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DATE ON WRAPPER shows the month at the end of which the subscription expires. The sending of remittances for renewal prior to that date will be much appreciated by the publishers.

Of this issue of the Street Railway Journal 8000 *copies are printed. Total circulation for* 1907 *to date,* 378,950 *copies, an average of* 8238 *copies per week.*

Incorrect Use of the Title Superintendent of Motive Power

On several systems having sub-shops in charge of men with the title "master mechanics," the master mechanic of the largest shop who is usually in authority over the superintendents of the sub-shops, is known as the superintendent of motive power. In giving this title steam road organization has been used as a pattern. The name is correct in steam railway service, because the official so designated has charge of the maintainence of the locomotives and really is the superintendent of motive power, but the title seems to be a misnomer when applied to the electric railway man in charge of the car equipment. On an electric railway system the "motive power" originates in the power house, and to the power house superintendent, it appears, rightfully belongs the title of "superintendent of motive power." The title for the man in charge of the cars its seems should be "superintendent of car equipment."

Erecting Overhead Motors in Shops

In the extension of the applications of individual motor drives in repair shops it often happens that a motor must be installed in an overhead position, either upon a platform hung from the ceiling or by being bolted inverted to convenient planks or stringers. The advantages of locating a motor for group driving well out of the way of the shop force and machine tools are obvious, but the ease with which motors can be installed at the floor level often leads to their being located in the latter position. As a matter of fact, it is not nearly as awkward a problem to install a motor overhead as is often supposed.

The use of a stout chain and balls is a great advantage in most cases of erecting motors overhead. It generally pays in erecting several motors to build a wooden horse or platform from 6 to 10 ft. in height on which the motor can be rested pending the final adjustment of its bolts in the overhead timbers, though if the motor is to stand upright on a suspended platform the chain and balls will usually be sufficient. A motor of 7.5 hp may easily weigh 1000 lbs., and a 15-hp motor of slow speed type 1500 lbs. The importance of amply strong supports is evident on its face. In some cases, where the shop is built in two or more stories, a hole about 2 ins. in diameter can be bored through the ceiling above the point where the motor is to be located; the chain can be dropped through this hole and the motor hoisted close to its final position without the use of the platform. Sometimes the tackle can be supported best from a horse on the floor above or a stout eye bolt can be pressed into service in the second floor ceiling, with a plate set into the floor as a check against pulling out.

When no upper floor is available to drop the chain through, it may be possible to screw an eye bolt into the stringer nearest the point of final motor support, and to hoist the motor from 7 to 10 ft. above the floor by a tackle depending from this bolt. The horse or movable platform can then be slipped under the motor, and the latter jacked into its proper place opposite the suspension bolt holes. Of course, when a shop is equipped with pneumatic or electric hoists, the erection of overhead motors can be much more easily done, but it will generally be found that some special rig will be needed in getting the motor exactly into the right place. The last few inches of vertical adjustment with a

weight too large for manual handling are the sticking points. In many cases motors are slowly jacked up from the floor, and in a busy shop with a high ceiling this takes a considerable time with possible inconvenience due to interruptions. For this reason the use of hoists and movable platforms is better practice when the conditions are favorable. When the motor is hoisted into close proximity with belts, shafting and other equipment, the use of a guiding rope to steer it clear of these obstructions is very important. A blow struck by a 1000-lb. motor moving, even though an inch or two, is capable of doing serious damage. Objections to the boring of holes in the floors can be largely overcome by plugging them afterwards. In shops with concrete or tile ceilings the jack must be pressed into service to supplement the hoist in most cases. Hap-hazard work in overhead erection brings the natural result of excessive vibration and power losses, to say nothing of the danger of accidents and throttling of production. Skilful planning to meet the conditions of each case is absolutely necessary for the best results.

The Twentieth Century Locomotive

The discussion of steam versus electric locomotives has been active of late and we have published not a few interesting contributions to the subject within the past three or four years. The chief difficulty in a proper consideration of the matter is the seeming impossibility of securing a judicial view point. The literature has been made up of briefs for plaintiff or defendant, very ingeniously constructed and full of telling arguments, yet not wholly convincing. In the nature of things this is the course of events to be expected, since there are practically no engineers who have acquired anything like adequate experience with both classes of motive power. For a full grasp of the problem much more is necessary than to consider it purely from the standpoint of design. Effective railway operation is not so much a matter of small economies in motive power as of infinite finesse in dealing with questions to which tractive efforts and critical speeds are entirely subsidiary. Bearing all this in mind our readers will nevertheless find Mr. Armstrong's Institute paper and the resulting discussion a highly interesting contribution to the subject. The former is particularly striking because the author carries the war into Africa and proceeds to attack the supremacy of the steam locomotive in the very territory that has seemed most its own—the haulage of heavy freight trains—although for the time considered in connection with mountain grades.

There is no doubt whatever, as a matter of theory and of practice as well, that it is possible to build an electric locomotive of bigger output at any and all speeds that it seems practicable to duplicate with steam power. The boiler is the weakest point of steam locomotives, especially when heavy continuous duty is concerned. In taking a "double header" up a steep mountain grade it will generally be the case that the two engines are not simultaneously at maximum duty but ensure a high average duty by relieving each other. With electric locomotives both engines could be pushed to their full power hour after hour without cessation and without exhausting the crews. Moreover, the electric locomotive is better adapted to overloads. We are not inclined to lay so much stress as Mr. Armstrong on the mere increase of speed up grade. While it is true that the economical speed of an electric locomotive may be fairly high, it is an open question from the standpoint not of dynamics but of the art of transportation, whether high speed up grades is worth the while in case of freight haulage. It might even be doubtful whether even were it decided to use electric locomotives the freight speeds should be raised, owing to the effect upon the power stations, especially in the otherwise favorable case of the transmission from water powers. The best conditions for the generation of electric power demand uniformity of load, which is precisely what the employment of gigantic motor units renders extremely difficult. On the other hand the ability of the electric locomotive to surmount formidable grades is a very strong point for electric traction, as in the existing state of railroading the latter form a sort of natural barrier that is the source of many inconveniences. They limit the schedule and hamper the dispatch of the long trains which are feasible elsewhere in the system.

Mr. Armstrong took absolutely the right position in pointing out that the really important gain from electrical equipment is not a saving in the cost of motive power on a particular division but an improvement in the general economy of transportation. Up to the present there have been very few data on the actual performance of electric locomotives in comparison with steam, but the discussion brought out some valuable statistics on this point from Messrs. Wilgus and Murray. These figures are very reassuring, especially when we consider the point so clearly elucidated by Dr. Steinmetz, that all experience with electric traction up to the present has been with the limitations imposed by methods of handling business and operating trains which belong peculiarly to steam service. For example, take the matter of schedules, terminals, and the requirement in the New York Central service that the electric locomotives must furnish steam for heating purposes. In the long run, as Dr. Steinmetz points out, the use of electric motive power will produce appropriate means of handling the traffic and meeting suitably the new requirements which will arise. The objections now raised against it are in no small measure due to the formation of habits directly determined by the use of steam locomotives. Certainly the change of motive power must imply new methods in transportation. This necessity may for a time impede electric traction but it is very unlikely to prove a permanent obstacle.

Schedules, Load Factor and the Cost of Power

The relation of load factor to efficiency is well known. An improvement in the load factor, or the relation between the average and the maximum loads, will result in a reduction of the all-day losses in the feeder system, as well as in an increase in the efficiency of boilers, engines and electrical machinery, besides oftentimes allowing a reduction to be made in the number of power station units operated, thus reducing labor costs, and still further reducing the cost of power as delivered to the motors.

The influence of schedules upon the power station load factor is also well known, but often not properly studied. The load factor of the station which furnishes power for a large number of cars is always better than the one serv-

ing fewer cars, this being true whether the train units are large, as in trunk line operation, elevated and subway work, or small, as in street railway practice with the smallest single-truck cars.

When but relatively few cars or trains are operated from a power station, the resulting low load factor influences the cost of power to a considerable degree, but both may sometimes be considerably bettered by slight changes in the schedule and operating rules of the road. After the operating engineer of the power station has brought his plant to the best possible operating efficiency, the application of some engineering ability to the arrangement of schedules and operating rules may still further cover the cost of power per car-mile and per kilowatt-hour in a manner which may be surprising to the management.

This subject may be studied to the best advantage on the type of interurban road which has become so common throughout the country. These roads are in many instances single track and operate cars weighing from twenty-five to forty tons on a regular hourly or half-hourly schedule, passing at fixed sidings every fifteen or thirty minutes. If, in addition to this handicap, the crews of both cars are expected to telephone the despatcher from every siding, the telephone wires are "red hot" at passing times, while the power station is cooling down. Immediately thereafter, the power station has all that it can care for, as the cars all start from the sidings at practically the same time, and if cars are on time these minimum followed by maximum peaks recur every fifteen minutes or half hour through the day. If one or two cars become late, this bad state of the schedule actually betters conditions at the power station, but only temporarily, as it is usually the case that sidings exist only at regular passing points, and these late cars must either make up their time or throw all cars on the run off time in one trip, so that the bad load factor is very soon restored at the station.

As the cost of power is a very considerable percentage of the total operating expenses, anything that may be done to benefit the load factor, which has such an influence on the cost of power, should be very carefully considered.

For the purpose of illustration, take the concrete case of a road 30 miles in length, operating eight cars on a thirty-minute headway, at a schedule of 15 m. p. h., the sidings, consequently, being located approximately 3¾ miles apart. With such a regular schedule, all cars are either at terminals or passing at sidings at regular fifteen-minute intervals. It might be possible, in this case, without detriment to the service, to increase the schedule speed of cars in one direction to 15.65 miles per hour, at the same time reducing the schedule speed of cars in the other direction to 14.4 miles per hour. This makes the running time, in one direction, 2 hours and 5 minutes, in the other direction, 1 hour and 55 minutes, a total of 4 hours for the round trip, the same as before. The passing time on sidings, however, has been changed. Before the change two cars left the terminals at the same time that all the others were due at sidings—two cars at each of Nos. 2, 4 and 6 sidings. Now, however, as a car leaves one terminal, the other cars are just approaching sidings; a minute and a quarter later two cars are passing at No. 2 siding; in 2½ minutes, two others are passing at No. 4 siding; in 3¾ minutes two at No. 6 siding; and a full 5 minutes later the remaining car leaves the other terminal. In this way the regular quarter-hourly minimum and maximum peaks at the power station have been flattened out, with practically no change noticeable to patrons of the road, with no change affecting the car equipment, unless the schedule was already too high for the equipment, and with no change in the location of sidings. If the despatcher has been called at each siding, as is the practice on some roads, his work has been spread over five minutes each quarter hour instead of receiving reports from all cars in rapid succession. If a good system of rules, printed train schedules and written train orders is in effect, however, it does not seem that it should be necessary to call the despatcher at every siding, and if this can be done away with, not only will the load factor be bettered on such roads, but these waits, so annoying to passengers, will be eliminated.

On single track roads, the over-ambitious motorman is very likely to leave sidings by rapid accelerations and crowding his motors to the limit, with the firm and steadfast resolution to make the next siding on time or know the reason why, only to be compelled to kill time during the next mile or two or on the siding, this still further crippling economy at the station, especially if practiced by a number of trainmen on a regular schedule. A careful watching of the motormen, and careful arrangements of the schedule, not only on a single track division along some such line as suggested above, but by interlacing schedules on different divisions and lay-over times at different terminals, will do much toward improving the load factor and reducing the cost of power, especially on the road which operates only a small number of train units.

Taking Care of Defective Parts of the Car Equipment

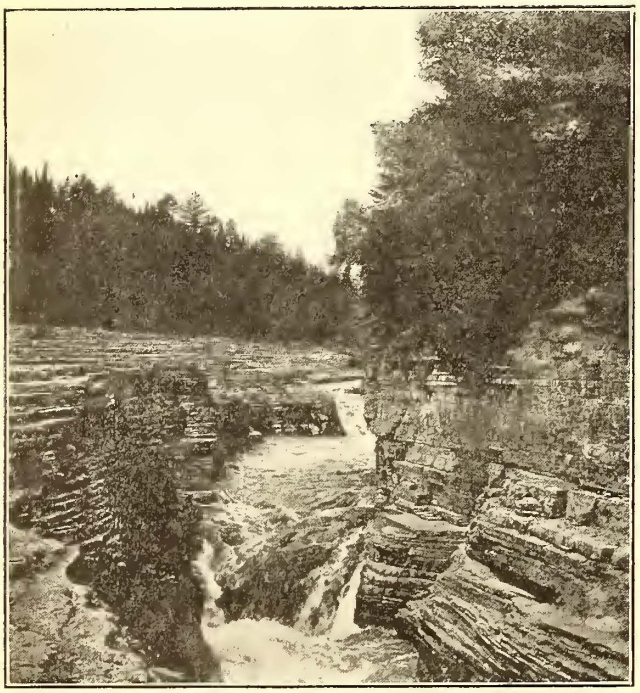
Judgment of several men may differ widely as to when a worn or defective piece of car apparatus has passed its period of usefulness and should be scrapped. Some shops recognizing this have adopted a plan of caring for defective apparatus, which saves a great deal of money.

A separate room in charge of one man is provided for the apparatus and all burned, broken or worn parts are sent directly to him. He passes judgment on each piece and consigns it to the junk pile, tears it apart and reserves the good pieces, or repairs it as he sees fit. Shelf compartments are provided for the separate parts of each kind of apparatus, and very frequently he is able to reclaim a device which would otherwise be thrown away because of the lack of one lug or coil or other part necessary for its further use. Parts repaired are marked o. k., and are usually kept in the repair department rather than turned over to the store room because of the likelihood of confusion in accounts in crediting and checking out. When in need of a circuit breaker, a controller cylinder, brush holder or other part a repair man must assure himself that what he wants is not in the repair department before being allowed to draw a new one out of the store room.

A similar plan could no doubt be adopted to great advantage in many shops and particularly on systems where there are several sub-shops. On such a system where the repairs of defective apparatus are not centralized one man may be in great need of small parts which may have been scrapped at another sub-shop.

THE MONTMORENCY DIVISION OF THE QUEBEC RAILWAY, LIGHT & POWER COMPANY

The Montmorency division of the Quebec Railway, Light & Power Company is a combined steam and electric line 25.2 miles long, extending from Quebec to St. Joachim and along the St. Lawrence River. The distance of 6.6 miles to Montmorency Falls is double-track and has a 30-minute service, while the section to Ste. Anne de Beaupré, 21 miles from Quebec, is operated on an hourly schedule. Dispatching is done by telegraph only. The Sunday time tables are arranged so that passengers can attend church services and return without loss of time. All freight is carried by steam trains, but the greater part of the pas-



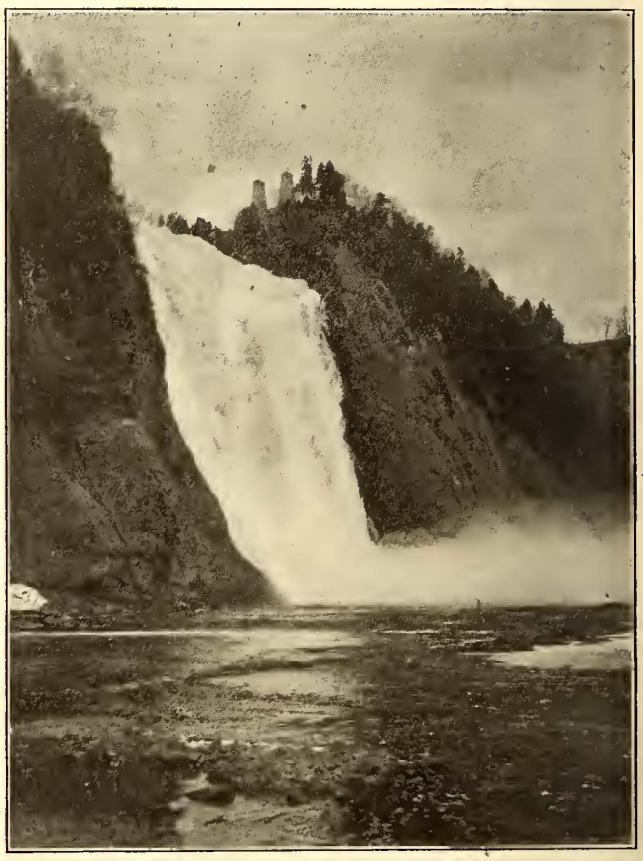
THE FAMOUS NATURAL STEPS OF THE MONTMORENCY RIVER

senger business is handled on electric cars either singly or in trains, as conditions demand. On Sundays, however, the heavy pilgrimage traffic to the shrine of Ste. Anne makes it necessary to operate a couple of long steam passenger trains in addition to excursion traffic originating on the connecting steam trunk lines. The Quebec terminus is within a block of the Canadian Pacific, Great Northern and Quebec and Lake St. John railroads, and is about ten minutes' walk from the ferries connecting with the Grand Trunk, Intercolonial and Quebec Central railroads. Passengers from the first two lines can go to Ste. Anne de Beaupré without changing cars, while those from the other lines find the cars waiting for them at the ferries.

PILGRIMAGE AND PARK TRAFFIC

Most of the traffic of the Montmorency line is due to the pilgrimages mentioned and to Montmorency Falls. The shrine of Ste. Anne is a genuine Mecca, for every year hundreds of thousands of Catholic devotees journey to it to view the fragment of Ste. Anne's arm. Many of these pilgrims are cripples seeking the miraculous aid of this noted relic, and, in fact, the church is filled with numerous crutches, eye-glasses and other physical aids left by visitors. Aside from its religious features, Ste. Anne de Beaupré attracts many others owing to its historical associations, for this section properly is called the Cradle of Canada. It was one of the first districts colonized by the French on their ascent of the St. Lawrence and the conservative spirit of their descendants has permitted the preservation of many old buildings and customs of interest to the tourist.

During the pilgrimages season of 1907, 126 excursions were handled between Quebec and Ste. Anne de Beaupré. Of these 53 pilgrimages were from Quebec and adjacent parishes around the city. The others were divided as follows: Seven via Canadian Pacific Railway from the city of Montreal, seven from different places in the Province of Quebec, one each from Pembroke, Ont.; Winnipeg, Man.; two from Ottawa, Ont.; Rutland, Vt.; Sault Ste. Marie, Ont.; Detroit, Mich.; Duluth, Mich.; Kingston, Ont.; Albany, N. Y., and Alexandria, Ont. Via Grand Trunk Railway: One from Montreal City, five from different places in the Province of Quebec, and one each from Biddeford, Maine; Gananoque, Ont.; Kingston, Ont., and three from Lewiston, Maine. Via Quebec Central Railway: Ten from Providence of Quebec, one each from Meriden, Conn.; Woomsocket, Mass.; Pittsfield, Mass.; Oldtown, Maine; Salem, Mass., and two from Waterville, Maine. Via Intercolonial Railway: Five from Province of Quebec, one from Memramcook, N. B. Via Canadian Northern Quebec Railway: One from Province of Quebec. Via Quebec & Lake Saint John Railway: Six from Province of Quebec; and via Richelieu & Ontario



MONTMORENCY FALLS, AND PIERS OF DESTROYED SUSPENSION BRIDGE

Navigation Company: One from Cincinnati, Ohio, and one from Picton, Ont.

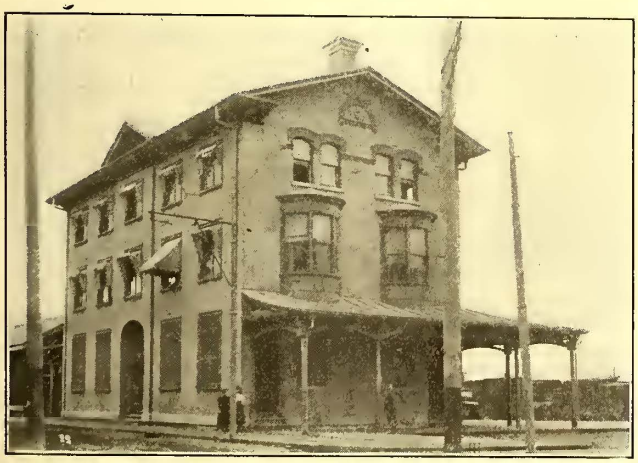
Fourteen outside pilgrimages numbered between 1000 and 2450 passengers, all others averaging 500 each. From the city of Quebec and vicinity there were eight pilgrimages numbering over 1000 passengers. Pilgrimages numbering over 1000 are handled in three sections, when coming from foreign railways, and consist of first-class coaches, parlor

and sleeping cars, one refreshment and café cars on each section. Pilgrims are in charge of the clergy.

The other important attraction on this line is Montmorency Falls, which on account of its great height, 274 ft., and size is a worthy rival of Niagara. Although the company utilizes the falls for its hydro-electric stations their beauty has been carefully preserved. Trains to Montmorency are run up a Y-connection from the main line, where passengers either climb the hill or take the elevator to the park grounds maintained by the company. From this park a few minutes' walk brings the visitor to the picturesque rocky ledges or natural steps of the Montmorency River before its plunge into the flats of the St. Lawrence River.

Montmorency is also of patriotic interest to Canadians, for it still possesses the Kent House, which was the residence of the Duke of Kent, father of the late Queen Victoria, during his stay in Quebec as commander-in-chief of the British army in Canada. The company has converted this structure into a very attractive hotel and banquet head quarters, without materially changing the original architecture. During the French and English war these grounds were occupied by the armies of Montcalm and Wolfe, and to this day entrenchments, old cannon and shot remain as memories of their struggles.

In addition to the natural features of the Kent House grounds, a very fine zoo is maintained by Holt, Renfrew & Company, Quebec furriers. Most of the animals are peculiar to northern America and in the case of the beavers, visitors can study them under natural conditions. There are also fine cricket, polo and baseball grounds for free use. The railway company maintains a rustic theater where vaudeville performances are given afternoons and evenings without charge except a 10-cent fee for reserved seats. Among other attractions are balloon ascensions in the summer and tobogganing in the winter. The management leases certain hunting and fishing districts which offer strong inducements to the sport-loving public. Visitors to



COMPANY HEADQUARTERS AND QUEBEC TERMINUS OF THE MONTMORENCY DIVISION

Ste. Anne de Beaupré are given the privilege of stopping at the Falls, either going or returning.

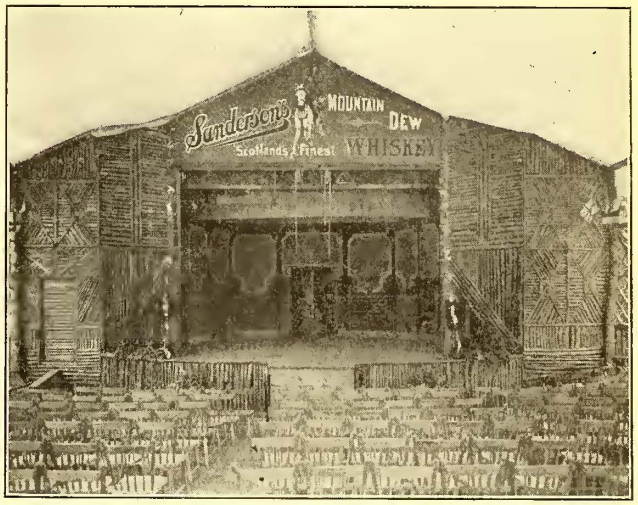
COMMUTER AND REGULAR TRAFFIC

Every effort is made to foster the growth of commuter business. The usual fare is about 2 cents per mile, but 50-ticket books are sold at a reduction from this figure and unused tickets are redeemed. An excess of 10 cents over the regular fare is charged on trains.

The company issues a circular every season giving the location and rates of the summer boarding houses and hotels on the line. For the encouragement of this summer commuter traffic the company undertakes the free transportation of household effects at the owner's risk, providing the owners produce commutation book tickets to the des-

A WINTER VIEW OF THE INCLINE RAILWAY TO KENT HOUSE

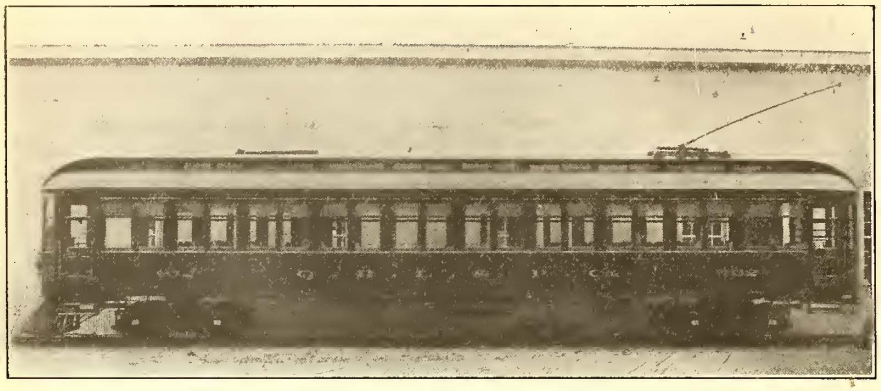
tination, and the goods are shipped in one lot. Laundry bags are carried free of charge in both directions when plainly addressed.



RUSTIC THEATER IN KENT HOUSE PARK, MONTMORENCY FALLS

Personal baggage up to 150 lbs. is carried free on full-priced tickets and up to 75 lbs. on half-price tickets. Passengers are permitted to check bicycles and baby carriages free as baggage when without other baggage, if the value of the ticket bought is 40 cents or over one way or 60 cents both ways. In all other cases they are treated as freight weighing over 100 lbs. and are charged no less than 25 cents. Commercial travelers are allowed to have 300 lbs. of samples or personal apparel carried free on presenting the

proper credentials. Dogs accompanied by owners are carried on special tickets for 25 cents any distance in one direction and 50 cents in both directions. Dogs in crates or chained are billed as freight. Parcel rooms are maintained at Ste. Anne's and Quebec where baggage may be checked for the day at a cost of 5 cents per article.



STANDARD MOTOR CAR ON THE MONTMORENCY DIVISION

EXPRESS FREIGHT RECEIPT.

QUEBEC RAILWAY, LIGHT & POWER CO.
(MONTMORENCY DIVISION)

This Railway will not be responsible for any goods mis-sent unless they are consigned to some Station on the Railway, such Station being plainly stated.

Date 190

RECEIVED from

the undermentioned Property, in apparent good order, addressed to

to be sent by the said Railway, subject to the terms and conditions as stated above, and upon the other side.

ARTICLES	Weight	Charges	RECEIPT BY

EXPRESS FREIGHT RECEIPT

PASSENGER ROLLING STOCK

The electric rolling stock consists of eight motor cars and five trailers, seating sixty-two each. The five large motor cars, which seat 117 passengers, are fitted with four No. 56 Westinghouse motors each, while the other three, seating fifty-five passengers, are fitted with four 38-B motors each. The cars have a section for smokers and a baggage closet at the front. All are mounted on Taylor trucks and have Westinghouse air brakes.

The steam passenger equipment consists of five locomotives and twenty-two cars, seating 120 passengers each.

EXPRESS AND FREIGHT HANDLING

The company has always encouraged both express and freight business on the Montmorency division, and has met with success in both. The material is shipped as express freight or regular freight.

Express freight is understood to mean that all goods weighing less than 100 lbs. and offered for shipment will be carried on any regular steam passenger or electric train with all despatch possible. The shipper on delivering a package is given a receipt for the same embodying the following conditions on the back: Non-liability for any loss or damage to a receipted package exceeding $10 whether the trouble be caused by the railway or otherwise; non-liability for losses due to improper packing, breakage, leakage or stealing; refusal to carry fish, meat or other perishable articles except at the owner's risk; responsibility of shippers of dangerous articles for damage therefrom, unless the contents are plainly marked and special terms made by the railway for their carriage. No C. O. D. articles are accepted.

The express tariff, which is the same regardless of the distance the goods are carried, is as follows: 0 to 10 lbs., 5 cents; 11 to 20 lbs., 10 cents; 21 to 30 lbs., 15 cents; 31 to 50 lbs., 20 cents; 50 to 100 lbs., 25 cents. Articles over 100 lbs. are carried on the freight trains only.

An illustration shows the form used by the station agents

NOTE.—Agent will be particular to note the authority by which any deviation is made from Tariff Rates: otherwise the proper rate will be substituted, and the Agent held responsible for the deficiency

QUEBEC RAILWAY, LIGHT & POWER CO.
(MONTMORENCY DIVISION.) (No. Ex. 201

EXPRESS WAY-BILL OF FREIGHT FORWARDED 190

From BEAUPORT STATION. To

Train No.

SHIPPER	CONSIGNEE	No. Packages	DESCRIPTION OF ARTICLES	Weight	Paid	Advanced Charges	Our Charges	To Collect	Signature for Goods

EXPRESS WAYBILL OF FREIGHT FORWARDED

190

M

TO THE QUEBEC RAILWAY, LIGHT & POWER COMPANY, DR.

For Transportation of *Our charges*

From *Advanced*

Shipped by *Total $*

Weight lbs.

Received payment for the Company.

Agent.

STATION AGENT'S RECEIPT FOR GOODS RECEIVED

KENT HOUSE AT MONTMORENCY FALLS, MAINTAINED AS A HOTEL AND RESTAURANT BY THE QUEBEC RAILWAY, LIGHT AND POWER COMPANY

in way-billing. This is made out in duplicate, one copy going to the motorman of the electric train or the baggageman of the steam trains. The agent retains his copy of the way-bill which is accounted for in the same way as regular freight. Agents receiving express freight issue immediately the receipt previously mentioned, and when the goods are delivered a receipt is taken on the agent's way-bill opposite the article for which the receipt is required. The way-bills received are accounted for like regular freight. Conductors on all regular trains are permitted to accept express freight for shipment at any station on the special form illustrated. The conductor sends a duplicate to the main office and turns the original over to the proper station agent.

The regular freight charges are in general governed by the Canadian freight classification, but special rates are given as shown in the following tables for building material, coal and wood:

SPECIAL CAR LOAD RATES.—TO AND FROM QUEBEC ONLY.

FROM OR TO QUEBEC	Miles from Quebec	MAXIMUM 40,000 lbs.			CORD WOOD Minimum 12 Cords		REMARKS
		Cement Stone Brick † Lime Sand	Lumber Timber Shingles Mill Refuse Laths Slab Wood Box Stuff Tanbark Ties	Coal all kinds	2½ feet per Cord	3 feet per Cord	
Limoilou Jonction.	½	$4 00	$5 00	$4 00	45	55	
*Mastaï	2	4 00	5 00	4 00	45	55	
Beauport	3	4 00	5 00	5 00	45	55	These rates do not apply to cut stone, pressed bricks, dressed or other valuable lumber, &c., which must be billed according to classification.
Montmorency Falls	7	5 00	6 00	6 00	45	55	
L'Ange-Gardien	10	5 00	6 00	7 00	45	55	
*Petit Pré	12	5 00	7 00	7 00	45	55	
*Lemoine	14	5 00	7 00	7 00	45	55	
Chateâu Richer	16	5 00	7 00	7 00	45	55	
*Rivière des Chiens	19	6 00	7 00	7 00	50	60	
Ste. Anne de Beaupré	21	6 00	7 00	7 00	50	60	
Beaupré	23	6 00	7 00	7 00	50	60	
St. Joachim	25	6 00	8 00	8 00	60	70	
*Cap Tourmente	30	7 00	8 00	10 00	60	70	

* Flag stations—Freight must be prepaid.
† Lime in barrels only.

SPECIAL LOCAL MILEAGE FREIGHT RATES FOR CAR LOADS.

FROM OR TO QUEBEC	MAXIMUM 40,000 lbs.			CORD WOOD Minimum 12 Cords		REMARKS
	Cement Stone Brick Brick † Lime Sand	Lumber Timber Shingles Mill Refuse Laths Slab Wood Box Stuff Tanbark	Coal all kinds	2½ feet per Cord	3 feet per Cord	
Not exceeding 2 miles	$4 00	$5 00	$4 00	45	55	These rates do not apply to cut stone, pressed bricks, dressed or other valuable lumber, which must be billed according to classification.
Over 2 and not over 3	4 00	5 00	5 00	45	55	
" 3 " 6	4 00	6 00	6 00	45	55	
" 6 " 8	5 00	6 00	6 00	45	55	
" 8 " 10	5 00	6 00	7 00	45	55	
" 12 " 14	5 00	7 00	7 00	45	55	
" 14 " 16	5 00	7 00	7 00	45	55	
" 16 " 24	6 00	7 00	7 00	66	70	
" 24 " 30	7 00	8 00	8 00	66	70	

† Lime in barrels only.

Milk from all stations is carried to Quebec for 8 cents per 100 lbs. and empty cans are returned free. Empty boxes, tins, barrels, bags, etc., which have served for transport of farm produce to Quebec from any station on which freight charges were paid to Quebec are also returned free. The minimum accepted for any freight shipments is 25 cents. The personal freight of employees is carried at half-prices and when they are obliged to change their residence at the order of the company their household effects are carried free. Agents do not deliver freight consigned to order without first obtaining the original bill of lading, properly endorsed to whose order the freight is consigned. When freight is not removed by the consignee after the expiration of 24 hours it is stored free for an additional period of 48 hours (exclusive of Sundays and legal holidays) after which time the charge for storage is as follows: First to fifth class, 2 cents per 100 lbs. per week or portion thereof; sixth to tenth class, 1 cent per 100 lbs.; minimum charge for any single consignment 10 cents. When freight is to be loaded by the consignor or unloaded by the consignee, not less than $1 per car a day or fraction thereo, for delay beyond 48 hours in loading or unloading is added to the rates.

The company has devised a considerable number of forms to keep track of the amounts and classes of freight business handled. One of the cuts illustrates the usual form of duplicate way-bill made out by station agents in collecting freight. The agents are required to send to the audit office weekly statements of freight traffic received, freight outstanding and freight forwarded, as derived from way-bills. The agents also send in monthly reports covering outstanding freight collected; number, kind, tonnage, ton-miles and revenue of carload shipments; a report covering the details of less than carload shipments, and balance sheets.

STATISTICS

For the year ended June 30, 1907, the company carried 1,235,260 passengers over the Montmorency line. During June, 1907, which may be considered a typical summer month, the earnings from passengers amounted to $14,-999.91, which was equal to the collection of $0.1026 per passenger mile.

The mileage records for typical winter and summer months compare as follows:

	Month Ending Jan. 31, 1907*
Passenger car mileage	4,147
Loaded freight	6,692
Empty	2,902
Foreign freight	3,210
Snow plow	425
Electric car	15,654

*No foreign passenger cars in winter.

	Month Ending June 30, 1907
Steam passenger car mileage	18,006
Loaded freight cars	8,013
Empties	3,529
Foreign passenger car mileage (from C. P. R)	5,094
Electric car mileage	29,591
Foreign freight mileage	1,814

The following table covers the earnings from all sources, passengers transported and tons of freight carried, since the opening of the line in 1889. From this it will be noted that the freight has almost doubled in three years and the passenger business has also steadily increased.

COMPARATIVE STATEMENT OF EARNINGS

From Aug. 10, 1889, to June 30, 1907. Railway in operation, Aug. 10, 1889.

Year ending June 30	Earnings	Passengers carried	Tons of freight
1889-90	$20,043	88,863	2,720
1890-91	36,163	167,960	17,853
1891-92	45,424	190,875	4,995
1892-93	52,144	219,697	6,544
1893-94	49,915	221,369	6,513
1894-95	48,835	217,764	9,419
1895-96	48,546	213,303	7,178
1896-97	50,919	203,916	11,546
1897-98	54,533	221,040	16,027
1898-99*	58,882	239,593	15,470
1899-1900	65,615	261,178	21,083
1900-01	92,049	537,938	24,492
1901-02	102,934	649,087	18,857
1902-03	121,951	797,941	24,753
1903-04	130,331	877,310	35,363
1904-05	139,730	947,070	44,813
1905-06	170,501	1,112,197	66,441
1906-07	185,493	1,235,260	84,897

*Operated by steam only up to September, 1899; then steam and electric.

The traffic and cost of operation for the year ending June 30, 1907, given below, show that the freight business, roughly speaking, constitutes about one-third of the regular passenger business.

STATEMENT OF TRAFFIC AND COST OF OPERATION FOR THE YEAR ENDED JUNE 30, 1907.

EARNINGS

Passenger fares	$129,647.78
Freight	39,585.03
Passenger elevator	10,330.05
Montmorency Falls Park	4,622.33
Mail	1,223.04
Parcel offices	85.55
Total	$185,493.78

THIS WAY-BILL TO BE MADE IN DUPLICATE AND ONE COPY TO BE SENT TO AUDIT OFFICE

QUEBEC RAILWAY, LIGHT AND POWER CO. No. 4050

(MONTMORENCY DIVISION.)

.....190....

CONDUCTOR'S WAY-BILL OF FREIGHT FORWARDED *from* ..... *to* .....

Initials of Car .....

No. of Car .....

NOTE.—Conductors in Way-Billing Freight will not enter the odd pounds—when the fraction is 5 or over, call it ten pounds; when it is under 6 call it 0.

Shipper	Consignee and Destination	No. Packages	Description of Articles	Weight	Rate	Net Frieght	Advanced	Total Collect

CONDUCTOR'S WAYBILL OF FREIGHT FORWARDED

COST OF OPERATION

Maintenance of way	$20,687.26
Maintenance of equipment	14,005.55
Conducting transportation	68,487.71
General expense	23,395.86
Elevator	3,721.42
Total	$130,297.80

The passenger earnings per mile of road were $4863.62; passenger earnings per train mile, $55.10; average number of passengers carried per train mile, 24.48; average receipts per passenger per mile, $0.0210; average income per passenger, $0.1040; and average income per passenger on Montmorency elevator, $0.0487.

NOTE.—Agent will be particular to note the authority by which any deviation is made from Tariff Rates; otherwise the proper rate will be substituted and the Agent held responsible for the deficiency.

QUEBEC RAILWAY, LIGHT & POWER CO.

(MONTMORENCY DIVISION)

No.....

.....190....

WAY-BILL OF FREIGHT FORWARDED *from*.....*to*.....

Initials of Car.....

NOTE.—Agents in Way-Billing Freight will not enter the odd pounds—when the fraction is 5 or over, call it 10 pounds; when it is under 5 call it 0

No. of Car.....

Shipper	Consignee and Destination	No. P'kgs.	Description of Articles	Weight	Rate	Net Freight	Unpaid	Adv. Charges	Prepaid	Total Coll ec

STATION AGENT'S WAYBILL OF FREIGHT FORWARDED

The freight department handled for the traffic year ended June 30, 1907, 84,897 tons; earned an average of $0.4662 per ton and $1319.50 per mile of road. The average receipts per ton per mile were $0.029. The number of carloads hauled was 5277.

The average daily number of trains handled in and out of the Quebec terminal is 76. During the last fiscal year 2237 trains were handled by steam and 25,503 by electricity. The mileage records are as follows: Steam locomotive mileage, 33,233; steam passenger cars, 109,084; motor cars, 256,510; electric trailers, 27,292; foreign passenger cars, 17,333; loaded freight cars, 83,230; empty freight cars, 35,762; foreign freight cars, 21,181; snowplows, 1554.

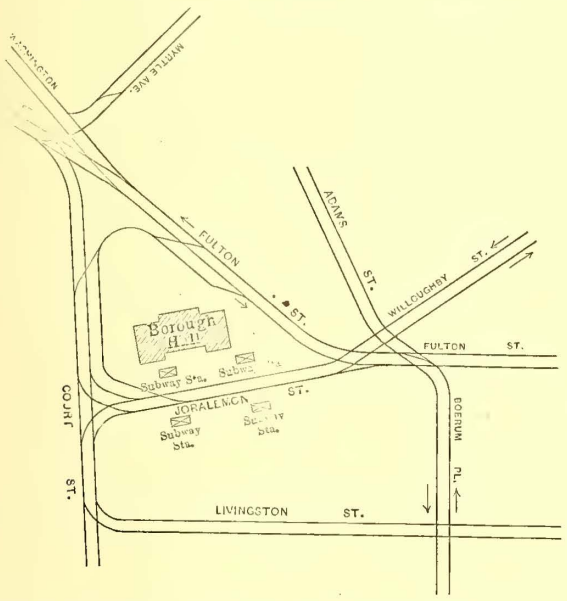
THE LIVINGSTON STREET RAILWAY IMPROVEMENT FOR RELIEVING BROOKLYN RUSH-HOUR TRAFFIC

In 1898 tracks were laid for the operation of trolley cars over the Brooklyn Bridge. Up to that time passengers on the surface lines desirous of getting into New York by crossing the bridge were obliged to transfer to special bridge cars and buy another ticket, which was sold for three cents singly or two tickets for five cents. As this fare was more than that charged by ferry, or two cents, the traffic from Brooklyn to New York was divided to a considerable extent between the ferries and the bridge. The inauguration of a through ride by surface cars for five cents, from any part of Brooklyn to the New York terminus of the bridge, effected a radical change in the distribution of traffic. Many of the lines of the Brooklyn Rapid Transit Company operated to Fulton Ferry were diverted from that route and run over the bridge to New York, where four terminal loops were laid on a level with the street for returning the cars to Brooklyn. At the time of the change the population of Brooklyn was 1,180,000, whereas figures just compiled for 1907 show the population to be 1,426,166. This is an increase of 21 per cent. in nine years. The effect of this change was not only to congest the routes leading to the bridge, but on account of the reduction in fare to attract so many new residents to Brooklyn as still further to increase the patronage of the lines reaching New York by the bridge route.

Unfortunately the number of streets leading to the bridge and suitable for street railway operation is limited. Moreover, Fulton Street, the main business street of Brooklyn, about 40 ft. wide from curb to curb, is the street through which most of the cars of the Brooklyn Rapid Transit Company were originally routed. Consequently congestion on Fulton Street between the Borough Hall and Flatbush Avenue has steadily increased. Meanwhile the company had been casting about for a solution of the problem of congestion on Fulton Street, but without success, as no streets were available to which to divert cars from Fulton Street that would not complicate matters by removing cars in some cases many blocks from their regular routes and increasing the burdens of the conductor and creating

operating problems, as other lines were already well loaded.

In 1904 the number of loops on the bridge was increased from four to eight, thus helping the movement of cars over the structure, which by this time was carrying sixteen lines of cars, of which six were operated on Fulton Street between Borough Hall and Flatbush Avenue, a distance of six-tenths of a mile. In addition to this, service was operated over this territory on the lines mentioned to Fulton Ferry, for the accommodation of the ferry traffic, and around the Borough Hall to accommodate the business establishments along Fulton Street, two of which employ



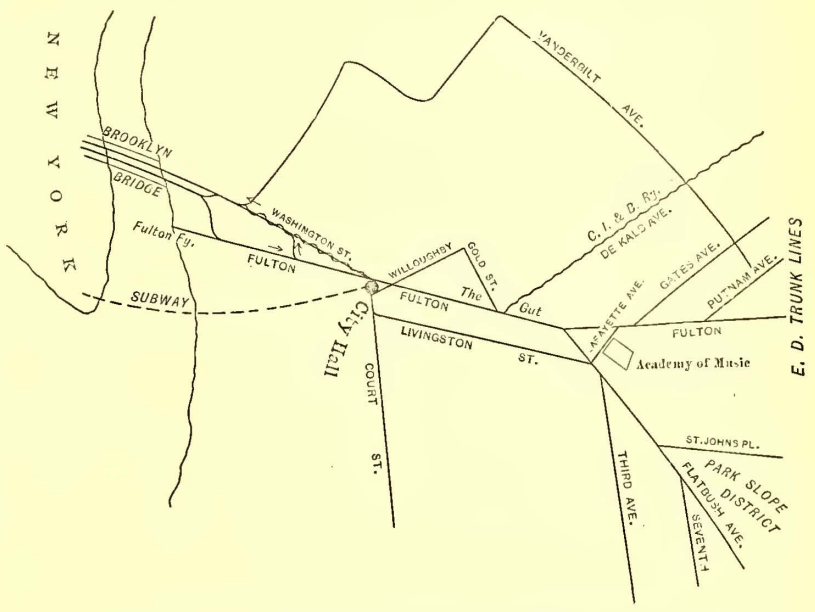
TRACK LAYOUT NEAR BOROUGH HALL, BROOKLYN

4000 people each. For stated periods during the morning and the evening rush, cars of such lines as Gates and Putnam avenues bound to and from New York were diverted from Fulton Street to lessen the congestion, but a return to the old operation had to be made in the case of the Gates Avenue line because of the confusion that resulted among the passengers who seemed never to learn that lower Fulton Street was avoided to facilitate the handling of traffic.

Paralleling Fulton Street between the Borough Hall and Flatbush Avenue, as the first street to the south, is Livingston Street, a narrow thoroughfare upon which back many of the large Fulton Street stores. The only solution of the problem seemed to be to place tracks on this street and thus parallel Fulton Street, or in other words double the ability to handle cars between the Borough Hall and Flatbush Avenue. To this end it was decided if possible to secure from the city the right to build a double track line on Livingston Street after the widening of that thoroughfare from 40 ft. to 80 ft. by the city as a public improvement had been accomplished. This right was secured by a special franchise in the name of the Nassau Electric Railway Company purchased from the city at auction, the terms of which were determined after many conferences between city, borough and railroad officers and a fixed compensation made for the use of this street. A line has just been built on Livingston Street, as shown in the accompanying diagram of the congested district in Brooklyn, extending from Court Street to Third Avenue. Thence the route is continued along Lafayette Avenue to Fulton Street, making parallel routes of Fulton and Livingston Street not more than 200 ft. apart. Over this route two lines have been run for several weeks in slight degree and a third was placed in operation Nov. 7, all of which will be almost completely operated hereafter. By this means it is expected that the time between the Borough Hall and Flatbush Avenue will be cut down from between ten and twelve minutes to seven or eight minutes.

The lines now traversing Fulton Street between the Borough Hall and Flatbush Avenue are Fulton Street, Gates Avenue, Putnam Avenue, Third Avenue, Flatbush Avenue, Flatbush-Seventh and St. Johns line. In addition the Coney Island & Brooklyn Railroad operates over Fulton Street between the Borough Hall and DeKalb Avenue, as shown in the map. Of these lines the Flatbush, Third Avenue and St. Johns lines will be permanently diverted to Livingston Street, and the Putnam Avenue and Halsey Street line, which has been partly diverted in the morning and evening rush hours, will be returned to its original route through lower Fulton Street. In this way about thirty Flatbush, twenty Third Avenue, and seventeen St. John's Avenue cars are being diverted an hour, while the advantage is gained of operating the Halsey Street line over its original route.

It was impossible to divert cars from Fulton Street to the north, as no street really parallels it. Willoughby Street, however, crosses Fulton at an angle of about 45 degs. above the Borough Hall, and in the case of "City Hall" cars of all the B. R. T. lines this was taken advantage of in the evening to run cars over the Gold Street tracks into Willoughby Street, looping the Borough Hall and returning to Fulton Street to accommodate Brooklyn retail stores. Willoughby Street, however, running as it does into Fulton Street at the angle mentioned, is several blocks from Fulton at Gold Street, which is below and opposite to Flatbush Avenue on the north side of Fulton



MAP SHOWING LINES FEEDING INTO FULTON STREET WHICH CAUSE CONGESTION

Street, and it thus had the disadvantage of introducing the element of uncertainty among the passengers and added to the complexity of the complicated crossing at Fulton, Willoughby and Adams Streets, the layout of which is shown in the accompanying map of the tracks near the Borough Hall.

In this connection it is of interest to refer to the map of the track layout in the vicinity of the Borough Hall. It will be noted that there is a very complicated crossing just above the Hall, where Adams and Willoughby Street cross Fulton. Over Adams Street cars also are operated to and from the bridge. Frequently more than 700 cars cross at this intersection in the rush, while more than 260 pass on Fulton Street in one direction, between Washington Street and the intersection of Adams, Willoughby and Fulton Streets. The company keeps a daily record of all cars passing the corner of Fulton Street and Court, and from this record the following table has been prepared, showing the lines and the number of cars for each half hour during the evening rush on Nov. 1, between 4:30 and 6:30 p. m.:

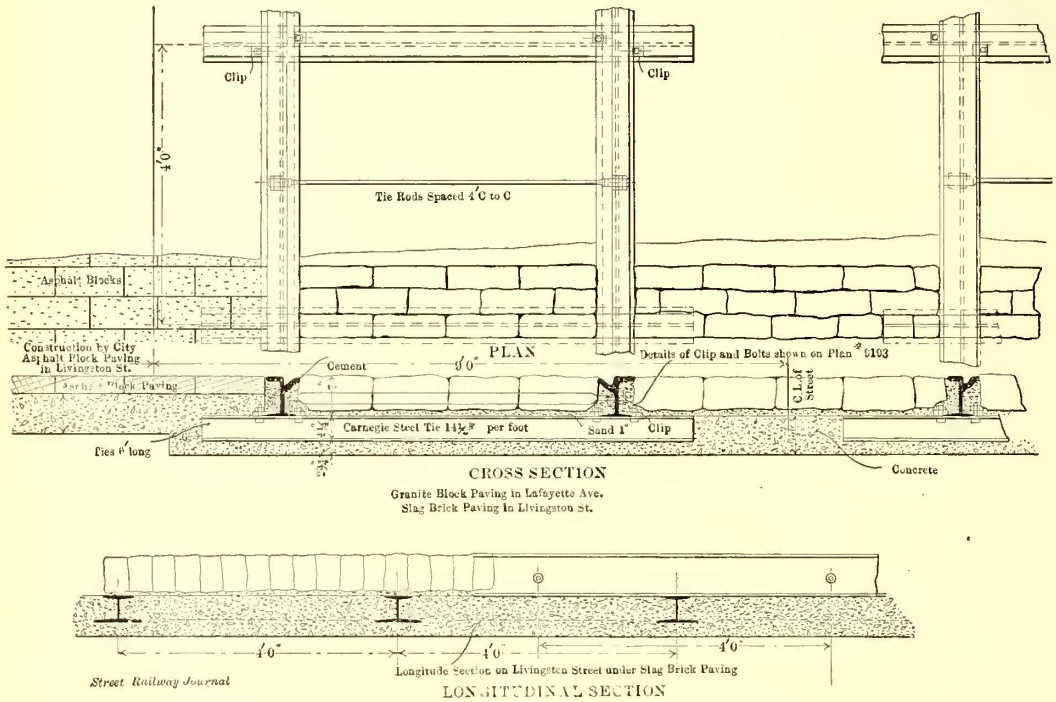
	Time			
Line	4:30-5	5-5:30	5:30-6	6-6:30
Fulton Street	15	18	20	22
Putnam Avenue	15	13	15	15
Gates Avenue	15	16	22	22
DeKalb Avenue	8	7	7	10
Myrtle Avenue	13	12	15	14
Court Street	13	12	13	14
Flatbush	13	15	18	17
Third Avenue	10	8	10	8
Flatbush-Seventh Avenue	8	10	9	9
St. John's	5	6	6	6
Union	6	5	6	7
Totals	121	122	141	144

From the record kept by the bridge commission of New York the following figures of round trips, by trolley car over the bridge by years since the inauguration of the service, has been compiled.

For the nine months ended Sept. 30, 1907, 1,062,661 trips have been made.

1898	1,119,348	1903	1,299,108
1899	1,379,815	1904	1,327,367
1900	1,348,864	1905	1,345,261
1901	1,398,071	1906	1,388,908
1902	1,275,522		

Two improvements under way are expected to have bearing on the problem of traffic in lower Fulton Street, however. They are the new subway extension under the East River from Manhattan running out Fulton Street to Flatbush and Atlantic Avenues and the new Manhattan bridge, under construction, which is the third to span the East River. The subway is expected soon to be opened to the public as far as the Borough Hall, but it will be at least five years before the bridge is completed. Just what effect the subway will have on traffic in Brooklyn it is impossible to foretell, but the company is planning to meet any change in operation that may be deemed necessary as a result of the subway.



STEEL TIE-TRACK CONSTRUCTION ON LIVINGSTON STREET, BROOKLYN.

An interesting feature in connection with the new Livingston Street line is the use for the first time in Brooklyn of steel ties. The service over the short route being heavy it was decided to install the ties, using a 7-in. Lorain rail, No. 393, and section 114. This is a grooved rail instead of a tram rail, and weighs 114 lbs. to the yard, which is very heavy considering that the rail is only 7 ins. high. Of the new line 3400 ft. are in Livingston Street and 800 ft. in Lafayette Avenue. Livingston street is paved with brick, but Lafayette Avenue is paved with granite. In Livingston Street, therefore, the concrete was brought up between the ties as shown in the cross-section of the track herewith. The ties were made by the Carnegie Steel Company. They are 6 ft. long and 4¼ ins. high and weigh 14½ lbs. per foot. The concrete bed on which they are laid is 2¾ ins. deep. The ties are spaced 4 ft. center to center. The tie rods are also spaced 4 ft. center to center.

FOUR-TRACK LINE IN CALIFORNIA

The Pacific Electric Company's four-track system, now in operation as far as Watts, is relieving congestion upon the southerly lines to a great extent. The Long Beach, San Pedro, Whittier and Santa Ana lines take that course out of Los Angeles. The local travel between Los Angeles, Watts, and intervening stations formerly delayed interurban passenger traffic to an annoying degree. With the operation of four tracks to Watts all difficulties have been overcome, and long distance cars are making their trips on schedule time.

COMPARATIVE PERFORMANCE OF STEAM AND ELECTRIC LOCOMOTIVES*

BY ALBERT H. ARMSTRONG

Among the many electrification projects now in course of construction, nearly all were inspired by such motives as cleanliness, smokelessness, convenience, etc., but few indeed have been considered strictly from the standpoint of direct financial benefits to be obtained. The improvements in and around New York City terminals, the various tunnel projects, such as the early Baltimore & Ohio installation, and later the Sarnia, Detroit River, and Cascade Tunnel projects—all are examples of steam road electrification in which there were distinct reasons for displacing steam as a motive power, but there are other sections of our steam lines where these same reasons do not apply with equal force, and benefits of a more far-reaching nature must be made evident before such electrifications can be considered as necessary or desirable. It is concerning these other sections of steam lines demanding other reasons for electrification that this paper is written, and the best means to be employed in getting a thorough grasp on the subject seems to lie in an investigation into the comparative inherent qualities of steam and electric locomotives.

Before considering the electric locomotive, much the simpler of the two, it is advisable to determine the general characteristics and limitations of the steam locomotive viewed from the standpoint of the electrical engineer, in order that the scope of the problem may be thoroughly understood and the lines of contrast be sharply drawn.

This preliminary study of the steam locomotive is made necessary by the fact that railroad practice to-day is essentially *steam* railroad practice and is hedged about by practices and methods of operation demanded by the use of the steam locomotive as a type of motive power. Viewed in the light of greatest benefits to be secured, the coming of the electric locomotive is not due to petty economies effected in coal consumption and cost of locomotive repairs. The use of water power, or of a cheaper grade of fuel than can be burned on a steam locomotive, will in many cases afford a means of reducing the fuel cost well below the present cost of high-grade coal required for successful locomotive operation; but in general the fuel item reduction does not in itself offer a sufficient saving to pay an adequate return on the large investment required for electrification. It is necessary, therefore, to look for more far-reaching benefits, and, not considering the reasons governing the introduction of the electric locomotives at terminals and in tunnels, we find in a comparison of the characteristics of the steam and electric locomotives a contrast so marked that it shows not only the superiority of the electric locomotive for general railway conditions, but it also suggests changes of a fundamental nature in present methods of operation now necessary with steam locomotives. And these benefits to be secured occur not only in the operation of passenger trains, but are felt to an even greater degree in the haulage of the heaviest freight trains, a field supposedly the exclusive domain of the steam locomotive.

The locomotive engine is distinct from the locomotive boiler, and when supplied with unlimited steam at constant pressure it has its own characteristics and maximum output both in tractive effort and horse-power. Engines are of two general types, simple and compound, the latter being introduced in orded to effect a saving in the large steam consumption inherent to non-condensing engine operation. The success of the compound locomotive is very much a matter of discussion among railroad men, but it seems to have found a permanent foothold upon easy-grade lines although its use is still open to serious question upon the heavy mountain-grade divisions. In general, the electric locomotive must compete with the compound steam locomotive on level divisions, and the simple engine on heavy grade divisions, although the Mallet compound has lately been introduced with some success in this latter class of work.

The general shape of the steam locomotive characteristic is given in Fig. 1, which shows the relation between the speed and tractive effort of a simple consolidation locomotive designed for heavy freight service. Owing to clearances it is seldom that a locomotive can work at more than

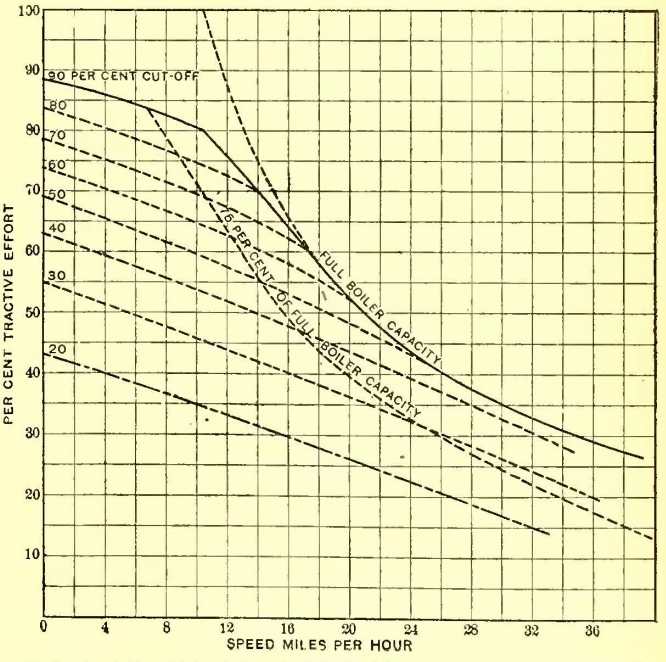


FIG. 1.—TYPICAL STEAM LOCOMOTIVE CHARACTERISTIC (SIMPLE)

90 per cent. of the theoretical full stroke, hence the maximum tractive effort at starting with lever in the corner will not be much greater than 88 per cent. of the theoretical tractive effort available with gage pressure in the cylinders. An inspection of Fig. 1 shows that the steam locomotive is limited as to maximum tractive effort by its engine design, and limited as to the speed at which this tractive effort is available by the capacity of the boiler to supply steam. Thus, assuming that the locomotive will give 88 per cent. of its theoretical tractive effort when starting, it is capable of providing but 80 per cent. tractive effort at a speed of 10.6 m. p. h. (with the constants of the particular locomotive chosen for illustration) at which the boiler is giving its full output. Hence higher speeds can only be reached with a less cut-off and a consequent reduction in mean effective pressure and tractive effort. Locomotive engines are generally designed to give their maximum tractive effort at 90 per cent. theoretical cut-off at a point corresponding to a coefficient of adhesion of approximately 22 per cent. of the weight upon the drivers; that is, at about slipping point of steam locomotives with good rail conditions. It is immediately evident, therefore, that the tonnage rating of the locomotive on ruling grade must be so proportioned that the maximum tractive effort called

*Abstract of paper presented at the meeting of the American Institute of Electrical Engineers, New York, Nov. 8, 1907.

for will be less than the available tractive effort of the locomotive in order to provide a small percentage, say 10 or 15 per cent., for possible starting under maximum grade and load conditions. In other words, as the steam locomotive is designed so that the maximum tractive effort is delivered at a point not greater than 22 per cent. of the weight upon the drivers, it is not possible to take advantage of possible abnormally good rail conditions (either natural or made abnormal by the use of sand) as the engine itself will fail to deliver any excess tractive effort thus made available with increased coefficient of adhesion.

On the other hand, the tractive effort of the electric locomotive is limited only by the adhesion between driving

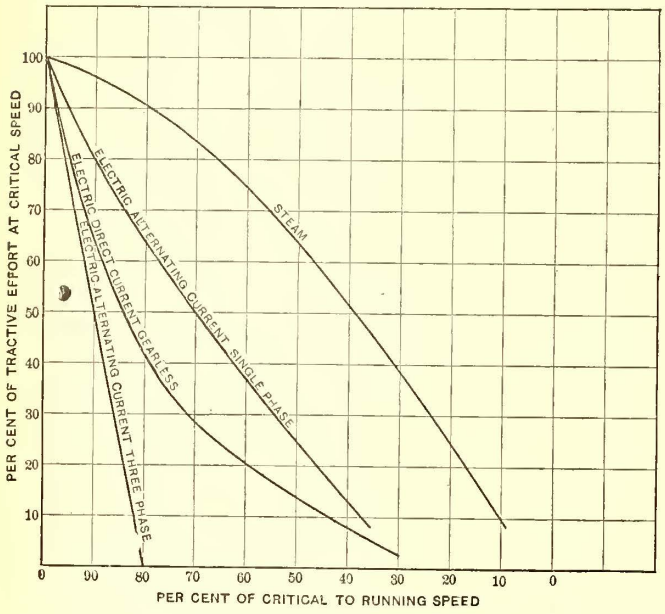


FIG. 2.—TYPICAL CHARACTERISTICS OF STEAM AND ELECTRIC LOCOMOTIVES

wheels and rail, and aside from some 15 per cent greater adhesion possible with the uniform tractive effort provided by the electric locomotive, it is possible with this type of motive power to take momentary advantage of abnormally good rail conditions or to derive full benefit from the use of sand; indeed, tests have been taken with electric locomotives showing as high as 35 per cent coefficient of adhesion between driving wheels and rail. This point is emphasized as with the greater tractive effort of the electric locomotive it becomes possible to give them a higher tonnage rating for the same weight upon the drivers than would be possible with steam locomotives operating over the same track profile.

There is a marked difference in the speed characteristics of the steam and electric locomotives, and indeed there is also a marked difference in the speed characteristics of different types of electric locomotives. Although this paper is not intended to enter into any discussion of the relative merits of different types of electric locomotives, there is so striking a difference in the several speed characteristics, each of which possess special advantages for certain operating conditions, that Fig. 2 has been prepared contrasting the characteristics of the steam locomotive and the direct-current gearless, alternating-current single-phase geared, and alternating-current three-phase geared electric locomotives. As all types of motive power share in common the fact of a certain critical speed beyond which full tractive effort cannot be maintained, the curves in Fig. 2 have been prepared on the basis of showing the relation between percentage of maximum tractive effort available at speeds higher than the critical speed, ordinates being tractive effort and abscissas percentage of critical speed to running speed.

A more familiar presentation is given in Fig. 3, showing a concrete case of a 22 in. x 30 in. steam locomotive of the simple type equipped with 57-in. drivers, contrasted with both an alternating-current geared and a direct-current gearless electric locomotive designed for the same tractive effort both maximum and running, but for a higher speed. The contrast of these different speed characteristics brings out sharply the small speed variation with different tractive efforts delivered by the electric locomotives, this small variation being even more marked in the case of the direct-current gearless than in the case of the alternating-current geared motor working at a lower iron saturation and thus affording a more sloping speed characteristic.

The steam locomotive chosen is typical of those in general use upon our mountain-grade divisions, the tonnage

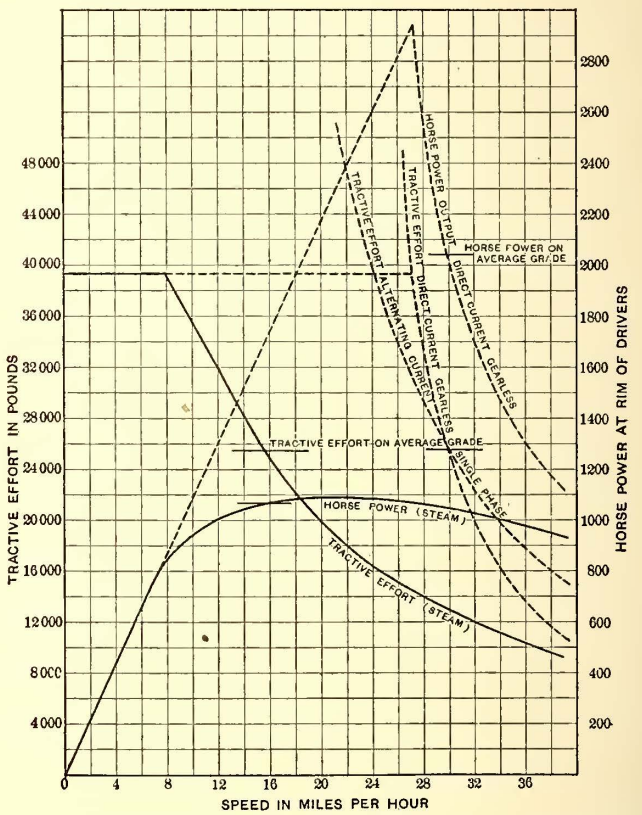


FIG. 3.—STEAM AND ELECTRIC LOCOMOTIVE CHARACTERISTICS

rating in operation of this particular locomotive being such as to call for a tractive effort of 25,600 lbs. on average grade and 33,200 lbs. on the maximum ruling grade occurring on a certain engine division, thus leaving a margin of 6,300 lbs. above the demands of maximum tonnage on maximum ruling grade for starting the train from rest.

The maximum speed available at the different tractive efforts is a matter of boiler capacity, condition of boiler, quality of coal, and efficiency of fireman. The first of these factors, the boiler capacity, can be controlled by properly proportioning the design of the boiler to engine capacity, but there are three other factors which the locomotive manufacturer cannot control and two of these factors constitute sufficient cause to warrant a considerable reduction in the theoretical rated capacity of the boiler. Thus, referring to Fig. 1, such a locomotive in prime condition carefully fired with the best coal (approximating 14,000 B. T. U.) should be able to deliver full tractive effort at

10.6 m. p. h., but in practice it has been found that the average condition of boilers and the average firing provided by the none too conscientious or diligent fireman, cuts the sustained boiler output down to not much greater than 75 per cent of its output under what must be considered exceptionally or momentary conditions. By sustained "output" is meant the output required while ascending the continuous up grades met with on our western mountain divisions. Though full boiler capacity may be attained for short periods, the average performance of all the locomotives on the division on the average up grade will show a marked reduction in capacity from the results obtained in a stationary test or single experimental test runs.

The locomotive characteristic in Fig. 3, has been prepared on the basis of 75 per cent. of the possible boiler capacity in the following manner:

General Constants of Simple Consolidation Locomotive.

Diameter of cylinders	22 ins.
Length of stroke	30 ins.
Diameter of drivers	57 ins.
Heating surface	3397 sq. ft.
Total weight of locomotive	103.5 tons
Weight on drivers	93 tons
Weight of tender	61.5 tons
Total weight locomotive and tender	165 tons

This particular locomotive has been chosen for illustration as it is the type in daily use on the mountain division of one of the largest Western roads.

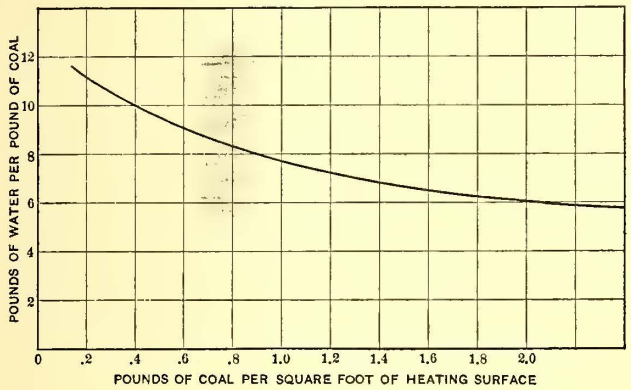


FIG. 4.—RATE OF EVAPORATION

Under the above conditions, the theoretical tractive effort is 49,500 lbs., of which 39,600 lbs. is available at 90 per cent cut-off. The contents of each cylinder is approximately 6.6 cu. ft. and with four cylinders of steam per revolution and with steam weighing 0.41 lbs. per cubic foot at 170 lbs. cylinder pressure, each revolution requires 10.85 lbs. steam. With 3397 sq. ft. of heating surface there is a possibility of evaporating 6 lbs. of water per pound of coal when burning 2 lbs. of coal per sq. ft. of heating surface, thus giving an available supply of 40,700 lbs. of steam per hour when working boilers in prime condition at the full output resulting from perfect firing with good quality of coal. In practice, however, the available steam for sustained output would not be greater than 75 per cent or 30,500 lbs. per hour, thus giving full tractive effort at 46.8 r. p. m. of the drivers corresponding to 7.93 m. p. h. on a 57-in. driver. The "critical speed" of the locomotive is therefore 7.93 m. p. h. when working at 75 per cent of full attainable boiler capacity, and the coal consumed under such circumstances will be 4,360 lbs. per hour, corresponding to 1.28 lbs. of coal burned per sq. ft. of heating surface, at which rate we would expect an evaporation of approximately 7 lbs. of water per pound of coal.

What might be termed the "performance capacity" of a steam locomotive may be worked out from the speed and tractive effort characteristics given in Fig. 3, using as a basis the 1000 ton-miles trailing load moved per hour on a level or any gradient selected. The prevalence of 2.2 per cent. ruling grade on many of our Western roads perhaps justifies the selection of that figure for demonstration purposes; and the coal consumed, crew wages, and maintenance charges, may all be worked out from the basis of continuous operation per 1000 ton-miles trailing load on 2.2 per cent grade, these results being shown in Fig. 5.

Certain assumptions are necessary and are as follows:

Cost of coal	$3 per 2000 lbs.
Engineer, wages per hour	$0.50
Fireman, wages per hour	0.35
Conductor, wages per hour	0.40
Three brakemen, wages per hour	0.90
Total crew	2.15

Average mileage per locomotive per year, 36,500.
Total maintenance, including round-house charges, $5,000.
Maintenance per locomotive mile actually run, 13.7 cents.
General locomotive constants are the same as previously given.

Having broadly outlined the performance characteristics of the simple consolidation engine frequently met with in heavy grade operation, it becomes necessary so to proportion the constants of the electric locomotive, assumed to replace it, as to gain the greatest benefit from the different inherent characteristics of the latter type of motive power.

Referring to Fig. 2, it is evident that with the small speed variation of the electric locomotive, and due to the fact that its motive power is separate from its unlimited source of power generation, it is possible to consider radical changes in the method of moving freight, more especially on mountain-grade divisions. It has become a partly accepted fact that the electric locomotive characteristic should be so proportioned as to enable it to operate trains at a high rate of speed on level track and at a much slower speed on grades, in fact conforming with present steam practice in this respect. The writer would again point out that steam railroading to-day is in reality steam locomotive practice in that the speed possibilities of different track divisions are restricted to a large extent by the limitations of the steam locomotive. In other words, the only reason why it is common practice to run at very low speeds on mountain-grade divisions instead of continuing the high speeds in vogue on more level portions, is because a steam locomotive cannot be built powerful enough to supply the heavy tractive effort required at any higher speeds than those now in vogue. Railway economies teach us that the lowest cost per 1000 ton-miles is obtained when operating the greatest train weight at the highest speeds, and J. J. Hill's well-known saying to the effect that "Expenses are per train-mile and receipts per ton-mile," is only partly true, as the time consumed in hauling the train one mile enters as a most vital factor.

Considered broadly, the one expense in train operation that is fundamental is the cost of fuel, this factor being influenced only by the economy of the fuel-burning plant. Other expenses, such as locomotive maintenance, crew wages, etc., are affected entirely by the method of operation, and no radical departure from present methods is to be looked for until the coming of a type of motive power which offers possibilities not equally enjoyed by the steam locomotive.

This point is further illustrated by reference to the operating sheet of one of our greatest Western roads using the simple consolidation locomotive previously described.

Speed Relations. Road "A" Mountain Division.

	Up Grade.	Down Grade.
Schedule speed.....	7.35 miles per hr.	12.5 miles per hr.
Av. speed while running.	12.1 miles per hr.	20.0 miles per hr.
Number stops per mile..	0.177	0.149

The average schedule speed of a number of trains, including all layovers due to the despatcher or failure of motive power, as obtaining on another mountain division of a different road, showed values as low as 6.7 m. p. h. up grade. In general it may be stated that the freight movement over mountain divisions is effected at very low schedule speeds, and the cause is evident from an inspection of the steam locomotive characteristic. Except for the fact that curves are usually of shorter radius on heavy grades than on levels, there is no reason for the slower speed of trains, provided a type of motive power is available that is capable of supplying great draw-bar pulls at high speeds. It is just this characteristic which the electric locomotive possesses to an almost unlimited extent, and such locomotives can be built which are even more powerful and operate at higher speed than can be utilized at present.

For example, the simple consolidation locomotive considered is capable of sustaining a tractive effort of 25,600 lbs. at a maximum speed of 15.4 m. p. h., and weighs

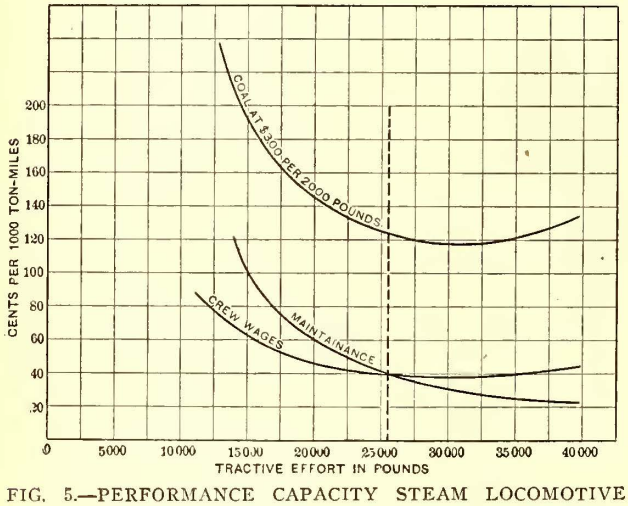


FIG. 5.—PERFORMANCE CAPACITY STEAM LOCOMOTIVE (SIMPLE), GRADE 2.2 PER CENT (UP)

165 tons with tender, while a single New York Central electric locomotive, of the 600 type is capable of delivering the same tractive effort at approximately 37 m. p. h., and the weight is only 100 tons. The Central locomotive is of course designed for moderate speed passenger service and could not be run continuously at such a large output, but it is cited only as an example of a well-known electric locomotive having an enormous horse power capacity, although in this respect it is but the forerunner of other electric locomotives having still greater outputs. Owing to the fact that such units may be run in groups of two or more and still be perfectly under the control of a single operator, the advantage of very large single units is somewhat modified, and the introduction of the electric locomotive may also introduce new ideas as to the size and construction of single hauling units.

The electric locomotive may be equipped with motors of several different types each having characteristics best qualifying it for certain classes of work. Fig. 6 and Fig. 7 illustrate the usual speed, torque, and efficiency curves of two typical motors, the direct-current gearless and the alternating-current single-phase geared type. The type of motor to be adopted is a matter requiring full local knowledge of the conditions obtaining in each individual instance before a proper selection can be made. All three of the available motors—direct-current, alternating-current single-phase, and alternating-current three-phase—possess the one needed characteristic of great output per pound and hence the arguments advanced for the substitution of the electric for the steam locomotive are general in character and do not apply strictly to locomotives equipped with any one type of motor to the exclusion of all others. As the direct-current gearless motor can be built in the largest sizes, is the best understood, and is in successful operation upon a very important division of one of the largest steam roads, it is here chosen as the equipment of a typical electric locomotive.

The large output, 840 hp for one hour and 400 hp continuous, shown in Fig. 6, illustrates what can be accomplished with this type of motor. The output of the complete locomotive is dependent upon the number of motors permitted with the construction adopted. Thus, such a four-motor equipment is capable of delivering a tractive

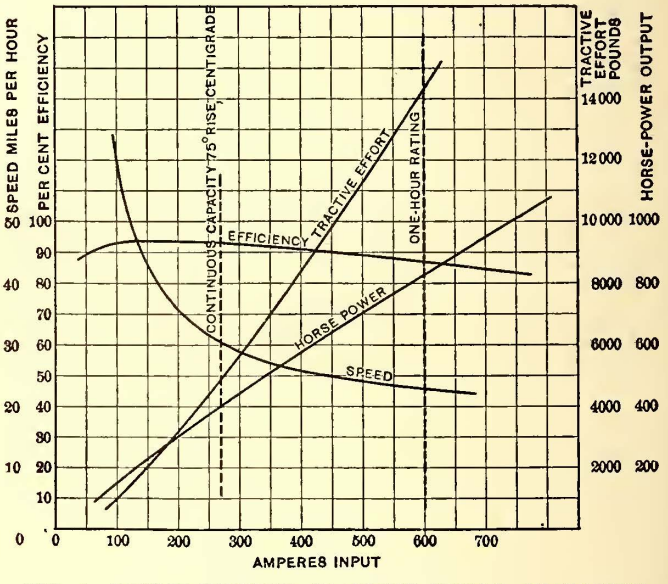


FIG. 6.—DIRECT-CURRENT GEARLESS MOTOR CHARACTERISTICS, 1200 VOLTS

effort of 56,800 lbs. at a speed of 23 m. p. h. approximate (depending upon the voltage) while the efficiency of conversion at this output would be 87 per cent, rising to a maximum of 93 per cent at higher speeds and lower tractive effort. Another form of construction, say one similar to that employed in the largest Mallet compound, would permit the use of two four-axle articulated trucks, providing an equipment of eight motors and an output of 113,600 lbs. at a speed of 23 m. p. h.

The same motors could readily be rewound to give the same tractive effort at considerably increased speeds if desired, without materially increasing the internal losses of conversion.

Returning to the direct comparison of the simple consolidation and electric locomotive, Fig. 3 was plotted on the basis of a speed of 30 m. p. h. for the electric and 15.4 m. p. h. for the steam locomotive, giving in each instance a tractive effort of 25,600 lbs. at the rim of the drivers. Though the electric locomotive could very readily be designed to give the same tractive effort at a higher speed, 30 m. p. h. was assumed as the highest speed permissible due to the alignment of the track on heavy grades.

To plot a performance capacity curve for the electric locomotive, certain further assumptions are necessary.

Type of equipment, direct-current gearless motors.
Weight of total locomotive.....125 tons
Weight on drivers.....100 tons
Engineer, wages per hour.....$0.50
Conductor, wages per hour..... 0.40
Three brakemen, wages per hour..... 0.90
Total wages of crew..... 1.80
Efficiency of transmission rail to bus-bar, 70 per cent.
Maintenance of locomotive, 5 cents per mile run.

The train crew is so divided as to permit the location of a brakeman in the engineer's operating cab.

The cost of electrical power must in this instance be most arbitrarily assumed, owing to the widely different cost of coal, possibility of water power, etc., obtaining in different localities. As the cost of coal for steam locomotives will also vary greatly as to price and quality, it has been assumed at $3 per 2000 lbs., and a cost for electric power of one-half cent per kw-hour is based upon using the same price and quality of coal. As it is further assumed that an entire engine division of say 150 miles is to be electrified, it gives promise of a 24-hour load-factor of 50 per cent and this figure has been taken. Approximating the

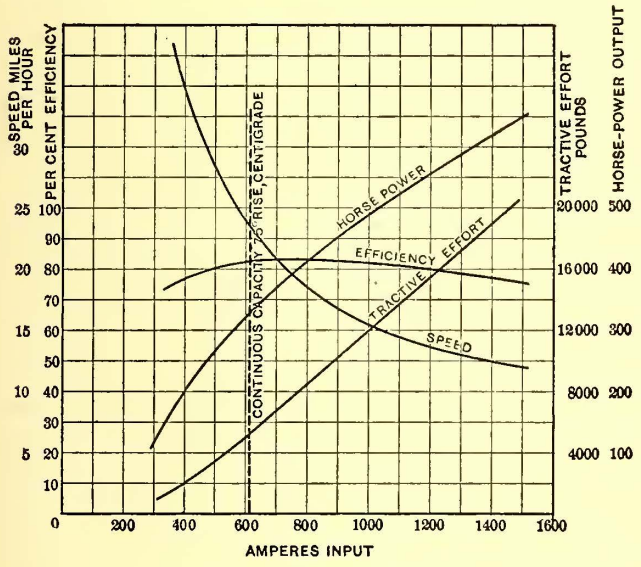


FIG. 7.—ALTERNATING-CURRENT SINGLE-PHASE MOTOR CHARACTERISTICS, 25 CYCLES, 375 VOLTS

first cost of installation of the generating station at $100 per kilowatt, and allowing 10 per cent per year for interest and other fixed charges, the cost of power is brought up to possibly $0.0075 per kw-hour at the station bus-bar. Other conditions obtaining will in a given instance modify the figures arrived at, but for purposes of demonstration $0.0075 is a conservative estimate, and such a figure is needed to compare the cost of power with the fuel item in steam-locomotive performance.

The effect of increased speed on cost of operation is clearly shown by comparing the performance capacity curves of the steam and electric locomotives, Figs. 5 and 9.

It will be observed that the reduction in the operating expenses is effected in the two items of crew wages and maintenance of locomotives, and that the cost of fuel remains practically unchanged. This is as it should be, as the cost of fuel in the case of steam locomotives or power with electric locomotives is the only fundamentally necessary expense in train movement. Overcoming train friction and raising a train up grade against gravity represents useful work performed, and this work is accomplished at an expenditure of approximately 4 lbs. of coal per hp-hour at the drivers with simple engines and 2.66 lbs. of coal per hp-hour at the drivers with electric locomotives, including all intervening losses between rail and generating station bus-bar. The speed at which this work is performed, therefore, does not affect the cost of fuel or power, it being assumed that the motive power for the various speeds is so proportioned as to operate at the point of greatest economy.

Thus with coal at $3 per 2000 lbs. in each case, the steam locomotive can generate a horse power at the drivers at an expenditure of $0.006 as against $0.0039 for fuel alone with the electric. The two figures are not directly comparable, as to the cost of fuel for steam locomotive operation must be added the extra cost of hauling, which on grade divisions may constitute a large percentage of its original cost; and the waste incident to handling and storing in many bunkers along the tracks. In addition, there is a considerable quantity of coal burned under the boilers of steam locomotives standing idle or coasting down grades, which will be shown later, may equal 10 per cent of the total consumption in main line freight movement and much more in the case of helpers and switching engines. If, therefore, coal be delivered at the engine division terminal at $3 per ton, the

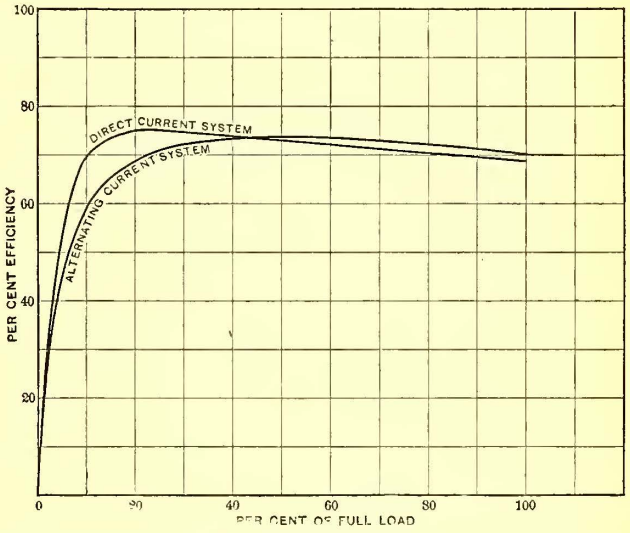


FIG. 8.—EFFICIENCY OF DISTRIBUTION GENERATOR TO RAIL

actual cost on the tender will be considerably in excess of this figure, and due allowance must also be made for the coal wasted, burned or otherwise, and not producing useful brake hp-hours at the rim of the drivers.

In the electric system also, besides the allowance made in distribution losses in arriving at 2.66 lbs. coal burned per hp-hour at the rim of the drivers, there will be an additional charge for labor and fixed expenses incident to power-house operation and first cost. The electric system, however, is not restricted to the use of high-grade fuel and coal of an inferior quality, and much lower cost, such as lignite, can be utilized, besides the large opportunities for cheap power presented by the water powers generally available on mountain divisions. A common cost of $3 per 2000 lbs. for coal is taken in this discussion; it is rather favorable than otherwise to steam locomotive operation, as coal can be dropped into the bin of a power house located at a division terminal at less expense than it can be hauled up a severe long grade and distributed in several pockets along the route.

It is evident that the cost of fuel or power, being fundamental, constitutes a fixed item in the total cost of operation while the other two items, crew wages and maintenance expenses, will be determined solely by the method of

operation and the excellence of motive power used. We have become so accustomed to consider that fuel, crew wages, and engine maintenance each constitute approximately 10 per cent of the total cost of operating a railway that we rather lose sight of the fact that two of these items are a theoretically needless expense and subject to considerable modification in practice with the adoption of another type of motive power possessing characteristics which will permit making radical changes in operating methods.

While the figures shown in Figs. 5 and 9 indicate a certain relation among the three items of fuel, crew, and maintenance expense, this is not the true relation obtaining in practical operation for the reason that the values given in the curves assume continuous operation up grade under the conditions outlined. Unfortunately, train crews must be paid full value per mile whether the mile be up grade or down, and with steam locomotives there is also a considerable loss in fuel resulting from engines standing or running

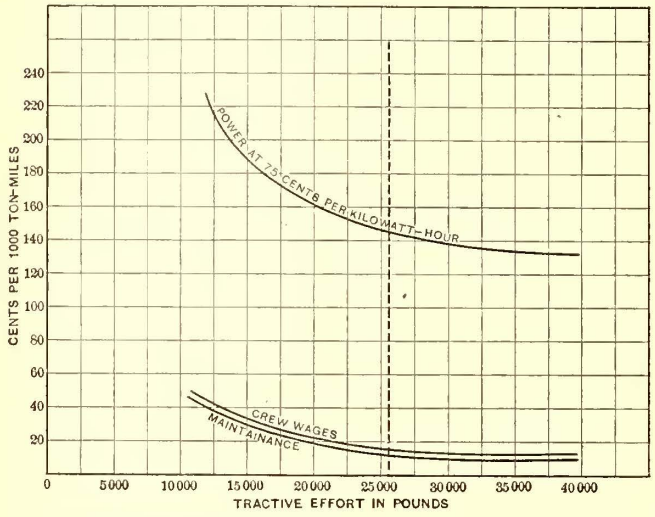


FIG. 9.—PERFORMANCE CAPACITY ELECTRIC LOCOMOTIVE (DIRECT-CURRENT GEARLESS) GRADE 2.2 PER CENT (UP)

light which must be also taken into account; hence it becomes necessary to modify the figures arrived at, and for this purpose certain references must be made to current railroad practice on mountain-grade divisions in order to arrive at the proper tonnage relations, schedule speeds, etc., obtaining in up-grade and down-grade operation.

Previous figures have been given showing that the schedule speed on several mountain divisions is approximately 50 per cent of the average running speed and this figure is assumed in the following statement of cost of operating 1000 ton-miles with steam locomotives, averaging the cost of up- and down-grade running. Owing to the higher schedule speed of electrically operated trains, resulting in fewer meeting points with the same tonnage handled, and due to the absence of forced stops to take on fuel and water, etc., it is assumed that with electric motive power the schedule speed may be 60 per cent of the running speed.

With the electric locomotive standing, or coasting down grade, there is no demand whatever made upon the generating station, and hence the only expense carried through these periods is that for train crew and a certain amount for maintenance. On the other hand, with the steam locomotive there is a considerable amount of fuel burned and water wasted when standing at sidings and when coasting. In the case of mountain railroading with its frequent and prolonged delays, this waste may reach considerable proportions.

The following results of a carefully conducted series of tests will illustrate this point. Two test locomotives and trains were operated over a mountain division under regular service conditions—steam and fuel consumption, duration of delays, etc., being carefully noted. The total work expended up grade was 5700 hp-hours at the rim of the drivers including allowance for 1.54 per cent average grade and seven pounds per ton track and curve friction. The total water evaporated on the trip divided by the total hp-hours gave a steam consumption of 36 lbs. per brake hp-hour at the rim of the drivers. Indicator cards taken upon the engine in question at all cut-offs up to 90 per cent showed that the greatest steam consumption did not exceed 32 lbs. per indicated hp-hour, or 35.5 lbs. per brake hp-hour, allowing 10 per cent internal engine friction. Values as

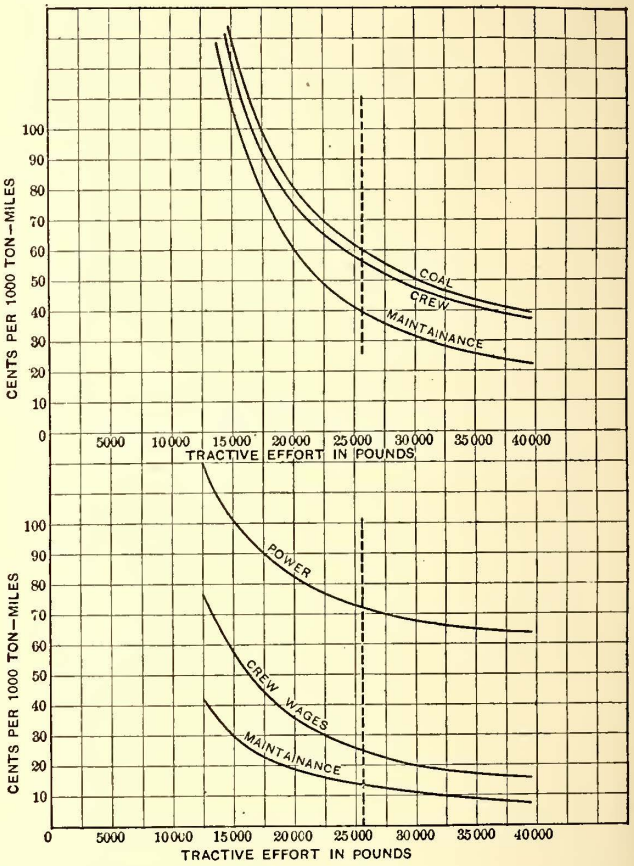


FIG. 10.—TRACTIVE EFFORT IN POUNDS. SERVICE CAPACITY STEAM AND ELECTRIC LOCOMOTIVES AVERAGE OF UP AND DOWN 2.2 PER CENT GRADE

low as 23 lbs. of steam per indicated hp-hour or 25.5 lbs. per brake hp-hour were recorded for the average cut-off of 40 to 50 per cent used throughout the run. A third and fourth series of tests conducted up the same grade gave similar results, except that the values were slightly higher than those quoted, showing that there was a considerable loss of water unaccounted for by indicator cards and useful work performed.

Operating down grade, it was necessary to accomplish 1110 hp-hours on account of the somewhat broken profile, and again the water consumption showed on two trips 57.7 lbs. of steam per brake hp-hour, and on two subsequent trips 66.5 lbs., values entirely unaccountable on the basis of useful work performed. During the runs up grade the trains were in motion but 66 per cent of the total elapsed time, and down grade the trains were in motion from 52 per cent down to 40 per cent of the total elapsed time. As these delays were frequent and undetermined, it was neces-

sary to maintain full steam pressure while waiting for the momentarily expected release from the block, hence the waste of fuel and water was considerable. Averaging this waste at 400 lbs. per hour, at which low rate of consumption the water evaporation would approximate 10 lbs. of water per pound of coal burned, or 4000 lbs. of water evaporated per hour, and reducing the total water consumption measured by the waste losses thus obtained, the steam consumption in eight different tests up and down grade ranged 34.7 lbs., 32.4 lbs., 28.1 lbs. and 25.3 lbs., etc., water per brake hp-hour. These values are fairly commensurate with results of indicator cards taken, and, with the type of engine used and under the operating conditions obtaining an allowance of 400 lbs. of coal stand-by losses per idle locomotive-hour seemed not too great a value to allow, and this figure has been taken in subsequent calculations.

Locomotive performance capacity curves may therefore be plotted which will show approximately the true relation

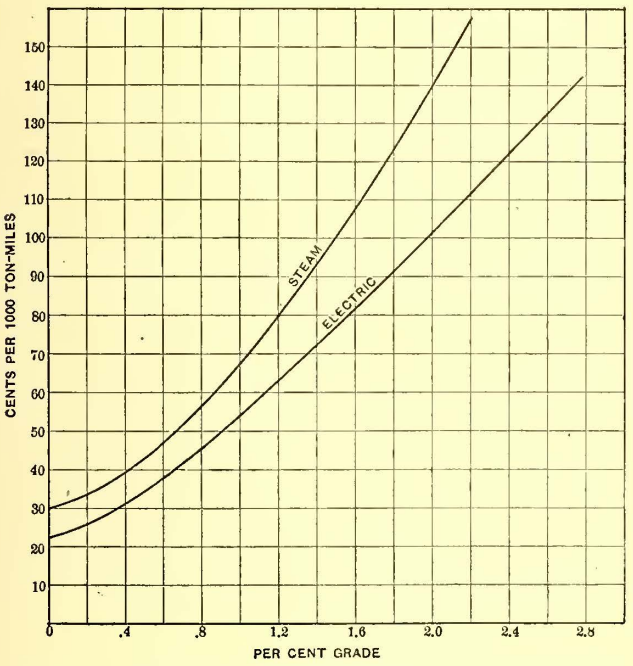


FIG. 11.—SERVICE CAPACITY OF STEAM AND ELECTRIC LOCOMOTIVES, AVERAGE BOTH DIRECTION AND ANY GRADIENT

between the several items of fuel, crew wages, and motive power maintenance, by adhering to the following assumptions:

Ratio schedule to running speed up-grade steam locomotive ..... 50 per cent
Ratio schedule to running speed electric locomotive..60 per cent
Schedule speed down-grade steam.....15 miles per hour
Schedule speed down-grade electric.....18 miles per hour
Cost of coal .....$3.00 per 2000 lbs.
Cost of electric power.....0.0075 per kw-hour
Efficiency of distribution.....70 per cent
Crew wages per hour steam.....$2.15
Crew wages per hour electric.....$1.80
Maintenance locomotive steam.....$0.137 per mile
Maintenance locomotive electric.....$0.05 per mile
Fuel waste per idle hour steam.....400 lbs.

An inspection of the performance curves shows that in practical operation the fuel expense approaches more nearly to the value of the other items considered, instead of being greatly in excess of them as indicated in the theoretical performance curves, Figs. 5 and 9, showing up-grade operation only. For operation on less grades than 2.2 per cent, all items are reduced and the total and subdivided comparative costs are given in the following table and in Fig. 11.

COMPARATIVE OPERATING EXPENSES PER 1000 TON-MILES STEAM (SIMPLE) AND ELECTRIC LOCOMOTIVES

AVERAGE OF UP AND DOWN GRADE OPERATION

Steam Locomotives

Grade	½%	1%	1½%	2%
Coal	$0.15	$0.25.5	$0.38	$0.53
Crew	.13.5	.24	.36	.50
Maintenance	.10.5	.17.8	.26	.36
Total	$0.39	$0.67.3	$1.00	$1.39

Electric Locomotives

Grade	½%	1%	1½%	2%
Power	$0.20	$0.35.5	$0.50.5	$0.66
Crew	.07.2	.12.2	.18	.24
Maintenance	.03.6	.06.2	.09.0	.11.9
Total	$0.30.8	$0.53.9	$0.77.5	$1.01.9

Saving effected by electric operation

Grade	½%	1%	1½%	2%
	$0.08.2	$0.13.4	$0.22.5	$0.37.1

A study of the above table is most instructive, as it shows that while the percentage saving with electric operation is approximately the same whatever the ruling grade, yet the actual money saving is much greater on the heaviest grades. As about the same investment must be made in each case for distribution system including third-rail or overhead trolley, sub-stations, etc., the inference must be drawn that heavy-grade divisions present a more attractive field for electrification than level sections when considered from the purely economic standpoint.

So far, the matter has been viewed from the standpoint of comparative operating expenses for a given tonnage moved. There is another argument for electrification which may in certain instances be of a much more controlling nature. Most of our mountain roads are single track and transcontinental tonnage has so increased as seriously to congest these mountain divisions. The heavy trains of the plains, weighing 2000 to 3000 tons, must be split up into units of about 1000 tons in order that the present steam engines, operating double and even triple, may haul them over the heaviest grades. The slow speed obtainable makes the number of trains on a mountain division large, the meeting points frequent, and hence, however good the despatching system employed, there will of necessity be a considerable amount of lost time introduced. Add to this the failures of motive power being worked to its limit, and there is reason for the claim that the tonnage capacity of the division will be greatly increased by the introduction of electrically hauled trains.

Lest the writer be accused of unfairness in selecting the simple engine for comparison, it is proper to touch upon the economies effected with the use of the compound locomotive and also by the introduction of such coal-saving devices as superheaters and feed-water heaters.

Reference to Fig. 13 shows a saving in water consumption per horse power of approximately 20 per cent with the compound locomotive, but in spite of this generally accepted saving the simple locomotive still rules the mountain division after repeated trials of the compound. Not being an ardent supporter of either type of locomotive, the writer leaves the battle of the simple and compound to their enthusiasts, commenting only upon the fact that, except in the case of the Mallet compound, the arguments for the compound are based upon fuel economy only.

The latest Mallet compound, weighing 413,000 lbs., is the largest steam locomotive yet built, and is of particular interest owing to the enormous boiler which such a construction permits. With a total heating surface of 5300 sq. ft. we should expect an evaporation of 63,600 lbs. of water for

a short period and possibly 48,000 lbs. water continuously. With a possible evaporation of 6 lbs. of water per pound of coal, this would necessitate the burning of 8000 lbs. of coal per hour, requiring the best efforts of two firemen if maintained for several hours. Assuming a steam consumption of 22 lbs. per brake hp-hour, such a locomotive should give a sustained output of 2180 hp. at the rim of the drivers, and this with a weight with tender of approximately 300 tons, or three times the weight of an electric locomotive of the New York Central 6000 type giving the same horse-power output.

The two locomotives are, of course, designed for entirely dissimilar classes of work; but it is not unfair to compare them on a horse-power basis, as it is the huge boiler of the Mallet that is remarkable, and upon this basis the selling price of the two machines is approximately the same.

The comparative cost of electric and steam locomotives is generally considered as very favorable to the steam units, but reversing the usual methods and comparing the cost of the electric with that of the steam locomotive or locomotives required to replace it, may reverse the relations. The electric locomotive requires no more than casual inspection, can be side-tracked indefinitely and still be ready for instant operation at full capacity, can run 24 hours without a stop, if necessary, and all these advantages and others offer a guarantee for a much greater annual mileage than is possible with its steam competitor. Then, too, compare the cost of a group of steam locomotives (no single unit could be designed to give the output) capable of delivering even 4000 hp continuously with a single electric unit of this output, and the difference in cost is not great. It may be stated broadly that for a given gross annual ton-mileage moved, the cost of steam locomotives may be even greater than the cost of the electric units replacing them.

The term "horse power" is perhaps not fully appreciated by the steam railway fraternity. When the statement is made that a certain electric locomotive is rated at so many horse-power output, it does not leave the impression it should. The horse-power output of a locomotive is a direct measure of its capacity to do work, and while the tractive effort available governs the tonnage of the trailing load, it is the product of the tractive effort times the speed at which

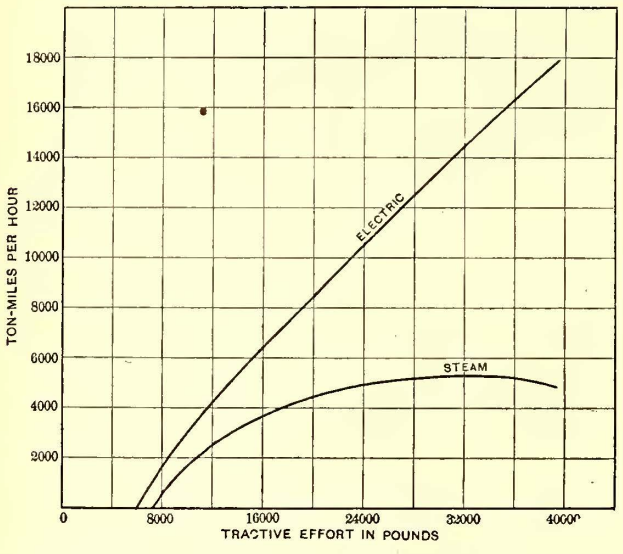


FIG. 12.—HOURLY TONNAGE CAPACITY OF STEAM AND ELECTRIC LOCOMOTIVES UP 2.2 PER CENT GRADIENT

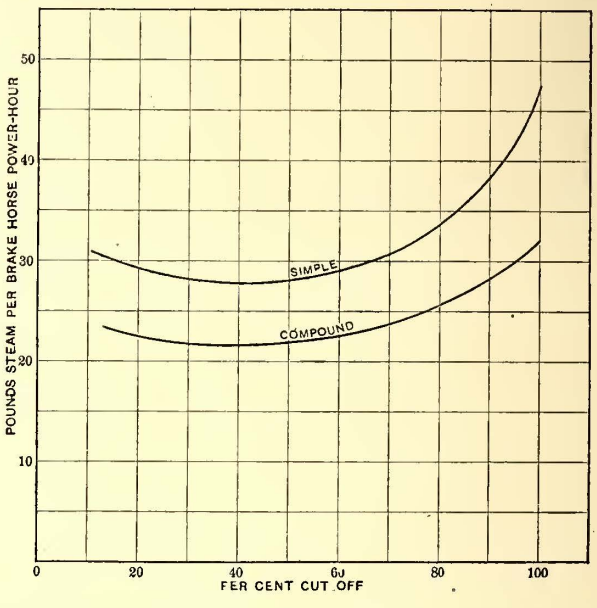


FIG. 13.—COMPARISON OF SIMPLE AND COMPOUND LOCOMOTIVES IN STEAM PER BRAKE HORSE-POWER

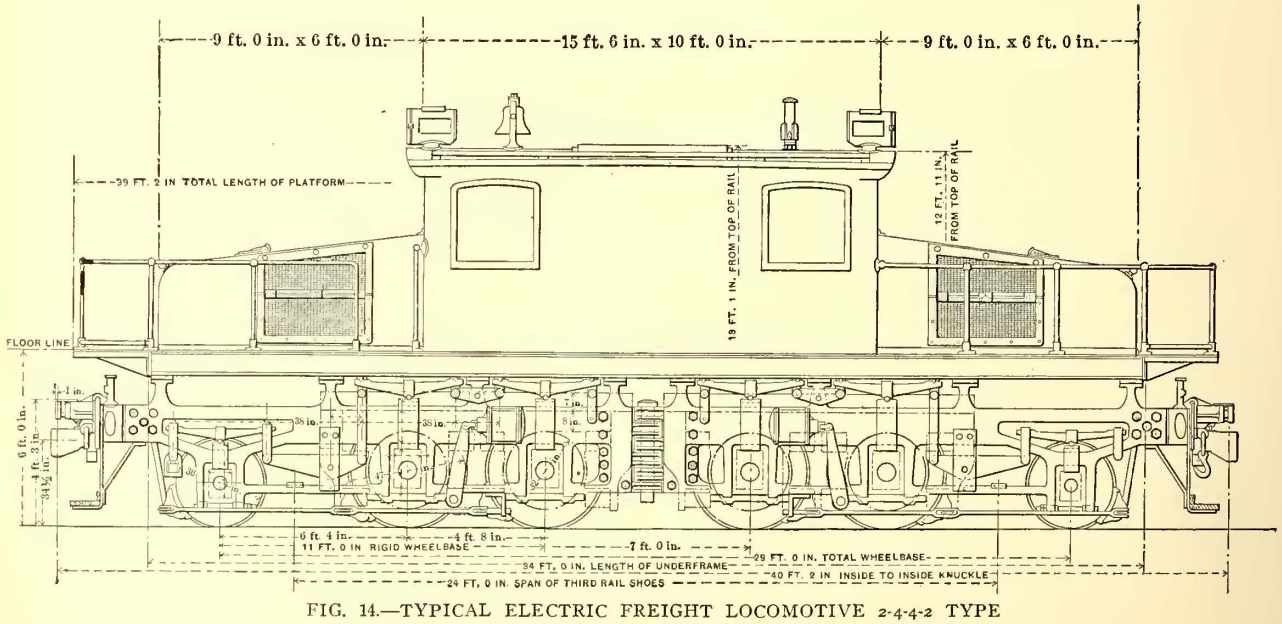


FIG. 14.—TYPICAL ELECTRIC FREIGHT LOCOMOTIVE 2-4-4-2 TYPE

it is available, or in other words, the horse-power output, that measures the hourly tonnage capacity of the locomotive upon which the crew expenses of the entire train depend. Hence the great claim for recognition of the electric locomotive lies in its great horse-power output, that is, its ability to carry full tractive effort or to slip its wheels at speeds two or three times greater than can be done with any steam locomotive yet built.

Superheating promises something in fuel economy, as does the introduction of feed-water heaters. Such improvements, together with the adoption of the four-cylinder locomotive, either compound or simple, must necessarily call for more expense to maintain and less reliability in operation. In fact, superheating in stationary boiler plants has given much trouble, and excessive superheating has not been a complete success even when used with turbines, with which superheating has given the best results. Judged from stationary engine practice, it seems fair to assume that the amount of superheat in locomotive practice must be moderate and result in small benefits to be secured.

The feed-water heater is also a coal-saving device and should prove to be worth its added complication as soon as it is commercially developed.

As against the reduction in fuel expenses promised by the use of the compound locomotive fitted with superheaters and feed-water heaters, the electrical engineer has up his sleeve the great possibilities offered by regeneration of power while electrically braking on mountain-grade divisions. The amount of power saved by this means may in certain installations amount to as great a percentage of the total as is the saving effected in coal expenditure with steam locomotives by compounding and providing superheaters and feed-water heaters. Such an electrical saving is of course restricted to heavy-grade divisions, but the feasibility of electric braking by regeneration is unquestioned. Indeed with three-phase induction motors regeneration is automatic, the motors being perfectly reversible and returning energy when operating down grade with no change whatever in their connections. Other types of motors may be adapted for regeneration with slight modifications in the control system.

All of our railway managements have felt the need of establishing a so-called express freight service comprising a light train operating at much higher speed than is the case with the bulk of the freight movement. It is well known that the cost per 1000 ton-miles for moving express freight is very much higher than in the case of low-speed freight. An inspection of Fig. 3 illustrates the reason for this. The steam locomotive is essentially a slow-speed unit when delivering its full tractive effort; that is, a tractive effort equal to 22 per cent of the weight upon the drivers, and high speed is only obtained at the sacrifice of tractive effort. Hence a high-speed freight train is of necessity a lighter train than could be handled over the same profile by a given locomotive, and the crew and maintenance expense is therefore large. That such a class of service is nevertheless profitable or at least necessary is evidenced by the continuance of the practice and the proposed introduction of electric locomotives, in effect, makes all trains fast freights, gaining the benefits of such a service without incurring the penalty of increased operating expenses inherent to steam operation.

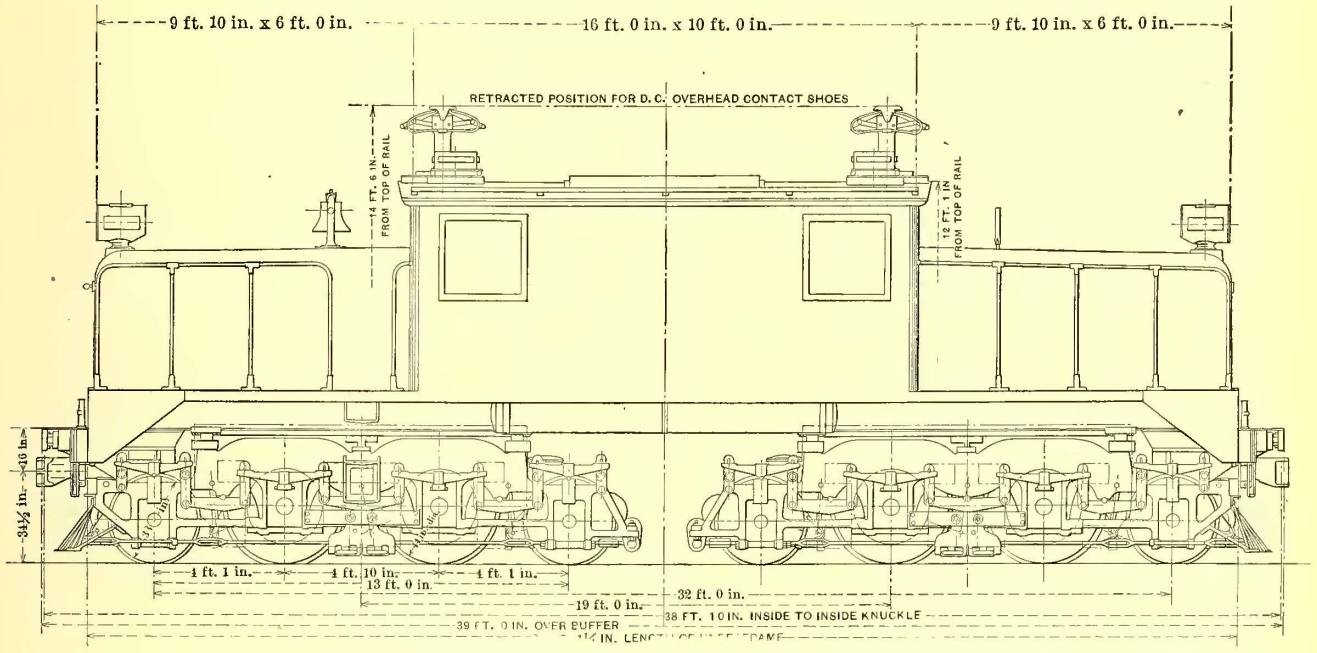


FIG. 15.—TYPICAL HIGH-SPEED PASSENGER ELECTRIC LOCOMOTIVE

In this paper the writer has attempted to outline some of the fundamental reasons for the electrification of steam roads; the figures submitted are used for illustrative purposes only and are not intended as being directly applicable to any concrete case. Many of the points touched upon, such as steam locomotive improvements, compound versus the simple, and the comparative advantages of different types of electric locomotives, etc., could all be treated in separate papers by themselves, so replete with interest are the different points raised. Rather than befog the main question at issue, which is the electrification of steam roads, detailed proof of many statements made has not been attempted. Nor does the writer believe that the time is ripe for the electrification of steam roads at large; indeed, the electrical enthusiasts would be hard put to it if called upon to show reason for the electrification of many branch steam lines carrying a small tonnage at infrequent intervals. There are, however, certain divisions of our steam railways which, either on account of their broken profile or heavy traffic, offer an opportunity to introduce a superior type of

motive power which will effect such economies in operation as to provide adequate return on the investment required for the electrification. There are still other divisions where a much desired increase in the track-tonnage capacity can only be effected by double tracking so long as the steam locomotive is adhered to as the type of motive power used. Double tracking a mountain-grade division is often a matter of enormous expense, and electrification of the single track may relieve the present traffic congestion at a moderate cost.

On mountain-grade divisions the subject of regeneration with electric locomotives should receive very careful consideration, not so much on account of the saving in power which it may effect, but rather on account of the greater safety of operation which it guarantees by eliminating the serious defects of holding trains on heavy grades by wheel and shoe friction. Finally, there are the many incidental advantages to be gained with electrification which cannot be predicted with any accuracy, as they result from changes in operating methods sure to follow the introduction of a type of motive power not subject to the service limitations of the steam locomotive. No attempt has been made even to approximate the saving effected in engine supplies, round-house expenses, elimination of water supply with its often attendant expensive purifying outfit, and the many items incident to steam locomotive operation. These items are incidental and seldom assume an importance sufficiently great to class them as fundamental, though the difficulty of procuring good water, even with purifying plants, may approach very closely to being a controlling factor in certain cases.

The freight-car shortage problem itself is a very serious one at certain times of the year on some roads, and as the total freight-car mileage can be increased with the higher speeds provided with electric locomotives, it should result in the saving of a considerable expense now incurred for rental of foreign cars, or even increase the gross receipts by the movement of tonnage which more available cars would make possible.

The subject of the electrification of steam roads is, therefore, a very broad one, and while this paper has been devoted largely to a discussion of operating expenses as affected by the different characteristics of the two types of locomotives, it has been done to illustrate the advantages resulting from increased locomotive capacity. The keynote of electrification is capacity; by approaching the problem from this standpoint only can full benefits be obtained.

DISCUSSION.

W. J. Wilgus, recently vice-president of the New York Central Railroad, believed that electricity in heavy traction work had come to stay. He said that conservative advocates of heavy electric traction, while urging its self-evident advantages in the abolition of the products of combustion in tunnels and cities, the increasing of terminal capacities and opportunities for growth of traffic, have refrained from dwelling too strongly on saving money. They have been contented with the belief that more money could be made. The burden of additional interest charges, taxes, maintenances and depreciation attendant upon the substitution of electricity for the old form of motive power, has very properly caused the careful engineer to pause in admitting, even to himself, that, in addition to increased capacity to handle traffic, there might be a net saving in cost of operation. This caution has sprung from the absence, until recently, of any actual data on the cost of heavy electric traction operation. The pioneer electrical installation in heavy trunk line service, on the New York Central & Hudson River Railroad, has now been in complete and successful operation since July 1, 1907, the gradual change from steam power having commenced in December, 1906. The working side by side of both kinds of motive power has given unsurpassed opportunities for the observation of their comparative capacity and efficiency. The results are even more gratifying than were expected, and substantiate many of the author's claims of superior capacity of electric equipment, although the conditions widely differ from those that he has assumed. After uttering a word of caution in regard to the necessity of including all factors in any statistics on cost, Mr. Wilgus gave the following concrete examples from actual practice on the New York Central:

Because of less cost of maintenance of electrical equipment, and less idle time in shops, the greater cost of interest charges and depreciation is not only neutralized, but a net saving in repairs and fixed charges over steam equipment is effected of 19 per cent.

Electric locomotive inspection and light repairs, as compared with coaling, watering, drawing fires, repairs, etc., of steam locomotives show a saving in time in favor of the former of over four hours per day, equal to 18 per cent.

The electric locomotive, while busy, is a much more nimble and efficient machine than the steam locomotive, showing an increase in daily ton mileage of 25 per cent.

While not so important in freight service, the question of locomotive weight is a large factor in a comparison of the relative economy of handling passenger traffic by steam and electricity. For instance, in switching service at the Grand Central terminal, 65 per cent of the total steam ton mileage is due to locomotive or "dead" weight, while the electric locomotive percentage is but 54 per cent, a saving for the latter of 11 per cent.

In the regular schedule service the steam locomotive shows 51 per cent dead ton mileage as against 35 per cent for the electric equipment, a saving for the latter of 16 per cent. When we realize that this saving of "dead" ton mileage has a direct proportionate effect on the cost of fuel and current, and an indirect effect on wages and fixed charges, its importance is manifest.

The speed advantage of electric over steam locomotives, to which Mr. Armstrong calls attention in mountain grade operation, is strikingly apparent in the New York Central installation, where the increase in coal consumption for car ton mileage in high speed service, as compared with slow speed service, is shown to be 165 per cent, whereas under exactly the same conditions the increased consumption of current for electrical equipment is but 18 per cent, a difference in favor of electrical operation of 147 per cent.

The net results of all of the economical advantages of electric operation over steam, for the conditions existing on the New York Central, after including all elements of cost of additional plant, show a saving in summer months of from 12 per cent to 27 per cent, depending on the character of service. A larger saving may be expected under winter conditions. In addition to this saving, the nuisance and dangers from smoke and gas in the Park Avenue tunnel have been eliminated, and the capacity of the Grand Central terminal has been increased about one-third. Later, when the New Haven Company effects its change of power, complete electrical operation in the tunnel will permit the use of shorter blocks, and correspondingly increase the capacity of the four-track main line entrance to the terminal.

Dr. Cary T. Hutchinson agreed with Mr. Armstrong that the electrical equipment of steam roads up to the present time had been undertaken on account of some special problem, either in connection with the terminals or mounting grades or the elimination of dirt or smoke. He doubted whether it was at present possible to secure data on the economy. He viewed the capacity of the locomotives from a somewhat different standpoint than Mr. Armstrong. The steam locomotive is generally limited to a weight of 50,000 lbs. on one axle. With a coefficient of traction of not over 25 per cent this will mean 9000 lbs. drawbar pull per driving axle. There is not room enough on the axle of an electric locomotive to give this amount of continuous tractive effort, but the capacity of an electric locomotive will be determined by average performance. If the grade is broken a motor can be secured which will give an average of from 5000 lbs. to 6000 lbs. per driving axle, but the same machine on ruling grades will give a tractive effect of 10,000 lbs. to 15,000 lbs. without slipping the wheels. From this point of view, the consideration of the ruling grade in determining the size of motor is eliminated; that is, the electric motor can be chosen with sufficient capacity for the average service, while the steam locomotive has to be chosen for the maximum service. The six-axle Mallet compounds which had been mentioned cannot do better in every-day service than pull 800 tons or less up a 2.2 per cent grade at a speed of 8.5 miles per hour. This is equivalent to about 1200 hp. at the driving wheel, and the locomotive with tender will weigh 250 tons. An electric locomotive weighing 100 tons will haul this same load up the same grade at a speed of 15 m. p. h. and will develop approximately 1800 to 1900 hp. It will not do so continuously, but long enough to get up a grade of fifteen or twenty miles. Another point is in connection with the saving of dead haulage owing to the less weight of the electric locomotive. There are 150 tons difference in the two machines working under the same conditions, and taking a mileage of 100 miles per day there are 15,000 ton miles per day worth $30 a day, or $10,000 a year, in the actual cost in the dead haulage of the two machines. It is sometimes thought that one of the great objections to the three-phase system is the fixed speed, but on a mountain problem on the Great Northern Railway, with which the writer has been concerned recently, it was considered by the operating officials an advantage to have a locomotive which could not run above a certain speed going down hill. This simplified the handling of freight trains, which was the principal question considered. The effect of recuperation is also important, not so much in saving energy as in diminishing the power capacity required.

N. W. Storer, chief engineer of the railway department of the Westinghouse Electric & Manufacturing Company, expressed himself as in hearty accord with the concluding remarks of Mr. Armstrong's paper, as the keynote of the whole subject lies in increase in capacity. While not a wild enthusiast on the immediate electrical equipment of all of the steam roads, he believed that it would come as fast as the manufacturing companies of the country would be able to handle it. In regard to speed on down grades, he thought it would be an advantage if the trains could be operated safely down grades at the highest speeds, as that would mean an increase in capacity. While not expecting to discuss the relative advantages of a. c. or d. c., he thought a single-phase locomotive was more desirable than either direct current or three-phase in controlling the speed on down grades, as it would restore energy to the line at all speeds. He thought that the curve in Fig. 8 must have been based on the assumption of a lower efficiency of the a. c. motor than of the d. c. motor. In that connection he showed curves of an a. c. motor of the same capacity as the d. c. motor treated in the diagram, which had an efficiency without gears of 91 per cent and with gears of 86 per cent, instead of 83 per cent as shown in Fig. 7.

W. S. Murray, electrical engineer of the New York, New Haven & Hartford, also agreed with the closing sentences of Mr. Armstrong's paper, but would have expressed the sentence by saying that the keynote of electrification is ton-miles, then capacity to handle it. The track capacity of a railroad is tremendously enhanced by electrical equipment, but ton-miles must be on hand to make necessary the increased locomotive capacity. He also believed that the saving in electrical operation from coal consumption and cost of locomotive repairs would be greater than might be considered from a perusal of the paper where they were called "petty economies." To substantiate this he presented the following table showing the saving of fuel which will be effected on the New York division of his company, when all the steam freight and passenger trains on that division are converted to electric power.

	Ton-miles per annum	Tons of coal, steam traction	Tons of coal, electric traction	Cost of coal, steam traction	Cost of coal, electric traction	Saving of electric over steam traction
Express	592,240,000	57,447	29,870	$183,830	$89,620	$94,210
Local express.	348,000,000	58,300	28,600	186,560	85,800	100,760
Freight	2,223,000,000	187,844	139,010	563,530	417,030	146,500
	3,163,240,000					$341,470

By reference to this tabulation, it is noticed that in express work 2,055 indicated hp-hours are developed in the evaporation of 57,594 lbs. of water, giving an average, therefore, of 28 lbs. of water per indicated hp-hour. On local trains this figure is slightly increased, the evaporation being 42,987 lbs. of water for 1435 hp-hours, making the rate 30 lbs. of water per indicated hp-hour. In view of the familiar turbine guarantees of 20 lbs. of water, including auxiliaries, per kw-hour at the switchboard, or 15 lbs. per hp-hour, and remembering the ratio of 7 to 10 in the evaporation of locomotive versus stationary boilers per pound of coal, it is not a stretch of conscience to concede that twice the drawbar can be developed by the electric method of traction for coal burned under the boilers of stationary plants versus coal burned in the fire boxes of locomotives. Mr. Murray also referred to some statistics which he had presented at the meeting of the Institute on Jan. 25 (see STREET RAILWAY JOURNAL for Feb. 2) bearing on the cost of repairs and maintenance of twenty steam freight and passenger locomotives; these were kept most carefully over a period of one year and showed 8.1 cents per locomotive mile for freight engines and 5.6 cents per locomotive mile for passenger engines. The engine mileage of the New York division of the New Haven road amounts to about 4,836,992 miles. This mileage is divided for passenger and freight service into 2,993,328 and 1,843,664, respectively. These figures were based on week ending Oct. 25, 1907, and it is to be noted that it will, therefore, be below the average, on account of the summer months bringing the heaviest traffic. This means an operating cost of $316,962 per annum for the maintenance and repairing of engines.

Mr. Murray continued that the average figures that he had been able to secure on electric engine repairs per locomotive mile are about 2 cents. Increasing this figure 25 per cent for safety and assuming the same number of electric engines replacing steam locomotives (as a matter of fact,

there would be less electric engines required, on account of the greater mileage per diem derived from electric locomotives), the total would be $120,924 per annum, showing a saving over steam locomotives of $196,038, Therefore, the net saving on fuel and locomotive repairs in favor of electrification gives a round sum of $562,470 per annum. This, upon a capital basis with money at 5 per cent, represents $11,249,000, an effective credit on the expense necessary to investment. These figures confirm those presented by Messrs. Stillwell and Putnam in their recent paper. In closing, Mr. Murray referred to two other details in operation which unquestionably increase the capacity of the given trackage for trains operating by electricity, viz., yard switching and turning of engines at terminals. As regards the first, he thought that double the amount could be accomplished in the same time, and as regards the second, that electric engines are ready to make their reverse train movements in 25 per cent of the time required by steam locomotives, assuming that the water tanks, ash dumps and turn tables are within the yard limits of the terminal.

William McClellan, consulting engineer, thought that the electrical engineers would have to admit that the cost of electrical equipment was large and that it was necessary to have facts to prove the economy or desirability of its adoption. For this reason the figures presented by Messrs. Wilgus and Murray were very acceptable.

Mr. Muralt, consulting engineer, referred to a problem upon which he was recently engaged, where a road with eighty miles of double track was at the end of its ability to handle traffic so long as steam locomotives were used. Two additional tracks would cost about $15,000,000. An electrical equipment for the existing tracks could be installed for $3,000,000, and there would be a saving in operating expenses of $200,000 out of $800,000, and the tonnage capacity would be increased up to 50 per cent. Mr. Armstrong's definition of capacity not as draw-bar pull, but as draw-bar pull times speed was the correct one. A steam locomotive of the New York Central Atlantic type weighs about 160 tons and develops a tractive effort at 45 m. p. h. of about 13,000 lbs. The New York Central d. c. locomotive weighs about 95 tons, and at a speed of 45 m. p. h. will develop a tractive effort of about 15,000 lbs. One European type of three-phase locomotive weighs about 70 tons and at 45 m. p. h. will develop about 23,000 lbs. tractive effort. The electric locomotives can, therefore, per unit of weight develop far greater draw-bar pull at high speeds than steam locomotives. Thus they greatly increase the possible tonnage capacity of a given road, so that the lines likely first to be electrified will be those now at the limit of traffic capacity under steam railroad conditions. That type of electric locomotive will in the end prove to be most useful, which, for a given unit weight offers the greatest amount of tractive power.

W. N. Smith, of Westinghouse, Church, Kerr & Company, agreed with Mr. Murray that the saving in cost of fuel and repairs was of considerable importance. It is very true that the whole question focuses upon capacity, and there are several different ways of looking at capacity. The possibilities of increasing the capacity of double track by electrical equipment are considerably greater than those of increasing the capacity of single track, especially if the profile is undulating and operating conditions generally are difficult. The questions of signals, turnouts, etc.. are important matters to be considered. The load factor also enters into the question.

B. F. Wood, of the Pennsylvania Railroad, called attention to the fact that some of the railroads are being reconstructed to reduce the ruling grade, and enough money is being spent in this way as almost to offset the cost of electrical equipment. He doubted the necessity of electrical equipment from the standpoint of motive power until there was a density of traffic of say half-hour service, or unless there was some other important condition.

Dr. Steinmetz, of the General Electric Company, thought that the leading conclusion of Mr. Armstrong's paper was the advantage resulting in increased capacity or the ability of the road with the same trackage to handle a greater amount of traffic. This, however, means that the change from steam power to electric power is not a mere substitution of the electric locomotive for the steam locomotive, but a readjustment of the ways of operation, that is, an increase of the speed of operation of freight service by taking advantage of the feature of the electric locomotive being able to carry its drawbar pull up to a higher speed. This appears very essential, because when one motive power is substituted for another it always means not a mere substitution, but to get the greatest benefit from the new way, a rearrangement of methods is necessary. Nearly a century ago the stage coach was replaced by the steam engine. The first attempts to attach the steam engine to the stage coach and pull it over the country roads naturally came to naught, and it was successful only when they put the carriage on an iron track, and that developed the present steam locomotive traction. One characteristic of the steam locomotive is that it is essentially a constant power motor. The steam locomotive can give approximately the same power whether running at high or low speed. The drawbar pull does not tell the whole story, the limit is the steaming capacity of the boiler. If this is exceeded, the drawbar pull is reduced. With the electric motor the efficiency rapidly increases with the speed. This would mean then a readjustment of traffic methods, including that of the freight trains, to higher speed. Higher speeds necessarily mean increased capacity of the system, even without any increased drawbar pull, even with less drawbar pull, and in this feature lie the main advantages of electric traction, but it is necessary to readjust the method of operation to the changed condition of railroad motive power, to get the best results with the electric locomotive.

In summing up the remarks, Mr. Armstrong referred to the tractive effort of electric and steam locomotives mentioned by Dr. Hutchinson. The steam locomotive with 50,000 lbs. on the drivers and a tractive effort of 20 per cent might have 10,000 lbs. available, but few, if any, roads are constructed with grades to use the full tractive effort of the locomotive indefinitely. The speaker knew of no continuous grades of more than twenty-five to forty miles, except in one case on the Southern Pacific, which had a grade of 1.54 per cent for eighty-three miles. But an electric locomotive could make that run in less than four hours, so that the continuous capacity of the steam locomotive is not of paramount importance. The word "petty" economies used in his paper was perhaps an unfortunate selection, but it had been the means of drawing out some important statistics, and so had accomplished a good purpose. It would be withdrawn in a revision of the paper. He was interested to learn from Mr. Murray that a steam consumption of about 28 to 30 lbs. per i. h. p. h. was arrived at in actual test. He was interested to learn whether it was obtained by indicator or whether it was a total coal consumption for twenty-four hours. In one instance he

had found, as shown in the paper, that on a certain road 4000 lbs. of steam were used per hour, while the locomotive was idle on turnouts or coasting down grades. He had learned that the Mallet compound, which he believed was the largest locomotive yet built, requires not only 400 lbs. of coal per hour, but a greater amount, and also requires steam when going at a speed of over ten miles per hour down grade. All of these losses count up to a large total. He thought the advantages of equipping single-track roads as important, if not more so, than on double-track roads. A single-track road is limited in its tonnage capacity by trains going in both directions over the same track with frequent meeting points. Many of the forced stops of steam locomotives on account of taking on water or coal would be eliminated by the use of electric locomotives. It is entirely safe to say, then, that the total capacity of a single track, or, in other words, the advantages of electrically equipping a single track, are very great indeed, and far surpass the advantages of equipping a double track carrying the same tonnage.

HEARINGS ON ACCOUNTING BY THE NEW YORK STATE PUBLIC SERVICE COMMISSION

The subject of a uniform system of accounts for New York State has been taken up by the Public Service Commission of the Second District of that State in conjunction with a committee of the Street Railway Association of the State of New York and one from the American Street & Interurban Railway Accountants' Association. The first hearing on this subject was an informal one, at which W. J. Meyers, of the Division of Statistics and Accounting of the Public Service Commission, presided and which was held in Albany Oct. 22. The New York State Association was represented by a number of its prominent members and the Accountants' Association by Messrs. Henry, Duffy and Ham. Subsequent to this meeting a committee of the State Association was appointed to take charge of the subject. The committee consists of T. W. Wilson, C. Loomis Allen, Edgar S. Fassett, A. L. Linn, Jr., H. M. Beardsley, J. C. Collins and W. H. Williams. This committee has appointed a sub-committee consisting of A. L. Linn, Jr., chairman, H. M. Beardsley and J. C. Collins, to take up the matter more in detail. The sub-committee has held several meetings and expects to have its report ready for the main committee next week.

NO POLICY ANNOUNCED.

In spite of the fact that several statements have been published that the Commission has announced a policy as to its treatment of the subjects of depreciation, repairs and casualties in the accounts, no decision on these points has been reached. The Commission has not issued any circulars on these matters to the railroad companies of the State, and the entire subject is still under joint consideration by the accounting departments of the Commission and the railway companies. The misunderstanding undoubtedly arose from the fact that some circulars of this kind were under consideration by the Commission. It has, however, passed the following resolution:

"*Resolved*, That all railroad corporations owning, operating, managing, or controlling any railroad, or any cars, or other equipment used thereon or in connection therewith, be and hereby are directed to report to this Commission on or before Dec. 1, 1907, all important permanent improvements to their roadway, buildings, bridges and terminals, within this state, not intending hereby repairs or replacements to existing structures, which have been completed during the year ending June 30, 1907; also all such improvements now in progress but not completed, with their estimated cost and estimate of time when the same will be completed; also all new additions to their rolling stock and equipment, together with the cost of the same; also all orders now outstanding for equipment, which have not been filled. That such reports be made in concise form in a manner to be suggested in a circular to be issued. That such reports, when properly classified or tabulated, be published in the annual report of this Commission, to be submitted Jan. 13, 1908, for the purpose of advising the public of the expenditures actually being made by railroad corporations to relieve existing unfavorable conditions. That a copy of this resolution and of such circular be served at once upon each railroad corporation operating in this state."

In conformity with this resolution the following circular was issued Nov. 1, 1907:

"*To All Railroad Corporations:*

"It is the purpose of this Commission to devise and put in operation as early as practicable a system of reports which will give complete information from time to time of the permanent additions and betterments made by railroad corporations to their tracks, bridges, buildings and terminals; of the increase to their equipment and of the cost of the same. Such information is indispensable to enable the Commission and the public to know whether proper and adequate efforts are being made to increase facilities as demands for transportation increase. It has been found impracticable to require this information in the form of precise answers to definite questions in time for the report of the Commission, which must be submitted to the Legislature Jan. 13, 1908.

"It is, however, very desirable that the work of this character which the railroads have done during the past year and that which is now in progress be made known to the Legislature and the public in that report. It is confidently hoped that such information will dispel much of the impression now prevailing with many that the railroads have not been making exertions to meet the extraordinary demands made upon them by the great increase of traffic.

"To this end, the resolution herewith served upon you has been adopted. It is in large degree self-explanatory, and it is hoped that the railroad companies will give the fullest information in their power in the limited time allowed regarding the matters specified.

"The precise form in which it shall be given necessarily cannot be prescribed, and the extent of detail and fullness of description is left to a very large extent to the good judgment of the companies. Slight and unimportant matters may be omitted, but all large works should be described in an adequate manner, to the end that their full scope and purpose may be understood. To illustrate, the Gardenville yard of the N. Y. C. & H. R. R., near Buffalo, and the work of the Lehigh in and about the same city; the cut-offs of the Erie in Chautauqua, Orange and Alleghany counties, are deserving of the fullest treatment. The electric work of the Central at New York is another instance.

"It is believed that the foregoing explanation sets forth clearly the spirit and purpose of the resolution, which is really in the nature of a request for the railroads to avail themselves of an unequalled opportunity to show just what they are endeavoring to do to meet the demands upon them. Of course those companies not reporting in time will necessarily appear to have done nothing by way of enlargement and improvement. This may be unjust, but it is unavoidable."

A moving platform is contemplated for the central parts of Paris, not on the footpaths or street level, but under the causeway in the new sections of the underground railway which is being built, and which is to comprise the Central Circular Railway, along the principal boulevards, on the right bank, and the Boulevard Saint Germain, on the left bank of the Seine. Tunnelling for the greater part of this circular railway is nearly completed, and the city engineers are considering whether it is not advisable to have a movable platform installed, instead of conveying the passengers by train. One of the Municipal Councillors, M. Duval Arnold, who is a member of the committee on the Metropolitain, states that the project is being very seriously entertained. On the existing underground lines, where trains start every two minutes, the crowding at certain hours is very great. Trains cannot be put on the line with safety more frequently, and the only solution seems to be in the movable platform.

REPORT ON THE TENTATIVE CLASSIFICATION OF OPERATING EXPENSES

As stated in the report of the Atlantic City Convention of the Street Railway Accountants' Convention published in this paper Oct. 26, the report upon the tentative classification of operating accounts, submitted by the committee on standard classification of accounts and form of report, was amended in several particulars and was referred back to the committee with instructions to embody these suggestions in the report. The committee was also empowered to change or alter the classification still further if it should be considered in their opinion desirable. The members of the committee are Wm. F. Ham, chairman; H. L. Wilson, F. R. Henry, Wm. G. McDole and C. N. Duffy.

With the permission of Frank R. Henry, president of the association, and Wm. F. Ham, chairman of the committee, a copy of the tentative report, with the changes adopted at Atlantic City, is presented herewith. It must be clearly understood, however, that the committee does not recommend the adoption of the classification in its present shape as there may be some other changes.

REPORT ON TENTATIVE CLASSIFICATION OF OPERATING EXPENSE ACCOUNTS BY THE COMMITTEE ON STANDARD CLASSIFICATION OF ACCOUNTS AND FORM OF REPORT

LIST OF ACCOUNTS.

MAINTENANCE:

WAY AND STRUCTURES.

1. Roadway and Track:
   - A. Ties.
   - B. Rails.
   - C. Rail fastenings and joints.
   - D. Special work.
   - E. Ballast.
   - F. Paving.
   - G. Bridges, trestles and culverts.
   - H. Fences, road crossings, cattle guards and signs.
   - I. Signal and interlocking system.
   - J. Roadway and track labor.
   - K. Miscellaneous roadway and track expenses.
2. Electric Line:
   - A. High-tension transmission lines.
   - B. Low-tension transmission lines.
   - C. Track bonding.
   - D. Telephone and telegraph system.
   - E. Miscellaneous electric line expenses.
3. Buildings, Fixtures and Grounds:
   - A. Power plants.
   - B. Sub-stations.
   - C. Carhouses and yards.
   - D. Shops.
   - E. General offices.
   - F. Stations, waiting rooms and platforms.
   - G. Docks and wharves.
   - H. Miscellaneous buildings.

EQUIPMENT.

4. Power plant equipment.
5. Sub-station equipment.
6. Passenger, mail, baggage and combination cars.
7. Freight and express cars.
8. Electrical car equipment.
9. Miscellaneous Equipment:
   - A. Electric locomotives.
   - B. Work car equipment.
   - C. Snow equipment.
   - D. Horses, harness and vehicle equipment.
   - E. Automobiles.
   - F. Miscellaneous equipment.
10. Miscellaneous shop expenses.

TRANSPORTATION:

OPERATION OF POWER PLANTS AND SUB-STATIONS.

11. Wages of power plant employes.
12. Fuel for power.
13. Water for power.
14. Lubricants for power plant.
15. Miscellaneous supplies and expenses of power plant.
16. Operation of sub-stations.
17. Purchased power.

OPERATION OF CARS.

18. Superintendence of transportation.
19. Wages of passenger motormen.
20. Wages of passenger conductors.
21. Wages of freight and express motormen.
22. Wages of freight and express conductors and trainmen.
23. Wages of miscellaneous car service employes.
24. Wages of car house employes.
25. Car service supplies.
26. Miscellaneous car house expenses.
27. Tickets and transfers.
28. Printing and stationery—car service.
29. Miscellaneous car service expenses.
30. Wages of station employes.
31. Miscellaneous station expenses.
32. Operation of signal and interlocking system.
33. Operation of telephone and telegraph system.
34. Dining, buffet, parlor and sleeping car service.
35. Loss and damage.
36. Injuries and damages.

MISCELLANEOUS.

37. Cleaning and sanding tracks.
38. Removal of snow and ice from tracks.
39. Rent of equipment.
40. Rent of tracks and terminals.

TRAFFIC:

41. Salaries of traffic staff.
42. Miscellaneous traffic expenses.
43. Advertising and attractions.

GENERAL:

44. Salaries of general officers.
45. Salaries of general office clerks.
46. Printing and stationery—general.
47. General office expenses.
48. Miscellaneous general expenses.
49. Law expenses—general.
50. Insurance.

ACCOUNT NO. 1

MAINTENANCE ROADWAY AND TRACK.

This account is intended to embrace repairs and renewals of roadway and track; of culverts, tunnels and subways; of tracks in yards, terminals, car houses, repair shops and other buildings; on piers, wharves, track scales, bridges and trestles.

A proportionate part of Accounts Nos. 101 to 105 should be charged to this account.

The cost of repairs and renewals of work-car equipment, harness and wagons used in connection with track and roadway maintenance, should be charged to Account No. 9, Subdivision B, Work Car Equipment, or D, Horses, Harness and Vehicle Equipment. All paving is to be charged to Subdivision F.

A Ties:

Charge to Subdivision A, cost of iron or wood cross, switch and bridge ties, head blocks and cross timbers, including freight charges, if any, cost of inspection, and all expenses incurred to the point where delivered for use in track.

(*Note.*—Cost of placing ties into track should be charged to Account No. 1, Subdivision J, Roadway and Track Labor.)

B Rails:

Charge to Subdivision B, cost of straight rails and guard rails, including freight charges if any, and all expense incurred to the point where delivered for use in track. Credit to be given for value of old rail taken up.

(*Note.*—Cost of placing rails into track should be charged to Account No. 1, Subdivision J, Roadway and Track Labor.)

(*Note.*—Third-rails used for transmission of power should be charged to Account No. 2, Subdivision B.)

C Rail Fastenings and Joints:

Charge to Subdivision C, cost of fish plates, braces, tie plates, tie rods, nuts, bolts, spikes, etc., including freight

charges if any, and all expenses incurred to the point where delivered for use in track. Cost of cast on electric welded joints should be charged to this subdivision.

(*Note.*—Cost of applying rail fastenings and joints should be charged to Account No. 1, Subdivision J, Roadway and Track Labor.)

D Special Work:

Charge to Subdivision D, cost of labor and material repairing and renewing special work, including steam and street railroad crossings, cross-overs, curves, frogs, run-offs, automatic switches and appliances, switches, switch-mats, turn-outs; cost of hauling, distributing and placing same in track; all material used directly in connection with special work; also cost of removing old material.

E Ballast:

Charge to Subdivision E, cost of all material used as ballast, including freight charges if any, and all expenses incurred to the point where delivered for use in track.

F Paving:

Charge to Subdivision F, cost of labor and material repairing and renewing paving, including granite, wood, brick and asphaltum pavement, sand and concrete work made necessary by repairs and renewals of paving; hauling and distributing of material; also cost of removing old material.

Repairs and renewals of street paving in connection with roadway and track required by municipalities, should be charged to this subdivision.

G Bridges, Trestles and Culverts:

Charge to Subdivision G, cost of labor and material repairing and renewing bridges, trestles and culverts (both sub-structure and super-structure), piers, abutments, masonry and drain-pipes, subways, tunnels, viaducts, retaining walls, rip-rapping and dikes necessary to protect or strengthen bridges and culverts against ice, water or drift; also wooden guards on bridges, framing ties for bridges, bridge signs or number boards; cost of hauling and delivering material, including freight charges, if any; cost and expense of pile drivers and other equipment; cost of cleaning channels under bridges and cleaning culverts; cost of removing old bridges, etc., whether another one is built to replace it or not; cost of construction and removal of temporary or false work; expense of maintaining gravel decking for fire protection.

(*Note.*—Any structure carrying the tracks over other tracks, a stream, highway or canal, shall be considered a bridge or culvert. The cost of maintaining structures carrying other tracks, canals, highways, etc., over the company's tracks should be charged to Account No. 1, Subdivision H, Fences, Road Crossings, Cattle Guards and Signs.)

H Fences, Road Crossings, Cattle Guards and Signs:

Charge to Subdivision H, cost of labor and material used, including freight, if any, and all expenditures incident to the maintenance of the following:

Highway Grade Crossings. Including street and road crossings at grade, crossing drains, crossing gates, crossing signal bells and batteries with their connections, water pipes, etc.

Other Crossings. Including overhead bridges of all kinds, roadways erected over tracks of the company, viaducts (foot or wagon), roadways of undergrade crossings, and warning signals and their connections; drainage and excavation for undergrade crossings; the opening of public roads in order to eliminate grade crossings.

Fences and Cattle Guards. Includes right-of-way fences, cattle guards, wing fences, aprons and hedges; not including those around station and shop grounds.

Signs. Includes yard limit signs, subdivision boards, mile, section, whistle, slow and stop signs, boundary posts, overhead bridge and tunnel cautions, and all signs except station and telegraph signs.

I Signals and Interlocking System:

Charge to Subdivision I cost of labor and material, including freight, if any, and all expenses incident to the maintenance of the following:

Signals. Including block, automatic and semi-automatic signals, home and distant signals, signal posts, signal bridges, semaphore and flag station signals, gates at crossings of other railways, and all other road and track signals not otherwise provided for in the government of cars; also signal and switch lamps and their connections; pay of signal engineers, supervisors of signals, their assistants, their office and traveling expenses, pay of mechanics and laborers while engaged in repairing and renewing signals and interlocking system, with cost of special tools used for said work.

Interlocking System. Including power interlocking plant (except buildings) and all machinery such as air compressors, levers, boilers, dynamos, engines and machinery, fixtures and appliances used in connection therewith.

(*Note.*—Cost of inspection and supplies for operation are chargeable to Account No. 32.)

J Roadway and Track Labor:

Charge to Subdivision J labor *only* removing old track whether new track is laid in its place or not, grading, relaying ties and rails, applying fish plates and rail attachments of all kinds, surfacing, ballasting, cutting weeds and caring for right of way. All track labor, not otherwise provided for, should be charged to this Subdivision.

(*Note.*—The cost of punching and drilling rails for repairs and renewals of track wire, and the removing and replacing ballast for the same purpose, should be charged to Account No. 2, Subdivision C, Track Bonding.)

K Miscellaneous Roadway and Track Expenses:

Charge to Subdivision K salaries and expenses of chief engineer, assistant engineer, general roadmaster, assistant roadmaster, draftsmen and clerks in office; injuries and damages when caused directly in connection with track and roadway maintenance, including the expenses which cannot be actually allocated to any case, which expense is to be based upon the per cent. the amount paid for injuries and damages, an account of track and roadway maintenance, bears to the total amount paid for injuries and damages; also incidental expenditures that are not properly chargeable to any of the foregoing subdivisions of roadway and track, viz.: ice, lanterns and fixtures, torches, oil, incandescent lamps, tools, water, printing and stationery, etc.

ACCOUNT NO. 2

MAINTENANCE OF ELECTRIC LINE.

This account is to cover repairs and renewals of electric line of overhead, underground or third-rail systems, and to embrace electric line in yards, terminals, tunnels, subways, car houses, repair shops and other buildings.

A proportionate part of Accounts Nos. 101 to 105 should be charged into this account.

The cost of repairs and renewals of work-car equipment, and harness and wagons used in connection with electric line maintenance, should be charged to Account No. 9, Subdivision B. Work-Car Equipment, or D, Horses, Harness and Vehicle Equipment.

A High-Tension Transmission Lines:

Charge to Subdivision A, cost of labor and material, repairing and renewing high-tension transmission lines, including taking up and resetting poles; painting poles and cross-arms; altering and changing insulators; substituting new wire for old wire. Credit to be given for value of old material.

Also, cost of delivering and distributing material, including freight charges, if any; cost of changing route of line or removing line where no replacement is made.

B Low-Tension Transmission Lines:

Charge to Subdivision B, cost of labor and material repairing and renewing low-tension transmission lines, for transmitting power from power stations and substations, including poles, cross-arms, brackets, insulators and connections; span, guard, feed and overhead trolley wires; third-rail with braces, supports and devices for insulating, covering or protectors. Credit to be given for value of old material.

Also, cost of delivering and distributing material, including freight charges, if any; cost of changing route of line, or removing line where no replacement is made.

C Track Bonding:

Charge to Subdivision C, cost of labor and material repairing and renewing track bond wires, including cost of punching and drilling rails for track bond wires; testing for defective joints; removing and replacing ballast, when made necessary by repairs and renewals of track bonding; delivering and distributing material, including freight charges, if any.

D Telephone and Telegraph System:

Charge to Subdivision D, cost of labor and material repairing and renewing telephone and telegraph lines owned by the company, or for which it is responsible, including conduits, poles, cross-arms, wires, insulators, cables, cable-boxes, instruments, battery jars, switchboards and all other appurtenances forming a part of the telephone and telegraph system. Rental of telephone and telegraph system should not be charged to this account, but to Account 33, or Account 48.

E Miscellaneous Electric Line Expenses:

Charge to Subdivision E, salaries and expenses of superintendent of electric line, assistants and clerks in office; injuries and damages when caused directly in connection with electric line maintenance, including the expenses which cannot be actually allocated to any other case, which expense is to be based upon the per cent. the amount paid for injuries and damages for account of electric line maintenance, bears to the total amount paid for injuries and damages; also, incidental expenditures that are not properly chargeable to any of the foregoing subdivisions of electric line, viz.: ice, lanterns and fixtures, torches, oil, incandescent lamps, tools, water, printing and stationery, etc.

ACCOUNT NO. 3

MAINTENANCE OF BUILDINGS, FIXTURES AND GROUNDS.

This account is to cover repairs and renewals of buildings; cost of fixtures, and repairs and renewals of same; cost of maintaining walks, driveways and grounds connected with buildings; cost of delivering material, including freight charges, if any, and all incidental expenses connected with the maintenance of buildings, fixtures and grounds.

The term "Buildings, Fixtures and Grounds," in addition to embracing the buildings proper, is understood to include: fixtures when immovable and built in as a part of the structure; pipes for gas, water, sewerage and drainage; apparatus for heating, lighting and ventilating freight and passenger elevators with fixtures and appurtenances; platforms; appliances for protecting buildings against fire; fences, walls, sidewalks and pavements within the limit of grounds immediately adjacent to buildings or yards (except paving in tracks).

The cost of repairs and renewals of tracks in buildings, yards or grounds should be charged to Account No. 1.

The cost of repairs and renewals of electric line in buildings, yards or grounds should be charged to Account No. 2.

A Power Plants:

Includes generating-station building; coal-storage building; coal bins; building fixtures which are not a part of machinery equipment; fences and grounds connected therewith.

B Sub-stations.

C Car houses and yards.

D Shops.

E General offices.

F Stations, waiting rooms and platforms.

G Docks and Wharves:

Includes piers and other landings, pontoons, slips, bulkheads, jetties and inclines thereto, including cost of filling, strengthening, bracing and painting; expenses of pile-drivers, tugs, barges and floats while engaged in such work; cost of dredging about docks, piers, bulkheads and slips, or for approaches to such properties and removing material dredged out; labor and expense operating dredges, mud-scows, barges and floats while engaged in such work; cost of crib work, tracks or caissons constructed for preserving the depth of water secured by dredging; cutting ice around docks and wharves to prevent damage; guard and other piling for protection from damage by drift or ice; also,

The pay of supervisor of docks and wharves, labor and expense operating work trains, pile-drivers, dredges and tugboats while engaged in work pertaining to docks and wharves.

H Miscellaneous Buildings:

Includes repairs and renewals of buildings not included in any of the foregoing subdivisions, also incidental expenses not applicable to any of the foregoing subdivisions of Buildings, Fixtures and Grounds, viz.: Ice, lanterns and fixtures, torches, oil, incandescent lamps, tools, water, printing and stationery, etc.

EQUIPMENT.

ACCOUNT NO. 4

MAINTENANCE OF POWER-PLANT EQUIPMENT.

Charge to this account all expenditures for labor, material, tools, freight, hauling of material and all other expenses incident to repairs and renewals of steam plant, water-power plant, or electric plant, including turbines, engines and engine parts, appliances and fixtures, belts, belt tighteners and fixtures, receivers, lubricators and oiling devices, shafting, clutches, cranes, hoists and other engine-room appliances; boilers, boiler fittings and appliances; furnaces, economizers, stacks, mechanical draft machinery, pumps, feed-water heaters, purifiers, tanks, condensers, coal and ash conveying machinery, mechanical stokers and other boiler-room appliances; piping and steam fitting, including valves, separators, water and sewer connections and water meters; generators and generator parts, switchboards, cables and feeder terminals and wiring in connection with same, storage batteries, boosters, rheostats, circuit-breakers, ammeters and other electric equipment.

Commutator brushes for generators should be charged to Account No. 15.

ACCOUNT NO. 5

MAINTENANCE OF SUB-STATION EQUIPMENT.

Charge to this account all expenditures for labor, material, tools, freight, hauling of material and all other expenses incident to repairs and renewals of sub-station apparatus, including oil switches, transformers, rotary converters, switchboards and switchboard appliances, and wiring in connection with same.

ACCOUNT NO. 6

MAINTENANCE OF PASSENGER, MAIL, BAGGAGE AND COMBINATION CARS.

Charge to this account all expenditures for repairs and renewals of passenger, mail, baggage, express cars, electric locomotives used in passenger service, and other cars (exclusive of freight cars) from the operation of which revenue is derived, including labor, material, tools, freight, hauling of material, and all other expenses incident to the work.

The term "Cars" includes car bodies and trucks and all fixtures or appliances inside of or attached to the car body or truck, except the electric equipment of the car.

The cost of cars purchased to keep good the original number of cars should be charged to this account, less the amount realized from the sale or other disposition of the cars so replaced.

The cost of repairs and renewals of the electric equipment and wiring of cars should be charged to Account No. 8.

Bell and register cord, trolley rope, incandescent lamps, commutator brushes and other supplies for cars should be charged to Account No. 25.

ACCOUNT NO. 7

MAINTENANCE OF FREIGHT AND EXPRESS CARS.

Charge to this account all expenditures for repairs and renewals of freight and express cars from the operation of which revenue is derived, and electric locomotives in freight and express service, including labor, material, tools, freight, hauling of material, and all other expenses incident to the work.

ACCOUNT NO. 8

MAINTENANCE OF ELECTRICAL CAR EQUIPMENT.

Charge to this account all expenditures for repairs and renewals of the electric equipment and wiring of passenger, mail, baggage, express and freight cars, electric locomotives not used in revenue service, work-cars, and snow equipment, including labor, material, tools, freight, hauling of material and other expenses incident to the work.

The cost of shifting the electric equipment of revenue cars, electric locomotives, work cars, or snow equipment from one type of car or miscellaneous equipment to another should be charged to this account.

The cost of equipments purchased to keep good the original number of equipments should be charged to this account, less the amount realized from the sale or other disposition of the equipments so replaced.

The cost of commutator brushes, incandescent lamps, oil and other supplies for electric equipments should be charged to Account No. 25.

ACCOUNT NO. 9

MAINTENANCE OF MISCELLANEOUS EQUIPMENT.

Charge to this account all expenditures for repairs and renewals of electric locomotives, work-car equipment (water cars, sprinkling cars, sand cars, salt cars, supply cars, other work-cars), snow equipment (snow plows, sweepers, scrapers, miscellaneous snow equipment), horses, harness and vehicle equipment, automobiles and all other miscellaneous equipment not operated for the purpose of revenue (except electric locomotives which may be operated for the purpose of revenue in passenger or freight service and may also be operated in work-car service) including labor, material, tools, freight, hauling of material and all other expenses incident to the maintenance of miscellaneous equipment.

The cost of electric locomotives, work-cars, snow equipment, horses, harness, wagons and vehicles, and automobiles purchased to keep good the original number should be charged to this account, less the amount realized from the sale or other disposition of the equipment so replaced.

Horses lost by death or worn out in service should be charged to this account.

Repairs and renewals of the electric equipment and wiring of electric locomotives, work-cars and snow equipment should be charged to Account No. 8.

Bell and register cord, trolley rope, incandescent lamps, commutator brushes and other supplies should be charged to Account No. 25.

A Electric locomotives.
B Work-car equipment (water cars, sprinkling cars, sand cars, salt cars, supply cars, other work-cars).
C Snow equipment (snow plows, sweepers, scrapers, miscellaneous snow equipment).
D Horses, harness and vehicle equipment.
E Automobiles.
F Miscellaneous equipment.

ACCOUNT NO. 10

MISCELLANEOUS SHOP EXPENSES.

Charge to this account all expenditures for repairs and renewals of shop tools, machinery and appliances, such as engines, boilers, shafting, motors, etc., used in general repair work, including labor, tools, coal, coke, lubricants, waste and other material, freight, hauling of material, fuel, light, water and ice, wages of master mechanic, shop foreman, engineers, firemen and other employees engaged in operating shop engine, and all other expenses incident to the general repair shops, including amounts paid shop employees for injuries and damages when caused directly in connection with maintenance of equipment, including the expenses which cannot be actually allocated to any case, which expense is to be based upon the per cent. the amount paid for injuries and damages for account of maintenance of equipment bears to the total amount of injuries and damages.

Hand tools of mechanics or laborers used exclusively in connection with work chargeable to Accounts Nos. 1 to 9, 15, 16, 25, 26, 29, 31, 32, 33 and 34, should not be charged to this account, but to the account benefited by their use.

TRANSPORTATION.

OPERATION OF POWER PLANTS AND SUB-STATIONS.

ACCOUNT NO. 11

WAGES OF POWER PLANT EMPLOYEES.

Charge to this account all expenditures for labor in power plants, except labor employed in making repairs or renewals.

Wages of sub-station employees should be charged to Account No. 16, Operation of Sub-Stations.

ACCOUNT NO. 12

FUEL FOR POWER.

Charge to this account all expenditures for coal, oil, gas or other fuel used at power plant, including freight and hauling.

ACCOUNT NO. 13

WATER FOR POWER.

Charge to this account all expenditures for water used to produce steam or to operate a water-power plant.

ACCOUNT NO. 14

LUBRICANTS FOR POWER PLANT.

Charge to this account all expenditures for lubrication of power plant, including oil, grease, etc.

NOTE.—Waste and rags should be charged to Account No. 15, Miscellaneous Supplies and Expenses of Power Plant. Lubricants for sub-stations should be charged to Account No. 16, Operation of Sub-Stations.

ACCOUNT NO. 15

MISCELLANEOUS SUPPLIES AND EXPENSES OF POWER PLANT.

Charge to this account all expenditures for operation of power plant not otherwise provided for.

ACCOUNT NO. 16

OPERATION OF SUB-STATIONS.

Charge to this account all expenditures for labor in sub-stations, except labor employed in making repairs or renewals; cost of lubrication and all miscellaneous supplies and expenses of sub-stations.

ACCOUNT NO. 17

PURCHASED POWER.

Charge to this account all expenditures for power purchased from other companies or power plants.

OPERATION OF CARS.

ACCOUNT NO. 18

SUPERINTENDENCE OF TRANSPORTATION.

Charge to this account wages of the superintendent of transportation, division superintendents, their assistants and aids, road officers, inspectors and others employed in superintending transportation.

ACCOUNT NO. 19

WAGES OF PASSENGER MOTORMEN.

Charge to this account wages of motormen engaged in operating passenger, mail, baggage and combination cars.

ACCOUNT NO. 20

WAGES OF PASSENGER CONDUCTORS.

Charge to this account wages of conductors engaged in operating passenger, mail, baggage and combination cars.

ACCOUNT NO. 21

WAGES OF FREIGHT AND EXPRESS MOTORMEN.

Charge to this account wages of motormen engaged in operating freight and express cars.

ACCOUNT NO. 22

WAGES OF FREIGHT AND EXPRESS CONDUCTORS AND TRAINMEN.

Charge to this account wages of conductors, brakemen and other trainmen engaged in operating freight and express cars.

ACCOUNT NO. 23

WAGES OF MISCELLANEOUS CAR SERVICE EMPLOYEES.

Charge to this account wages of starters, transfer agents, switch-tenders, flagmen, trolleymen, trail-car couplers and other car service employees.

ACCOUNT NO. 24

WAGES OF CAR HOUSE EMPLOYEES.

Charge to this account wages of car house foremen, watchmen, car placers, car shifters, car and motor inspectors, car cleaners, lamp and head-light tenders, car oilers, car-stove firemen, trolley oilers, and other car house employees not engaged in making repairs and renewals.

The cost of shifting trucks and electric equipment from summer to winter cars, and vice versa, should not be charged to this account, but to Accounts Nos. 6 and 8.

ACCOUNT NO. 25

CAR SERVICE SUPPLIES.

Charge to this account all expenditures for lubricants and waste for cars and electric equipment of cars, incandescent lamps, oil and other supplies for lighting cars, water and other supplies for cleaning cars, fuel for heating cars, bell and register cord, trolley rope, commutator brushes, tools and other material and supplies, except such as are used for repairs or renewals of cars or electric equipment of cars.

ACCOUNT NO. 26

MISCELLANEOUS CAR HOUSE EXPENSES.

Charge to this account the cost of fuel, light, water (except

water used for car washing chargeable to Account No. 25), ice and all other car house expenses not otherwise provided for.

ACCOUNT NO. 27

TICKETS AND TRANSFERS.

Charge to this account the cost of tickets, transfers, baggage and parcel checks.

ACCOUNT NO. 28

PRINTING AND STATIONERY—CAR SERVICE.

Charge to this account all expenditures for printing, stationery and stationery supplies used in connection with the operation of cars.

The cost of printing folders and other printing used for advertising purposes in the interest of traffic should not be charged to this account, but to Account No. 43.

ACCOUNT NO. 29

MISCELLANEOUS CAR SERVICE EXPENSES.

Charge to this account all expenditures for secret inspection, conductors' books, punches, portable registers, tools for motormen, car service employees' badges and uniforms, cost of getting derailed cars on track and removing obstructions and wreckage, and all other car service expenses not otherwise provided for.

ACCOUNT NO. 30

WAGES OF STATION EMPLOYEES.

Charge to this account wages of agents and others employed at stations.

ACCOUNT NO. 31

MISCELLANEOUS STATION EXPENSES.

Charge to this account the cost of heating and lighting stations, furniture, tools and implements for handling freight and baggage, station employees' uniforms and badges, water, ice, and all other station expenses not otherwise provided for.

ACCOUNT NO. 32

OPERATION OF SIGNAL AND INTERLOCKING SYSTEM.

Charge to this account wages of employees engaged in inspecting and operating signal and interlocking system, fuel, water, lights, furniture, tools and all supplies used in inspecting and operating signals.

ACCOUNT NO. 33

OPERATION OF TELEPHONE AND TELEGRAPH SYSTEM.

Charge to this account wages of train dispatchers, and their assistants, telegraph and telephone operators; cost of chemicals, copper, zinc and other supplies; payments for use of telegraph and telephone lines and conduits, and all expenses incident to the operation of the telephone and telegraph system not otherwise provided for.

Repairs and renewals of telephone and telegraph system should not be charged to this account, but to Account No. 2, Subdivision D.

This account is intended to cover the expenses of operating a telephone or telegraph system used primarily for the dispatching of cars.

The cost of telephone service for general purposes should be charged to Account No. 48, Miscellaneous General Expenses.

ACCOUNT NO. 34

DINING, BUFFET, PARLOR AND SLEEPING CAR SERVICE.

Charge to this account wages of all employees in dining, buffet, parlor or sleeping car service; office and traveling expenses of those whose wages are chargeable to this account. Uniforms and badges for employees in this service, and all expenses in this service not otherwise provided for.

ACCOUNT NO. 35

LOSS AND DAMAGE.

Charge to this account all expenditures for loss or damage of freight, express matter, live stock and baggage, and all expenses incurred in connection with the settlement of such claims.

ACCOUNT NO. 36

INJURIES AND DAMAGES.

Charge to this account all expenditures on account of persons killed or injured and damage to property, salaries and expenses of claim agents, investigators, adjusters and others engaged in the investigation of accidents and adjustment of claims, salaries, fees and expenses of surgeons and doctors, nursing, hospital attendance, medical and surgical supplies, fees and expenses of coroners and undertakers, fees of witnesses and others, also all law expenses incurred in connection with the defense or settlement of damage claims, including the compensation of general solicitor or counsel, salaries, fees and expenses of attorneys, fees of court stenographers, cost of law books, printing of briefs, court record and other records, court costs, expenses connected with taking depositions and all other court expenses.

The compensation of the general solicitor or counsel and other attorneys engaged partly in the defense or settlement of damage suits and partly in other legal work should be apportioned between this account and Account No. 49.

This account is intended to cover only the expenditures on account of injuries and damages resulting from the operation of cars.

Injuries and damages when caused directly in connection with roadway and track maintenance should be charged to Account No. 1, Subdivision K, Miscellaneous Roadway and Track Expenses; when caused directly in connection with electric line maintenance, to Account No. 2, Subdivision E, Miscellaneous Electric Line Expenses; when caused directly in connection with maintenance of equipment (other than plant and substation equipment), to Account No. 10, Miscellaneous Shop Expenses. Similarly, injuries and damages might properly be charged to Account No. 3, Subdivision H; Account No. 4; Account No. 5; Account No. 15; Account No. 16; or other proper operating account, or to Construction if the damage occurred in the process of work properly chargeable to Construction.

The expenses in connection with injuries and damages which cannot be actually allocated to any cause are to be divided in the same proportion as the amounts paid for injuries and damages in specific cases are divided among the above accounts. If it is desirable that the charge to operating expenses on account of injuries and damages shall be upon some arbitrary basis, the account so charged should be credited to a reserve account and the actual disbursements above enumerated should be charged against said reserve account.

MISCELLANEOUS.

ACCOUNT NO. 37

CLEANING AND SANDING TRACKS.

Charge to this account all expenditures for cleaning, greasing, watering, sprinkling roadway and tracks; sanding tracks, including wages of men engaged in the work; cost of sand and of hauling, drying and distributing same; cost of track brooms and other tools; curve grease, water for sprinkling and watering track and all other supplies and expenses incident to the work.

Repairs and renewals of sprinkling and sand cars used in connection with this work should be charged to Account No. 9, Subdivision B, Work Car Equipment.

Repairs and renewals of harness and wagons used in connection with this work should be charged to Account No. 9, Subdivision D, Horses, Harness and Vehicle Equipment.

Cost of sprinkling rendered necessary by repairs or construction of track or paving should be charged to the proper maintenance or construction account.

ACCOUNT NO. 38

REMOVAL OF SNOW AND ICE FROM TRACKS.

Charge to this account all expenditures for removal of snow and ice from tracks, whether done by the company or otherwise, including labor, materials, tools and expenses, cost of salt and delivering same in car houses or bins, and the wages of men engaged in salting track and operating snowplows, sweepers, scrapers, etc.

Repairs and renewals of salt cars, snow plows, sweepers, scrapers and miscellaneous new equipment used in connection with this work should be charged to Account No. 9, Subdivision C, Snow Equipment.

Repairs and renewals of harness and wagons used in connection with this work should be charged to Account No. 9, Subdivision D, Horses, Harness and Vehicle Equipment.

ACCOUNT NO. 39

RENT OF EQUIPMENT.

Charge to this account rental of cars, electrical car equipment and other equipment.

ACCOUNT NO. 40

RENT OF TRACKS AND TERMINALS.

Charge to this account all rents paid for tracks and terminals, bridge rentals and tolls.

The word "terminals" is not meant to refer to depots, car houses, or other buildings at the termini of the road. Rents for these should be charged to Account No. 26, Miscellaneous Car House Expenses, or Account No. 31, Miscellaneous Station

Expenses. Rent of leased lines or terminals, the operation of which has been temporarily or permanently abandoned by the lessor, is not considered an operating expense and should, therefore, not to be charged to this account, but treated as "Deductions from Income" under "Rent of Leased Lines."

TRAFFIC.

Note.—Accounts Nos. 41, 42 and 43 cover only expenses incidental to the securing of traffic. All expenses in connection with handling traffic are included in Accounts Nos. 18 to 37, inclusive.

ACCOUNT NO. 41
SALARIES OF TRAFFIC STAFF.

Charge to this account salaries of officers directly in charge of traffic, such as traffic directors, traffic managers, general freight, passenger and ticket agents; their clerks and assistants; of commercial, city, district or excursion agents engaged in soliciting traffic, and employees of their offices; of traffic agents and solicitors when employed on or off the line of road.

ACCOUNT NO. 42
MISCELLANEOUS TRAFFIC EXPENSES.

Charge to this account all miscellaneous expenses of the traffic department, including expenses of all officers and agents whose salaries are charged to Account No. 41; printing and stationery, furniture and supplies, heat, light, ice, water and other miscellaneous expenses of the traffic department and traffic agencies.

ACCOUNT NO. 43
ADVERTISING AND ATTRACTIONS.

Charge to this account the cost of advertising of every description, including printing hand-bills, dodgers, posters, folders, etc., net expense of music, parks, park properties and resorts (after deducting all income from admittance fees, sale of privileges, etc.), and all donations made and other expenses incurred for the purpose of attracting travel.

GENERAL.

ACCOUNT NO. 44
SALARIES OF GENERAL OFFICERS.

Charge to this account salaries of president, vice-president, secretary, treasurer, auditor, general manager, assistant general manager, chief engineer, general superintendent, purchasing agent and all other officers whose jurisdiction extends over the entire system.

ACCOUNT NO. 45
SALARIES OF GENERAL OFFICE CLERKS.

Charge to this account the salaries of bookkeepers, cashiers, receivers, paymasters, stenographers, clerks employed in counting cash, tickets and transfers, and all other clerks employed in the general office.

Salaries of clerks employed elsewhere than in the general office should be charged to the proper account affected; for instance, timekeeper in the Roadway and Track department should be charged to Account No. 1, Subdivision K, Miscellaneous Roadway and Track Expenses; also salaries of clerks in the office of the master mechanic should be charged to Account No. 10, Miscellaneous Shop Expenses.

ACCOUNT NO. 46
PRINTING AND STATIONERY—GENERAL.

Charge to this account all expenditures for printing, stationery and stationery supplies for the use of the general office.

Cost of printing tickets and transfers should be charged to Account No. 27, Tickets and Transfers.

Cost of printing and stationery in connection with the operation of cars should be charged to Account No. 28, Printing and Stationery—Car Service.

The cost of printing briefs and other legal papers should be charged to Account No. 36, Injuries and Damages, or to Account No. 49, Law Expenses—General.

The cost of printing signs, posters and other advertising matter should be charged to Account No. 43, Advertising and Attractions.

The printing of stationery in connection with maintenance of roadway and track should be charged to Account No. 1, Subdivision K, Miscellaneous Roadway and Track Expenses; in connection with maintenance of electric line, to Account No. 2, Subdivision E, Miscellaneous Electric Line Expenses; in connection with maintenance of buildings, fixtures and grounds, to Account No. 3, Subdivision H, Miscellaneous Buildings; in connection with maintenance of equipment, to Account No. 10, Miscellaneous Shop Expenses; in connection with operation of power plant and sub-stations, to Account No. 15, Miscellaneous Supplies and Expenses of Power Plant, or to Account No. 16, Operation of Sub-stations; in connection with traffic, to Account No. 42, Miscellaneous Traffic Expenses.

ACCOUNT NO. 47
GENERAL OFFICE EXPENSES.

Charge to this account the cost of office supplies, repairs and renewals of office furniture, wages of janitors, porters and messengers, rental of general offices and all other miscellaneous expenses of the general offices. Office expenses of departmental offices should be charged to account affected.

ACCOUNT NO. 48
MISCELLANEOUS GENERAL EXPENSES.

Charge to this account the cost of public telephone service, telegrams, subscriptions and donations, except those provided for in Account No. 43, Advertising and Attractions, traveling expenses of general officers and others connected with general office; and contingent expenses connected with the general management not otherwise provided for.

ACCOUNT NO. 49
LAW EXPENSES—GENERAL.

Charge to this account all law expenses, except those incurred in connection with the defense or settlement of damage claims.

The compensation of the general solicitor or counsel and other attorneys engaged in the defense and settlement of damage suits and partly in other legal work should be apportioned between this account and Account No. 36, Injuries and Damages.

The term "law expenses" should be understood to include the salary of the general solicitor or counsel, salaries, fees, and expenses of attorneys, fees of court stenographers, cost of law books, printing of briefs, court records and other papers, court costs, expenses in connection with taking depositions, and all other court expenses.

ACCOUNT NO. 50
INSURANCE.

Charge to this account the cost of fire, casualty, fidelity and all other insurance, except insurance affecting loss and damage, or injuries and damages.

If it is desirable to establish an insurance fund in the case of a company carrying its own insurance, in whole or in part, charges to this account may be made upon some arbitrary basis.

APPORTIONMENT ACCOUNTS.

ACCOUNT NO. 101
STORES EXPENSES.

Charges to Stores Expenses, including all salaries and expenses in connection with storerooms, including cost of sending material and supplies from general storeroom to branch storerooms, and the collecting of scrap material, should be closed out monthly and carried to such Operating Expense Accounts, Construction and Equipment Accounts, or other accounts, as would be proper, based on the proportionate value of the material issued by the stores department.

ACCOUNT NO. 102
STABLE EXPENSES.

Charges to Stable Expenses, including the cost of feed, keep and shoeing of horses, and all other stable expenses, also wages of drivers, (horses lost by death or worn out in service, repairs and renewals of harness and vehicle equipment to be charged to Account No. 9, Subdivision D), should be closed out monthly and carried to such Operating Expense Accounts, Construction and Equipment Accounts, or other accounts, as would be proper, based on the use made of the horses.

ACCOUNT NO. 103
USE OF POWER PLANT STEAM.

(For other purposes than generation of electric current.)

Power plant steam, used for other purposes than generation of electric current, should be charged monthly to the work or accounts benefited by its use and credited to Account No. 103, Use of Power Plant Steam. (For other purposes than generation of electric current.) The credit so shown should be deducted from operation of power plants and sub-stations in order that the actual net cost of the generation of electric current for the propulsion, lighting and heating of cars operated for revenue be ascertained as shown.

If revenue is derived from the sale of steam, the credit should not be made to this account but to Miscellaneous Earnings.

ACCOUNT NO. 104

USE OF ELECTRIC CURRENT.

(For other purposes than operation of Revenue Cars.)

Electric current, used for other purposes than the propulsion, lighting or heating of cars, operated for revenue, should be charged monthly to the work or accounts benefited by its use and credited to Account No. 104, Use of Electric Current. (For other purposes than operation of Revenue Cars.) The credit so shown should be deducted from operation of power plants and sub-stations in order that the actual net cost of the generation of electric current for the propulsion, lighting or heating of cars operated for revenue be ascertained and shown.

If revenue is received from the sale of electric current, the credit should not be made to this account, but to Miscellaneous Earnings.

ACCOUNT NO. 105

OPERATION OF ELECTRIC LOCOMOTIVES, WORK-CAR EQUIPMENT AND AUTOMOBILES.

Charges to operation of Electric Locomotives, Work-Car Equipment and Automobiles, including use of electric current, wages of employes operating electric locomotives, work-cars or automobiles, proportionate cost of car service supplies (Account No. 25) and all other supplies and expenses incident to the operation of electric locomotives, work-cars or automobiles (cost of maintenance to be charged to Account No. 9, under the appropriate subdivision) should be closed out monthly and carried to such Operating Expense Accounts, Construction and Equipment Accounts, or other expense accounts, as would be proper, based on the use made of the electric locomotives, work-cars or automobiles.

THE ALBERG TUNNEL ELECTRICAL EQUIPMENT

Further particulars are available in regard to the electrical equipment of the Alberg tunnel division of the Austrian State Railways, about which a few facts were published last week. The division lies between Innsbruck and Feldkirch in the Austrian Tyrol, and forms a link in the through line from Vienna via Innsbruck and Zürich to Paris. The division upon which it is proposed to use electrical equipment is about 140 miles long and single-track, except for a double-track tunnel at the summit about 7 miles long. The maximum grade on the west side of the tunnel is 3.14 per cent and that on the west side 2.64 per cent. The curves are numerous but are of fairly large radius. At the present time there are about 40 daily trains going over the line in each direction, about one-third being passenger and the balance freight. C. L. de Muralt, of Muralt & Company, of New York, who has been appointed consulting engineer in charge of this project by the Austrian State Railways, states that three-phase alternating-current locomotives, to develop about 25 to 30 per cent higher speed than the existing steam locomotives, will be used. The drawbar pull and speed which are specified for these machines demand an output of practically 3000 hp from a locomotive weighing not more than 60 tons. It is expected that the capacity of the line will be increased about 50 per cent. In addition it is estimated that some $200,000 will be saved annually by the return of energy to the system by trains descending the grade, not to speak of the saving in maintenance of brake rigging and wheels made possible by electric braking.

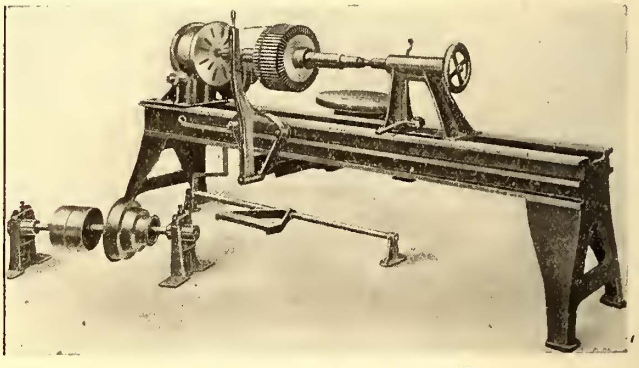
There will be about fifty locomotives, of which five or six are reserves. The hydraulic power plant will have a maximum output of 40,000 to 45,000 kw. It is probable that two separate power plants will be built, one on either side of the tunnel. Two years is the estimated time for the completion of the entire plant, and by that time the entire steam equipment of the road will be supplanted by the three-phase locomotives.

ECONOMY OF GRAPHITED WOOD GREASE IN GEAR CASES

In a recent test made by a Colorado company, with a view to determining the relative values of several different compounds used in lubricating the enclosed gears of electric cars, a remarkable record was made by graphited wood grease made by the United States Graphite Company, of Saginaw, Mich. Two gear cases were packed with from eight to ten pounds of the grease May 13, and upon being opened for inspection Oct. 15 the gears were found to be in first-class condition and well lubricated, enough grease still remaining to run the car at least thirty days longer, which would mean a six months' run on not to exceed ten pounds of grease per gear or approximately one and a half pounds per gear per month. The explanation offered of this economy is that the wood grease all did effective work in lubricating the gears instead of adhering to the interior of the case. At the same time there was opened another case filled with a compound which is softened by heating before introduction, and most of this compound was found packed to the interior of case where the gears in revolving had thrown it and where it stuck instead of dropping back on to the gears. This test was conducted during the summer, and it would seem that during the winter time a hard tar-like grease would be even more inefficient. The graphited wood grease is so compounded of wood pulp impregnated with powdered graphite as to be of practically the same consistency in any climate or season.

AN ARMATURE BANDING MACHINE

The Columbia Machine Works & Malleable Iron Company, of Brooklyn, N. Y., is now making an armature banding machine, the invention of Charles Remelius, of the Public Service Corporation of New Jersey. The device consists essentially of a suitable frame with a slideway, upon which the carriage may be anchored in any position desired, the

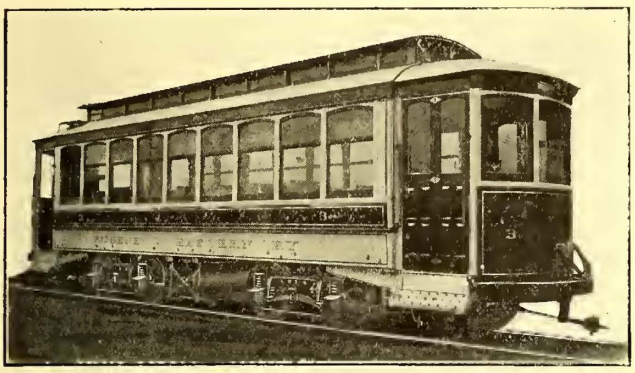


ARMATURE BANDING MACHINE

machine being driven by a worm and worm-wheel enclosed in air-tight dust-proof cases. All danger to the operator is eliminated, there being no necessity for straddling the wire, as the reel is hung on the carriage in the rear of the machine. By means of special tension mechanism instant adjustment may be made to any tension desired. The bearings are all of bronze. After the armature has been mounted on the machine the carriage is placed in the desired position and the wire from the reel passed around the tension rollers and around the armature. As the lathe turns, the swing guide arm is shifted sufficiently to maintain the wire in alignment. The machine is so constructed that it may be electrically driven by means of a motor.

SEMI-CONVERTIBLE CARS FOR PORTLAND, ORE., AND DISTRICT

There were recently ordered by the Willamette Valley Company from the American Car Company a number of semi-convertible cars for operation on the Eugene & Eastern line, the city lines in Portland and on the interurban line connecting Eugene with Springfield, a distance of about six miles. It is probable, however, that the line from



TYPE OF SEMI-CONVERTIBLE CAR FOR PORTLAND

Eugene north to Portland will require some of the new rolling stock. The new cars measure 25 ft. 4 ins. over the end panels and 34 ft. 9 ins. over the crown pieces. The other principal dimensions are: Width over sills including panels, 7 ft. 11½ ins.; over posts at belt, 8 ft. 2 ins.; height from floor to ceiling, 8 ft. 5½ ins.; from under side of sills over trolley board, 9 ft. 6½ ins.; size of side sills, 4½ ins. x 7¾ ins.; center sills, 3½ ins. x 4½ ins.; end sills, 5¼ ins. x 6¼ ins.; sill plates, 12 ins. x ⅜ in. The inside finish of the cars is cherry, while the ceilings are of birch. The seats and such specialties as the sand boxes, signal bells, angle iron bumpers, etc., are of Brill manufacture. The trucks are of the No. 27-G1 type with 4-ft. 6-in. wheel base. Trailers will be used in connection with the cars as is evidenced by the air-brake attachment at rear end.

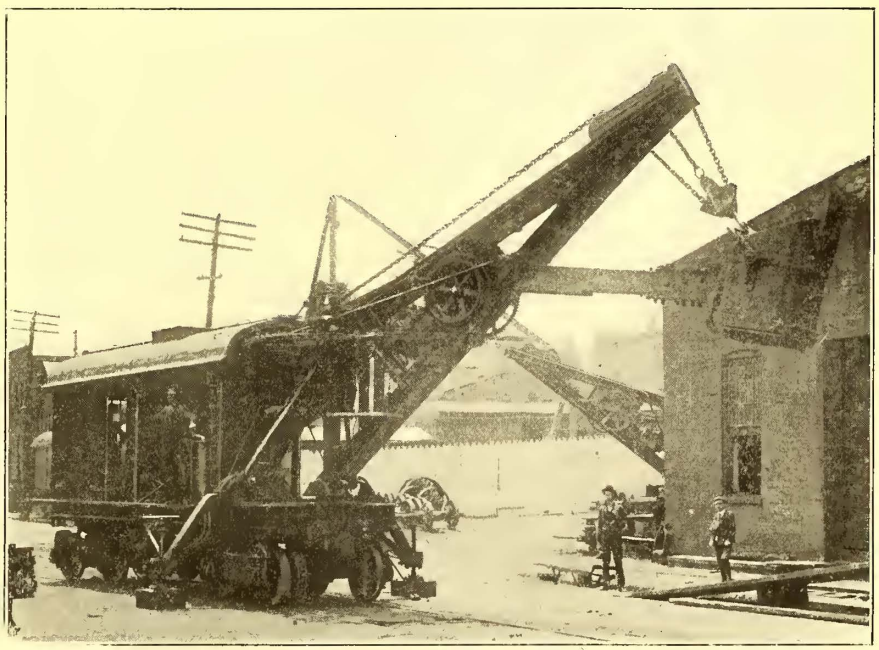
Two other roads in Portland operate with the Brill semi-convertible car, namely, the Portland Railway Company and the Oregon Water Power & Railway Company, the latter using 30-ft. 8-in. and 38-ft. 8-in. (interurban) cars. Another road in Oregon to use the type is the Astoria Electric Company.

ELECTRICALLY OPERATED BALLAST SHOVELS

The Chautauqua Traction Company, of Jamestown, N. Y., has recently installed a 45-ton shovel to dig ballast for its new lines. The shovel is the product of the Vulcan Iron Works Company, of Toledo, Ohio, and is of particular interest because it is electrically operated. The car frame for this shovel is 27 ft. long and 7 ft. 8 ins. wide, mounted on standard gage trucks. It is equipped with a dipper of 1½ cu. yds. capacity and has a clear height of 12-ft. lift above the rail with the dipper door open. It will make a 26-ft. cut at the level of the rails. Three motors are required, one for hoisting the dipper, a second for swinging the crane and a third on the crane for crowding the dipper into the bank. These motors are of standard Westinghouse railway type, built for 600 volts direct-current at 700 r. p. m. The main hoisting motor is of 75 hp, while the swing and crane motors are of 30 hp each. In working in a cut 12 ft. deep and operating at its full capacity the hoisting motors were found to take 80 amps. on an average, sometimes running up to 180 amps. momentarily when the man on the crane crowded the dipper into the bank so far that it carried a great overload, or at other times when the dipper encountered boulders. The material dug was a tough mixture of gravel, sticky clay and sand, but in no case in filling the dipper with one scoop were the motors ever overtaxed. The crowding, or crane, motor averaged about 30 amps., but sometimes ran as high as 80 amps. when crowding the dipper into the bank with its full force. The swinging motor averaged between 30 and 40 amps. The shovel used made three complete dips and swings per minute.

The power for operating the motors was tapped directly from the trolley wires. At no time during the operation of the shovel did the power-house men notice any appreciable change in the line power. Neither was the train service on the line interrupted in any way.

The general appearance of shovels of this type is shown in the accompanying illustration. This shovel is made from

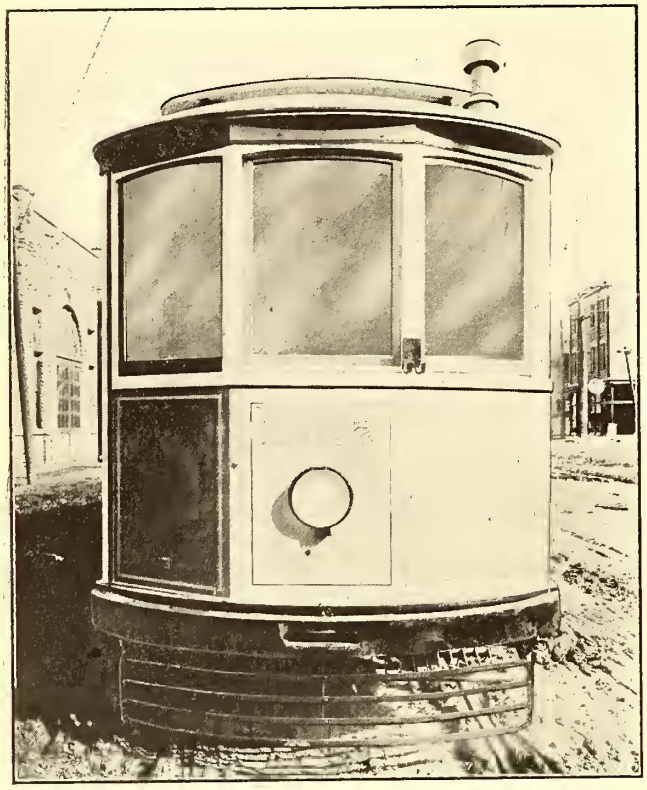


BALLAST SHOVEL OF TYPE USED BY THE CHAUTAUQUA TRACTION COMPANY

20 to 45 tons weight, but the makers are prepared to equip any other size shovel of their manufacture with electric power. The advantage of an electrically operated shovel is the elimination of the boiler, the expense of firemen and of hauling coal under unfavorable conditions. This type should appeal particularly to electric railways, especially in working on extensions to which power connections can be made as the work progresses. The Toledo & Western Railway and the Milwaukee Electric Railway & Light Company are also using machines of this character. The Milwaukee shovel was illustrated on pages 162 and 165 of the STREET RAILWAY JOURNAL for Aug. 3, 1907.

NEW CINCINNATI CARS

The Cincinnati Car Company has just delivered to the Cincinnati Traction Company fifty single and double-truck cars fully equipped, ready for operation. The accompanying illustrations show exterior and end views. The cars are equipped with Brill No. 27-FE-1 trucks, Westinghouse



HEAD-ON VIEW OF CINCINNATI CAR

single-end quadruple equipment No. 92-A motors, K-6 controllers, National Brake & Electric Company's schedule "O", A-1 compressors with 8" brake cylinders; International double fare registers; Peacock brakes with cast-iron freight-car type hand brake wheel; Hunter fenders; perforated sheet-steel destination signs on ends and side of deck illuminated from the interior. The dashers at both ends are furnished with brackets to attach poster notices and with Dayton headlights.

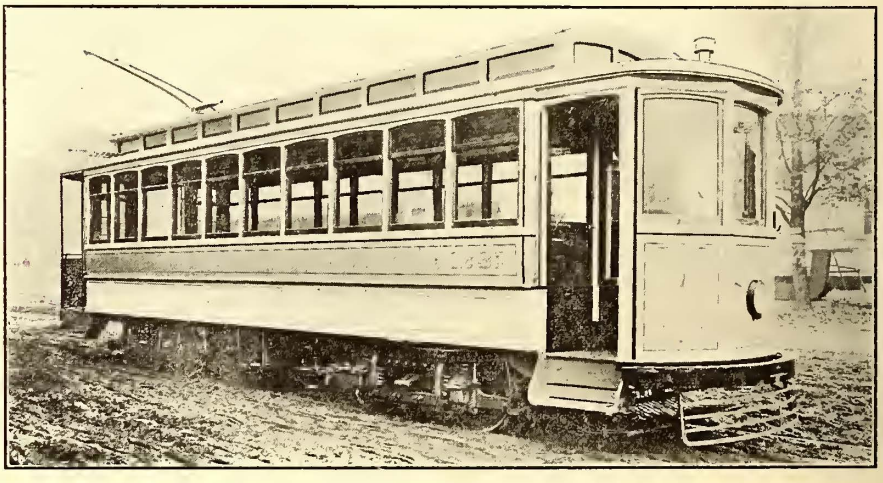
The side sills of these cars consist of heart long leaf yellow pine 3¾ ins. x 7¾ ins. finished sizes, while the end sills, cross joists and diagonal members of white oak measure 5¼ ins. x 7¾ ins., 2¾ ins. x 6 ins. and 1½ ins. x 4 ins. respectively. The cross members are reinforced with 3/16-in. steel plates, and the side sills with 20 in. x ¼ in. steel plates. The side sills are reinforced with 20 in. x ¼ in. steel plates in one piece, extending round the corner posts to the door posts. These plates are bolted to the side sills with ½-in. finished oval head bolts. The side posts are also bolted to these plates which also form the lower panel, thus making a very light, rigid construction, proof against damage by wagon tongues, hubs and wheels. The convex panels are formed of No. 16 gage steel in three sections, the center one being the longest and covering the space of four windows, while the end ones each cover the space of three windows. The roof is reinforced with nine ⅜ in. x 1½ in. steel car lines, one placed over each post. The balance of the body framing is of white ash. The interior finish including doors, sash, headlinings, etc., is of Honduras mahogany with plain molding. The seats and backs are of Heywood Bros. & Wakefield Company's longitudinal pattern, upholstered with canvas-lined hard enameled rattan.

The cars have furnace heaters placed in the front vestibule. The heat is discharged into the car through the bulkhead just below the lower deck headlining. The air is taken into the heater from the inside of the car which keeps the air in the car in circulation. The heaters were manufactured from designs by the car builder. The front and rear platforms are of the Detroit type with dividing rail. The dasher on the rear platform is placed flush with the bumper, leaving no space for passengers to stand. The window spaces have two sash; the upper one is stationary, but the lower drops into pockets with a hinged dust cap to cover the opening. The front door is placed to the right of car. The rear doors are of the mutually operated type.

The local conditions, such as narrow streets, heavy grades, heavy travel and quick transit with a minimum consumption of power, demanded a strong but light car and in designing the new type, the car builder has carefully figured each member with that end in view. The results are shown in the following tabulation of weights:

Weight of car complete, fully equipped, ready for collecting fares, 40,100 lbs.; car body fully equipped with electric controlling apparatus, air brakes, heaters, fenders, etc., except trucks and motors, 16,780 lbs.; car body as above, exclusive of heater, air brakes and electric control apparatus, 14,352 lbs.; two trucks with four motors, gears and gear covers, 23,320 lbs.; air brakes, 1225 lbs.; electrical control apparatus, 928 lbs.; hot air furnace heater, 275 lbs.

The principal dimensions of the cars are as follows: Length over bumpers, 39 ft.; from rear dasher to outside of front vestibule, 38 ft. 6 ins.; over corner posts, 28 ft.; rear platform, 6 ft.; front vestibule, 5 ft.; width over the posts, 8 ft., and over the sill plates, 7 ft. 10½ ins.; extreme width, 8 ft. 4 ins.; height from bottom of sill to top of roof, 8 ft. 11½ ins.; height from rail to top of trolley stand, 11 ft. 10¼ ins.; truck centers, 17 ft. 4 ins.; wheel base of trucks, 4 ft. 6 ins.; track gage, 5 ft. 2½ ins.; diameter of wheels, 33 ins.; width of tread, 2½ ins.; depth of flange, ¾ in., and diameter of axles, 4 ins.



GENERAL EXTERIOR VIEW OF CINCINNATI CAR

FINANCIAL INTELLIGENCE

WALL STREET, NOV. 13, 1907.

The Money Market

There has been a decided improvement in the monetary situation during the past week, and there is every indication that normal conditions will prevail in the not distant future. The improvement was due largely to the continued heavy importations of gold, which now aggregate $60,900,000, and to the return to the banks of considerable moneys that were withdrawn several weeks ago when the disturbances in the local money market first developed. These heavy additions to the supply of funds have been reflected in a pronounced relaxation in rates for call money, the range for the week being between 12 and 4 per cent, as against 50 and 10 per cent in the preceding week. In the time loan branch of the market business was practically at a standstill. The banks and trust companies are still out of the market and there is nothing in the situation at present to indicate that they re-enter the time loan market at an early date, and the supply of time money consisting of small amounts was put out by individual lenders at rates ranging from 12 to 15 per cent for over the year. One of the most important developments of the week has been the sharp fluctuations in foreign exchange, demand sterling selling as high as 4.89. Notwithstanding this high rate for exchange, and the action of the principal European banks in advancing the minimum rates of discount, local bankers have been able to draw gold from abroad, this being made possible by the high premiums paid for currency in this city, and which more than offset the advance in the rate of sterling. The advances in the European bank rates were due almost entirely to a desire on the part of those institutions to check the heavy flow of gold to New York. The Bank of England advanced its minimum rate to 7 per cent, the highest rate reached since 1873. The Imperial Bank of Germany advanced its rate to 7½ per cent, while the Bank of France and the Bank of Belgium advanced their rates to 4 and 6 per cent respectively. There was also an advance in the Bank of Bengal rate to 6 per cent and in the Bank of Bombay to 5 per cent. These advances partly checked the engagements of the metal by our bankers in Europe, but at the close of the week reports were received that the Bank of France had signified its willingness to furnish $15,000,000 gold for New York, and it is believed that further considerable amounts of the gold will be picked up in the European markets from time to time. The shipments of currency to the interior have been fairly large, the loss by the banks on Sub-Treasury operations since last Friday amounting to upwards of $3,000,000. Quite an active demand was reported for currency during the early part of the week and a premium of 3½ per cent was paid. There has, however, been a decided falling off in transactions of this kind and dealers report the supply greatly in excess of the demand.

The bank statement published on last Saturday was about as expected. Loans increased $38,863,800, and deposits increased $35,091,200. Cash decreased $4,313,000, but as the reserve required was $8,772,800 more than in the preceding week, the deficit was further increased by $13,085,800. It was generally accepted, however, that the statement did not reflect the true condition of the banks in as much as only a comparatively small part of the gold arrivals from Europe were included in the bank figures. It is expected that the forthcoming bank statement will make a more favorable exhibit. The total deficit of the banks now stands at $51,924,625 and compares with a deficit of $1,514,125 in the corresponding week of last year and a deficit of $2,428,800 in the corresponding week two years ago. The percentage of reserve held by the banks on last Saturday was 20.22, as against 20.30 in the preceding week.

The Stock Market

Slowly, but none the less surely, confidence in the financial world, which had been rudely shaken by the developments of the past few weeks in connection with the local banking, trust company and monetary situations, is being restored. This is evidenced by the complete disappearance of the panicky conditions that prevailed in the stock market and the substitution of a gradual recovery in prices, resulting largely from a continuance of the practically unprecedented demand from investors. This demand has in the main been for small lots of the dividend-paying stocks, indicating that a large percentage of the money that has been withdrawn from banks and other depositories is finding its way into the security market. In consideration of the unusually large investment yields which many of the stocks now afford, this buying is by no means surprising, and it is safe to presume that the movement will keep up until the supply of all desirable issues has been exhausted. In the mean time there has been more or less liquidation of a forced character by some of the larger holders of stocks, which has served at intervals to bring about greater or less recessions in prices. Thus a good deal of irregularity has attended the fluctuations in values, but on the whole the tendency has been unmistakably upward.

A relaxation in the money market, especially the call loan division, from the severe tension to which it has been subjected, has aided materially in restoring confidence. The decline in call money to something approaching normal rates has of course been chiefly due to the enormous importations of gold, which were assisted in no small degree by the willingness of the Bank of France to part with large amounts of the precious metal to London. It is even now asserted that in addition to the aid already given by that institution, it still stands ready to ship to this side, either direct or through London, $15,000,000 or more. The fact that the Bank of England, Bank of France, Bank of Germany and all the other leading European and Continental banks raised their minimum discount rates during the week to the highest figures in years, had no material effect on the movement of gold this way, the premium on currency prevailing here having acted as an offset to such matters.

Apart from the clearing up of the local banking and trust company situation and the easing off in money rates, there has not been much that has attracted notice, even the fact that the Clearing House banks showed in their last statement a deficit of over $51,000,000, being practically ignored, for the reason that it was known that the exhibit did not truly reflect the present condition of those institutions. An interesting development has ben the passing of control of the Tennessee Coal & Iron Company to the United States Steel Corporation, but aside from causing a sharp decline in the price of the former's stock, as well as in the latter's 5-per cent bonds given in exchange for Tennessee Coal shares, the incident was without noteworthy influence marketwise. The passing of dividends on American Cotton Oil common, North American and Parrot mining tended to unsettle the market for industrial stocks at times, but the effect was not farreaching nor of long duration, as it was appreciated that these suspensions were merely temporary and wholly the result of prevailing monetary conditions. In short, the general stock market has acted very well in consideration of the period of great despondency and depression through which it has just passed.

In so far as the stock market goes, there has ben nothing of special importance concerning the local traction situation. However, no little interest was manifested in the suit instituted in the United States Circuit Court by the Morton Trust Company, as trustee, to foreclose the mortagage executed March 21, 1902, by the Metropolitan Street Railway Company to secure an issue of $65,000,000 four per cent bonds, and of which $16,604,000 are now outstanding. This action, which was brought to protect bondholders and to prevent the separation of the system into different parts, is based upon the failure of the Metropolitan Company to pay the guaranteed rental on the Third Avenue Railroad, which, it is contended, broke the lease and constituted a default in the terms of the mortgage.

Philadelphia

The market for local traction issues during the past week was devoid of special feature. Trading was upon a much smaller scale than for some time past, and while prices moved with

more or less irregularity at times the net changes were as a rule confined to the fractions. Interest in the trading centered in Union Traction, which was the most active issue of the group. Opening at 47, the price declined a point, on rather heavy selling, and after a fractional rally it reacted and closed at the lowest. Philadelphia Rapid Transit was unusually quiet, less than 2000 shares changing hands at 16¼ @ 16. Consolidated Traction of New Jersey was comparatively active, and after a display of weakness the price rose sharply from 55 to 57. Philadelphia Traction fluctuated between 82¾ @ 83½ and closed at 83. American Railways sold at 45 and Philadelphia Company common at 35 @ 34.

Chicago

There has been no important developments in the local traction situation during the past week. Representatives of Western interests in the Chicago Union Traction Company are in New York, but it is not expected that any attempts will be made to push the reorganization of the company until the banking and monetary situation becomes clearer.

Transactions included South Side Elevated at 69; Metropolitan Elevated preferred at 49 @ 50 and Chicago & Oak Park Elevated common at 2½.

Other Traction Securities

The market for traction issues at Baltimore developed considerable activity and strength, the prominent features being the United Railway issues, all of which rose sharply on rather heavy transactions. The 4-per cent bonds which sold as low as 79¼ early in the week, advanced to 80 and closed at the highest, while the income bonds, after selling at 42, rose to 43, on transactions aggregating $125,000 by far the heaviest dealings recorded for weeks. The refunding 5-per cent bonds advanced from 67¾ to 70 and sales of the stock were made at 9. Lexington Street Railway 5's brought 96; Atlanta Steel Railway 5's, 98¾; City & Suburban 5's, 106½, and Baltimore City Passenger 5's at 99½. The Boston market was dull and irregular. Boston Elevated, after a decline of a point to 119, recovered to 120. Metropolitan Electric issues were quiet, the common selling at 10¼ @ 9¾, and the preferred from 41 to 39⅝ and back to 40. West End common sold at 79 @ 80, and the preferred stock at 95 @ 96.

Little business has been done on the Cleveland Stock Exchange the past week, the financial situation having had the effect of stopping all trading except that which is done on a cash basis. A few small lots of Cleveland Electric changed hands before the city election, but since that time the asked price has advanced and there has been little buying. Aurora, Elgin & Chicago preferred has been quoted around 65 bid and 72 asked, while Lake Shore Electric common fell off a few points and was held at 10. The bid price on Northern Ohio Traction & Light was 20¼, just about where it has stood for some time. Forest City closed at 96¼ bid and 100 asked.

Security Quotations

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

	Nov. 6.	Nov. 13.
American Railways	—	44½
Boston Elevated	a120	a119½
Brooklyn Rapid Transit	32½	30⅞
Chicago City	150	150
Cleveland Electric	40¼	37
Consolidated Traction of New Jersey	55½	55
Detroit United	32½	32¼
Interborough-Metropolitan	5¼	5⅝
Interborough-Metropolitan (preferred)	16½	16½
International Traction (common)	a45	40
International Traction (preferred)	a59¼	a58½
Manhattan Railway	105	108
Massachusetts Elec. Cos. (common)	—	9½
Massachusetts Elec. Cos. (preferred)	39½	39
Metropolitan Elevated, Chicago (common)	21	21
Metropolitan Elevated, Chicago (preferred)	50	48
Metropolitan Street	29	—
North American	44	40¼
North Jersey Street Railway	40	40
Philadelphia Company (common)	33½	34
Philadelphia Rapid Transit	16	15⅞
Philadelphia Traction	85	84½
Public Service Corporation certificates	54	54
Public Service Corporation 5 per cent notes	90	89
South Side Elevated (Chicago)	69	69
Third Avenue	19½	15
Twin City, Minneapolis (Common)	73	74½
Union Traction (Philadelphia)	46¼	45½

a Asked.

Metals.

Special inquiries made by the "Iron Age" during the past few days show that since the first of the month blast furnaces have blown out whose weekly capacity is estimated at 28,000 tons per week. Six others with a capacity of 5500 tons per week are preparing to stop. Therefore, from Oct. 1 to the end of this week the rate of production has been cut down 53,500 tons per week or a little over 10 per cent.

In the metal trade the flurry in copper is apparently over. It has been shown that prevailing conditions do not justify any pyrotechnics and that the sounder course of allowing time to cure the severe blows under which the industry has staggered is the safest.

THE DALLAS AND SHERMAN PROJECT MEANS SIXTY-FIVE MILE LINE FOR TEXAS

The American Railway & Lighting Company, a holding and operating company, which has full ownership in and operates six electric light and gas plants within 100 miles of Dallas, has contracted to build for the Texas Traction Company an interurban line which, within a few months, will go into operation between Dallas and Sherman, a distance of some 65 miles. Theodore Stebbins, as announced in the personal column in this issue, has just been appointed general manager of the Texas Traction Company, and is in charge of the work now under way. Mr. Stebbins would like to receive a supply of catalogues from manufacturers offering goods for use on a road such as he is installing.

CHICAGO TRACTION PLAN AGREED TO—BASIS OF EXCHANGE OF SECURITIES

What is known as the "modified reorganization plan" has been agreed to by all interested parties. It was devised by Judge Peter S. Grosscup, of the United States Circuit Court, and Prof. John C. Gray, of Harvard University. Under the modified plan a new company, the Chicago Railways Company, will take up all the outstanding evidences of indebtedness of the seven constituent companies and issue in lieu thereof new bonds and stocks of its own. They will run in three series, "A" being the first lien on the property, and the other two secondary liens. The holders of the securities of the old companies will receive bonds of series "A," "B," or "C," according to the priority of their liens. The percentages on which the new securities of the Chicago Railways Company will be exchanged for the old ones of the Union Traction and its underlying companies is given in this table:

	New Sec.		
Present Securities	Series A	Series B	Series C
North Chicago City Railway Co.:			
First mortgage bonds	$1,000	.....	.....
Second mortgage bonds	1,000	.....	.....
Stock (every ten shares)	.....	$1,800	.....
Chicago West Division Railway Co.:			
First mortgage bonds	1,000	.....	.....
Stock (every ten shares)	.....	800	.....
North Chicago Street Railway Co.:			
First mortgage bonds	200	800	.....
Refunding bonds	.....	1,000	.....
West Chicago Street Railway Co.:			
First mortgage bonds	200	800	.....
Consolidated mortgage bonds	.....	1,000	.....
Certificates of indebtedness	.....	600	$400
Chicago Passenger Railway Co.:			
Consolidated mortgage bonds	.....	1,000	.....
Stock (every ten shares)	.....	250	.....
West Chicago Street Railway Tunnel Co.:			
First mortgage bonds	500	500	.....

The stock of the new Chicago Railways Company also is divided into four series. The stockholders in the old company will be allowed shares in either series A, B or C, according to their value.

Holders of the securities of the seven Chicago companies involved in the reorganization have been invited, through an advertisement which appeared in the New York papers, to deposit their securities under the modified plan of reorganization approved by Judge Grosscup and Prof. Gray.

THE WORK OF THE PUBLIC SERVICE COMMISSION OF THE FIRST DISTRICT OF NEW YORK

The Public Service Commission of the first district of New York is now engaged in the preparation of its annual report, which must be presented to the Legislature by the second Monday in January. When the report is presented it will be more complete than any summary of the commission's work up to date would be, since that body is yet only four months old. It is certain that the report to the Legislature will contain a chapter on the Interborough-Metropolitan-Brooklyn Rapid Transit investigation, which is still to be completed.

Three important orders for increases in train service have been made by the commission. All of these are being compiled with by the companies. They are:

1. Interborough Rapid Transit Company—Order requiring approximately 20 per cent increase on subway and elevated lines.

2. New York City Railway Company—Order requiring approximately 20 per cent increase on Fourth and Madison Avenue lines.

3. New York City Railway Company, Forty-Second Street, Manhattanville & St. Nicholas Avenue Railway Company—Order requiring approximately 20 per cent increase of service on Broadway line.

Besides these, an order has been issued to the Coney Island & Brooklyn Railroad Company requiring additional equipment, and an order requiring an additional stairway at the 137th Street and Broadway station on the subway.

Then also three final orders have been issued, after hearings, directing certain changes in the methods of operating which are expected to work improvements in the service. These orders were:

1. Richmond Light & Railroad Company—Order requiring safe operation of cars around Fort Wadsworth curve.

2. Union Railway Company and Westchester Electric Railroad Company—Order requiring operation of Williamsbridge cars on White Plains Road to 242d Street, instead of terminating line at 233d Street.

3. Union Railway Company and Westchester Electric Railroad Company—Order requiring transfers between cars of former company and "Bedford Park and New Rochelle express cars" of latter company.

The Interborough Rapid Transit Company order applies to all subway and elevated trains in Manhattan and the Bronx, and prescribes increases varying from about 5 per cent to about 66⅔ per cent in the service during periods extending for about an hour before and about an hour after the rush hour. The New York City Railway Company orders prescribe approximately a 20 per cent increase on the Broadway line and a similar increase on the Fourth and Madison Avenues line for the same part of the day as that covered in the Interborough Rapid Transit Company order.

The Coney Island & Brooklyn Railroad Company has announced, through its counsel, William N. Dyckman, that it will pass two dividends to provide the additional equipment required in the orders of the commission and other equipment which representatives of the company have promised. The installation of the additional equipment ordered is expected to result in a quicker movement of surface cars over the Brooklyn Bridge.

Another final order of the commission, approving the application of the Nassau Electric Railway Company for permission to extend its tracks to Livingston and other streets, settled within five days of the filing of the application a question involving material relief for the most congested point of surface transportation in Brooklyn, as treated at length in an article elsewhere in this issue. The application of the company was made in its final and proper form on Aug. 8 to the new commission. The hearing required by law was held on Aug. 12, the only delay being that required by law for advertising it lawfully, and on Aug. 13, just twenty-four hours after the hearing, Commissioner McCarroll, to whom the matter had been referred, made his report and the commission adopted a final order approving the extension.

Chairman Willcox, of the commission, says it has been a source of gratification to receive the ready compliance and, in many cases, the co-operation of public service corporations in carrying out the commission's work. Frequently the companies have joined with the commission, says Mr. Willcox, in endeavoring to improve service conditions and the officials have expressed their willingness to do all in their power because of having to look now to but a single public department, organized on a sound, sane basis.

The New York "World" on Sunday quoted Mr. Willcox in an interview as follows: "Our work in dealing with this physical condition of traffic has been divided into two endeavors, one to get the greatest amount of improvement out of existing facilities and the other looking to the construction of additional subways and extensions. It was impossible for us to proceed far in either of these directions without encountering the financial structure of public service corporations. Financiering has so direct a relation to quality of service that complete knowledge of its intricacies became a necessity to us.

"Manifestly it was the first duty of the commission to deal with the existing traffic facilities of New York, to endeavor to get out of them greater accommodations for the public. Several years would be required to construct additional lines, and meanwhile there is a constantly increasing demand for better and more extensive service. For the last few weeks the commission has been giving almost its undivided attention to this phase of the situation.

"More recently we have taken up discussion of the next step, the providing for new lines. New York is growing so rapidly that even the maximum service on existing lines cannot fully accommodate the traveling public. New subways are necessary, and we must plan them. Here, too, knowledge of actual cost is necessary and requires examination of past financing to form a basis for the future.

"The work of the Public Service Commission is constructive, not destructive. The object of our investigations is not to tear down, but to build up. It is not to retard, but to improve."

The Morton Trust Company, as trustee of the Metropolitan Street Railway 4 per cent refunding bonds, moved on Saturday to foreclose the mortgage covering these bonds in foreclosure proceedings in the United States Circuit Court, before Judge Lacombe. The Metropolitan Street Railway, as well as the receivers of the New York City Railway, Adrian H. Joiin and Douglas Robinson, are made parties defendant. This action, the Morton Trust Company states, is taken at the request of holders of the refunding bonds outstanding to a total of $16,604,000. No default has occurred on these bonds. The foreclosure petition is based on the fact that under the terms of the mortgage the Metropolitan Street Railway pledged itself to pay all amounts payable on any lease pledged under the refunding mortgage. The Third Avenue lease is so pledged, and in failing recently to meet the rental on that road the Metropolitan Street Railway, the Morton Trust Company as trustee for the bondholders alleges, was guilty of an infringement of the terms of the mortgage, which entitles the trustee for the bondholders to institute foreclosure proceedings. A majority of the refunding bonds of the Metropolitan Street Railway outstanding are in the control of a committee of which Edgar L. Marston, president of the Farmers' Loan & Trust Company, is chairman. Co-operating with the Metropolitan Street Railway bondholders' committee there is a committee of Third Avenue Railroad bondholders already organized, with Dumont Clarke, president of the American Exchange National Bank, at its head. The Third Avenue bondholders are in prospect of having the receivers default upon the interest on their bonds, throwing the Third Avenue system into their hands, just as the Metropolitan Street Railway will be thrown into the hands of the bondholders of that system in case the foreclosure goes through. This will eliminate the stockholding interest in both instances, so far as a voice in a reorganization goes, and will place the traction combination in the hands of the holders of the Interborough-Metropolitan bonds issued against the stock of the Interborough Rapid Transit Company on the one hand and the combination of bondholders' committees on the other. It is believed that in case the foreclosure is allowed, the present receivers will be named to act on behalf of the holding interest, pending the reorganization.

Four members of the Public Service Commission inspected the electrified portion of the New York Central Railroad on Saturday, traveling from the Grand Central Station to Mount Vernon, inspecting the power plant and traversing the freight route on Eleventh Avenue, the tracks of which will soon have to come up. The trip occupied the greater part of the day. The party included all the commissioners except Chairman Willcox.

The commission has issued an order to the Richmond Light & Railroad Company returnable Nov. 21 for the purpose of inquiring into the service of the company on Staten Island, where it operates.

THE CONFERENCE IN CLEVELAND

On invitation of Mayor Johnson the officers of the Cleveland Electric Railway Company held a conference with the Mayor, members of the City Council and councilmen-elect in the council chamber Saturday morning, Nov. 9, in an effort to arrive at some understanding, if possible, as to what action will be taken to accommodate the people of the West Side when the franchises expire. In his letter of invitation to the Cleveland Electric officials, the Mayor intimated that the administration might have some suggestions to make that would lead to a fair and satisfactory settlement of the entire street railway question, but it was found that he expected the company to make a proposition to that end instead. President Andrews said that he had been unable to have a full meeting of the board of directors previous to the meeting, and that he could speak only for himself. He then suggested that the fairest way to arrive at a conclusion was by arbitration, the arbitration board to consist of disinterested traction experts. This did not meet with the Mayor's views. He stated that much time would be required in a process of this kind, and that the result would be binding upon no one. It is evident that the Mayor desires a holding company to take over the property on a leasing arrangement, and it is believed that he would not favor giving the old company a franchise on any terms. It seems that he wants to adhere to the old offer made to the company of fixing leasing terms upon a certain valuation, which is far below the real worth of the property. Under the offer made last spring the basis for the lease would be a valuation some place between 42 and 46, as there was to be a drop of two points a month for the delay in accepting the offer.

As the Mayor insisted upon a proposition from the Cleveland Electric on either the holding plan or a direct franchise plan, President Andrews stated that he would call a meeting of the directors at the earliest moment to consider the matter. The Mayor then set Thursday of this week as the time for hearing the report. All through the meeting Mr. Andrews showed a disposition to treat fairly with the city and said that similar treatment is all his company asks. If the Mayor really wants to settle the question to the best interests of the people, there is a general belief that the company will meet him half way. On the other hand, if he insists that the property be turned over to an irresponsible holding company at a ridiculously low valuation, with the privilege of purchase at a figure but little higher, at any time the Mayor sees fit, it is safe to say a settlement will not be reached for some time to come.

The Cleveland Electric officials and the Mayor, in consultation a few days ago, arranged a new routing for what are known as trippers, in order to avoid congestion at the Public Square. Increasing traffic, morning and evening, with the addition of a number of cars on the low-fare lines, resulted in frequent blockades which delayed traffic quite a little at times. Under the new plan the trippers will turn before reaching the Square, and thus avoid having all the cars reach one point. Fewer East Side cars will be run to the Union Station. This is a distinct disadvantage, but under present circumstances can not well be avoided. Plans of building additional tracks about the Square have been discussed, and the Mayor has suggested that the $84,000 received by the city from the Cleveland Electric for the use of Central Avenue and Quincy Street be used for building additional tracks for this purpose, and that the property belong to the city. This matter will also be presented to the Cleveland Electric directors for consideration. In rerouting the tripper cars, the Cleveland Electric will use a short strip of track built by the low-fare companies on East Ninth Street.

The business men of Cleveland were somewhat dismayed at the result of the election in that city, as the plan suggested by Congressman Burton was considered by them to be fair and honorable in every particular. They felt that the sensible, wide-awake element of the city would support a platform of that kind, since the declaration of the Cleveland Electric that the plan would be accepted was made in the last days of the campaign, after the matter had been pointed out as uncertain by the Johnson side. It seems, however, that many voters favored the lowest fare possible, without consideration for the good of the city and the future development of its suburbs. People at large do not stop to consider what they are getting in street railway service, and the judgment as recorded at Cleveland would seem to auger anything but well for companies in other cities seeking extensions. The officers of the Cleveland Electric Railway have not given any intimation of the course they will pursue in case the administration insists upon plans that cannot be accepted, but the company is prepared to protect itself and its property in case of an attempt to confiscate. It is believed that transfers might be withdrawn between the lines that formerly composed the Cleveland City Railway Company and those of the old Cleveland Electric Railway Company, and a fare of ten cents charged to Euclid Beach, Collinwood and other points, as the company voluntarily made the reductions some years ago. While resulting in a hardship to the people, such action on the part of the company would increase its income quite materially. On the night of the election, when it became evident that Mr. Johnson was re-elected as Mayor, the company withdrew the seven for a quarter tickets and put the old rate of eleven for half a dollar in force again. Many people, anticipating what might happen, had purchased large numbers of the cheaper tickets and are taking advantage of the low fare still. These tickets might have been redeemed, but the company did not see fit to take action to that end. However, it was stated that there will be no further tests of the low fare, as a majority of the people have said they do not appreciate it.

Should the administration succeed in making an arrangement by which the Cleveland Electric will operate at a lower fare than has been offered, all hopes of rapid transit lines will be blasted, so far as it is concerned, unless a more liberal spirit should be displayed regarding this matter than has been shown in others. The city is badly in need of some form of rapid transit service in all directions and such lines would be liberally patronized by those who live in the suburbs and must now spend from forty-five minutes to an hour on the cars morning and evening.

The directors of the Cleveland Electric Railway Company held a meeting Monday to discuss the action to be taken in connection with the request of Mayor Johnson that some proposition looking toward a settlement be made. While it is not known what course the directors will favor, it is said that the holding plan on a proper valuation of the stock is looked upon as better than a franchise at a flat three-cent fare. However, it is believed that the directors will have to have some assurance that the dividends or rentals will be paid and that the holding company would have to be stronger and in better shape than the one that is now in operation here.

Rumors are to the effect that Mayor Johnson would be willing that the Cleveland Electric directors have representation in the directorate of the holding company, so that they may know at all times just what is being done. The zone question and the proposed clause allowing the holding company to change its rate of fare if found necessary, as was proposed in the original contract, will have something to do with the settlement. It will be remembered that President Andrews insisted that any holding company that proposed to take over the Cleveland Electric properties should agree to bind itself to a three-cent fare and in case it was found impossible to operate at this, the properties were to revert to the old company. Mr. Johnson objected to this, even in the zone system proposed.

On Thursday Mayor Johnson refused the proposition of the Cleveland Electric Railway to give six months' test of three-cent fares and accept 25-year franchise on any fare determined by a disinterested board of experts which would yield 6 per cent. He also refused the plan fixing the value of the stock for entering a holding company and demanded that the company state a figure at which it is willing to go on this plan.

ECHOS OF THE MATTOON CITY WRECK

Petitions, charging fraud in the management of the Mattoon City Railway, were filed in the Circuit Court at Mattoon by Attorney L. Chezem for those seeking damages for injuries received in the recent wreck on the line in which about seventeen people were killed.

Soon after the wreck the road was put into the hands of a receiver. The petitions claim the road is solvent. Damage claims amounting to $219,000 have been filed.

Regarding the petitions, Judge Grosscup, of Chicago, who is director and part owner of the road, is quoted as saying:

"The charge is either made maliciously or else by a person who does not in the least understand the situation. The receivership protects the claimants; it does not destroy their rights. It will prevent the property from being scattered and all creditors will fare alike. The reason for the receivership was to take care of the creditors, not to defraud them."

BRIDGE RELIEF IN NEW YORK

The submitting on Tuesday of this week to the Municipal Art Commission of New York of the plans for the Brooklyn Bridge station, stairway and esplanade has resulted in making public the elaborate plans that have been made for modifying this structure so as to make it of greater value in the service which it performs, and also brings forward the plans affecting the New Manhattan bridge and the Williamsburg Bridge and their relation to transit matters affecting Brooklyn.

To relieve the congestion at the Brooklyn Bridge temporarily Commissioner Stevenson originated the idea of extending the present tracks of the structure across Park Row into City Hall Park. This construction work is in progress now and will be completed shortly. The extended terminal will provide additional platform space and increase the present limited switching facilities. With its completion the cable car service during the rush hours will come permanently to an end. Through elevated trains will be operated over the structure during all hours of the day and night. Included in the plans for permanent relief one of the most important details is the distribution of the traffic which crosses the structure on the trolley lines. Under the new plan the Bridge Department proposes to raise the trolley loops from the ground surface to the mezzanine floor above. Passengers using the trolley lines will proceed through the ground floor of the bridge where the loops are located now. There will be separate stairways reaching each loop. With this arrangement the traffic will be distributed and there will be none of the confusion and congestion which now exists on the ground floor. On each of the stairways will be a sign designating the lines which may be reached on the floor above. The platforms will be large and spacious and the present system of having passengers cross four or five different tracks to reach a trolley loop will be eliminated.

The plans for the elevated service and the subway lines as soon as the subway loop is completed, are even more elaborate. The present terminal which is used for the elevated lines, will be extended out on the bridge to increase the length of the platforms and the switching facilities. As soon as this is completed the temporary extension which is being built across Park Row into City Hall Park will be taken down. The tracks will only extend to the house line on Park Row. The façade of the new terminal on Park Row will be approached by a passageway extending over Park Row into City Hall Park. On the mezzanine floor the passengers will pass along a platform which will be raised over the platforms of the trolley loops. Here another set of stairways and escalators will be found upon which the passengers will ascend to reach the platforms of the elevated lines on the floor above.

Already the work of widening the roadways of the bridge is under way. This widening is made necessary for the subway cars which will cross the bridge and descend into the tunnel which is to connect the structure with the subway terminal station and the subway loop. When the roadways are widened the trolley tracks will be moved out to permit the installation of another track on each side of the bridge to connect with the subway. While all this construction work is in progress, there will not be the slightest obstruction to the present traffic on the bridge.

Running parallel with Center Street and beginning from the site of the old "Staats Zeitung" Building, the subway terminal will cover a distance of three blocks. There will be three loading and two unloading platforms, each 450 ft. long. The trains from the bridge will cross under William Street and Park Row, where they enter the station. There will be five stairways leading to the station where Park Row and Center Street form a triangle. Three of the stairways will be for passengers, bound for the loading platforms. The other two will be exits for passengers coming from the trains. A system of railings is provided whereby these two lines of people going in opposite directions will not come in contact with each other. Half of the length of the station and directly in the center another series of entrances and exits are provided, leading from Duane, Reade and Center Streets. The people here will descend to a mezzanine floor, with stairways leading up and down from both sides to the platforms below. At the extreme northerly end of the terminal there will be another series of exits and entrances. The passengers here to reach the platforms will pass under the tracks and then up a number of stairways.

From the terminal station the subway with its four tracks will proceed through Center Street. At Leonard and Franklin Streets there is to be another commodious station; between Howard and Grand there is to be another. The subway then will turn and proceed through private property to the Delancey Street approach to the Williamsburg Bridge. At the Bowery and Delancey Street there is to be another station.

Here the trains will enter the subway station which has been constructed under Delancey Street for the entire width of the street and covering almost three city blocks. For the trains three platforms have been provided in this station. The center platform will be used by passengers leaving the trains and the two side platforms for passengers boarding trains. From the subway station the trains proceed on an incline to the elevated tracks on the Williamsburg Bridge. The Bridge Department is now at work lowering the tracks on the bridge to meet those from the subway station.

This subway station is to have a number of novel features. In addition to accommodating the elevated subway trains it will be the terminal for the trolley lines which cross the Williamsburg Bridge. Eight loops will be provided for these lines, each reached by a separate stairway.

The regulation of traffic in Manhattan, so as to allow the freest possible operation of surface cars compatible with the use of the streets for other purposes, occupied the attention of the Public Service Commission at the public hearing on Tuesday, Nov. 12. The Charter Revision Commission, the chairman of which is Williams M. Ivins, who is also special counsel for the Public Service Commission in its traction investigation, will recommend that the city's charter as amended shall centralize the power of regulating street traffic in some one city department, instead of leaving it divided up between several department heads, as at present.

Police Commissioner Bingham is in favor of a set of traffic regulations embracing practically all the features of the plan advocated by Mr. Shonts, but putting it in the hands of the police commissioner by legislative enactment to determine the conditions governing the movement of traffic. Commissioner Willcox, of the Public Service Commission, and the Deputy Commissioner agreed that further legislation was needed on this matter at least. The Deputy Commissioner suggested that it would be a wise move to take a strip of 5 ft. or 6 ft. off the sidewalk on such streets as Twenty-Third and Forty-Second, where there is approximately 40 ft. of roadway and 30 ft. of sidewalk on each side. In connection with this he favored an ordinance limiting the width of wagons to be used in the daytime to 8 ft. 6 ins.—about the present maximum for the heaviest coal wagons. The narrowing of the sidewalk and such a limitation on the width of wagons would allow two teams to pass each other on each side of the electric cars without infringing upon the car track.

INCREASING SERVICE IN SAN FRANCISCO

By Nov. 15 the United Railroads, declares General Manager Black, will have in operation a total of 450 cars, mostly of the new type, which will have an aggregate carrying capacity equivalent to 600 cars of the old cable and smaller cars used before the fire. The United Railroads has contracted with the City Electric Company for the supply of a large amount of power, and this will be available as soon as a frequency changer can be moved from the Martin station of the California Gas & Electric Company and set up in the North Beach power plant of the railway company. Within a week the lower end of Market Street, from the end of Sutter Street to the ferry loop, will have its outer set of tracks permanently set for regular service. These tracks have been raised to the new grade, ranging from 1 ft. to 3 ft. above the old grade, and the heavy rails are rapidly being imbedded in concrete, surfaced with basalt blocks as a flinty wheel guard for vehicles, while preparations are going forward for the pavement of the space between the rails with bitumen like that on Sutter Street. As soon as the outer tracks are made available for the Market and Sutter Street cars workmen will hurry the raising of the intervening grade so that the inner main tracks may be raised to the level of the outer tracks, and the whole end of lower Market Street for a distance of about three-quarters of a mile may be made like the smooth, central part of Sutter Street. Work is going ahead rapidly in the making of the new inner loop at the ferry for the passage of Clay and Sacramento Street cable cars. The old turntable and the straight tracks within the present loop are to be torn out and the loop space restored to a uniform grade.

DECORATION TO CARROLL D. WRIGHT

Hon. Carroll D. Wright, former United States Commissioner of Labor, formally received the cross of the Legion of Honor, conferred on him by the French government, for his efforts in bettering industrial conditions throughout the world, at a dinner given in his honor at the Engineers' Club, New York, Nov. 9. The host was Charles Kirchoff of the "Iron Age" and chairman of the advisory council of the American Museum of Safety Devices and Industrial Hygiene at the Thirty-Ninth Street Building, 239 West Thirty-Ninth Street. The occasion of the dinner to Mr. Wright was the recognition by his colleagues on the museum board of the distinction he had received from the French government. The letters of congratulation addressed to William H. Tolman, director of the Museum of Safety Devices and Industrial Hygiene, and read at the dinner included communications from President Roosevelt, S. N. D. North, director of the United States Census, and Andrew D. White.

The decoration was formally presented to Mr. Wright by Mr. Bonzom, acting French Consul-general.

Mr. Wright, in responding, said that the honor came as a surprise to him, and he took it as a recognition of the work which the American Museum of Safety Devices has accomplished. He said that his work in the government Labor Department was taken up by statistics, but that in all the years he was engaged in that field the need of a movement that would reduce the number of accidents appealed to him. He said that in maintaining an institution devoted to the saving of life we are following the European countries and following France. He continued: "The engineers were the first to work this new movement outside of their line of work. The movement should extend not only to adopting devices for preventing accident, but it should insist that an inspection be made by bodies of men of all parts and appliances of machinery. These are things that need action by the government as well as by society. The slaughter of life by accidents is a matter that needs thought and attention. If there is any way that the social engineers can assist the other engineers, you can count on me. I thank the French government and my colleague for the honor conferred on me."

Addresses were also made by Dr. Josiah Strong, who was the toastmaster at the dinner, and Professor F. R. Hutton, president of the American Society of Mechanical Engineers.

Mr. Wright, who is now president of Clark College, at Worcester, Mass., received a similar honor from the Italian government a year ago.

EAST CAMBRIDGE ELEVATED HEARING

A hearing was held Nov. 7 before the Massachusetts Railroad Commission in regard to the route of the East Cambridge elevated lines in the vicinity of Lechmere Square. Revised plans, avoiding the use of this square as a surface car approach to the structure, were shown by Chief Engineer Kimball. The new elevated structure, crossing the Charles River just outside the Charles River dam, will traverse the Boston & Maine Railroad yard parallel to Bridge Street until near Lechmere Square, where it will be brought down to the ground level on private land located inside the intersection of Cambridge and Bridge Streets.

From this point two sets of double tracks will connect with existing surface tracks, and the latter will, except for this new connection, remain as at present in the square. The surface lines will be necessary over the new dam into Boston to accommodate the West End and Charles Street routes, although cars for the center of the city will probably use the elevated structure. The new plan is acceptable to the city of Cambridge, the Charles River Basin Commission and the Boston & Maine Railroad, and will probably be approved.

STREET RAILWAY PATENTS

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

UNITED STATES PATENTS ISSUED OCT. 29, 1907

869,275. Block Signaling System; Louis H. Thullen, Swissvale, Pa. App. filed May 15, 1907. A cab and block system wherein the current for the signal operating relay in the cab is obtained by induction from a wire or other conductor extending parallel to the track.

869,298. Split Switch; George M. Ervin, Johnstown, Pa. App. filed April 22, 1905. A tip for switch points which may be readily removed and replaced when worn.

869,364. Air Brake System; Laurence A. Hawkins, Schenectady, N. Y. App. filed Feb. 3, 1906. An electrically operated air brake system having magnet-operated valves.

869,365. Block Signal System; Laurence A. Hawkins, Schenectady, N. Y. App. filed March 28, 1906. The system employs the rail as return conductor for the power current. Parallel tracks are cross-bonded so that a circuit may still be maintained in case a rail is broken.

869,298. Automatic Device for Protecting Trains; Eduard Unverricht, Altona, Germany. App. filed Jan. 8, 1906. Automatic means for protecting railway trains and controlled by electric circuits. Designed to prevent a collision of trains running in opposite directions along the same line. Covers details of construction.

869,403. Strain Insulator; Albert Anderson, Boston, Mass. App. filed March 2, 1906. Has a metallic shell inclosing insulating material in which the terminals of the conductors are embedded.

869,404. Strain Insulator; Albert Anderson, Boston, Mass. App. filed July 5, 1906. Modifications of the above.

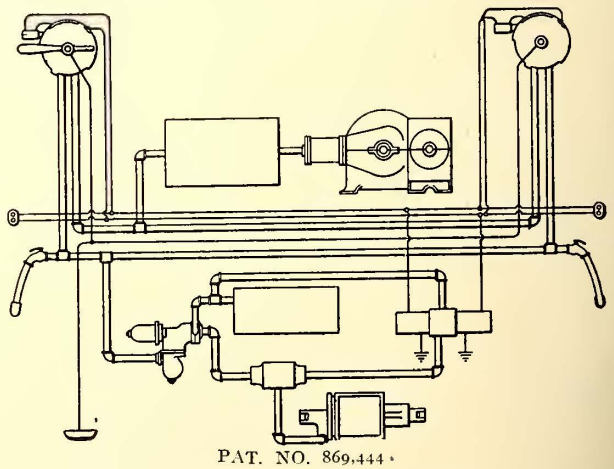
869,425. Railway Car Brake; Seth A. Crone, New York, N. Y. App. filed July 24, 1907. Has a cast metal body and plate back, the back having at its end a pair of opposite transverse inwardly inclined lips slit therefrom and embedded in the cast metal.

869,429. Folding Car Step; William G. Felkner, Sebree, Tex. App. filed Feb. 6, 1907. The car steps when not in use fold to form the lower portion of the car door, the upper part of the door being swung outwardly and upwardly simultaneously with the lowering of the steps to position.

869,444. Air Brake System; George Macloskie, Schenectady, N. Y. App. filed April 7, 1906. A combined electric and pneumatic air brake system in which the brakes are preferably controlled by electric means, but may be pneumatically controlled in case the electric means fail for any reason.

869,455. Motor Car; Spencer Otis and Harry S. Hart, Chicago, Ill. App. filed July 26, 1906. The motor mechanism is so located on the car as to take up a minimum amount of space and be readily accessible at all times to the motorman; also provides an improved motor and other details.

869,456. Motor Railway Truck; Spencer Otis, Chicago, Ill. App. filed Nov. 7, 1906. A motor truck in which the main driving motor may be operated continuously in the same direction of rotation while the drive-wheels of the truck may have their direction of rotation reversed. Has bevel gear mechanism with clutches.



PAT. NO. 869,444.

869,459. Electric Railway System; William B. Potter, Schenectady, N. Y. App. filed April 3, 1900. Relates to sectional electric railway systems provided with means for preventing trains from approaching nearer to each other than the length of the section. Has arrangements for operating the brakes and signaling devices especially adapted for the system.

869,465. Third-Rail Contact Shoe; Samuel B. Stewart, Jr., Schenectady, N. Y. App. filed July 5, 1902. A collector shoe of the underneath contact type. Relates to mechanical details of construction.

869,467. Railway Signal; Charles W. S. Turner, Mountville, Va. App. filed Feb. 1, 1907. Mechanical and electrical features of construction of a block signal system having section rails energized by a direct current and employing polarized relays.

869,506. Train Pipe Coupling; William H. Myers and William G. Stevens, Belleville, Ill. App. filed April 12, 1907. A train pipe coupling comprising a pair of fluid conducting pipes having openings in the walls thereof; valves carrying the pipes, and a pair of spring-pressed coupler heads slidably mounted upon the pipes and arranged for assemblage with each other.

869,531. Railway Signaling; Jacob B. Struble, New York, N. Y. App. filed June 27, 1906. Relates to the use of apparatus by means of which an alternating current in the railway conductors may be changed to a direct current and used in circuits for controlling the passage of the trains.

869,552. Signal Apparatus; Clarence W. Coleman, Westfield, N. J. App. filed Feb. 4, 1907. The signal has a normal bias to danger position and normally operates to go to danger position in response to said bias. Has a fluid-pressure piston motor for moving the signal to safety position.

869,555. Block Signal System; William Daves, Bloomington, Ill. App. filed April 22, 1907. Provides a signal system in which any negligent action on the part of the signalman in the manipulation of the apparatus at his station will result in the display and maintenance of a danger signal until normal conditions are resumed.

869,576. Signaling System; Edward E. Kleinschmidt, New York, N. Y. App. filed Aug. 10, 1906. A block system for single track electric roads in which the return current is carried by rails. Has means for registering the number of cars which enter a block in both directions.

869,592. Fluid Pressure Brake; Robert A. Parke, New York, N. Y. App. filed Aug. 1, 1902. An improved valve device operating in response to variations in fluid pressure and in connection with an additional or supplemental reservoir for controlling the release from the brake cylinder, and communication from the additional reservoir, or source of pressure to the auxiliary reservoir or valve device.

869,606. Fluid Pressure Brake; George Westinghouse, Pittsburg, Pa. App. filed Jan. 25, 1904. Provides an improved means for securing a local discharge from the train pipe at or near each triple valve device throughout the train in service applications of the brakes, to thereby accelerate the movement of the successive triple valves by the well-known serial action as the wave of reduction is thus carried rapidly through the full length of the train pipe.

869,645. Railway Tie; Martin J. Nolan, Philadelphia, Pa. App. filed March 5, 1907. A railway tie consisting of a solid mass of slag and having vertical openings adjacent to the rail seats for the reception of the rail fastenings.

869,711. Trolley; Samuel D. Hunt, Youngstown, Ohio. App. filed April 24, 1907. In place of a trolley wheel a pair of rounded fingers are provided with ball and socket connections to the harp and which are guided between separate trolley wires.

869,812. Controller; Emmett W. Stull, Norwood, Ohio. App. filed Aug. 17, 1904. Motor control system for a plurality of motors designed to obtain a uniform acceleration of the motors through series and parallel connections.

869,824. Control System; Louis M. Aspinwall, Wilkinsburg, Pa. App. filed Jan. 3, 1905. A control system for electrical translating devices. Provides means for preventing the formation of such circuit connections in the power motors that they may act as translators and deliver current to the controlling devices.

869,843. Trolley Head for Electric Traction; Garnet B. Holmes and Arthur D. Allen, Wellington, N. Z. App. filed Aug. 7, 1907. The axle of the trolley wheel is mounted in journal blocks which have a slidably yielding movement.

12,710. Air Pressure Brake; Erwin Kramer, Berlin, Germany. App. filed July 1, 1907. Provides a brake in which the pressure exerted by the brake-blocks above a certain speed depends on the rotative velocity of the wheels. The valve device which charges or discharges the compressed air into or out of the brake cylinder is regulated by a device which acts on the valve with a varying force, tending to displace the same in accordance with the velocity of rotation of the wheel axle.

12,712. Air Brake System; Frank H. Dukesmith, Meadville, Pa. App. filed May 10, 1907. Provides a system whereby the engineer may control the engine brakes and train brakes independently of each other or in unison.

PERSONAL MENTION

MR. ROBT. SHERMAN has resigned as superintendent of the Los Angeles-Pacific Railway.

DR. THOMAS B. SHUMWAY, president of the Plymouth & Middleboro Street Railway, of Plymouth, Mass., is dead.

MR. P. G. GOSSLER, of New York, has been elected to succeed President W. E. Harrington, of the Pottsville Union Traction Company, who resigned several weeks ago. Mr. W. L. Sheafer, of Pottsville, has been chosen vice-president of the company.

MR. C. S. MELLEN, president of the New York, New Haven & Hartford Railroad Company, has withdrawn from all official connection with the electric railway companies in Massachusetts held by the New England Investment & Securities Company, of Boston.

MR. W. F. HERRIN has been selected as the responsible head of the Pacific Electric Railway, Los Angeles Interurban Railway Company and the Los Angeles Railway Company, to act during the absence from California of Mr. H. E. Huntington, who is sick at Oneonta, N. Y., his old home.

MR. E. B. McKINNEY, superintendent of power of the New Orleans Railway & Light Company, has been appointed superintendent of equipment in connection with his office as superintendent of power, and besides the various power stations and sub-stations, will have entire control of the car barns, car shops and all rolling stock belonging to the company. Mr. McKinney is one of the best informed men in electrical matters in the South, and has been connected with the operation of power plants and equipment in New Orleans since 1889.

MR. B. E. MERWIN has resigned as general superintendent of the Interurban Railway & Terminal Company at Cincinnati to accept a similar position with the Aurora, Elgin & Chicago, with headquarters in Chicago. Mr Merwin has been with the company since its organization and when he left he was presented with a diamond stud by employes and those associated with him in the work. Mr. F. H. Talbot, who has been assistant to President Charles H. Davis for some years, has been appointed to succeed Mr. Merwin with the Interurban Company.

MR. D. L. BENSON, for a number of years on the constructon and operating staff of H. M. Byllesby & Company, of Chicago, died at the Lake Geneva Sanitarium, Lake Geneva, Wis., after a lingering illness, Monday evening, Nov. 4, at the age of 40 years. Mr. Benson was well known in the electric light, street railway and gas fields of the Middle West, having been prominently connected with the construction of utility plants at Shelby, Ohio; Muskogee, I. T.; Oklahoma City, Okla.; Ottumwa, Iowa, and other points. Mr. Benson is survived by a widow and a daughter.

MR. ELMER M. WHITE has resigned as treasurer and auditor of the Birmingham Railway, Light & Power Company, of Birmingham, Ala., and will be succeeded by Mr. C. M. Cory, who was formerly auditor of the Birmingham system, but who has recently been auditor of Ford, Bacon & Davis. This position is now abolished, and Mr. Cory has returned to his former position. Mr. White has been secretary of the American Street and Interurban Railway Accountants' Association since January, 1904. He has been engaged in street railway work for a long time, and for 20 years was associated with the accounting department of the Hartford Street Railway Company, of Hartford, Conn. Mr. White resigned this position in 1905, after the road was acquired by the Consolidated Railway Company, of New Haven. From Hartford he went to Birmingham, first as assistant treasurer and assistant secretary, and later was appointed to the position which he has just resigned. He is now temporarily in New York at the office of the American Street and Interurban Railway Association, where he is engaged in supervising the publication of the Proceedings of the Atlantic City Convention of the Accountants' Association.

MR. H. C. PAGE, general manager of the Springfield Street Railway Company, of Springfield, Mass., has been elected vice-president and general manager of the company, while Vice-President L. S. Storrs, who is also vice-president of the New England Investment & Securities Company, has been elected

president of the company, to succeed President Charles S. Mellen, of the New York, New Haven & Hartford Railroad, who, as announced elsewhere in this issue, has decided to withdraw as an officer from the Massachusetts street railway companies controlled by the New Haven Railroad. Mr. Page has been in charge of the Springfield Street Railway for about two and one-half years, coming to Springfield from Pittsfield, where he was manager of the Berkshire Street Railway. Before that he was general superintendent of the Boston & Northern Company, which had some 450 miles of trackage. Mr. Page began his railroading experience with this latter company, and served it in various capacities for 20 years. Mr. Page is president of the New England Street Railway Company.

MR. HARRO HARRSEN, general superintendent of the Mexico Tramways Company since April and acting general manager of the company, has been appointed general manager. The new appointment does not affect the personnel of the company, as under a general order issued June 17, just previous to the departure of Mr. R. C. Brown, managing director, for the United States, heads of departments were directed to report to Mr. Harrsen as the acting general manager of the company during the absence of Mr. Brown. Mr. Harrson first came to Mexico about fourteen years ago. While acting as assistant foreman of the Emerson Electric Manufacturing Company, of St. Louis, Mr. Harrsen received the appointment as assistant superintendent of the Aguascalientes Electric Light Company, in the city of that name. After twelve or fourteen months in the employ of that company Mr. Harrsen was appointed private secretary to Mr. Thomas H. McLean, president and general manager of the old mule and steam tramways operating company of Mexico, and served in this capacity until April, 1898. He left Mexico at that time, accompanying Mr. McLean to Toledo, Ohio, where Mr. McLean had been appointed general manager and vice-president of the Toledo Railway & Light Company. After the death of Mr. McLean, Mr. Harrsen continued in the employ of the company and held successively the positions of chief dispatcher, division superintendent and superintendent. Upon severing his connection with the Toledo Company he undertook the management of the International Companies. After about a year in this capacity, Mr. Harrsen was made general superintendent of the Mexico Electric Tramways Company.

MR. THEODORE STEBBINS has accepted the position of general manager of the Texas Traction Company, which, as mentioned elsewhere in this issue, will put in operation within a few months an interurban electric railway between Dallas and Sherman, Tex. The distance between these cities is about 65 miles and the company has under contemplation important extensions southward. The line is being built by the American Railway & Lighting Company, which owns and operates six electric lighting and gas properties in the neighborhood of Dallas, with which Mr. Stebbins is also connected and for whose lighting properties he will act in an advisory capacity. Mr. Stebbins has a wide acquaintance with electric traction and lighting properties, which eminently fits him for the work which he now has on hand. Soon after his graduation from the Massachusetts Institute of Technology, in 1886, he became connected with the General Electric Company and had charge of its interests in connection with the many local electric railway and lighting companies in which it was part owner. In 1904 he resigned from the General Electric Company to accept the general managership of the important system of interurban railways centering in Columbus then owned by Mr. A. E. Appleyard. When these lines went into the hands of a receiver Mr. Stebbins was appointed manager under the receivers and conducted their operation until the early part of 1906, when their mortgages were foreclosed and they were reorganized. Just at this time the National Civic Federation commenced its investigation of the management of public utility companies and Mr. Stebbins was offered and accepted the position of expert on electric lighting properties during the investigation. He has recently returned from an extensive trip to South America and Europe, undertaken for American and London financial interests. Mr. Stebbins presented papers on economic subjects at the last two meetings of the American Street & Interurban Railway Association.

THEODORE STEBBINS.

MR. C. D. WYMAN, of Stone & Webster, Boston, died very suddenly from heart trouble, Sunday morning, Nov. 10, while en route from Boston to Seattle, where the company has important properties. Mr. Wyman was a very prominent figure in the street railway industry for the last 20 years, and held many positions of responsibility and trust. He was a native of Racine, where he was born Aug. 28, 1850. At an early age he moved with his mother to Rochester, where he lived for a number of years and where his education was for the most part gained. After spending one year at the University of Rochester he went to Chicago and completed his university course at the Chicago University, graduating therefrom with the degree of B.A. in 1872. In the fall of the same year he accepted the position of private secretary to Hon. G. Hilton Scribner, at that time secretary of the State of New York. Mr. Wyman then moved his residence to Albany, where he took up the study of law and received the degree of B.L. from Union University, at Schenectady. Mr. Wyman's street railway work began in 1874, when he was elected secretary of the Central Park, North & East River Railroad Company, of New York City, commonly known as "the belt line." He held this position until 1879, when he resigned to accept a directorship and the office of secretary and treasurer of the American District Telegraph Company. In the fall of 1880 he was elected a director and vice-president of the Belt Line Company, of which Mr. Scribner at that time was president. During his residence in New York, Mr. Wyman was active in the New York State Street Railway Association, and served as president of that organization during 1892-93. In the latter year he resigned from the Belt Line to organize and manage the electric launch service at the World's Fair grounds in Chicago at the time of the exposition. After the close of the fair Mr. Wyman accepted the position of general manager of the Milwaukee Electric Railway & Light Company, where he remained until 1896, when he accepted the position of general manager of the New Orleans Traction Company, under which title the principal railways in New Orleans had then recently been consolidated. While in New Orleans the city was visited by a yellow fever epidemic, but Mr. Wyman remained at his post throughout the entire period. In 1900 he resigned from New Orleans to accept the connection with the firm of Stone & Webster, which he held at the time of his death and where his wide experience was of the greatest value in settling the policies of management and operation of the various properties whose affairs this firm is conducting. At the time of his death he was in immediate charge of their Pacific Coast properties, serving as president of two of them, as vice-president of eight and as a director in nineteen. He was also a member of the following organizations: The Exchange Club, City Club and Twentieth Century Club, of Boston; the Transportation Club, of New York; and Lodge No. 30, B. P. O. Elks, of New Orleans. He was first vice-president of the American Street Railway Association in 1889-90 and a member of the executive committee in 1886-87 and 1897-98. He was also chairman of the committee on municipal ownership of the American Street and Interurban Railway Association for the last two years, and as such presented the reports on this subject at the last two meetings of the association which have attracted wide attention. Mr. Wyman was also a frequent contributor to the technical press, one of his most interesting articles having appeared in the Souvenir Issue of the Street Railway Journal dated Oct. 8, 1904, entitled "The Evolution of the Industry, In Horse Car Days." Mr. Wyman is survived by a widow and three daughters. The funeral services will be held Nov. 18, 1907, at 2 p. m. from his late residence in Brookline, Mass.

MR. C. D. WYMAN.