York and Cincinnati; locally the sales were about 250 shares. Two hundred shares of Toledo Railways & Light sold at 25 to 25¾, and then the price shot up. Northern Texas Traction came into demand upon reports of largely increased earnings. Sales were 164 shares at 41, dividend on. There were some small offerings of Aurora, Elgin & Chicago common at 10 to 12. Northern Ohio Traction & Light sold at 14½, a point off.

At Toledo the last of the week there was a tremendous demand for Toledo Railways & Light, due to the indications that the franchise matter would soon be settled favorably to the company. It opened the week at 24¾ and advanced steadily to 27, sales about 4000 shares. Many of the orders came from Montreal, Louisville, Columbus, Cincinnati and other cities. Several blocks of Toledo 4s sold at 80. Toledo & Western advanced to 17 on small sales, and two blocks of the 5s of this company sold at 85.

Toledo Railways & Light, Rochester Railways & Light and Columbus Railways & Light were active at Columbus. Columbus Railway common sold at around 95, and Rochester preferred at 78½. Columbus, Buckeye Lake & Newark Traction preferred has been selling steadily at around 91, an advance of several points, due to the fine earnings now being reported by the road.

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. 18	Oct. 25
American Railways	47¾	48¼
Aurora, Elgin & Chicago	5	—
Boston Elevated	153	153
Brooklyn Rapid Transit	67½	67¼
Chicago City	170	178
Chicago Union Traction (common)	7½	8¼
Chicago Union Traction (preferred)	—	—
Cleveland Electric	74⅛	—
Consolidated Traction of New Jersey	74	74½
Consolidated Traction of New Jersey 5s	110½	110
Detroit United	73½	73½
Interborough Rapid Transit	148⅛	159½
Lake Shore Electric (preferred)	—	—
Lake Street Elevated	3½	3½
Manhattan Railway	158	161¼
Massachusetts Electric Cos. (common)	a14	12½
Massachusetts Electric Cos. (preferred)	54½	55
Metropolitan Elevated, Chicago (common)	23½	23¼
Metropolitan Elevated, Chicago (preferred)	66	66
Metropolitan Street	122⅛	127
Metropolitan Securities	84	85
New Orleans Railways (common)	10	10
New Orleans Railways (preferred)	27	28½
New Orleans Railways, 4½s	76	77
North American	97	95⅛
Northern Ohio Traction & Light	13½	—
Philadelphia Company (common)	42⅞	42¾
Philadelphia Rapid Transit	15	15⅞
Philadelphia Traction	97⅞	98
St. Louis (common)	9½	—
South Side Elevated (Chicago)	92	93¾
Third Avenue	128½	132½
Twin City, Minneapolis (common)	103½	103¼
Union Traction (Philadelphia)	56½	56½
United Railways, St. Louis (preferred)	68¼	67½
West End (common)	91¼	91¼
West End (preferred)	110	111

a Asked.

Iron and Steel

The "Iron Age," in its weekly review of the iron and steel trade, says that all sections have enjoyed a share of the heavy buying movement in pig iron of the past week. Sales are reported at $12 Birmingham for No. 2 Foundry, which two weeks ago would have been considered completely out of the question. While large foundry interests have been heavy buyers of pig iron, the greatest blocks have been bought by steel makers, particularly the manufacturers of plates whose trade has been so decidedly improved by numerous orders for steel cars and lake vessels.

The only branch of steel manufacturers now really lagging is the rail trade, which will continue quiet till price for next year, is settled.

ANOTHER MOVE IN CLEVELAND LOW-FARE CASE

The Cleveland Electric Railway Company has filed with the city authorities a list of its stockholders. This list includes about 600 names, nearly all of which are of prominent Cleveland business men. Governor Herrick is a stockholder. The list also indicates that Henry A. Everett and his immediate family still have holdings, although it was supposed that the Everett holdings were all sold at the time of the Everett-Moore embarrassment. The filing of this list was made in compliance with a promise made by the officials of the Forest City Street Railway Company, the so-called "three-cent fare company," that it would file a list of its stockholders as soon as the Cleveland Electric Company had filed a list of those interested in its property. The list, since filed by the new company, includes only the names of M. A. Fannin, president; C. H. Miller, vice-president; Fred C. Alber, secretary-treasurer; John B. Foster and John Witzell. Mayor Tom L. Johnson's name is not mentioned. The company, since it first appeared as a rival to the Cleveland Electric Railway Company, has obtained franchises on Woodland Avenue and Central Avenue, now held by the Cleveland Electric Company, and for Denison Avenue and Rhodes Avenue extension, it being the plan to run the cars over the Superior Street Viaduct and other free territory.

The company laid two miles of track, which at present is covered with a foot of mud. The company is prevented by injunctions from building or operating any of the lines for which it has franchises.

THE CLEVELAND, PAINESVILLE & ASHTABULA RECEIVERSHIP

The Cleveland, Painesville & Ashtabula Railway Company, of Cleveland, and other defendents in a suit brought by J. G. Mitchell, of Toledo, which has resulted in the appointment of A. B. Cleveland as receiver of the company, have filed a petition to have the receivership vacated. They enter a general denial of the specifications alleged by the plaintiff in the other action. They claim that the company is solvent and has no floating debt; that for the past year the bond interest has been paid promptly out of the earnings of the road; that all the money raised through the sale of bonds went into construction, for which they have vouchers: that the construction company formed to build the road received for its work stock which at the present is of little or no value. They claim that A. B. Cleveland, who was appointed receiver, is not a fit person to manage the property, as he is not a railroad man and is not eligible to act as receiver. They further contend that he is a party to the action brought against the company.

An official of the company who gave the Street Railway Journal his version of the situation claims the entire action is the result of the failure of A. B. Cleveland, president of the company, to carry out his plan of locating the car house and repair shops of the company at Unionville. Up to a few weeks ago Mr. Cleveland was acting as general manager of the company. Plans had been completed and work started on the buildings at Unionville, which is Mr. Cleveland's home and where he owns considerable property adjoining the site which it is planned to improve.

The neighboring town of Geneva was anxious to secure the shops, and offered a site and to pay for the work already done at Unionville. The majority of the directors favored the change because fire protection was offered at Geneva. Mr. Cleveland thereupon tendered his resignation as general manager, which was accepted. The application for a receiver followed within a few days, and Mr. Cleveland secured the appointment and is again in control of the property. It is claimed that his first move was to stop the work at Geneva and commence work again on the Unionville site, hoping, it is said, to complete the buildings before the final hearing of the case. On application made by the directors, further work on the car houses has been stopped. The entire matter will be settled by the court in the near future.

AWARDS IN DEPARTMENT OF MACHINERY AT ST. LOUIS EXPOSITION

Following is an unofficial list of awards in the Department of Machinery of the St. Louis World's Fair. There may be some new additions to this list.

GRAND PRIZES

United States:

Alberger Condenser Co., New York City.
Allis-Chalmers Co., Chicago, Ill.
American Meter Co., New York City.
Ashcroft Mfg. Co., New York City.
The Aultman & Taylor Machinery Co., Mansfield, Ohio.
E. W. Bliss Co., Brooklyn, N. Y.
Brown Hoisting Machinery Co., Cleveland, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Coe Mfg. Co., Painesville, Ohio.
Continental Iron Works, Brooklyn, N. Y.
Crosby Steam Gage & Valve Co., Boston, Mass.
Abner Doble Co., San Francisco, Cal.
Estate of W. S. Doig, Brooklyn, N. Y.
General Electric Co., Schenectady, N. Y.
Gisholt Machine Co., Madison, Wis.
Goldschmidt Thermit Co., New York City.
R. Hoe & Co., New York City.
E. & B. Holmes Machinery Co., Buffalo, N. Y.
Laidlaw-Dunn-Gordon Co., Cincinnati, Ohio.
A. Leschen & Sons' Rope Co., St. Louis, Mo.
Lidgerwood Mfg. Co., New York City.
Niles-Bement-Pond Co., New York City.
Norton Grinding Co., Worcester, Mass.
Otis Elevator Co., New York City.
Pawling & Harnischfeger, Milwaukee, Wis.
Pratt & Whitney Works, Hartford, Conn.
Robins Conveying Belt Co., New York City.
The Schaeffer & Budenberg Mfg. Co., Brooklyn, N. Y.
Wm. Sellers Co., Inc., Philadelphia, Pa.
The Shaw Electric Crane Co., Muskegon, Mich.
Sloan & Chace Mfg. Co., Newark, N. J.
The Warner & Swasey Co., Cleveland, Ohio.
Westinghouse Machine Co., Pittsburg, Pa.
R. D. Wood & Co., Philadelphia, Pa.
Henry R. Worthington, New York City.

France:

Association Francaise de Propriétaires D'appareils a Vapeur, Paris.
Compagnie pour la Fabrication des Compteurs & Materiel d'usines a Gaz, Paris.
Frederic Fouche, Paris.
Savy, Jeanjean & Co., Paris.

Germany:

Elsaessische Maschinenbau-Gesellschaft, Muelhausen.
Orivit Works, Coeln.
Schaeffer & Budenberg, G.m.b.H, Magdeburg-Buckau.

Great Britain:

Davidson & Co., Ltd., Belfast, Ireland.
John Fowler & Co. (Leeds), Ltd., Leeds, England.

GOLD MEDALS

United States:

Acme Machinery Co., Cleveland, Ohio.
The Alvey-Ferguson Co., Louisville, Ky.
American Steam Gauge & Valve Mfg. Co., Boston, Mass.
Armstrong Bros. Tool Co., Chicago, Ill.
Ashton Valve Co., Boston, Mass.
Bocker-Brainard Milling Machine Co., Hyde Park, Mass.
Betts Machine Co., Wilmington, Del.
Bignall & Keeler Mfg. Co., Edwardsville, Ill.
Black Bros. Mfg. Co., Mendota, Ill.
E. W. Bliss Co., Brooklyn, N. Y.
Wm. T. Bonner Co., Boston, Mass.
Hugo Bilgram, Philadelphia, Pa.
Buckeye Engine Co., Salem, Ohio.
Buffalo Forge Co., Buffalo, N. Y.
Builders' Iron Foundry, Providence, R. I.
A. S. Cameron Steam Pump Co., New York City.
The Carborundum Co., Niagara Falls, N. Y.
The Philip Carey Mfg. Co., Lockland, Ohio.
Chicago Pneumatic Tool Co., Chicago, Ill.
Cleveland Automatic Machine Co., Cleveland, Ohio.
The Consolidated Safety Valve Co., New York City.
Crane Co., Chicago, Ill.
Dearborn Drug & Chemical Works, St. Louis, Mo.
DeLaval Steam Turbine Co., New York City.
Dodge Mfg. Co., Mishawaka, Ind.
Eureka Fire Hose Co., Jersey City, N. J.
E. & T. Fairbanks & Co., St. Johnsbury, Vt.
Fairbanks, Morse & Co., Chicago, Ill.
Ferracute Machine Co., Bridgeton, N. J.
The Fisher Governor Co., Marshalltown, Iowa.
Geiser Mfg. Co., Waynesboro, Pa.
The Goulds Mfg. Co., Seneca Falls, N. Y
Green Engineering Co., Chicago, Ill.
The Hancock Inspirator Co., New York City.
Harrisburg Foundry & Machine Works, Harrisburg, Pa.
Harrison Safety Boiler Works, Philadelphia, Pa.
Haden & Derby Mfg. Co., New York City.
Hall & Brown Wood Working Machine Co., St. Louis, Mo.
Heine Safety Boiler Co., St. Louis, Mo.
Hendey Machine Co., Torrington, Conn.
Hercules Gas Engine Works, Inc., San Francisco, Cal.
The Hooven, Owens, Rentschler Co., Hamilton, Ohio.
C. W. Hunt Co., New York City.
Jones & Lamson Machine Co., Springfield, Vt.
Kieley & Mueller, New York City.
Lagonda Mfg. Co., Springfield, O.
Landis Tool Co., Waynesboro, Pa.
The Lombard Governor Co., Boston, Mass.
The Long & Allstatter Co., Hamilton, Ohio.
The Lunkenheimer Co., Cincinnati, Ohio.
Medart Patent Pulley Co., St. Louis, Mo.
August Moitz, New York City.
The National Acme Mfg. Co., Cleveland, Ohio.
National Meter Co., New York City.
National Supply Co., Chicago, Ill.
Norton Emery Wheel Co., Worcester, Mass.
The Otto Gas Engine Works, Philadelphia, Pa.
Pittsburg Meter Co., Pittsburg, Pa.
Pratt & Whitney Works, Hartford, Conn.
Prentice Bros. Co., Worcester, Mass.
Putnam Machine Co., Fitchburg, Mass.
F. E. Reed Co., Worcester, Mass.
Richardson Scale Co., New York City.
Rider-Ericsson Engine Co., New York City.
Wm. Sellers Co., Inc., Philadelphia, Pa.
Shultz Belting Co., St. Louis, Mo.
H. B. Smith Machine Co., Smithville, N. J.
L. S. Starrett Co., Athol, Mass.
The Stillwell-Bierce & Smith-Vaile Co., Dayton, Ohio.
Voorhees Rubber Mfg. Co., Jersey City, N. J.
Walworth Mfg. Co., Boston, Mass.
Weber Gas & Gasoline Engine Co., Kansas City, Mo.
J. H. Williams & Co., Brooklyn, N. Y.
Williams, White & Co., Moline, Ill.
Yale & Towne Mfg. Co., New York City.

Belgium:

Association des Industriels de Belgique Pour L'Etude et la Propaganda des Engins et des Mesures. propres a preserver les Cuvriers des Accidents du Travail, Brussels.
Vertongen-Goens Co., Ltd., Termonde.

France:

A. Domage & Fils, Paris.
Prof. Ribourt, Le Besvinet.
Charles Sebin, Paris.
Société De Laval, Paris.

Germany:

H. Bieling, Iscglitz-Berlin.
Friedrich Dick, Esslingen a. Neckar.
Dryer, Rosenkranz & Droop, Hanover.
Dusseldorf-Ratinger Rohrenkesselfabrik, Ratingen.
C. Otto Gehrckens, Hamburg.
Friedrich Goetze, Burscheid bei Coeln a. Rh.
Friedrich Lux, Ludwigshafen a. Rh.

Japan:

Shibaura Works of Mitsui & Co., Tokio.

Mexico:

Fabrica Nacional de Armas, Mexico, D. F.
Jeronimo Elizondo, Monterey, Nuevo Leon.

REPORT OF THE NORTHWESTERN ELEVATED RAILROAD OF CHICAGO

The annual report of the Northwestern Elevated Railroad Company for the year ending June 30 shows net earnigs of $1,158,853, as against $996,793 for the previous year and $946,597 in 1902. After the payment of all operating and interest charges, there was left a dividend of 4.06 per cent on the preferred stock. The ratio of operating expenses to gross earnings of both the loop and Northwestern lines was about 32 per cent.

The statement of earnings for the year to June 30, as compared with the preceding one, is as follows:

Earnings—	1904	1903
Northwestern proper	$1,274,684	$1,215,071
Loop division	403,516	387,232
Total	$1,678,200	$1,602,303
Rents and miscellaneous	46,729	40,153
Gross	$1,724,929	$1,642,456
Operating expenses—		
Maintenance of way	$22,968	$19,698
Maintenance of equipment	67,096	66,754
Reserve for maintenance	36,000	36,000
Transportation	383,897	343,243
General and legal	56,113	51,746
Total	$566,076	$517,441
Net earnings	1,158,853	1,125,015
Charges—		
Bond interest	$779,350	$779,350
Other interest	15,096	6,155
*Taxes	161,153	156,100
Total	$955,599	$941,605
Surplus	203,254	183,410

* Including compensation to city on account of loop.

The comparison of the balance sheet for the year ending June 30 with that of the previous year is as follows:

ASSETS

	1904	1903
Cost of road and equipment	$29,086,954	$28,589,089
Stocks and bonds owned	31,292	4,307
Cash and bills receivable	634,762	108,520
Accounts receivable	91,105	579,056
Materials and supplies	17,269	17,912
Land and buildings	456,000	456,000
Sundries	157,729	199,588
Total	$30,475,113	$29,954,472

LIABILITIES

Capital stock	$10,000,000	$10,000,000
Bonds outstanding	18,387,000	18,387,000
Real estate mortgages	119,000	119,000
Interest accrued	241,504	241,504
Taxes accrued	90,031	95,164
Accounts payable	688,836	424,294
Reserves	132,982	72,925
Sundry	11,981	14,062
Profit and loss	803,778	600,523
Total	$30,475,113	$29,954,472

THE NATIONAL ELECTRIC COMPANY'S LATEST DEVELOPMENT

The National Electric Company, of Milwaukee, has entered into an important arrangement with Robert Lundell and Robert T. Lozier, by which the National Electric Company will manufacture and market the new motors and generators, and systems of operation and control that are covered by the latest inventions of Robert Lundell; the commercial direction of the undertaking being placed in the hands of Robert Lozier, who will also act as general manager of the electrical sales department of the National Electric Company. Under this arrangement Mr. Lundell assumes the direct supervision of the engineering involved under the license that he grants the company. It might be said that this license covers all of Mr. Lundell's inventions not already under license to other companies, and all inventions that he may hereafter make during the life of this license.

These inventions of Mr. Lundell are of particular interest to the trade, in that they cover important developments in direct-current apparatus. Some of these patents are for a new type of motor and dynamo frame construction, as well as a new method of commutation, by which a material gain is obtained in the space occupied by the apparatus, its efficiency, and the flexibility of its speed control and regulation. This form of construction represents an important departure in standard motors of fixed speed, and is particularly advantageous in variable speed motors for direct application to machinery, both from point of construction and flexibility of control. These Lundell inventions are equally valuable in systems of regenerative operation and series parallel control, and to the numerous other uses to which electric motors are now so generally applied, among which can be prominently named: Railways, elevators and automobiles. The whole group of patents are comprehensive in their scope, they cover a new type of machine construction, new principles of commutation and new methods of operation, based on Mr. Lundell's long and varied experience in the direct-current field, in which Mr. Lundell has won both fame and distinction, his apparatus being now largely used, not only in this country, but throughout the other countries of the world. It might be said that the Johnson-Lundell Traction Company, of England, has been organized to manufacture under these patents in Great Britain and elsewhere abroad.

The National Electric Company, of Milwaukee, formerly operating under the style "Christensen Engineering Company," has in the past seven years made a specialty of the manufacture of air brakes. Four years ago the company built its present plant and abundantely equipped it with the best tools and labor-saving machinery; a foundry having open hearth and crucible furnaces for making steel castings; also cupolas for gray cast iron, and a complete brass foundry as well. The plant has all the other features necessary to make it one of the most comprehensive and up to date plants to be found in the electrical manufacturing business.

The success met with in the air brake business encouraged those financially back of the National Electric Company to enter into the general field of electrical machinery, and two years ago a competent engineering corps, under the able direction of W. L. Waters, chief engineer of the National Electric Company, and an active sales organization was put into operation, and the results of this work have in turn been so thoroughly successful that the National Company has now decided to follow up the material gain already made, with a view to developing this branch of its business to its fullest capacity, and to this end have established a separate electrical department.

Samuel Watkins is the president of the National Electric Company. He organized it, and under his able direction the company has reached its present prominence.

Bernard T. Becker, who represents the interests of those financially back of the company, and who is himself a large stockholder and a director in the company, will act in an executive capacity in connection with operation of the company.

The first vice-president and general manager of the National Electric Company, Frank C. Randall, is widely known throughout the electric street railway field, and the air brake sales will continue, as in the past, under his direct charge.

Of the operative force, R. P. Tell is the secretary and treasurer. J. H. Denton, well known to all those who come in contact with the air brake business, is general superintendent.

OHIO INTERURBAN ASSOCIATION TO MEET IN NOVEMBER

The meeting of the Ohio Interurban Railway Association, which was announced for Toledo the latter part of October, has been postponed until the latter part of November, at a date to be announced later.

NEW YORK SUBWAY OPENED

As this issue of the Street Railway Journal goes to press, the ceremonies are being held in the New York City Hall to mark the opening of the subway for regular passenger traffic. Bishop Potter was unable to accept the invitation to say the opening prayer, so Coadjutor Bishop, David H. Greer, agreed to take his place. Mayor McClellan and Rapid Transit Commissioners Orr and Starin are to make formal speeches. According to the programme, John B. McDonald, the contractor; August Belmont, president of the contruction and operating companies, and William Barclay Parsons, chief engineer of the commission and designer of the subway, will speak informally. Others may speak extemporaneously. After this programme is ended the special guests invited to take the first train will walk to the loop station under City Hall Park. The train, seating 250 passengers, will make a return trip to 145th Street and Broadway. By the time it has got a good start on the upward journey other trains for holders of invitations will be started. Until 6 p. m. the road is to be operated solely for the benefit of holders of these passes, the trains running on regular schedule. Between 6 and 7 p. m. there will be an interval during which the company's officials will see that everything is ready for regular traffic, make any schedule changes that appear necessary, see that the stations are all properly manned and make such other finishing touches as are desired. Promptly at 7 o'clock the agents from City Hall Park to 145th Street and Broadway will begin to sell tickets at 5 cents each. In honor of the occasion all the city building and many public ones were decorated. Flags were also displayed at many private residences.

The schedule of trains for the first days of operation has been arranged as follows:

LOCAL TRAINS, FIVE CARS EACH

5:30 a. m. to 12 midnight, three-minute headway.

EXPRESS TRAINS, EIGHT CARS EACH

6:30 to 7 a. m., five-minute headway.

7 to 9:30 a. m. four-minute headway.

9:30 a. m. to 2:30 p. m., varying from five to ten minute headway, the trains running most frequently about noon time.

2:30 to 4:30 p. m. five-minute headway.

4:30 to 8 p. m., four minute headway.

8 p. m. to 12 midnight, five and six minute headway.

12 midnight to 6:30 a. m., no express trains at all.

TOLEDO COMPANY'S OFFER FOR FRANCHISE RENEWALS

What the company says is its final ultimatum for a franchise extension has been presented to the city of Toledo by the Toledo Railways & Light Company. It is in the shape of a skeleton ordinance, and undoubtedly is the most liberal concession that has as yet been made by any company of its kind for the renewal of privileges about to expire. It is, of course, a lengthy document, and its presentment here in full is necessarily precluded. Stripped of the mass of legal verbiage, it provides in the main for the following: The extension of existing franchises for twenty-five years; six tickets for 25 cents, or twenty-five tickets for $1, until the earnings amount to 25 cents per car mile, when the fare is to be seven tickets for 25 cents, with a further reduction to eight tickets for 25 cents when the receipts reach 30 cents per car-mile; children between the ages of six and ten years to ride for 2 cents each; universal transfers; the company to pay the Robison tax of 1 per cent on earnings, and the city its lighting bills, leaving a balance in favor of the city of $4,298; the expenditure by the company of $2,000,000 in betterments in nine years, and $400,000 of that sum the first year; forty cars to be added in six months; all track more than seven years old to be rebuilt; the company to pay $150,000 to $200,000 toward a new or enlarged Cherry Street Bridge; an extension to Ottawa Park and a new cross-town line; the company to pave 12 ins. on the outside of each rail; owl cars to be operated every hour, if the Council passes an ordinance directing their operation.

A meeting of the Council was held on Monday evening, and many stirring scenes were enacted, although the question of franchise extensions was not taken up. A thousand men marched in a body to the Council Chamber, and protested against the passage of the ordinance. Previous to the meeting of the Council the board of directors of the Chamber of Commerce met and adopted resolutions asking the Council to delay passing the franchise ordinance until the public has had ample time to discuss the matter.

STREET RAILWAYS NOT RAILROADS IN IOWA

The Supreme Court of Iowa has decided that not only city street car lines, but such portions of interurban railway lines as occupy city streets, are not subject to the laws governing railroads, but are subject only to the laws governing street railways.

In a case arising at Sioux City an effort was made to recover damages from the Sioux City Traction Company, a former employee being the claimant, and he set up the negligence of a fellow employee as the cause of the injury. The rule exempting employer from liability to an employee on account of a fellow servant's negligence is recognized in Iowa, except as the same has been abrogated by section 2071, which does abrogate the rule as to "every corporation operating a railway." This does not include those portions of interurbans operated on the streets of a city, according to the new decision of the Supreme Court.

The phrase "every corporation operating a railway" in its broadest and most general sense "is sufficient to include a street railway corporation," says the Supreme Court in the Sioux City case, "but in ordinary parlance the word 'railway' or 'railroad' when not qualified by the word 'street' or other expression of similar import has special reference to what are sometimes denominated as 'commercial railroads.'

"By this is meant these larger, more expensive and more permanent lines or systems extending from town to town and city to city, accommodating a heavier and more miscellaneous traffic and requiring larger forces of employees who are exposed to greater risks than is the case with street car lines and systems.

"It is in this more restricted sense that we feel compelled to interpret Section 2071."

The court points out that it has made this sort of distinction in some cases heretofore decided, and adds:

It is argued that the distinction, if it ever existed, has been abrogated by the enactment of Chapter 81 of the acts of the Twenty-Ninth General Assembly. This is the act governing interurban railways. Section 2 of the act provides generally that the words "railway" and "railway corporation," "railroad" and "railroad corporation," wherever used in the statutes, shall apply to and include all interurban railways and all companies and corporations constructing, owning, or operating street railways. But the next section provides that interurbans upon such streets as are used for transporting passengers, express, etc., in combination cars, shall be deemed a street railway and subject to the laws governing street railways.

This statute, says the court, clearly recognizes that the legislation theretofore enacted did not generally have application to street railways and it was sought to extend such legislation over interurban lines, but to reserve from the operation of that enactment so much of the interurban lines as occupy city streets. Within such streets they are to be treated and considered in law as street railways.

In the Sioux City case it was argued that as the defendant traction company had an interurban line between Sioux City, Ia., and South Sioux City, Neb., its entire system is to be regarded as interurban, and that under the law it becomes a railway in the strict sense of the word.

The court cautiously refrains from deciding that the extension of one of its lines or branches beyond the corporate limits of a city to another city would make the entire system "interurban" in some sense. But even if it did the follow servant rule would not be abrogated by the law affecting commercial railroads, so far as the portion within city limits was concerned.

PROPOSED RAILWAY DEVELOPMENT AT HOT SPRINGS

D. S. Ryan, of Hot Springs, Ark., is of the opinion that an excellent opportunity is offered for the investment of capital in a combined water-power and street railway development in that city. Professional advisers have told him that there is sufficient power in the Ouachita River, about 4 miles from the city, to supply power for the developments he has in mind. A company has already been chartered by Mr. Ryan in the interest of the scheme, and he has secured a thirty-year street railway franchise and the pledge of the local lighting company and the local street railway company to take all the power needed for their use, provided the new plant is ready by January, 1907, to supply such power. Mr. Ryan is anxious to get into touch with financial interests with a view to their becoming interested in the enterprise.

In connection with plans for the general betterment of its road and the reconstruction of its Hoboken terminal, the Erie Railroad is taking up the question of electricity for its suburban passenger traffic. The whole plan as regards electrification is vaguely indefinite so far as it has been made public, but is understood to provide for a change of power on not less than 50 miles of track. Rumor has it that a central power station will be erected at Paterson.

THE LOW FARE QUESTION IN CLEVELAND

Judge Wing, of the United States Circuit Court at Cleveland, has under consideration the question of making permanent an injunction granted two months ago preventing the city from assigning the Kinsman Street franchise to the Forest City Railway Company, the so-called low-fare company, which is endeavoring to build a system in Cleveland. The city claims that the grant on Kinsman Street and other streets has expired, and granted franchises to the low-fare company. It its arguments the Cleveland Electric Railway Company advances the important principle that a franchise granted for an extension of a line operated to extend the franchise of the connecting lines to the date of the extension of the latest franchise. This proposition was contested by the city. The Kinsman Street and the West Side line were consolidated as the Woodland Avenue & West Side Railroad Company. The company admits that the Kinsman franchise expired in September, 1904, but it is claimed that this line ceased to exist at the time of the consolidation and that the franchise for this consolidation does not expire until 1908. As an addition to this argument, the company introduced the grant of the Willson Avenue cross-town line. The ordinance passed in 1894 gave the two companies then existing the joint right to build the line, and required among other things that transfers be given to and from all connecting lines. This requirement, the company claims, extends by implication the franchises of the connecting lines to 1914, the date of the expiration of the cross-town line.

THE ST. LOUIS TRANSIT REORGANIZATION

Negotiations for refinancing the St. Louis Transit Company were completed at a special meeting of stockholders on Thursday, Oct. 20, and under the terms of a proposition made by Brown Brothers, of New York, the Transit Company ceases to exist. The plan provides for the cancellation of the lease of the United Railway Company to the Transit Company, and the cancellation of the Transit Company's $20,000,000 funding and improvement mortgage of 1903, of which $8,000,000 has been issued, and for the exchange of the outstanding stock of the Transit Company for $6,905,720 in common stock and of the United Railway Company on the basis of five shares of Transit for two shares of United Railways. The Transit Company is to issue $10,000,000 of 5 per cent bonds, to be guaranteed by the United Railways Company, to be used to retire the outstanding $8,000,000 issue of improvement bonds remaining; to be sold at 85 to the syndicate, and the common stock of the United Railways Company is to be deposited under voting trust agreement which shall endure for five years.

LACKAWANNA RAILROAD INCORPORATES COMPANY TO BUILD HUDSON RIVER TUNNEL

A certificate of incorporation of the Lackawanna Tunnel Railroad Company, with headquarters in Manhattan Borough, N. Y., was filed Oct. 24 with the Secretary of State. It is proposed to build and operate a tunnel railroad, single or double track, and to be operated by electricity, steam or other motive power, from some point in Manhattan south of West Twenty-Third Street, New York, under the Hudson River to the New Jersey shore, where railroad connection will be made. The length of the tunnel road is to be 5 miles. The capital stock is $300,000, consisting of shares of $100 each. The directors, all of New York City, are as follows: W. H. Truesdale, E. E. Loomis, O. C. Post, Thomas W. Lee, George F. Wilson, A. B. Chambers, Frederick F. Chambers, William S. McGuire and Walter P. Ross.

STREET RAILWAY PATENTS

[This department is conducted by Rosenbaum & Stockbridge, patent attorneys, 140 Nassau Street, New York.]

UNITED STATES PATENTS ISSUED OCT. 18, 1904

772,432. Car Replacer; Hermann H. Rippe, Cleveland, Ohio. App. filed Feb. 29, 1904. A car replacer comprising a grooved inclined bar pivoted at its butt, on the under side, to a block constructed to fit in the groove of a rail.

772,436. Sander; Alexander Shields, Winnipeg, Canada. App. filed June 24, 1904. Pneumatic means whereby the engineer may readily clean out the air orifice which controls the supply of air to the sand bank to force the sand out.

772,456. Electrical Conductor for Electric Railways; Theophilus

P. Chandler, Philadelphia, Pa. App. filed April 18, 1904. A coupling connecting two conductors and consisting of two tubular parts connected together and adapted to secure the threaded ends of the sections of the electrical conductor together.

772,536. Emergency Car Brake; Wallace M. Rynerson, Kansas City, Mo. App. filed Feb. 1, 1904. A brake mechanism embodying brake-shoes to engage the rails and immediately thereafter to form a chock for the rear wheel and cause the latter to impose a large proportion of the weight of the car upon the shoes to increase the pressure of latter upon the rails.

772,575. Apparatus for Replacing Derailed Cars; Joseph G. McNichols, Osceola, Ia. App. filed March 1, 1904. A rail cover wider at one end than at the other and provided with two parallel grooves in its under side, extending from end to end to admit track rails, and having an inclined plane at its narrow end, two inclined planes at its wide end, and parallel groves in its top face, and inclined grooves extending from its wide end, and intersecting the parallel grooves near the inclined planes at the narrow end.

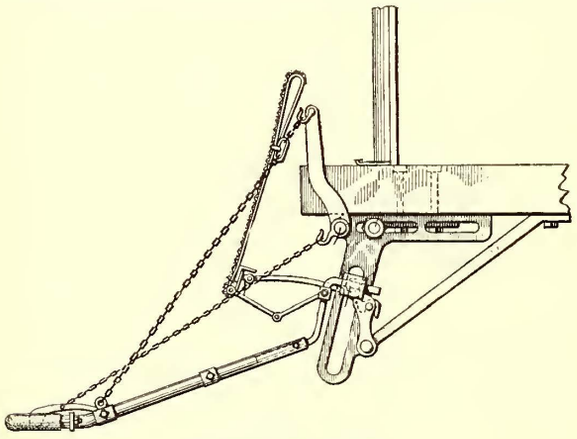
772,638. Trolley Head for Electric Tram Cars; Wilhelm Willenbucher, Manchester, England. App. filed Jan. 7, 1904. Relates to a trolley head capable of swinging on a vertical pivot, together with flaring arms which facilitate its emplacement on the conducting wire.

772,715. Switch Operating Mechanism; Sheshbazzar Kennedy, Riverview, Pa. App. filed April 21, 1903. Details of a shoe and lever by which the switch is thrown when actuated by a moving car.

772,718. Switch Throwing Mechanism; August Kollar and Henry Young, Bridgeville, Pa. App. filed July 28, 1904. Relates to means whereby the switch may be thrown from the platform of a moving car.

772,730. Electric Railway System; Edmund C. Morgan, Chicago, Ill. App. filed Aug. 27, 1902. In an electric railway system, a truck, traction rails, truck-wheels carried by said truck and operating on the rails to support the truck thereon, a third and traction rail, a conductor and traction gear carried by the truck and engaging the rail, a motor carried by the truck, and gearing for positively driving the wheels and gear from the motor.

772,732. Switching System for Combined Third and Traction Rails for Electric Railways; Edmund C. Morgan and John H. Morgan, Chicago, Ill. App. filed Aug. 8, 1904. Main and branch track rails and switching track rails, a traction rack for each pair of track rails, the traction racks occupying substantially the same horizontal plane as the tread surfaces of the track rails, said



PATENT NO. 772,851

traction tracks and track rails made in section, one section of each rack and rail being movable and connections between said movable section for coincident movement thereof.

772,735. Throw Rail for Combined Third and Traction Rail Switching Systems; John H. Morgan, Chicago, Ill. App. filed April 16, 1904. A throw rail for combined third and traction rail switching systems having a plurality of rows or lines of perforations or rack teeth, wherein in a single throw rail, provision is made for effecting continuity of traction rack along a main track or one or more branch or switch tracks, and wherein the lines of rack teeth in the throw rail conform to the curvature or path traversed by the truck when proceeding along the switch tracks.

772,838. Life Guard for Tram Cars or Other Electrically Propelled Vehicles; William Simm, Portico, Prescot, England. App. filed Jan. 12, 1903. Electro-magnetic means for normally holding up the fender by magnetic pull, a feeler and a switch device in circuit with the motor, the switch device being adapted to be actuated by backward movement of the feeler to cut out and de-energize the electro-magnetic means, thereby allowing the fender to drop and to simultaneously cut out the motor.

772,839. Extension Step for Railroad Cars; Euchariste Sirios, Denver, Col. App. filed May 3, 1904. A movable frame carrying a step, a latch for holding the frame when raised, and a rod for raising the frame and disconnecting the latch.

772,851. Car Fender; William T. Watson, Newark, N. J. App. filed Dec. 28, 1903. An approved car fender arranged to automatically assume a basket-like form upon a person falling into the fender, so that the fallen person will be held safely until the car can be stopped.

PERSONAL MENTION

MR. H. F. VOGEL, vice-president and general manager of the St. Louis Car Company, has started on a European trip. He will visit Berlin and London in connection with orders from the Buenos Ayres tramways.

MESSRS. JOHN B. PARSONS, president; W. S. TWINING, chief engineer, and JOHN M. MACK, director, of the Philadelphia Rapid Transit Company, are in Europe studying the subject of elevated and underground railways.

MR. JOHN M. COTTON, formerly with the Rockford, Beloit & Janesville Railway Company, of Beloit, Wis., has been appointed master mechanic of the Cleveland, Painesville & Eastern Railway Company, at Willoughby, Ohio, succeeding Mr. Thomas West.

MR. EDWIN C. FABER, general manager of the Aurora, Elgin & Chicago Railway Company, is receiving the congratulations of his friends on his marriage to Miss Bessie May Hawley, daughter of Mr. and Mrs. F. O. Hawley, of Aurora, at Aurora, Ill., Oct. 19, 1904.

MR. H. F. SMITH, for the past four years chief train dispatcher of the Lake Shore Electric Railway Company, with headquarters at Fremont, Ohio, has resigned to accept the position of superintendent of the Rockford & Interurban Railway Company, of Rockford, Ill.

MR. ALFRED GREEN, formerly master mechanic of the Rochester Railway Company, is now connected with the Galena Signal Oil Company, and is carrying on a series of extensive tests on the use of oil as a lubricant, on the system of the Brooklyn Rapid Transit Company.

MR. L. M. WILLSON, who has been connected with the Altoona & Logan Valley Electric Railway Company, of Altoona, Pa., as master mechanic for the last fourteen years, has tendered his resignation to take effect Oct. 26, 1904. Mr. James Honor, of Philadelphia, will succeed Mr. Willson, who will engage in the hotel business.

MR. C. G. WALDO has resigned as general manager of the Cincinnati, Hamilton & Dayton Railroad Company (steam), which owns and operates the Cincinnati, Hamilton & Dayton Traction Company, of Cincinnati. He has been succeeded by Mr. J. A. Edson, formerly general manager of the Denver & Rio Grande Railroad (steam).

MR. F. N. MERRICK, of Columbus, Ohio, a director, and the secretary of the Columbus, Buckeye Lake & Newark Traction Company, and of the Columbus, Newark & Zanesville Electric Railway, died recently. Mr. C. C. Williams, of Columbus, has been elected to the secretaryship of the two roads, while Mr. G. S. Shinnick, of Newark, has been elected director of the two companies.

COL. D. B. DYER, of Augusta, Ga., formerly president of the Augusta Railway & Electric Company, has presented his collection of Indian relics, valued at $200,000 to Kansas City, and it will be exhibited in the public library there. The number of articles is something over 12,000, and they include prehistoric remains, pottery and Indian relics from Mexico, a collection made by Dr. Irvin Bachmann, and the entire collection of the late Rear Admiral L. A. Beardslee, United States Navy.

MR. F. A. MARKHAM, Southern representative for the J. G. Brill Company, is in Cleveland at present, looking after the duties of Mr. D. B. Dean, sales manager of the Kuhlman plant, who met with a painful accident at the St. Louis convention two weeks ago. It will probably be several weeks before Mr. Dean will be able to resume his duties. Mr. Markham, who has been a resident of Cleveland for a number of years, is preparing to move his family to Atlanta, Ga., where he has his headquarters.

MR. R. E. DANFORTH, general manager of the Rochester Railway Company, is visiting in the West to make a study of street railway conditions in several of the large cities. His tour will include Minneapolis, where he will make a special study of the Twin City Rapid Transit Company operating in Minneapolis and St. Paul. Mr. Danforth was in attendance at the convention of the American Street Railway Association in St. Louis, and had intended to go West after the close of the session of the association, but business engagements made it necessary for him to return at once to Rochester.