"More Service, Less Cost" Issue

Electric Railway Journal

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The Story of the Light-Weight Frequent-Service Car

THE last twelve months have seen a very rapid increase in recognition by electric railway companies of the advantages of the light-weight frequent-service single-operator car. From small beginnings undertaken by far-sighted electric railway managers a few years ago, the use of this type of car has spread until now about 150 companies have cars with single operators in use or under order. These facts explain why our annual special issue is devoted to this subject. Briefly, its contents may be divided into two classes. The first tells what has been done in different cities with the light-weight frequent-service car. The contributed articles, which form the other class, outline the principles which underly such operation, and from them, to some extent at least, the future of this car in electric railway service may be determined. Of course, the present scarcity of labor is an impelling reason just now for the adoption of this car where it is suitable. This condition, in the view of many, is one which will probably continue for some years after the close of the war, so that the car is not one which should be considered as a war measure only. In fact, it had proved its desirability on a number of systems before August, 1914. The editors hope that this number will assist the railways in obtaining a better idea of the possibilities of the light-weight frequent-service car and so advance the cause of "More Service at Less Cost."

Government and Business Have a Reciprocal Responsibility

WHAT does business owe to the government? This is an important question in these days of war taxation, speeded-up production, price-fixing and the like. Hence it was most fitting that the Chamber of Commerce of the United States should have held a special convention in Atlantic City during the past week to learn how the government expects business men to aid in the successful prosecution of the war. We have been interested to note, however, that the reports of the convention have not been devoid of references to another question what does the government owe to business? To this point government officials are too often not inclined to give much consideration. Yet they have a large responsibility along this line, for just as far as they impose needless handicaps upon business or fail to show an appreciation of business men's problems, they are themselves preventing the service which the nation needs. How similar this situation is to that which exists to-day in regard to the lack of support being given to the electric railway industry by municipal and state governments. Electric railways have a vital need of higher fares, but local officials, legislators and commissioners are slow to understand the urgency of the relief. It is time for communities to realize that the responsibility for a successful transportation system is not single.

Reasonable Rules Carefully Enforced Are Essentials of Safety

MOVING-PICTURE films, illustrated articles, buttons, posters, lectures and similar means have been used in the endeavor to interest railway employees and the public in the safety of each other and themselves. These methods are doubtless excellent, as far as they go, and as part of the safety propaganda they are essential, but if they are made the sole dependence to reduce accidents they will prove a disappointment. The real backbone of safety is discipline within the railway organization, which means the enforcement of rules designed to secure safe operation. To this there are two essentials. The first is reasonableness—the rules must be of such a character as to commend themselves to those to whom they are addressed as the best means of securing the results sought. If employees can have a hand in formulating the rules so much the better. If the advertising propaganda acts to make the enforcement of rules easy, its cost is well justified; if not, its effect will be evanescent. The second requisite concerns the management. The rules adopted should be enforced tactfully but strictly. These were the two outstanding conclusions of the New York meeting of the electric railway section of the

National Safety Council last week. To repeat a figure used before, the brass band in the safety movement may have its place but it must be as a complement of discipline and not a substitute for it.

The One-Man Car as a Traffic Promoter

DURING the past year there has sounded for the electric railways of the country no clearer message than that of the necessity for frequent service. Here appears a means for stimulating revenue that seems now to have definitely established itself as practical in its working, and in several communities of moderate size, where prospective short-haul passengers prefer to walk rather than wait for a car, the change from long to short headway has spelled no less than the difference between bankruptcy and prosperity. An increase of one-third in service has actually produced 60 per cent greater revenue.

Why the One-Man Car Is Economical

To speak broadly, the new movement for shorter headways, which applies practically to every community of moderate size throughout the entire country, and even to certain districts of large cities, has been brought about through the development of the one-man car with automatic equipment. This, at the present time, offers a peculiarly ready means for establishing the desired traffic conditions. Its first cost, even with the greatest elaboration in regard to the latest improvements, is surprisingly small—so low, in fact, that the investment may frequently be written off out of the increased earnings of four or five years. Its economy is positive, not only because platform labor is reduced, but generally because its introduction means the substitution of modern and efficient equipment in place of obsolete apparatus and permits improved conditions of operation in place of those imposed by old-style, open-platform, high-step, badly-designed car bodies that need only half an excuse to be scrapped. In consequence, we are devoting the major part of this issue to discussions of the one-man car and its equipment with the aim that attention may thus be drawn to the almost untapped source of revenue that exists in short-haul traffic obtained through short headways.

Emphasis, however, should be laid on the fact that the one-man car is a means to an end and not the end itself. Obviously the one-man car is still in a stage of development, and the future may well see extended changes in design. In addition it is, as at present utilized, not suitable for heavy traffic on congested lines, and if the principles upon which it was originally devised are to be applied to off-peak service in the large communities, a wholly new set of problems will be encountered. Possibly this will develop a one-man-two-man system of operation such as has already been introduced in several cases, or it may be that the small-car train, as suggested in the article by Mr. Hild, will prove the ultimate solution. Still another possibility is that the service may be supplemented by the operation of existing large cars.

The Field for the Small Car

The fact is that, as with most new inventions and improvements, the exact future field of the one-man car remains yet to be determined. It was developed originally for use on routes of light traffic, largely as a means toward economy in operating expenses. Then, stimulated in part by the hope of providing a successful competitor for the jitney, operators began to use it to give more frequent service at higher speeds on routes of moderate traffic. On such lines, the rush-hour requirements are usually moderate both as regards length and intensity, so that a small-capacity body may be adopted without imposing excessive penalty in the form of numerous tripper cars. As at present designed, on heavy traffic lines with short headways, the *raison d'etre* of the one-man car disappears.

Nevertheless, the localities where headways of at least ten minutes are the rule are numerous enough to permit saying that the electric railways that serve them constitute the real backbone of the industry. In addition, there are many of the larger properties that have lines with extremely thin traffic which may well be capable of expansion by frequent service. Even in sparsely-settled outlying districts, where no short-haul traffic is latent, there are opportunities for one-man car operation, since this offers direct economies in the form of reduced operating expense. The field for the new type of equipment, therefore, is a wide one even though it may not be unlimited, and within this field nothing at present before the industry offers greater opportunities for return.

Obviously all of the advantages of the light, quick-service car would be outweighed if its use involved an increased accident hazard. The actual result is exactly the reverse. The concentration of responsibility in a single individual placed where he can see everything that transpires, together with the provision of every device that will obviate the occurrence of mishap, insures the safest possible operating conditions. The earlier fear that at crossings, and particularly at railroad crossings, the one-man car would introduce a new hazard has now generally disappeared. It is evident that if it is necessary for a platform man to go forward to inspect the crossing to insure safety the motor-conductor can do this as well as a conductor on a two-man car.

To sum up, the modern one-man car is not a mysterious panacea for curing all railway ills, but rather a simple business proposition. On a line where the old-style standard cars are running only half filled, the modern one-man car can be substituted direct, and would thereby effect a saving sufficient to pay something like 50 per cent on the new investment, leaving ample margin for writing off the book value of the old equipment. Aside from new cars, many existing cars could be used for this service by providing them with automatic equipments that are characteristic of the new one-man designs. Even where old-style standard cars are operated at approximately full capacity, and where possibilities for developing short-haul traffic exists, headways may thus be cut in half without appreciably changing operating expense, and while the charges due to the new investment would be met by no more than a 20 per cent increase in traffic, a 50 per cent increase would be conceivable under the circumstances. These figures may appear startling, but for their confirmation we commend the reader to the articles which largely make up this issue.

Equipment of the Quick-Service Car an Important Feature

IN considering the economies of the one-man car it must be emphasized that proper design of its equipment is a prime essential. It is useless to expect that, by closing the rear end of an old-style car and taking off the conductor, satisfactory results can be obtained. Platform expense will be reduced, it is true, but it is quite possible and even probable, except on short lines, that the decrease in schedule speed will add to operating expenses enough to offset the eliminated wages of the conductor. In other words, the one-man system of operation involves penalties that must be minimized by improved design, the major features of which include low floor height, power-operated vestibule doors, rapid acceleration, air brakes and light weight. Without these qualifications the one-man car suffers from a serious handicap in schedule speed when compared with a similar car operated by two men. Even with them the one-man system of operation is still under a handicap on speed as compared with a modern two-man car with automatic equipment, but the handicap, owing to the reduced time loss at stops with all modern equipment, is minimized, and when compared with an old-style, two-man car, which the one-man design is usually called upon to displace, the advantage in schedule speed actually lies with the modern one-man car.

We do not mean to say that there are not instances in which present rolling stock can be converted for one-man operation. Several such are cited in this issue, including the Calgary, Alberta, municipal lines. Of course, some cars are suitable for remodeling and some are not, but the general principle holds that the "cut" of modern cars differs so essentially from that of older styles that reconstruction is usually difficult and unsatisfactory. In some cases undoubtedly a transition period can be tided over, however, permitting cars and equipment to be retired gradually, but too much must not be expected of them under such circumstances.

LABOR SAVING DEVICES ARE ESSENTIAL TO SECURE FULL BENEFIT OF ONE-MAN OPERATION

A separate section elsewhere has been devoted to a general study of the special equipment of the light-weight cars. This shows in detail how motors, controllers, brakes, trucks and other essentials contribute to time saving, to weight saving, to safety and to comfort. Rapid acceleration and braking are the chief factors in increasing schedule speed, and these are made possible by the special motors and braking equipment which have been produced for this type of car. As the operator does not have to wait for a signal to go ahead or to stop he can utilize these facilities to the full, allowing a duration of stop only sufficient to permit him to perform the duties incident to that operation. In these he is assisted by numerous devices for door and step control, fare collection and registration, etc. Attention is directed particularly to the safety features of these cars. They are inherently safe because but one mind is concerned in the operation, and the motor-conductor, being solely responsible, instinctively tends to do the safe thing in any emergency. But he must also be assisted by appropriate mechanism. For example, provision must be made for emergency stops so that if he instantly performs the act to set the stopping apparatus into action it will respond positively in the minimum safe time. Thus the operator will have the confidence needed to enable him to make the best possible speed with his car.

The advent of the new car has naturally proved very stimulating to inventors and designers, as is illustrated in the equipment section and elsewhere in this issue. The motor-conductor's functions are so numerous that he must have every facility for performing them with minimum effort and with maximum reliability. From the present rate at which safety cars are being ordered or reconstructed from older types it is evident that successful devices will have a larger sale. Hence the appeal is not only to inventive talent but to commercial instinct as well. It is safe to predict that the equipment of these cars will be developed to meet the demands made upon it by the transportation department; in fact, it may even take the lead by showing what modern apparatus can do if given a chance.

Fort Worth's Revolution in Service

How the Northern Texas Traction Company, by Giving More, Faster and Safer Service, Has Increased Revenue 10 per Cent With Light-Weight Automatic Safety Cars—More Cars of This Type Now Ordered

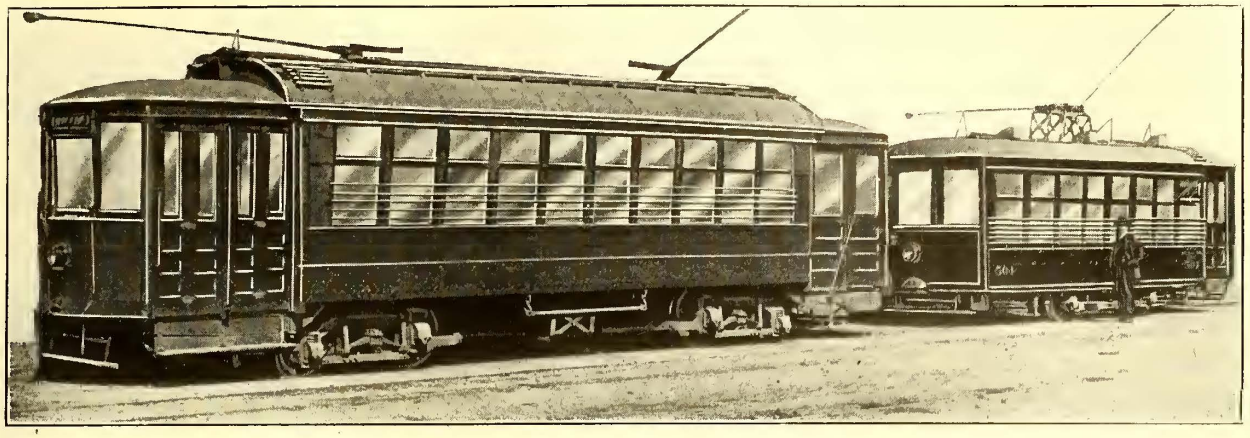
Residential Section Served by Summit Avenue Line

TO the Northern Texas Traction Company, Fort Worth, Tex., belongs the credit for the first extended and thorough trial of special light-weight cars designed for rapid service and equipped with automatic devices for safe handling by one operator. While the so-called "one-man" car is by no means new, the combination of all the foregoing features in a "safety" car involves unique factors and advantages. The results accomplished by these cars have been so impressive that one of the many railway men who visited Fort Worth to study their operation well expressed the prevailing opinion when he said: "This is not street railroading; it is a new kind of business."

There is something about the Forth Worth pioneering that will inspire the operators of electric railway properties with a new faith in their profession. It is not the mere substitution of a car with one operator for a car with a motorman and a conductor. It is far more than that. It is a frank recognition of the fact that old standards of car service must go by the board; that the American public, educated by the swifter, more comfortable private automobile, has set new transportation standards which the electric railway must satisfy or else relinquish its position as the people's common carrier.

The day when an electric railway figured on the largest possible car has gone by. The day when it must figure on a larger number of safer, faster and more attractive cars is here to stay. The railway which thinks it can fool itself and the public by nailing up the rear vestibule and discharging half the platform men is not going to get very far with either the public or its men. It must show, as Fort Worth has shown, that its first thought is "more service" and not "less expense." This can be proved to the satisfaction of the public and the employees only through replacing the existing large cars by an adequate number of small cars, which must be new or be equipped with modern automatic safety devices so that they will fit the job. In these days of world-wide warfare and unprecedented demands for labor, the fact that the small cars can be readily handled by one operator is an advantage that accrues to the public as well as to the railway, and this advantage will not be questioned by the public if it gets what it is after—safer, quicker and more abundant service.

The jitney years—1915 and 1916—were as hard



Summit Avenue Line—Displaced Car (in Front) and New Safety Car (in Rear) at Fort Worth

on the Fort Worth company as on many other properties. The jitney finally withdrew from this field as it did elsewhere in many cases, but it left behind the lesson that infrequent headway has no place in a city where walking distances are short and private automobiles many.

Experience in many places had shown that the jitney could not live and that the private automobile had less effect on revenue if the service was increased, say 50 per cent or more. But how could the railways afford to keep up the better service and make money?

Consideration of this problem led to the design of an entirely new type of car which would take such complete advantage of every development in car design and car-operating devices that more cars could be operated at less cost with respect to power and maintenance requirements, and that one man would be easily able to operate the new cars faster and more safely than the old standard cars could be operated by two men. In the Birney car the dream has come true. Hereafter this car will be standardized for light-weight car conditions on Stone & Webster properties from the smallest to the largest.

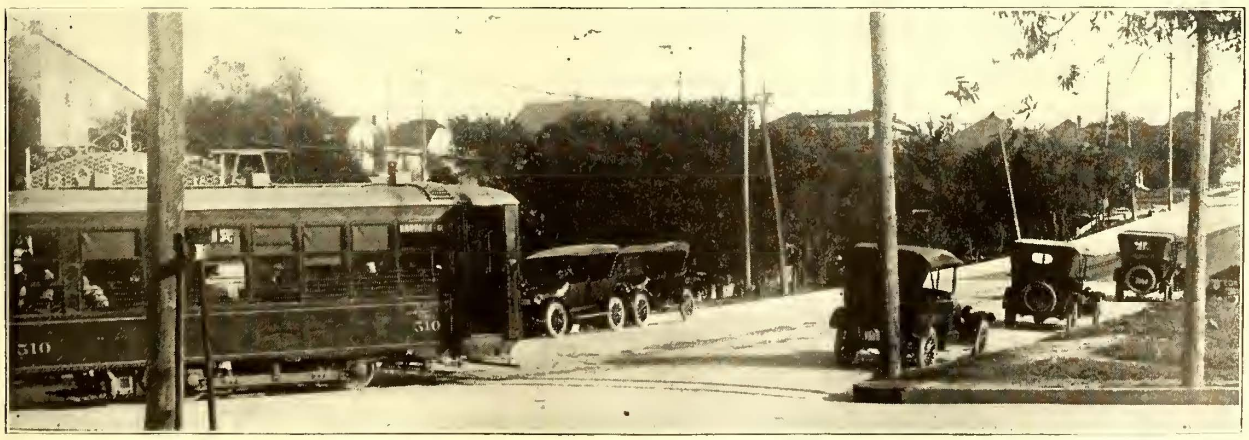
The Construction of the Car Itself

The Birney car has been described and it has been exhibited, but description and exhibition do not tell the story. The accompanying interior and exterior views will help the reader to visualize the car. One must ride in it, however, to appreciate the possibilities of starting and stopping at the rate of 3 m.p.h.p.s. with no jerking or excessive vibration. One must ride to see how the operators on a single-track line make their time points. One must ride to see how quickly the car is stopped, the door opened, the passengers gotten in or out, the money placed in the box, the transfers issued, the door closed and the getaway made. One must ride to appreciate many other things that appeal, each in its way, to the railway man, the car operator and the rider.

To refresh the reader's memory, the main facts concerning the first ten double-end cars at Fort Worth are recapitulated:

Length over all	27 ft.	9½ in.
Length of platforms over dasher	4 ft.	6 in.
Length over body corner posts	17 ft.	9½ in.
Width over sheathing	7 ft.	6 in.
Width over all	7 ft.	10 in.
Rail to floor	2 ft.	3 in.
Rail to roof	9 ft.	9 in.
Seat and post spacing	2 ft.	4½ in.
Width of entrance and exit doors (in the clear)	2 ft.	6 in.
Aisle width		20 in.

It is to be noticed that in the subsequent adoption of this car as a standard, the over-all width of the car has been increased 2 in. to allow a 22-in. aisle, thus reducing the liability of congestion and allowing freer access to the rear platform, which is used by smokers.

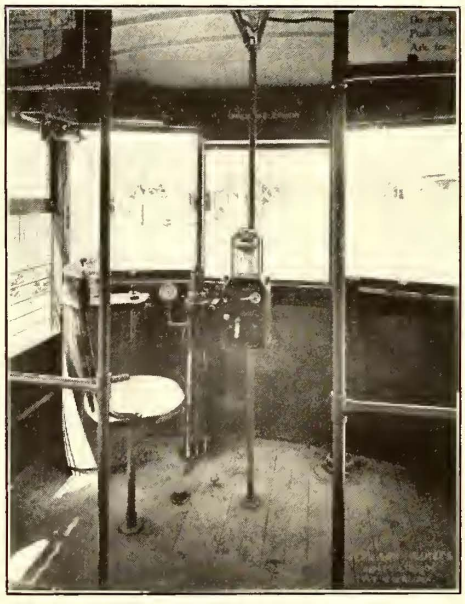


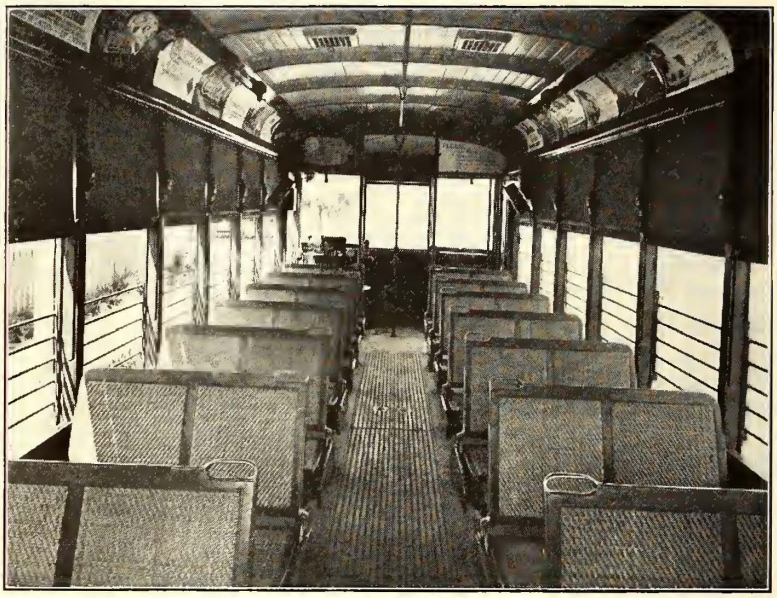
Summit Avenue Line—The Safety Cars have Their Share of Severe Grades and Curves in Fort Worth

The present cars weigh 13,400 pounds complete, and all maintenance experience so far indicates that strength has not been unduly sacrificed. The Brill 78-M-1 truck of 8 ft. wheelbase has 24-in. cast-iron wheels with Hess-Bright ball-bearing journals. The proved value of anti-friction bearings in permitting higher acceleration and lower energy consumption points to their use on all future cars of this type. The two GE-258 motors, rated at 25 h.p. each of 600 volts, used with K-63 controllers easily withstand the tremendous rates of acceleration as shown for level track in the curve on page 475. Likewise, the Westinghouse DH-16 compressor takes good care of door operation as well as braking. The cars originally had but one trolley pole. Now they have two, each with a Keystone catcher, so that the operator does not have to leave the car at turn-backs.

Divers People Served by the Summit Avenue Line

The Summit Avenue line was selected for initial trial of the new car, beginning Nov. 1, 1916, because of its diversified traffic conditions. It is estimated that about 10,000 people are served by the cars on this line. They comprise the workers in the business district, the people in a high-class residential section and those in a settlement of poorer workers. An idea of the varied character of the districts served may be secured from the illustrations on page 475. If the cars were satisfactory under the conditions of the Summit Avenue line, it was thought, they would be a success almost everywhere.





Summit Avenue Line—Operator's Equipment of Fort Worth Safety Car, and Interior View

The Kind of Service Offered

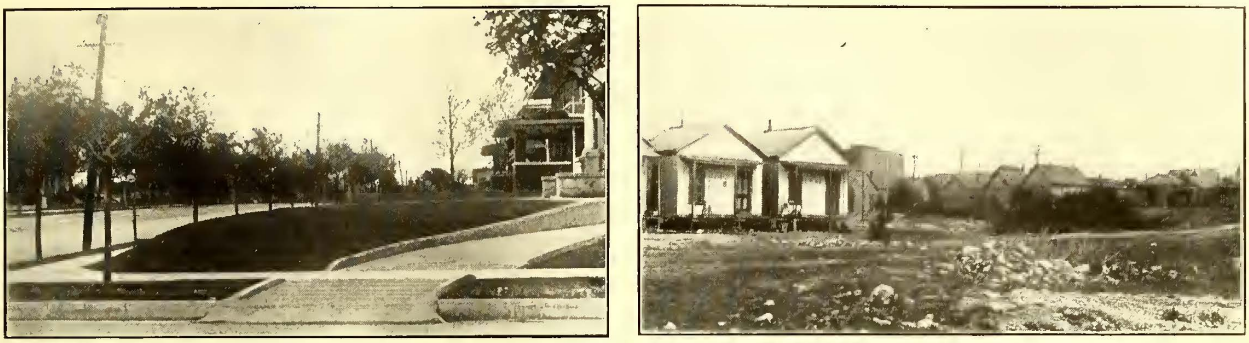
On Nov. 1, 1916, all of the double-truck cars on Summit Avenue were removed and the new cars installed. The headway from 8.30 a. m. and 3.30 p. m. and from 8 p. m. to midnight was cut from fifteen to ten minutes. Between 7 a. m. and 8.30 a. m. and between 3.30 p. m. and 8 p. m. it was cut from seven and one-half to five minutes. This was accomplished not alone by raising the maximum number of cars from six to eight, but also by raising the schedule speed 12.5 per cent (8.9 m.p.h. to 10 m.p.h.). This means that the round trip of 6.64 miles is now made in forty instead of forty-five minutes. With the five-minute service, the operators have to make seven meets on this line. A Nachod headway recorder at the center of the line is an encouragement to uniformity of headway. A specimen record is reproduced on page 476. The average haul is just 2 miles.

A typical comparison of service follows: Regular trips raised from 146 to 210; extra trips from fifty-four to ninety; regular car-hours from fifty-four to seventy-four; extra car-hours from twenty-one to thirty-four; regular car-miles from 485 to 698; extra car-miles from 179 to 299.

Incidentally, it may be mentioned that the high rate of acceleration gives the cars a bucking power which enabled them to weather an 8½-in. snowfall in January, 1917, better than the bigger cars were able to do.

Preliminary Publicity—The Public Response

When the new cars were received and made ready for service, the company decided that any extended advertising of their merits was undesirable. It was thought to be best to put the cars in service and let them speak for themselves. So all that was done was to distribute a four-page pocket pamphlet to the riders of the Summit Avenue line just a day ahead of the change. The people were told that they were going to have "More frequent, more rapid, more safe, more up-to-date service" and that judgment was up to them. The pamphlet, the front of which played up these points, contained explicit



Summit Avenue Line—Both High-Class Residences and Poorer Quarters Are Served by the Safety Cars on This Fort Worth Line

instructions as to fares, transfers, use of platforms and alighting.

That such publicity and the cars themselves have impressed the public is shown by what the patrons to-day tell inquisitive strangers. The remarks are of this order:

"I don't use my auto any more in making calls on Summit Avenue."

"I used to get many a lift on a friend's auto while waiting for a car, but now I am aboard these little whizzers before my friends show up."

"I wish they would put this car on other lines."

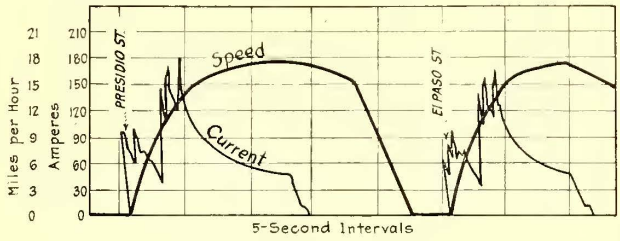
It will be noticed that the public sees clearly that it has been provided with more and better service and that it hardly stops to consider whether there is one operator on the car or two.

FARES, EMPLOYEES, STOPS AND COSTS

The cars are equipped with Johnson fare boxes for single registration of cash and with pedal-operated International R-10 registers for tickets and transfers. The operator does not cancel these at the time of collection, nor does he make out a separate ticket and transfer envelope for each trip. His trip sheet, shown on page 476, gives the number of fares counted by the fare box and register for each trip, and at the end of his run all tickets and transfers are deposited in one envelope. To date, the results have been excellent.

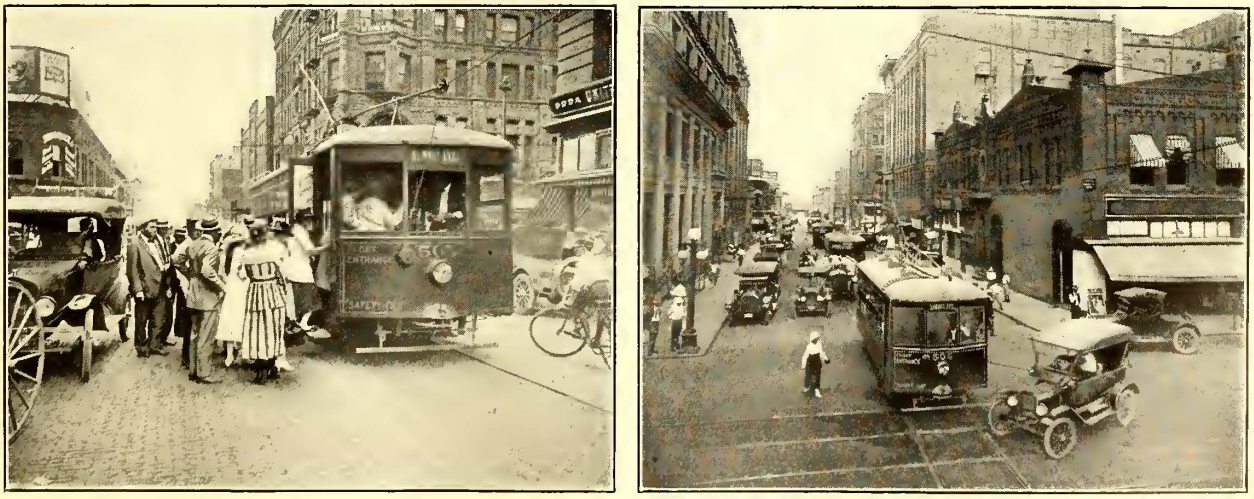
Transfers are pulled by the operator from a pad in his pocket. They are issued on payment of fare. The co-operation of the public can be shown in no better way than by the fact that about 85 per cent of the passengers tender the exact fare. Not more than 20 per cent of the riders call for transfers, one reason being that the downtown terminus is in the heart of the city within easy walking distance of stores, offices, etc.

In beginning safety-car service on the Summit



Summit Avenue Line—Current Per Car and Speed-Time Graphs, Showing Extraordinary Acceleration of 3 m.p.h.p.s.

Avenue line, the company selected its most active men for operators—not men who were the most robust but men who were the most alert. This was done because Summit Avenue was a test line and also was considered more difficult to operate than other lines. A general exercise of this care in selecting operators would not call for any material



Summit Avenue Line—Typical Views of Traffic in Fort Worth's Business Section

change in personnel. The running of the safety cars may be compared to the running of an automobile in that there are more things to do than in the ordinary electric car, but no severe physical effort is required. The doors and steps are air-operated and the hand-brake is only a standby.

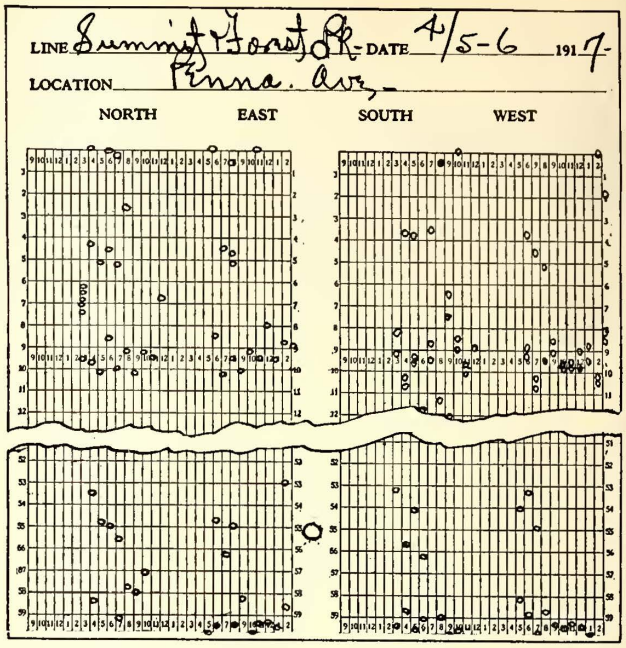
For handling cars on the Summit Avenue line the operators are divided for four morning runs, four evening runs and four split runs. The men are not required to work as many hours as regular motormen and conductors, but they receive at least as much pay for their day's work. On Jan. 15, 1917, after two and one-half months of operation, the operators were told that if they wished they could go back to their old runs without prejudicing their standing. Not one man went back. Ten to fifteen men from other lines are now on the waiting list.

Every car has in the front vestibule beside the entrance a frame containing a card with the name of the car operator. This is gratifying to the men and helps to make the service more personal in character. No badge numbers are used.

A comparison of the old and new cars with regard to stops shows the following for a typical run:

	Old Car	New Car
Total trips	18	22
Total car-miles	59.6	72.8
Total ton-miles	1,135	562
Total passengers	490	346
Total stops	323	326
Stops per 100 passengers	66	94
Stops per 100 ton-miles	29	58
Stops per car-mile	5.4	4.5
Stops per trip	17.9	14.8

The smaller number of stops per trip of the new cars is a material factor in the increased schedule speed. As far as the time of stops for loading and unloading is concerned, the new cars are faster than earlier types because of the low step, the air-operated doors and steps, the easier entrance and exit, and the remarkably high rate of acceleration which permits a very quick return to full speed. The extra time required for positive opening and closing of doors is negligible and is fully compensated for by the elimination of step accidents.



Summit Avenue Line—Headway Recorder Record, Showing How Car Spacing Is Maintained in Fort Worth

(The twin circles are due to overlapping cars of the Forest Park line.)

The following table gives boarding and alighting periods for passenger groups from one to nine:

Passengers in Group	Time in Seconds—Boarding—Total	Boarding—Per Pass.	Alighting—Total	Alighting—Per Pass.
One	6.4	6.4	4.0	4.0
Two	8.6	4.3	5.6	2.8
Three	10.8	3.6	7.6	2.5
Four	12.4	3.1	9.2	2.3
Five	16.2	3.2	11.4	2.5
Six	18.4	3.1	13.6	2.3
Seven	23.0	3.3	16.0	2.3
Eight	26.8	3.4	18.4	2.3
Nine	31.0	3.4	21.6	2.4

While the safety car seats twenty-nine passengers, it has handled in emergencies as many as sixty-five riders—giving the almost incrediblv low weight of 206 lb. per passenger.

The figures below are based on ten days' operation (Nov. 2 to Nov. 11, 1916, inclusive) of new cars compared with eleven days' operation (Oct. 20 to Oct. 30, inclusive) of old cars:

	Operating Averages—Old 18-Ton Cars	New 7-Ton Cars
Average car-miles per day	647	1,099
Average kilowatt-hours per day	1,559	1,088
Average watt-hours per car-mile	2,410	990
Average ton-miles per day	12,199	7,498
Watt-hours per ton-mile	128	145
Average passengers handled per day	4,035	4,541
Average passenger-miles per day	7,787	8,764
Watt-hours per passenger-mile	200	124
Average seat-miles per day	25,065	31,871
Watt-hours per seat-mile	62	34

NOTE—All energy figures are based upon substation readings.

Northern Texas Traction Company

Date 4/3 19 17 OPERATOR'S DAILY REPORT Fort Worth Division

Route Summit Ave. Run No. 8 Operator B. T. Gabbert No. 196

Fare Box No.	FARE BOX READING CASH		No. Fares	Transfer Register No.	Reg. Reading Transfers and Tickets		No. Fares
	When Left	73570			21621		
73	When Taken	73508	62	347	21593	28	
	When Left	73803			21728		
73	When Taken	73606	197	347	21640	88	
	When Left						
	When Taken						
	When Left						
	When Taken						
	When Left						
	When Taken						

Total Cash Fares 259 Total Tickets and Transfers 116

SUMMARY	No. PASSENGERS	AMOUNT COLLECTED
Cash Fares	259	12.95
Tickets, 2¢ for $ .05	14	
School Tickets	6	
Child's Tickets	7	
Post Office Tickets		
Empl. Tickets	3	
Comp. Tickets	1	
TOTAL TICKETS	31	
TRANSFERS	85	
TOTAL PASSENGERS	375	

CAR PERFORMANCE

CAR No.	TRIPS	MILEAGE
501	15	99.7

TRANSFERS

OPENING No.	CLOSING No.
024700	Out
021711	021718

TRIP No.	Started From	TIME	Arrived At	TIME	PASS	FARE BOX READING	TICKET REG. READING
1		M		M		73308	21593
2	13	2:00 M	26	2:20 M		513	593
	26	2:20 M	13	2:40 M		527	593
3	13	2:40 M	26	3:00 M		532	596
	26	3:00 M	13	3:20 M		541	604
4	13	3:20 M	26	3:40 M		551	611
	26	3:40 M	13	4:00 M		562	614
5	13	4:00 M	26	4:20 M		564	618
	26	4:20 M	13	4:40 M		73570	21621
6		M		M			
		M		M		73606	21640
7	13	6:00 M	26	6:20 M		635	658
	26	6:20 M	13	6:40 M		640	659
8	13	6:40 M	26	7:00 M		652	666
	26	7:00 M	13	7:20 M		657	667
9	13	7:20 M	26	7:40 M		664	672
	26	7:40 M	13	8:00 M		679	673
10	13	8:00 M	26	8:20 M		691	679
	26	8:20 M	13	8:40 M		703	681
11	13	8:40 M	26	9:00 M		716	688
	26	9:00 M	13	9:20 M		719	686
12	13	9:20 M	26	9:40 M		739	696
	26	9:40 M	13	10:00 M		741	696
13	13	10:00 M	26	10:20 M		758	702
	26	10:20 M	13	10:40 M		764	702
14	13	10:40 M	26	11:00 M		773	711
	26	11:00 M	13	11:20 M		778	711
15	13	11:20 M	26	11:40 M		794	720
	26	11:40 M	13	12:00 M		795	720
16	13	12:00 M	26	12:20 M		797	724
	26	12:20 M	13	12:40 M		797	724
17	13	12:40 M	26	1:00 M		801	4728
	26	1:00 M	13	1:20 M		803	728
18	13	1:20 M	10	1:40 M		73803	21728
19		M		M			
		M		M			
20		M		M			
21		M		M			

Starting Readings

Summit Avenue Line—Copy of Report for Day's Work Made by Safety Car Operator in Fort Worth

The present energy consumption is materially less than that shown in the table, for through the use of Rico coasting recorders the average coasting has been raised to 30 per cent. It is interesting to add that the air used for operating doors, steps and brakes requires 3 kw.-hr. per 100 car-miles or 30 watt-hours per car-mile.

Revenue Increase of 10 Per Cent

It is clear that the new cars will show a reasonable return upon their cost without credit for salvage from old equipment and with possible charges for completion of amortization of investment in this equipment. The question remains: To what degree has the public shown its appreciation by more riding?

In a way it is difficult to answer this definitely because the increased business has been due to several causes, such as better times, eliminated jitneys and drafts from nearby lines. Yet, when all allowances are made, it is fair to say that of the $992 increase in revenue (18.4 per cent) shown for November, 1916—February, 1917 as compared with corresponding months the year before, at least half or say 10 per cent was caused entirely by the better service—26.4 per cent more car hours and 34.1 per cent more car miles. Such an increase combined with a decrease in the cost of operation and maintenance is the most hopeful sign of a new day in electric railroading.

Plans for the Future

The public approval and the financial success of the original ten cars above described have led to the prompt ordering of fifteen more of the same type for further improvement in service.

These two purchases by no means measure the extent to which the new transportation standard will be adopted in Fort Worth. Radical changes require time; the characteristics of each district served and to be served must be studied; the organization must be conserved and adapted to the new methods of operation. Rolling stock, much of which is comparatively new and modern and representative of a large investment, cannot be lightly cast aside.

A considerable proportion of the passenger equipment of any large city system is used for rush-hour service and to replace regular cars undergoing repairs, painting, etc. The efficiency of such equipment, which is used only a small part of the time, is not of vital importance. The officials of the Fort Worth company have made a study of its standard single-truck cars and believe that some of them can profitably be equipped with the necessary automatic devices and otherwise fully adapted to serve as auxiliaries to the new light-weight cars. They may weigh nearly twice as much as the new cars, but the cost of moving the excess weight and the greater wear and tear on the roadbed during a few hours of the day should be less than the added fixed charges on entirely new lighter cars.

It is by no means impossible that traffic studies may disclose some situations where double-truck cars may also be similarly adapted and used, thereby further preserving existing investment. The problem of developing a proper economic balance between new and old equipment by such means is one which will require careful, continued study in the light of experience with the light-weight safety car. It will be a different problem for each community to which such studies are applicable.

Summit Avenue Line—Two Safety Cars Passing on Turn Out

The Design and Development of the Safety Car

It Was Suggested by the Success of the Jitney Bus—It Is Contributing to Progress in Car Standardization

By C. O. Birney

Stone & Webster, Boston, Mass.

THE circumstances leading up to the design, development and introduction of what has come to be known as the safety car date from the winter of 1914 and 1915, which period witnessed the more or less general introduction of the "jitney" in Southern and Southwestern cities. The writer was at Fort Worth, Tex., for a time during that period and observed the startling effect on street railway operation produced by that competitive form of transportation. Notwithstanding the fact that the Northern Texas Traction Company, operating at Fort Worth, was well supplied with equipment, modern in every respect, and was giving the best possible service, the popularity of the service offered by the jitney bus was such that the street cars were operated with greatly reduced patronage and receipts. This loss in itself was, of course, startling and the suddenness with which it occurred and also the rapidity with which it grew were such as to afford ample grounds for a most pessimistic view of the future of the street railway industry.

The Jitney Bus Gave the Cue

A careful analysis of the seemingly attractive features offered by the jitney bus indicated that the people appreciated the higher average speed and the more frequent service which were characteristic of the bus service, and it was but a short step to the conclusion that if the street railway business were to survive it also must offer these same attractive elements. To provide those elements, with the type of car equipment and under the methods of operation then considered standard in this country, would have involved an expenditure for equipment and facilities which could not by any means have been justified, particularly in view of the jitney bus competition. It was recognized at once that radical changes would be required, and that if increased speed and reduced headway were to be provided the operation must certainly be placed on a more economical basis. It will be remembered that the tendency in prices of material and labor was even at that time plainly upward, so that little hope for economy was offered in those commodities under the methods of operation then prevailing. This tendency has since grown to proportions then undreamed of.

As a result of investigation it became apparent that the very desirable elements of increased speed and reduced headway readily combined themselves with the operation of light-weight units of proportions smaller than had been considered standard up to that time. Furthermore, the proposition of operating a unit of relatively small capacity offered hope for additional economy in that the car could, if properly equipped, be operated by one person. Our efforts were accordingly directed at once toward the design and development of such a car unit. It is significant that our determination as to the proper course of development at that time lay along lines which offered more room for effecting economy than did any other in the street railway business. In other words, the economy to be derived from the reduced cost of propelling the car and the reduction in platform expense were much greater than could have been assured by improvements and efficiency in any other part of the street railway organization. That situation still holds good, particularly on account of the high cost of labor and material prevailing at the present time.

The proposition of operating safety cars was taken up by Stone & Webster and, after mature consideration, the writer was instructed to make an investigation as to the ability of the several manufacturers of street railway equipment to provide the necessary apparatus. The problems facing the street railway managements were placed squarely before car builders, and while the development was then in a very early stage, nevertheless hearty co-operation was received. The manufacturers mentioned hereinafter concurred in our idea that a tremendous effort was to be put forth to prove to the public that street railway transportation was after all the best transportation for general city service.

It was finally determined to construct two cars as a sample or demonstration cars, and arrangements were made for the bodies to be built by the American Car Company of St. Louis, the trucks by the J. G. Brill Company of Philadelphia, the electrical equipment by the General Electric Company of Schenectady, and the air-brake and safety-control equipment by the Westinghouse

Traction Brake Company of Wilmerding, Pa., all of the parts to be assembled at the American Car Company shops.

CARS FOR DIFFERENT CITIES BUILT IN SAME PATTERN

While these cars were under construction the following were ordered: Ten for Fort Worth, Tex.; four for Bellingham, Wash.; three for Everett, Wash., and one for Keokuk, Ia. The two sample cars were placed in operation in Seattle, Wash., and Everett, Wash., respectively, with the result that it was soon evident that in order to secure a fair test of the new idea of car operation, as well as the apparatus involved therein, it would be necessary to equip some one line with cars of this type so that the operation could demonstrate its qualities. For this purpose the Summit Avenue line in Fort Worth, Tex., was selected, and safety-car service was inaugurated there on Nov. 1, 1916. Its success was so complete and the outlook so promising that Stone & Webster have since placed orders for 159 new cars of the same type for use on properties which they manage. These cars are being built from the same designs, patterns and templates, notwithstanding the fact that they are to be used in different cities.

A remarkable condition has developed with respect to car construction as evidenced by the fact that the term "standard safety car" is now frequently used. It is a fact that very rarely have any two railway operators selected the same type of car; and furthermore, very rarely has the same operator selected any given type of car twice in succession. Our aim in the production of the safety car was to provide one which could be operated on any street railway property. On account of the same considerations which warranted Stone & Webster in placing orders for 159 of such cars, it is apparent that the numerous requirements of individual operators could easily be grouped and treated in such a way that a single type of car would be applicable to many different properties. Pursuance of that idea in our case paved the way for simplicity in car construction, promptness in delivery and great economy in the purchase, not only of the cars themselves, but of spare parts required for storeroom stock. There is no reason why car builders should not be able to build such cars in bulk like automobiles, leaving it to the electric railway engineers of the country acting together to propose improved standards.

LESSONS FROM THE FORT WORTH INSTALLATION

The actual operation of these cars in Fort Worth has demonstrated that increased average schedule speed with decreased headway and more economical operation can be secured in practice. These were the elements which prompted the development of the safety car. Following the inauguration of successful operation of this type of car, and as a direct result of the widespread consideration being given to it, many ideas have been advanced with respect to extending its field. Observation of the results attained at this time indicates that a lightweight car of larger proportions and still controlled by one person may materialize in the immediate future, and this is especially true at present when, as a result of the national stress, the conservation of man power becomes not a question of economy to the street railway industry but rather a patriotic duty. Suggestions have also been made relative to operating a considerable number of small units in trains in order to avoid congestion in city streets. It is not believed that this will prove popular or profitable, for the reason that once a number of the small units are coupled together they become, in loading and unloading characteristics, very much the same as a single large car. They thus lose the advantageous features of the small unit with less work to perform, which is capable of getting over a given piece of track quickly. As a general proposition, the smaller the car unit the more flexible is the car service, and the question as to whether a sufficiently large number of small cars can be operated through certain streets in a city depends largely on the track layout. Certainly the economy now secured in the operation of this type of car justifies more extensive track facilities in the center of a city than was justified by the large cars heretofore used. There is obviously a time in the growth of any city when it may be necessary to get away from the idea of operating all of the cars on some one particular street. While the operation of relatively small-capacity safety cars is not now necessarily coupled with the growth of the respective cities, it is an increase in service and therefore demands provision for eliminating congestion.

SAFETY CARS SUCCESSFUL UNDER PROPER OPERATING CONDITIONS

The expansion of safety-car operation into general city service has been much more rapid than was the case with the many other innovations. Its extensive use, however, must come under a process of careful thought with respect to its direct application. Coincident with its introduction, there have operated a considerable number of restraining influences brought about by city councils, state legislatures, state commissions, etc. Notwithstanding this, however, there is no instance where the success of the operation has not followed when the railway operator was possessed of a sufficiently broad vision to share part of the economy secured with the public in the way of better car service and with the car operators in the form of increased wages.

In general it may be said that the best method of inaugurating the new form of service is by means of new cars especially built for the purpose, sufficient in number to equip some one line in any given city, so that the meritorious features of their operation may stand out unhampered by restrictions involved in older types of cars. At any rate where this method has been followed there has not been a single instance in which economy of operation and success have not been realized.

The "Quick Service Car"

The Writer Believes that This Type of Car Has a Place in Cities of Medium and Larger Size, but Considers that for Such Cities Two or Three-Car Trains Will Be Necessary During Rush Hours — Other Suggestions Are Made

By F. W. Hild

General Manager Denver (Col.) Tramway

IN these critical days of the electric railway industry those who are charged with the responsibility of directing and financing these properties find themselves faced with difficulties which in variety and magnitude are experienced in perhaps no other industry. This has necessitated study of the various problems with an anxious care that must in the end result in good for the industry.

These difficulties are partly due to the fault of the electric railways themselves through the unwitting mistakes of the earlier operators or pioneers in the industry and also partly to causes entirely beyond the control of the railways.

In the former group are such things as overexpansion on many systems and also the old agreements to carry passengers for abnormally long distances for excessively low rates of fare, whether or not this resulted from the expansion of the city limits or the operation of the universal transfer. Still another is the failure generally among electric railway properties to recognize the need to provide adequate depreciation and renewal funds out of earnings. As the result of these things, on many such electric railway properties, particularly in the western part of the United States where overexpansion has been more general, the companies have been "selling goods below cost" and are therefore on a precarious economic basis.

In the second group of difficulties and in addition to all the foregoing are those adverse forces which the electric railways could not fully control, such for example as the diversion of transportation revenue by reason of the marvelous development and growing use of the automobile. Another is the heavy burdens laid upon the utilities through the various forms of taxation, and finally there are the enormously increasing costs of labor and materials. The second group has, of course, super-imposed its burdens upon the first group with the result that the economic position of the industry as a whole is seriously menaced.

If electric railways as developed in this country were but a passing phase of transportation, the problem would be of serious concern perhaps only to the investor in railway securities, but such cannot be the case and no discussion seems necessary to show the absolute economic necessity, now and for the indefinite future, of these properties and their immense importance to every community and to every citizen. Manifestly, the obvious and most sweeping remedy is a higher unit of fare sufficient to enhance the revenues to meet all expenses including an adequate return to the investor, and quite properly this is receiving the major consideration of the thoughtful and influential members of the electric railway fraternity.

In the meantime, the growing necessities of the situation have caused the highly able and inventive genius with which the industry is so generously endowed to seek by various means to increase revenues and to reduce operating costs, and it is the purpose of the writer briefly to discuss one important phase of this endeavor.

The jitney experience with its inroads upon electric railway revenues served to focus attention upon the automobile as an important potential competitor in urban, suburban and interurban transportation, and it has come to be appreciated that the diversion of electric railway revenues has not been confined to the pay jitney but is being accomplished also in surprisingly serious amounts by the privately-owned automobile. The experience of Denver, which fortunately has been free from the jitney pest, may serve in a measure to illustrate the effect of the privately-owned automobile on railway revenues.

A careful and exhaustive study by the traffic engineering staff of the Denver Tramway has served to develop certain data relating to automobiles and their competition which are believed to be fairly close to the facts and at least conservative as to the future. In the study it was assumed that saturation would be reached when there were eleven automobiles for each 100 of the population. With due allowance for other factors which would affect tramway revenues, certain conclusions were derived as shown in the table and the chart on the next page.

Mr. Hild's Recommendations

1. Multiple-unit control with automatic acceleration.

2. Vestibule connection affording passageway between cars even while in motion.

3. Further simplification in some of the accessories used on the cars.

4. Still further provisions for the comfort and convenience of the car operator.

ESTIMATED REDUCTION IN PASSENGER EARNINGS DUE TO AUTOMOBILE COMPETITION

Denver Tramway, City Lines

Year	Autos in Denver	Reduction in Railway Passenger Earnings	
		Per Auto	Total
1911	3,190	$50.00	$160,000
1912	4,000	45.00	180,000
1913	4,968	41.50	206,000
1914	6,120	39.00	238,000
1915	8,575	37.40	320,000
1916	12,200	36.00	440,000
	Estimated		
1917	16,000	35.00	560,000
1918	19,900	35.00	696,000
1920	25,200	35.00	882,000
1922	28,700	35.00	1,010,000
1924	30,700	35.00	1,073,000
1926	32,400	35.00	1,133,000
1928	34,200	35.00	1,197,000
1930	36,000	35.00	1,260,000

Obviously it is in no spirit of unfriendliness to the railways that privately-owned automobiles divert revenues from these companies. As a matter of fact it means no profit to the automobile owner unless it be the momentary feeling of good-will toward him by his deadhead passengers. In time, of course, these deadhead passengers will become somewhat fewer as the rapidly diminishing novelty, already greatly shrunken, makes the automobile yet more commonplace. On the other hand, as long as prospective electric railway passengers find more frequent opportunities to be carried to or near their destinations in the passing automobiles of their friends, just so long may the diversion of revenues from electric railways be expected to continue. Manifestly the remedy for this spells better, faster and more frequent service by the railways, and so, as a matter of important business consideration and in justice to themselves as well as in fairness to the private automobile owner, serious study and effort should be made to solve this particular problem. It is true that in our largest cities the automobile is not regarded as a factor adversely affecting the earnings of urban transportation companies. On the contrary, it might even be considered a welcome aid, for the problem in our larger cities as a rule is to devise ways and means to handle satisfactorily the enormous traffic which constantly offers itself. On the other hand, in the large majority of our cities this form of competition is keenly felt.

Fortunately a large amount of splendid constructive work reflecting considerable thought and careful study put into this, is expressed by the present development of the variously named "light-weight car," "one-man car" and "safety car," but which we in Denver prefer to designate the "quick service car." The origin and development of this car have been so thoroughly described in the technical press that we need only state here that the "quick service car" means one-man operation—therefore a substantial reduction in the platform expense per car; that it is very light in weight—therefore a substantial reduction in power costs and it is hoped in maintenance expense also. Since it is much smaller and much lighter, utilizing the single truck with but two motors, its first cost should be materially less than its big brother, the standard double-truck car. Some ingenious mechanical and electrical devices have been developed to facilitate safe and convenient operation by one man and, in the communities where it is being operated, the "quick service car" as designed to-day seemingly meets the requirements. But so far, this type of car has been used only in the smaller cities, although some experimental trials are being made in one or two larger cities, such for example as Seattle.

The "quick service car," besides having large and attractive possibilities in the way of low operating costs per car, is also deemed to be capable of more rapid acceleration than the ordinary double-truck city car. Hence, we have available the reasonable means of supplying that "better, faster and more

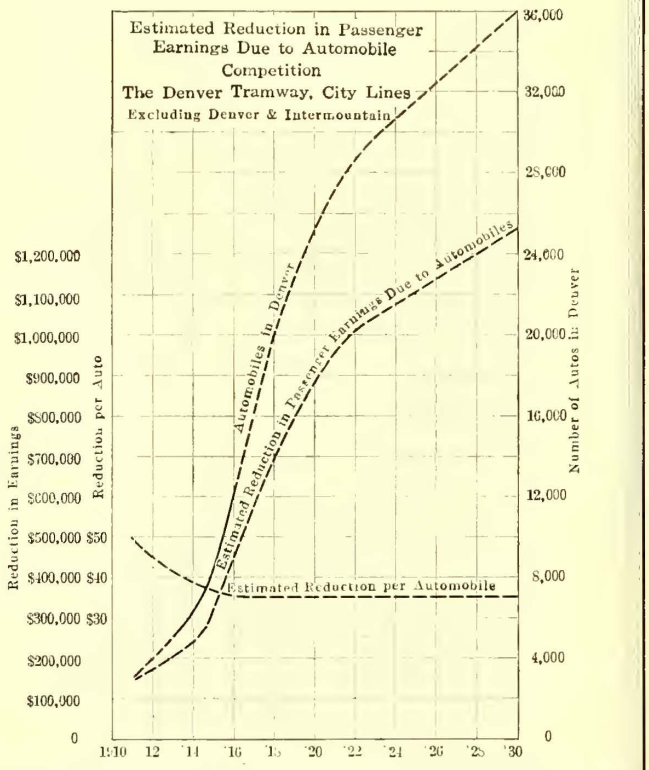


Chart Showing Estimated Effect of Automobile Traffic on Denver Passenger Earnings

frequent service" which should materially help the urban transportation companies regain much of the revenues now being diverted by the automobile and by the impatient individual who will walk rather than wait for the car.

From the standpoint of the public, while there may be expected some objection to a car smaller in size than the ones customarily in use, still the greater frequency and the faster service are so appreciated and welcomed as not only to offset the objections but to induce greater patronage of the cars. Such seems to have been the quite general experience where the "quick service car" is being operated.

From the standpoint of the employee, greater compensation is usually paid to the operator of the "quick service car" than to the platform men of the present standard car. Moreover, the greater frequency of service, together with the continual movement of the "rolling stones" among street car men,

insures to the trainman who desires to continue permanently with the company that he need have no apprehension about his job. Hence, it is reasonable to expect that the "quick service car" will be regarded favorably by the large majority of the employees.

With all these favorable factors the question arises: "Can this type of car be used to advantage in cities of medium and larger size, say up to about 500,000?" The writer is inclined to believe that it can, but certain further developments in his judgment are essential before it may be safely and successfully put into use in such cities. These are:

1. Multiple unit control with automatic acceleration.
2. Vestibule connection affording passage-way between cars even while in motion.
3. Further simplification in some of the accessories used on the cars.
4. Still further provisions for the comfort and convenience of the car operator.

Multiple-unit Control with Automatic Acceleration Desirable

Observation by the writer of the operation of these cars in a Southern city seemed to emphasize the importance of train operation in order to provide capacity during the rush hours. Although it was sought to meet this by operating so-called "double-headers," that is, two cars virtually together, but of course with a certain amount of space between them for safety, nevertheless the American determination to board the first car that came along regardless of its crowded condition, sometimes resulted in sixty-three and more in the little twenty-nine-seat car. If there is anything that will defeat successful introduction of the "quick service car," certainly in the larger cities, it is such excessive loading of individual cars.

When one stops to think, are not problems of urban transportation service substantially the same in all American cities? Thus in the New York subways, on the elevated in that city and in Chicago during the greater number of the twenty-four hours of the day, the train units may be relatively small. In Chicago at certain times single-car units are operated and two-car units quite generally, but, of course, during the one or two hours constituting the morning rush and likewise the evening rush it is necessary to tie together a number of these units, sometimes into six and eight-car trains. In the medium-class cities we find during the rush hour two-car trains or trailers, but generally the service is provided by trippers or additional single cars operated on much closer headway. Clearly the same general periodic flow of the daily travel obtains in practically all cities, the difference being only in degree. Probably 90 per cent of the troubles of the urban transportation companies are traceable to the rush-hour difficulties, and so it is not strange that the present big fifty-seat car is in fact a sort of compromise, reflecting the wish to meet the problem of the one or two rush hours even though the greatest percentage of its capacity be not utilized and therefore wasted during the remaining twenty-two hours of the twenty-four. So we may say that most surface lines operate throughout each of the twenty-four hours of the day relatively large units, each of which in a measure corresponds to the rush-hour train of subway or elevated.

The present development of the "quick service car" is a return to first principles when the early success of urban transportation was made possible by frequent small units. But, the rush-hour service requirements having been allowed up to now to dictate the choice and size of the surface car for the entire twenty-four hours, we should not now turn around and make the parallel mistake of forgetting the rush-hour difficulties and try to force the little car as it is to-day to handle that service.

The theory that frequent operation of the small units will serve to keep down sufficiently the accumulation of passengers at the various loading points seems to work out satisfactorily in the smaller cities and towns where the periodic flow of travel varies only to moderate degree, but under extreme rush-hour conditions of the middle class and larger cities that theory will not hold. In fact, as long as we find our factories, department stores, offices and other business institutions closing at substantially the same time and thus sending out a vast number of people, all of whom wish to get to their homes at the same time, traffic congestion will always be a problem and one which I feel can best be handled by offering adequate capacity, preferably by properly chosen units operated together in trains as on the elevated roads.

A further factor which must not be overlooked is the congestion in the streets due to the space occupied by the various vehicles. There should be no need to dwell upon this, as reflection will bring out the importance of it quite clearly.

Vestibule Connection Between Cars

Some years of operating two-car trains in city service in Portland and Denver have demonstrated quite clearly the desirability of a vestibule connection between the cars. In both cities, prior to January of this year, the far-side stop prevailed, and it was the unfailing experience to see the rear car of the train heavily loaded, with the front car very much less so and often with a surplus of unoccupied seats. Since January, the near-side stop has been in effect in both cities, and in Denver we now observe exactly the reverse. Now the front car is heavily overloaded while the trailers carry much the lighter loads. In St. Louis, where trailers are operated to some extent and where the near-side stop is in effect, exactly the same condition obtains. Vestibule connections would serve to equalize the loading. This, it seems to the writer, is good evidence that it would be highly risky and most unwise to rely upon a number of smaller detached units during the rush hour, for if people will not take the

trouble to go back to the second car of a train and there find plenty of seats, but instead will pack into the first car, no matter how overcrowded, what hope is there that they will pass up a crowded small "quick service car" immediately before them and wait for another, no matter if it is only a block away?

Vestibule and coupler designs for such purposes offer fine problems for the inventive minds, and it is perhaps of interest to say here that a coupler and a vestibule connection to meet the requirements have been designed.

Simplification of Accessories

Putting up to the average platform man the requirement to do the work which we now expect of two men calls for still further development of automatic apparatus and simplification of operations. For that reason alone the controller should provide automatic acceleration; but apart from that, is it not about time that control apparatus be designed as much with remembrance of the human element in the operation as with the view to safeguard the motors and the generating apparatus?

The ordinary K controller is a very effective piece of apparatus in the hands of a very competent or highly efficient trainman, but since in the practical operation of electric railway systems, this man does not remain long on the front platform of a car but is soon advanced to a better position, it follows that the average platform ability is after all what should be considered in the design and functioning of controller apparatus. For we find in practical operation, that the controller is handled in as many different ways as there are men employed to operate electric cars. Thus we have excessively fast feeding or vice versa, or running on resistance points, or widely different methods of acceleration, and these various methods of manipulating controller are reflected in various troubles with the equipment and in operation.

How well this has been appreciated in operating and manufacturing circles is evidenced by the fairly wide use of two auxiliary devices, one the automotorneer and the other the coasting clock. The coasting clock, of course, serves other functions than merely to better some of the existing shortcomings of the street car platform controller. These auxiliary devices have proved to be very helpful but do not get to the root of the problem since the original cause of it all is still allowed to continue, and not infrequently auxiliary devices operate to change earlier troubles into others of different kinds. In the view of the writer, the real answer is to provide city cars with control having automatic acceleration. If this should mean a master controller with contactors I believe railway operators would welcome such a change, particularly if the master controller could be kept within very small dimensions.

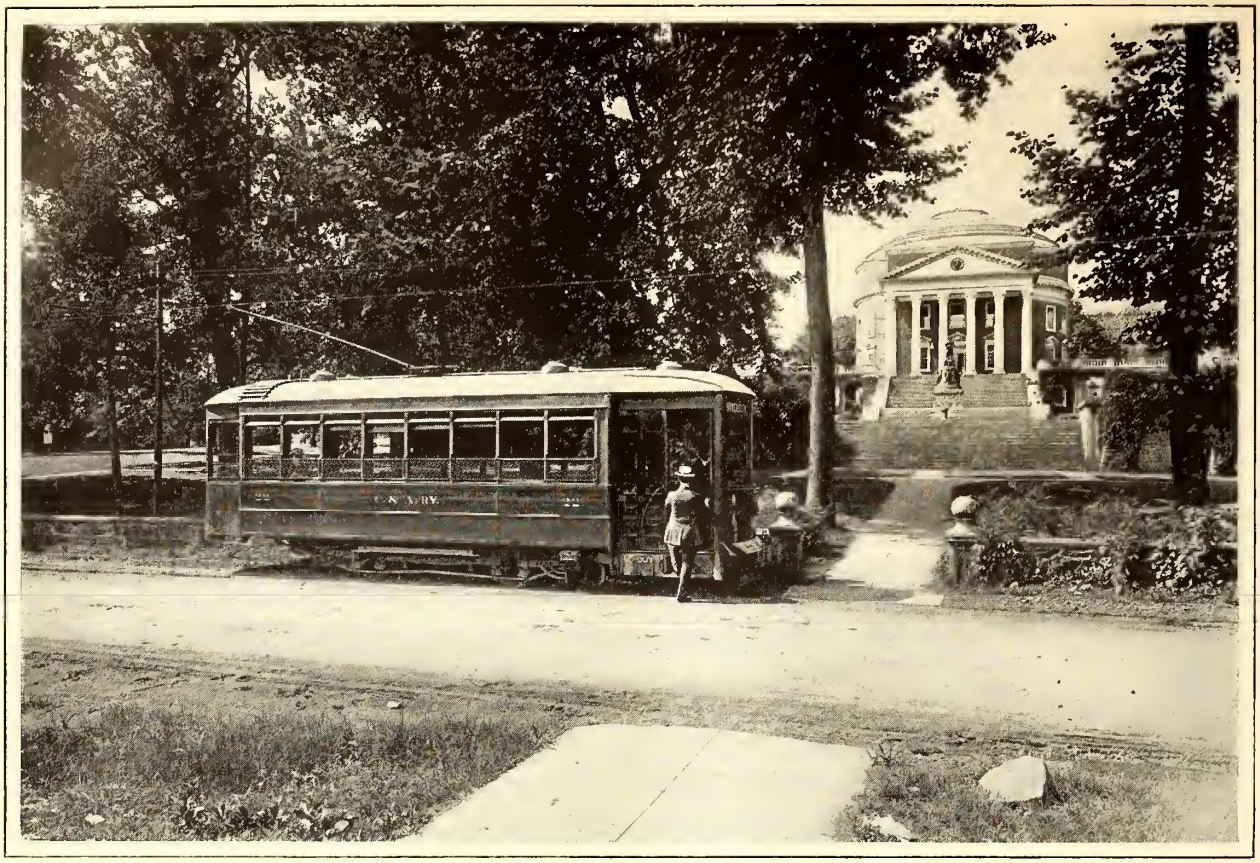
The entrance doors should be pneumatically operated, although the vestibule doors may just as well be opened by hand and be manipulated by the employee in the trailing car.

Comfort and Convenience of Car Operator

Motormen always object to the reflections in the front windows due to the lights behind them when operating a car without bulkheads, and it is undoubtedly an accident risk. That this is appreciated is manifested by the use of auxiliary curtains, but these do not fully meet the requirements and occasion some objection in that the car operator no longer then has a clear view of what is happening within the car and at the entrance and exit. Some day some bright person will point out a very simple solution of this particular problem; perhaps the use of curved glass as on some store fronts may furnish the idea.

With the "quick service car" thus developed the chances for its successful introduction into larger cities would certainly be much better, for then it would be entirely up to the operating organization to provide the needed capacity at the proper place and time. In any event the writer believes that it would be wise to utilize two men per car in the downtown business district during the busier portions of the day. This should usually work out to one extra motorman for each three or more cars. The original operator upon entering the downtown district would become the conductor, and therefore the same man would deal with the cash throughout the trip.

Mr. Hild says that the present development of the "quick-service car" is a return to first principles when the early success of urban transportation was made possible by frequent small units, but as the rush-hour service requirements have been allowed up to now to dictate the choice and size of the surface car for the entire twenty-four hours, he believes that we should not now turn around and make the parallel mistake of forgetting the rush-hour difficulties and forcing the little car to-day to handle that service.



Car in Operation in Front of Rotunda of University of Virginia

A Railway Without an Attorney

The Story of the Charlottesville & Albemarle Railway from the Time It Was a Joke Until Charlottesville Citizens Thought Enough of the Property to Put Their Own Money Into It

THIS is the story of Charlottesville, Va., and its electric railway. Charlottesville, if one includes the surrounding hills, has a population of 12,000. Yet not more than 4000 to 5000 people are near enough to be regular riders. The only favorable feature to encourage riding is the presence of the University of Virginia at one end of the line. There are no industries of importance. Quite a number of people have their own carriages, and still another large number, the colored folk, have no carriages at all and not much for carfare. It is only a few minutes' walk for almost anybody to the heart of the town. Nevertheless, on 3.5 miles of track the Charlottesville & Albemarle Railway in 1916 carried approximately 1,000,000 passengers. How was it done?

The Change That Has Been Wrought

The Electric Railway Journal for Oct. 17, 1914, had an article entitled "Making a Small Company Pay." This told in some detail of the physical rehabilitation of the Charlottesville company—how a steam turbine plant and a.c. distribution replaced reciprocating engines and d.c. distribution, and light one-man cars superseded heavy two-men cars. That article was written two years after the new interests had taken hold and when it was still too early to say that they would get back what they had put in.

To-day, after five years, it is no longer doubtful that Charlottesville has placed the railway in the same class with Thomas Jefferson, the University of Virginia, the First Families of Virginia and the Albemarle pippin—all being matters of peculiar pride and joy. There was a time when it was held a disgrace to ride in the shabby street cars; to-day walking on Main Street is almost a novelty. The reasons are the simplest—clean cars, frequent service, polite operators and the sale of tickets at so many drug and grocery stores that people have become accustomed to buying transportation as an inevitable part of the daily purchases.

It was on July 1, 1912, that a syndicate composed of F. C. Todd, Norman James and John L. Livers took hold of the discouraged scrap-heap called the Charlottesville & Albemarle Railway.

Charlottesville—Examples of How the Company Sold Its Preferred Stock to Local Investors

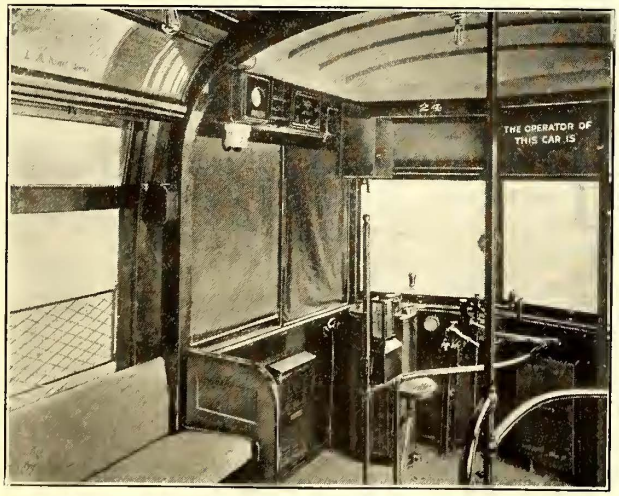
This consisted of 3 miles of track, antiquated cars, an obsolete arc-lamp system and 308 dissatisfied users of electricity. To this scrap-heap were attached certain encumbrances, to wit: A first mortgage of $25,000 at 5 per cent; a second bond issue at 5 per cent, of which $67,600 was outstanding, and loans, notes payable, etc., many personally indorsed by the directors, amounting to more than $26,000.

Since July 1, 1912, all the floating indebtedness has been cleared away, a $350,000 bond issue at 6 per cent has been sold at 92.5 net to pay for the improvements personally financed by the syndicate, and, last but not least, the property has been put on such a sound basis that the citizens of Charlottesville have taken up since April, 1915, an issue of $100,000 of 7 per cent preferred stock at par. Dividends at this rate have been paid since July 1, 1914. Nearly 100 of the most substantial residents now have a paying stake in their local public utility. No better proof than this could be offered of the sound character of the changeover.

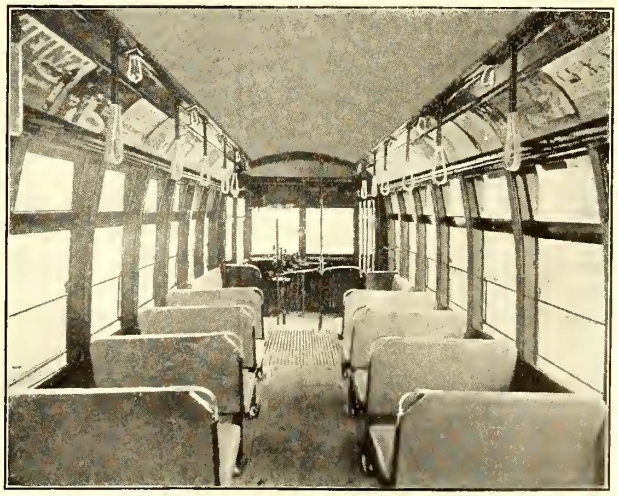
Mr. Livers himself wrote all the advertisements in connection with the sale of stock. Some of these are reproduced as examples of his horse-sense style and ability to make use of questions of current interest, such as the railroad strike then threatening.

WHY THE RAILWAY BUSINESS IMPROVED

The old trackage of 3 miles included a short spur on which a needless shuttle service had been operated. One of the first things that Mr. Livers did on becoming manager was to take up this track and use it for an extension toward the University grounds north. This encouraged the development of the University end of the town and so developed more riding. At the lower end of the town the company had to use a makeshift turntable for its



Charlottesville—View Showing Operator's End of New Light-Weight Car



Charlottesville—The Rides Are Short, but the Cross-seats Help the Riding Habit Immensely

Charlottesville—Views of Interior of Main Office and Winding Stairway

new single-end cars, but finally the Chesapeake & Ohio Railroad permitted the building of a loop at its station there so that people can enter the cars directly from the station sidewalk instead of tramping up an incline. The three sidings on Main Street were increased to five, so that a five-minute service can be given on the summer schedule.

As mentioned in the earlier article in the Electric Railway Journal, Mr. Livers made popular the park at Fry's Spring, the southern end of the line, by converting a deficit-making hotel into a group of cottages and the leftovers into a glazed dance pavilion. As only half the cars go through to Fry's Spring, the car operator blows his whistle once on outbound trips and twice on inbound trips, so that prospective passengers do not have to leave their homes in bad weather until the last minute.

But the great change was in the character of the rolling stock. Before the new cars came, bathtub enamel and scrubbing brushes were freely used as evidence of the new management's good intentions. Then came the near-side one-man cars—there are now seven of them—weighing 18,000 lb. as compared with 24,000 lb. to 30,000 lb. for the old ones. Some views of these cars are reproduced herewith. Through using such cars the platform expense was cut in two. Energy expense was cut even more, for it cost the old plant almost 8 cents a kilowatt-hour and the present cars are billed at 2 cents a kilowatt-hour. Yet the end in economical operation has not been reached, for lately the cars were equipped with "Economy" meters which will pay for themselves many times over.

The cars are 31 ft. 2¼ in. over all and seat

Charlottesville—Not a Colonial Residence but the Office and Salesroom of the Company

thirty-six passengers. The doors are hand operated. Fare collection is simple, as about one-half of the passengers buy tickets and deposit them in a New Haven locked farebox. All passengers, of course, enter and leave via the front platform, but colored passengers take the rear seats. The cars are roomy; the cross-seats comfortable, and the company never passes a nickel.

The operator of the car handles very little cash, because so many tickets are sold through storekeepers. Tickets for adults are sold at six for 25 cents; for children, at 2.5 cents each. The storekeepers receive no commission except on children's tickets, for which they pay $14.25 in buying $15 lots—a commission of 5 per cent. All such transactions are cash. Once there were 20,000 deadhead riders a year—there are none now.

In a town of this size, a booklet of information hardly seems necessary. For all that, the company has got out a vest-pocket booklet with timetables and data for power and lighting customers. This booklet, by the way, cost the company nothing, as it was a part of a local trade directory.

No Accidents—No Attorney

It may be well here to explain the title of this article: "A Railway Without an Attorney." When the present administration came in, it found two other obligations besides those previously named. One of these was a judgment of $1,750 covering paving arrears, and the other was an accident judgment of about $6,000. Both cases were settled. Since the new way of doing things was begun, there have been no accidents or lawsuits of any kind. The Charlottesville & Albemarle Railway is really a railway without an attorney.

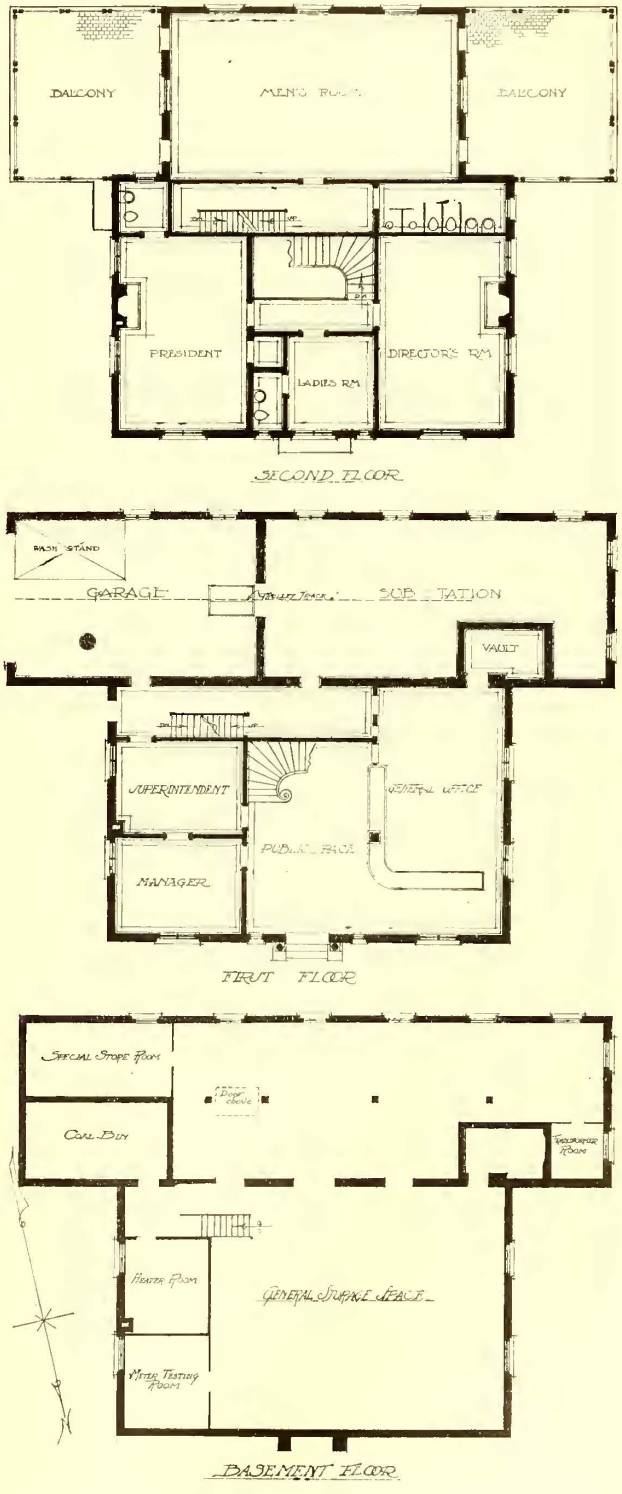
Relations with the Men

This is a short chapter and one worth thinking over. The men receive 17 cents an hour to-day, just as they did under the two-men system. While the total number of cars is seven, the number of trainmen is seventeen. The trainmen, however, also include carhouse men, shopmen and a lamp trimmer, all of whom are available for platform relief duty. Car service is maintained from 6 a. m. to 11 p. m., and the runs are usually eight hours, four in the morning and four in the evening. There is no extra list. The trainmen may be described in the same way as officeholders: "Few die and none resign." Since 1915 every employee of the company has received ten days' annual vacation with pay.

To every man on the property Mr. Livers is just "John." When in trouble they come to him as a matter of course. Nor is there any sense of patronage in this. A fine assembly room is provided for all the employees. When an entertaining talk about railroads—say the great electrifications—is to be given, Mr. Livers invites the big men of the town. It might be said here, by the way, that he is president of the Chamber of Commerce and a member of almost everything in town. No affair is thought to be complete without him. Yet he came to this famous Confederate town from Gettysburg!

The Short, Sad History of the Jitney

In the summer of 1915, when Mr. Livers was attending the National Electric Light Association convention at San Francisco, the jitney appeared in Charlottesville. When Mr. Livers returned, he



Charlottesville—How One Structure Houses the Company from Offices to Substation

maintained throughout the winter the five-minute summer schedule instead of a seven-and-a-half minute schedule, and he kept up the earnings at some increase in mileage. Before another summer came, the Council had passed an ordinance demanding that the jitneys maintain a regular schedule over a definite route and that they furnish a $1,000 bond. *Vale* jitney!

A New Home as Thomas Jefferson Would Have Had It

In and around Charlottesville cluster memories of one of America's greatest men, Thomas Jefferson. Jefferson was the greatest of early American architects, and specimens of his work are found not only in "Monticello" on a mountain overlooking Charlottesville, but also in many of the homes he designed for his neighbors. Therefore, the Charlottesville & Albemarle Railway could pay no finer compliment to the memory of Jefferson and to the town that was so long his home than to put up as a sales and administration building a $20,000 edifice which is a splendid example of Jeffersonian architecture.

The new building, shown on page 486, is located on Main Street at a point where there was formerly a collection of poor shacks. In front of the plot was a small municipal eyesore, which the company has converted into a park. Around the corner is a plot on which a public library is to be built. Instead of a dazzling, garish electric sign to advertise its business, the company floodlights the building at night. The effect of the light on the combination of red brick, white trimmings and green shutters is beautiful instead of blatant. A little modest cast-bronze lettering on the front is all that tells the visitor that this is the home of a corporation and not one of the First Families of Virginia.

The plans on page 487 show how one structure houses an electrical salesroom, offices, storeroom, garage, substation and men's room. A fireproof partition is provided between the building proper and the annex at the rear. On entering the building, the visitor will find that the interior fully harmonizes with the exterior. First to catch the eye is a perfect example of a Colonial winding staircase with a grandfather's clock.

All the sales counters are low, restful to lean upon and free from forbidding grillwork. At the left are the general offices open to every inquirer. Instead of advertising matter, the walls are ornamented with rare prints of Jefferson, Washington and other Revolutionary worthies. In the ladies' room and the directors' room upstairs are other old-time prints. The balcony outside the men's room has made an excellent rostrum for speakers at political gatherings.

While the architecture of the building is eighteenth century, the spirit of the organization inside is twentieth century. The Charlottesville & Albemarle Railway makes no loud noises but works quietly and sincerely, as if everybody on the property really liked his job of rendering service to the public.

Although Electric Railway Journal readers are interested primarily in railway operation and the selling of transportation, it may be well to close with a brief statement of what the Charlottesville & Albemarle Railway has accomplished in the central station business. It began with 308 customers; it has to-day more than 1600 customers—all live ones. The old rates of 18 cents maximum and 5 cents minimum have become 12 cents maximum and 2 cents minimum for large users of electric ranges. When the company has 2000 customers and a lighting income of $100,000, it will make a further reduction in rates. And this is by no means a hundred years away. For the fiscal year, July 1, 1910, to June 30, 1911, the light and power earnings were only $29,004; for the calendar year 1916 they were $68,867.

About one-fourth of all electric range prospects in town are now users of the service. There is not a gasoline engine or acetylene plant in Charlottesville to-day, and practically every workshop or store that can use electricity is now on the mains. One of the sales-getting devices is a paper drinking cup available to a passenger on the Fry's Spring line.

One of the latest customers is the Southern Railway. The company learned that the railroad was about to put up its own substation for 4400-volt signal and lighting circuits to care for service on the main line north and south of Charlottesville. The Charlottesville & Albemarle Railway secured this business, amounting now to more than $125 a month. It also agreed to take care of the necessary transformers and switchboard at its own substation, thus insuring better service than could be given off the distribution lines.

In conclusion, another typical instance of service may be mentioned, convenience for the customer in paying bills. The company prints a postcard statement, the coupon of which it retains, sending the larger portion to the customer. The amount due is payable, as noted on the statement, at either of Charlottesville's national banks. This plan is an excellent accelerator of payment. The old discount of 10 per cent for cash was abolished long ago, as the company found that there was no need of giving money away when the people were satisfied with its service. Furthermore, it is said, when a public service commission fixes rates, it does not take discounts into consideration.

The Moral

The moral of Charlottesville is plain. Good service can change a disreputable, run-down utility into a permanently paying proposition if the men who furnish the brains and the money have the patience to see it through. Those who play fair with the people will find that the people will play fair with them. Surely, Charlottesville can go no further than to invest its money in its home utility rather than in some outside corporation.

The Light-Weight Safety Car and Car Standardization

By W. H. Heulings, Jr.
Vice-President The J. G. Brill Company
Philadelphia, Pa.

The Author Shows That the Standardization Movement Has Received a Great Impetus Through the Advent of the Light-Weight Safety Car

PARADOXICAL as it may seem the transportation industry has been developing toward single-truck, one-man cars for many years. There were evidences of an increasing use of smaller car units before the prepayment methods came into use a decade ago, but the growth was halted by the turning of attention to prepayment schemes and their accompanying door and step-operating devices. Then came the use of steel in under-frame construction, later extending up the sides of cars, and finally including the whole framework and sheathing. This brought about a large reduction in weight. In changing from wood to steel, weight reduction naturally came in for a great deal of attention, especially in view of the fact that for a number of years previously there had been an illogical demand for large capacity cars.

For a time there was a tendency to build steel cars heavier than necessary. Purchasers had to "play safe" and avoid too radical a change in regard to maintenance charges, and builders could not obtain all of the material in the shapes and sizes desired. However, experience was gained quickly, the desired commercial and pressed shapes were produced, and car builders were able to standardize their material to a considerable extent.

Resuscitation of One-Man Car Idea

A number of years ago the managers of a few lines in different parts of the country had the hardihood to resuscitate one-man operation, which had been instituted on horse-car lines throughout the country soon after the close of the Civil War and had saved many a line from bankruptcy. It fell to the lot of The J. G. Brill Company to design and build these early one-man electric cars. This was before the days of steel construction, and of the two-leaf pivotal doors and the simple, balanced door and step-operating devices, so that the one-man cars were rather heavy and unwieldy to operate. Other companies having to reduce expenses, instituted the same system on all or part of their lines. The "Nearside" car, also, has had a wide influence in the field in the direction of one-man operation, because it long ago proved beyond any shadow of doubt that the location of entrance and exit at the forward end only, with doors and steps controlled by the motorman alone, was not only thoroughly feasible but eminently successful.

These were the beginnings, and there was a growing use of one-man cars in the succeeding years. Early in 1915 the engineering department of the Brill company sent out a questionnaire to those railway companies which had equipped their lines with cars purposely built for one-man operation. The answers received were compiled in a table of data which proved the practicability and satisfactory service of the car in every particular. The substance of this valuable table was published and discussed in the issue of the Electric Railway Journal for April 21, 1917, and the data have been otherwise widely circulated throughout the field. They have formed the basis of evidence of successful one-man car operation in many cases placed by railway companies before state public service commissions in petitions for permission to inaugurate one-man car operation.

In July, 1915, the Brill Company commenced a carefully planned publicity campaign on the subject of the one-man car and employed a page advertisement in the Electric Railway Journal each week to develop every viewpoint of improved service and greater economy obtained through their use. These advertisements were continued without a break for more than a year and should be credited with aiding very materially in the preparation of the field for the wide adoption of these cars.

That one-man car operation is both satisfactory and economical is a settled question so far as lines in small and medium sized cities are concerned, and it is very evident to me that sooner or later it will be adapted to parts of the service of large city systems, for present methods which permit the running of half empty cars during the greater part of the day are wasteful of power and plainly evidence a serious lack of flexibility. Managers in all quarters are seeking to rid themselves of this handicap to their earning capacity and to substitute a means for building up their service.

The Time Is Ripe for Standard Cars

From the carbuilders' standpoint, never since the horsecar days has there been such an opportunity to have a standard car as is now offered in the field of railway transportation in small and medium-sized cities, and probably to a considerable extent on the systems of large cities. Toward the end

of the horsecar days a few light-weight, one and two-horse types became standardized and met the requirements of most of the field. These same cars are still built for horse lines in foreign countries. Through this standardization car builders were enabled to turn out better work because their men became accustomed to certain patterns, templates, methods, etc. As a consequence costs were reduced and deliveries were made more promptly. Although it is a far cry from a wooden horsecar to a steel motor car, still there is much that may be made analagous by the focusing of efforts on a few types and developing them. This could replace the previous practice of constantly diverging in the endeavor to meet "local conditions" and working out features that, although good, are expensive to make and maintain because of their peculiarity. Car builders and car buyers are both to blame for this divergence in types, both have been actuated by the commendable desire to improve, but both should have realized long ago the inevitable result of the unorganized furnishing of equipment for an industry spread over a wide area and developing rapidly along similar lines.

However, this more or less useless divergence of car types will automatically cease in time and one of the causes for bringing it to an end is already at hand in the form of the light-weight, one-man car. If the Stone & Webster Engineering Corporation and its engineer of car design and construction, C. O. Birney, in collaboration with the American Car Company, had not produced the type of car that has been and is now being built in such large numbers, doubtless there would have been an indefinite continuation of the multiplicity of divergent types in this class of service. Instead, the field has been given the "safety car" a design remarkably logically adapted to the situation and one that has hit the target of the traffic problem of the average American city squarely in the bull's-eye. What Ford did in the automobile field Birney has done in the electric car field.

Benefits of Standardization

And this is what car standardization, as thus far achieved in the light-weight, one-man type, has done for the manufacturer: It has simplified the purchase of material because the light commercial shapes called for in the design are of sections, sizes and weights that have a large market and are most readily obtainable under normal conditions. It has enabled the parts to be made up in large quantities, permitting the larger steel parts to be painted and stored in the open. It has habituated the workmen to the routine of making the parts and building the cars, insuring greater accuracy and rapidity in the work. It has eliminated the necessity for making preliminary drawings, scale drawings, detail and working drawings, bills of material, etc. It has relieved the engineering department of an enormous amount of computation of strength of material, etc. It has done away with estimating, and has reduced correspondence and other clerical work to a minimum. It has done away with the necessity for new patterns, templates and jigs. It has permitted shop and storeroom organization to be made more specific and efficient, so that machinery and facilities can be utilized to better advantage and supplies ordered in larger quantities with greater definiteness and less waste.

Standardization cannot help but eliminate waste, speed up production and improve the product in any line of manufacture. The comparatively short experience in standardized car construction of the modern steel framed one-man type has proved what has long been evident—*i.e.*, that cars can be built at a much lower cost and in much shorter time if they are reduced to a few standard types for the different classes of service. It is probable that structural differences between types designed for the various classes of service also can be reduced by careful planning so that parts may be interchangeable to an even greater extent.

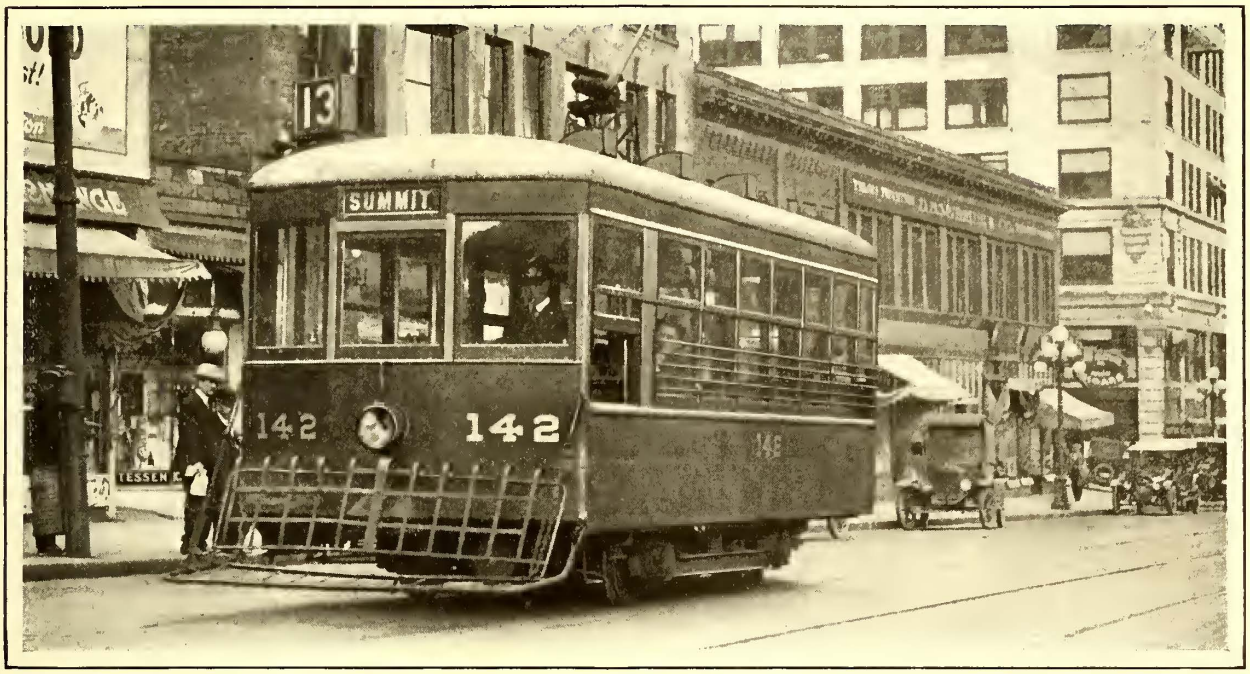
A very promising beginning has been made in the standardization of this light-weight, one-man safety car with its two or three modifications of platforms and its one design of body. It was only to be expected that standardization in cars would begin with the single-truck, city type and doubtless it will soon show its beneficent influence in the other classes of cars. Many railway men believe that the one-man car will prove so strong a competitor of the larger types that in most cities they will soon disappear. Others consider that the double-truck car will continue to have the chief place on the larger city systems, but will be arranged to operate as a one-man car outside of rush hours.

Whatever is the outcome of the impetus given to car standardization through the success of this one-man car, certain it is that the car builders will continue to co-operate in every way to further the adoption of standard types, for it is plain that whatever benefits the transportation industry benefits the car-building industry.

"The field has been given in the 'safety car' a design remarkably, logically adapted to the situation and one that has hit the target of the traffic problem of the average American city squarely in the bull's-eye. What Ford did in the automobile field Birney has done in the electric car field."

—W. H. Heulings, Jr.

Working Out the "More Service" Idea in Washington



Single-End Birney Car Used on Seattle Division

The Puget Sound Traction, Light & Power Company Has Successfully Used Light-Weight All-Automatic Safety Cars on Its Various Divisions for Supplementary Service and Better All-Day Service—Public Has Responded with Larger Patronage

WITH increased cost of service and decreased revenues, owing to higher prices of material, supplies and labor on the one hand and to automobile and jitney competition on the other, the electric railway operator has generally been confronted with the problem of making both ends meet. Increased rates, of course, would cure the condition. But increases sufficient to provide adequate income to insure all operating costs and a fair return on the investment are not possible in all cases, at least not without placing an undesirable burden on the public. Hence the electric railway operator is applying his own genius and initiative in an effort to find the way out.

The automobile has brought one thing home to electric railway managers, *i.e.*, that greater speed and more frequent service with fewer stops are popular. It is in that direction and in the operation of light-weight extra-service cars that some operators are now experimenting, using an all-automatic safety car with a single operator. Among those who are giving this type of car a careful trial is the Puget Sound Traction, Light & Power Company, which has put some of these cars into operation on its Seattle, Bellingham, Everett and Tacoma Divisions in the State of Washington.

The purpose of the experiment is to provide extra service on certain suitable lines up to the saturation point established by such extra service, and to see whether by this means increased revenues can be provided at a less proportionate operating expense. The feeling is that if this can be done accelerated and more frequent service will be furnished to which the public will respond with larger patronage, and increased operating costs will be met without asking too much of the public in the way of increased rates—provided it is done, of course, without causing serious disturbance in existing conditions. If successful the extra-service safety car will eventually mean more cars, fewer stops and more rapid movement—conditions that should meet the popular demand for service reflected in the use of the automobile and the jitney.

In addition to providing the supplementary service referred to above, the safety car has been used to replace heavier, standard cars and to give better all-day service. The conditions under which the new cars were introduced in both cases and the

results accomplished in the districts served by the Puget Sound Traction, Light & Power Company are detailed below.

Seattle Division

The city of Seattle, with its population of about 300,000, is served by more than 200 miles of electric railway lines. Facing Elliott Bay, an arm of Puget Sound, with more than 6 miles of deep water frontage and well-developed wharf and terminal facilities, it is the geographical center of the Puget Sound country. A distance of 3.5 miles back from the bay lies Lake Washington, a deep body of water about 28 miles long. This was recently connected with the bay by a canal to give the largest vessels a fresh water haven.

Between bay and lake the city has extended, largely to the north, to accommodate its growing population and industries. This extension has involved new and longer lines of electric railway communication. The city is one of many hills and, in spite of very extensive leveling activities in progress for several years, many steep grades still remain. Several cable car lines have resisted the inroads of their electric railway competitors, although the inroads did not stop until the cables were all electrically driven.

With these steep grades, long lines and a congested business district, which practically all cars enter, conditions in Seattle impress the casual observer as not particularly adapted to the use of small, light cars. For these reasons, and because of some delays in securing the necessary permits from regulatory authorities, the use of safety cars in Seattle has thus far been on a comparatively small scale. The results, however, have been satisfactory.

Increasing Service 24 Per Cent and Receipts 35 Per Cent

G. A. Richardson, general superintendent of railways, Seattle

Comparative Data of Operation on Summit Avenue Line

	*May 1-June 27	†July 27-Oct. 4	‡Oct. 5-Oct. 12
Car-miles per diem	661	761	834
Cars per hour	7.33	8.46	9.11
Headway in minutes (eighteen-hour average)	8.2	7.1	6.6
Longest headway in minutes	12	12	12
Shortest headway in minutes	5	5	4.5
Percentage increase in cars per hour over first period	.....	15.4	24.3
Percentage increase in receipts	.....	24.5	35.3

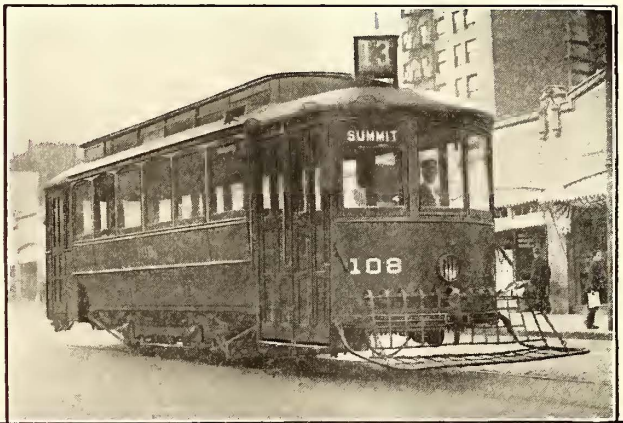
*Before either safety car was added to service. †Specimen period after Birney car was added. ‡Specimen period after remodeled car was also added.

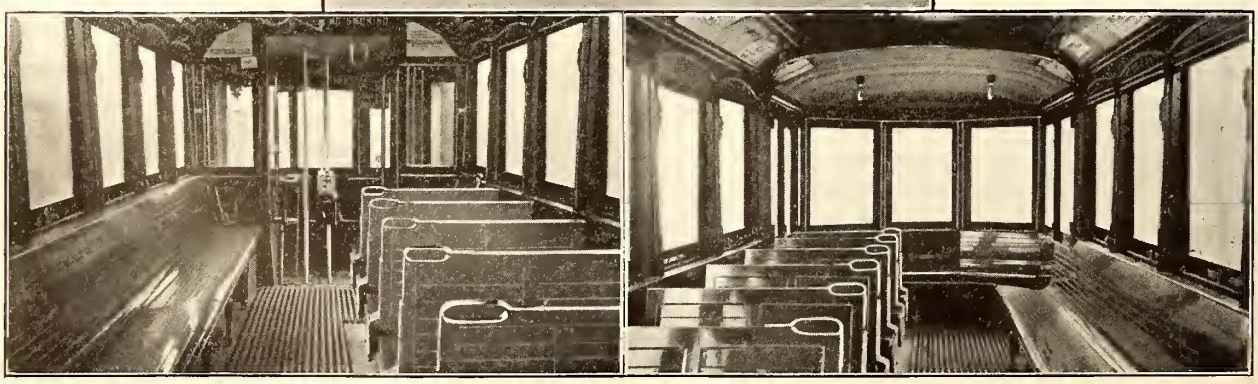
Note—The car-miles and receipts are the average per diem for all seven days of the week. The other figures are from only the week-day schedule.

Division, set forth in the 1915 Convention Number of the Electric Railway Journal his belief that light, extra-service safety cars could be used successfully for heavy traffic to supplement the regular operation of cars of maximum size. He has, since then, interpolated cars of the former type with one operator among larger cars on a forty-second headway without disturbance in car spacing.

The first attempt to ascertain the possibilities of the safety car was made late in 1914 on the Ray Street shuttle. Afterward, during 1915, cars of this type were installed on the Fremont and Ballard shuttles. The following year two extra-service cars were installed on the Summit Avenue line under a city ordinance providing for the operation of one-man cars with approved safety features. These cars were routed over Second Avenue under a forty-second headway during rush hours. One of the two cars is of the single-end Birney type, seating twenty-nine passengers. The other is a remodeled, prepayment, single-truck car seating thirty-six. Both have the same safety devices. The Birney car weighs 10,000 lb.; the other weighs nearly 22,000 lb. It cost only $800 to reconstruct the larger car. The accompanying illustrations show the Birney car (No. 142), the remodeled car (No. 108), and two interior views of the latter.

The installation of these two small cars on the Summit Avenue line





"More Service"—Remodeled Single-Truck Safety Car Used in Seattle, with Two Interior Views

was at different times in 1916, the first being added In June and the second in October. The table on page 492 tells the story of three specimen periods, before and after each car was added to the Summit Avenue service.

The point of this experiment is found in the addition of more service that proved to be self-sustaining. In this case the addition of 24.5 per cent of supplemental service through safety cars brought 35.3 per cent greater receipts.

It is assumed that every route produces a certain net return until a service saturation point is reached. Beyond this point the larger-type car would not earn enough from extra traffic to justify the extra service. Supplementing the service, however, by the lighter and less expensive extra-service car will pay until a new saturation point has been attained. What this new point will be, however, cannot be determined until it is seen how far the public will respond with more patronage in return for the increased service.

More Cars Ordered and Being Remodeled

There are at the present time six single-end safety cars in operation in Seattle—two on Summit Avenue, one on Twelfth Avenue, and one each on the Fremont, Ray Street and Ballard shuttles. All of these cars operate over the entire routes.

The company has on order twenty-five single-end Birney cars and is remodeling twenty-nine more after the model of the heavier prepayment-type car now in use on Summit Avenue. It will operate them over routes adapted to this sort of supplemental service, and it expects from experience to date that the new service will double headways in the close-in districts of the city without loading the downtown trackage to capacity.

Bellingham Division

Bellingham, which has its share of hills and hollows, stretches for about 5 miles along the shores of Bellingham Bay. The waterfront is in the form of a right angle. From the vertex the city reaches back into the hills that border Lake Whatcom. Like most Western cities, Bellingham possesses generous dimensions. For this reason, and in the hope of great expansion for the city, a relatively large track mileage was deemed necessary by those who built the original lines. As a result Bellingham is favored with more trackage—26 miles—than its size really warrants.

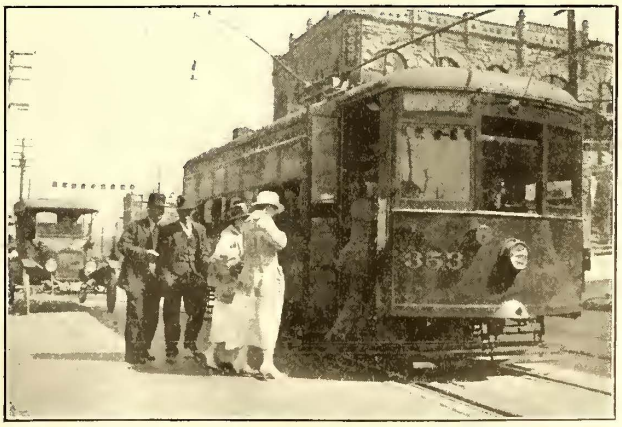
While traffic was better in pre-automobile days than it has been in recent years, the lines have not yielded a profit. The high-water mark in traffic was reached in 1913, when the average revenue per annum from a population of 27,850 was $6.84 per capita. By 1916 the private automobile and the jitney had lowered this average to $4.78 per capita. The prevalence of such carriers is well shown in the accompanying illustration.

As early as 1914, before the jitney began to widen the inroads of the automobile, L. R. Coffin, manager of the Bellingham Division, conceived the idea of a light and fast one-man car. His recommendations could not be met at that time, however, as the all-automatic type had not yet been perfected. It was not until Dec. 6, 1916, that three 13,000 lb. twenty-nine seat Birney cars displaced two thirty-six seat 23,000 lb. single-truck cars on the York-Addition crosstown line. This line is 2.5 miles long and a half mile of its middle section is on the busiest part of the city's main thoroughfare. Since the route is bisected by the business district, a large number of people have no occasion to ride more than half the line, or 1.25 miles.

"More Service"—The Jitney and the Private Automobile Had Worked Havoc with Electric Railway Revenues in Bellingham

Effect on Public and Employees

Public relations in Bellingham had been of the best for many years because the company took the attitude that there were no secrets about a public utility and the community met that frankness with unprejudiced fairness. When the all-automatic



"More Service"—Passengers Boarding Safety Car in Bellingham

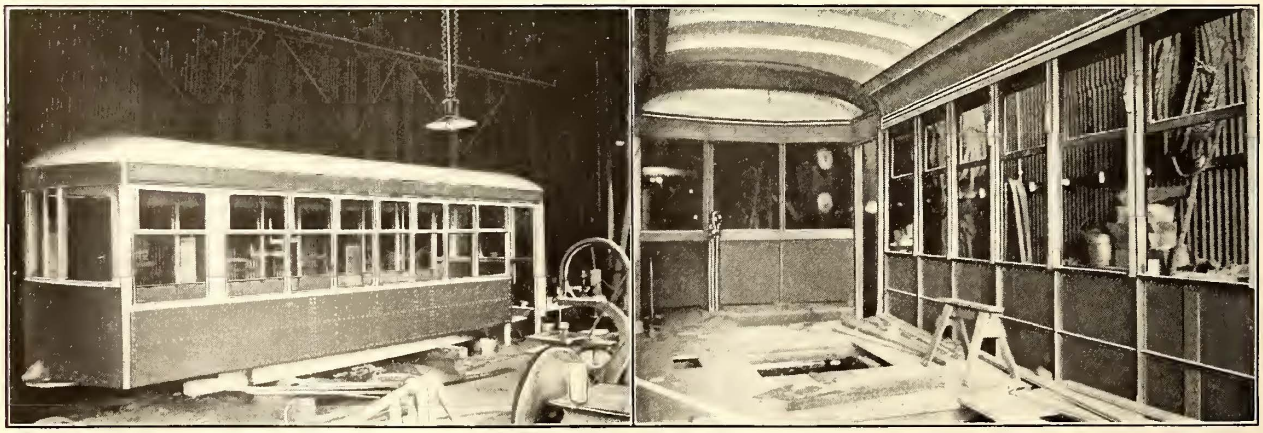
"More Service"—Exterior and Interior of Bellingham Safety Car

car was to be tried out, the management went directly to the City Council with all the whys and wherefores. The Councilmen were taken for a ride on the first car operated, and safety demonstrations were made en route. The result was that they were satisfied that the new cars meant better service and at once became boosters for them.

The Birney cars make the one-way trip of 2.5 miles four times an hour, an average speed of 10 m. p. h., including layovers. This must be granted to be unusually fast city service when it is considered that there are thirty-five safety stops in each round trip. The old cars were unable to make so good a schedule except on very light days. The increase in service, the more certain schedule, the low step and the safety features made a hit with the public, and criticisms were few and good-natured.

The appreciation of the public was shown in the form of increased traffic on the line concerned. For approximately the first five months of operation of the new cars the gross earnings showed a gain of more than 60 per cent over the earnings of the corresponding months the year before. This increase in patronage need not be considered as temporary, for experience is proving that the people are using these cars in preference to walking or automobiling. The State bonding act had eliminated the irresponsible jitneys that were unable to qualify, but some were still left on the short routes. These have now been driven off, however, not by the law but by the economic superiority of the new electric railway service.

In bringing the matter before the employees when the first cars arrived Mr. Coffin called a meeting at which he showed a chart with earnings going down and expenses going up, the curves being due to cross in two years if they continued their rush toward each other. Mr. Coffin told the men that the company had made every possible saving. If it were to attempt a saving by reducing service, it would be cutting off its nose to spite its face. It had concluded, therefore, that the only way to beat the jitney and the automobile was to increase the service by the use of a new-style light car with one operator. Mr. Coffin assured the men that the increase in traffic, car mileage and car-hours would be such that every man then employed would hold his job. After the new cars had been demonstrated, volunteers to operate them were called for. There



"More Service"—Safety-Car Bodies Being Built in Company's Shops at Bellingham

was some hesitation at first, but soon all the men preferred the new cars to the old.

RESULTS OF THE "MORE SERVICE" STUDIES IN BELLINGHAM

The success of the first cars led to a thorough analysis of the system as a whole to see how far the same benefits could be extended. In planning more service Mr. Coffin found that certain lines could be rerouted and through service applied to avoid the annoyance and time-loss of transfers. In one instance, the combined changes gave a residential district the equivalent of a ten-minute instead of an hourly service.

The "more service" studies as they affected the Bellingham electric railway system may be summarized as follows:

Regular cars increased from thirteen to nineteen.
Extra cars decreased from seven to six.
Regular car-miles increased from 781,452 to 1,117,045 (49 per cent).
Extra car-miles decreased from 73,015 to 68,650 (5.98 per cent).
Total car-miles increased from 854,467 to 1,239,695 (45 per cent).

As the greater part of the system is single track, the larger number of cars operated required more passing points, and in preparing the new schedules the management assumed that the delays occasioned by these additional passing points would about offset the speed advantages of the new cars. Hence, in the schedules for the new cars, the running time of the cars was not changed, and the car-hours have increased in practically the same ratio as the car-miles. With conditions more favorable it is believed that the new cars could make considerably higher schedule speed than the old.

THREE SETS OF MODERN CARS IN USE—ONE HOME MADE

The three York-Addition twenty-nine seat cars were made specifically for Bellingham according to Stone & Webster standards. They were built by the American Car Company. Eight cars of practically the same design were purchased from the St. Louis Car Company. These cars have two trolley poles instead of one to save time and trouble for the operator. They are now in service on the main line, which is 4.5 miles long. Six cars every ten minutes have replaced four 40,000-lb. forty-two-passenger cars every fifteen minutes. To secure more clearance for the wheel guard, the resistors have been placed on the roof under the trolley-base stand. The cars have 24-in. wheels and flush platforms.

The company itself has built eight Birney bodies under the direction of Superintendent Hickok. These have been put on the Brill 21-E trucks taken from the discarded single-truck cars, but 30-in. wheels were substituted for 33-in. Consequently these cars have a first step of 13 in., a second and recessed step of 11 in., and a platform riser of 6 in. The old 30-hp. motors and old control were also saved for service. Otherwise the cars were fitted with the Safety Car Devices Company's equipment, Johnson fare boxes, "Duraduct" fiber conduit and other Birney car appurtenances. Various car views in Bellingham are shown in the accompanying illustrations.

Everett Division

Everett is another division of the Puget Sound Traction, Light & Power Company where the "more service" idea is being worked out. Everett and Bellingham are similar in size, but Everett has advantages over Bellingham in topographical features and in the fewer miles of track required to serve practically the same population.

The town is located on a tongue-shaped peninsula, with the bay on the west and the Snohomish River on the north and the east. The possible length of ride north and south is from 3 to 4 miles, and crosstown, east and west, the main line is only 2.2 miles long. Everett has been through the whole gamut of automobile experience, from both private car and jitney. The electric railway operated sixteen jitneys and demonstrated to its own satisfaction that they were not destined to succeed electric carriers, but it also ascertained beyond doubt that frequent service was the strongest point of the jitney. Hence it has turned to the faster, lighter, more-frequent safety car as the cure for jitney competition.

WINNING EVERETT BACK TO ELECTRIC RAILWAY TRAVEL

The first effort to provide this was the substitution in March, 1915, of two remodeled single-truck cars, weighing 22,000 lb. each, for one double-truck car. In October of the same year two more remodeled cars were put into service. In October, 1916, four Birney cars were installed. Service on the River-Bay Side line was then furnished with six one-man cars, as compared to the old service of three two-men cars, and the headway was lowered from ten minutes to six minutes. The result of practically doubling the service was that the jitneys disappeared and the average daily earnings on this short line increased from $77 to $100. The platform force remained stationary, and the car operators received an increased hourly wage, as is the case for the same class of service on all of the other electric railway properties under Stone & Webster management.

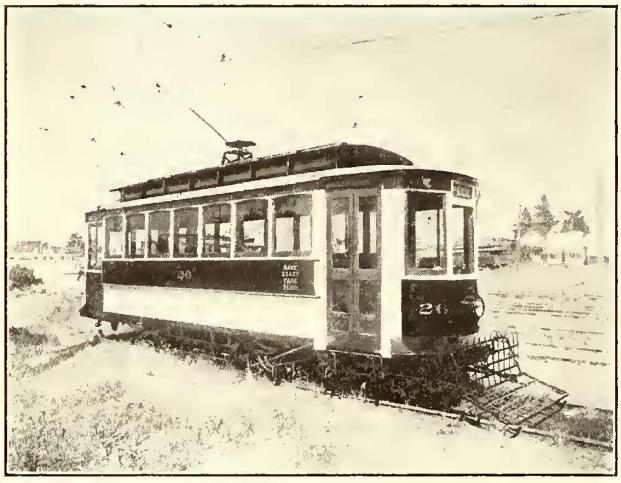
The first four Birney cars were single-enders of twenty-nine seat capacity and weighed only 10,000 lb. each. They replaced double-truck cars weighing from 48,000 to 50,000 lb. The influence which these four 10,000-lb. cars and the four remodeled 22,000 single-truck cars had on the system as a whole by displacing big cars is shown by the fact that in April, 1916, the average kilowatt-hours per car-mile were 3.81 and in April, 1917, 3.01. Another way of expressing this saving is to state that the instantaneous demand basis upon which the company buys power was reduced by 85 kw.

What the saving in paving and track upkeep will

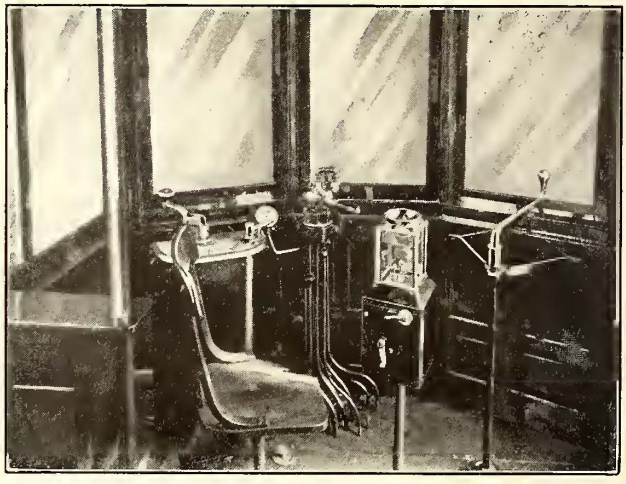
be can only be conjectured. It can be said, however, that 60-lb. rails, whether in brick, block, concrete or asphalt pavement, have not stood up under the shock of cars weighing 48,000 lb. or more. In fact, track put down in 1911 has already required complete overhauling instead of giving twenty years or more of real service.

Besides having four Birney cars in use, the company has ten on order. Eight of these, like the four already in operation, will be single-end for loop line use. The other two will be double-end cars, weighing 13,000 lb. and seating thirty-five people. Four single-truck cars of the remodeled type with the two new ones will care for all double-end operation. Thus, when the change is complete, Everett will have fourteen new and four remodeled single-truck safety cars in place of nine double-truck and four single-truck cars.

The carrying out of the "more service" idea and various industrial changes in Everett have led to considerable rerouting. The Lowell line, the long-



"More Service"—Remodeled Safety Car Operated in Tacoma



"More Service"—Front Platform of Tacoma Remodeled Safety Car

est in Everett, is still operated with double-truck cars. The old smelter line has been looped by way of the interurban station, and a ten-minute service substituted for the former fifteen-minute service. The Colby line has also been rerouted to meet industrial changes, and its headway altered from ten minutes to eight minutes. The rerouted Lowell line is 3.75 miles long, the smelter line 3 miles, the Colby line 2.6 miles and the River-Bay Side line 2.2 miles. Part of the travel of all lines is to the business center.

In short, it can be said with certainty that the "more service" plan, combined with the idea of a "car in sight," is winning Everett back to the electric railway car.

Tacoma Division

At this time Tacoma is operating six cars which were remodeled for "more service" operation. They have all the safety features, including air brakes, deadman's controller handle, pneumatically operated doors and steps, etc. The alterations, including the air brakes and prepayment facilities for double-end operation, cost approximately $1,300 per car.

The original cars were of the convex-concave-side type with monitor roofs and drop platforms. They were equipped with Brill 21-E trucks and GE-58 motors and were operated with hand brakes. The changes made in the car body proper included the removal of the bulkheads and the rearrangement of the seats. The bulkheads were cut off at the height of the inside window sills, the lower portion being cased over and a 1-in. pipe stanchion extended from each section to the end plate. This is arched to conform to the contour of the roof. The opening between the stanchions is 36 in.

Furthermore, for the reason that the width as measured between the posts at the floor line is only 6 ft. 4 in., it was necessary to retain the longitudinal seats along one side of the car. Cross seats were provided on the opposite side. The original stationary steps and manually operated doors on both sides of the car were removed, the left side of each platform was closed and a stationary window installed in its place. On the right side a two-leaf folding door, which swings out and against the body corner post, was installed.

Public Is Pleased—More Cars Ordered

These remodeled cars, views of which are shown herewith, are operated in Tacoma at one-half the former headway, and a great increase in traffic—approximately 100 per cent—has been effected. The public is well pleased with their operation.

Thirty-two Birney cars on order will be installed in connection with important improvements in headway—50 per cent or better. They will replace cars weighing 39,000 to 46,000 lb. and seating an average of fifty-two passengers. It is intended to run these cars on Sixth Avenue, Pacific Avenue and K Street. The Sixth Avenue line has a five-minute minimum headway to-day and this will, of course, be cut deeply by the change. The other lines are now on fifteen-minute headways.

Looking Through the Cedars at the Bay

Meeting the Menace of the Private Automobile at Corpus Christi

Within Two Years the Doubling of Service with the New Light-Weight Cars Improved Public Relations and Brought a Permanent Increase in Traffic of More than 30 per Cent in a Town Where Automobile Riding Was Three Times as Great as Car Riding

FAR down in the southwestern corner of the United States lies Corpus Christi, Tex., along the bay of the same name and adjacent to a country rich in agriculture and just developing gas fields. There are no town industries of importance, Corpus Christi being in many respects a seaside pleasure resort like Atlantic City. The population is about 20,000.

In 1910 an electric railway promoter came to town and blissfully laid down some cheap unbonded rail, paid 3 cents per kilowatt-hour at the a.c. end for energy, bought big, heavy second-hand cars and installed a fifteen to twenty-minute service as his ideal.

When the present owners took hold in the early part of 1914 they found that the real problem was to draw traffic away from the private automobile. In a town like Corpus Christi, neighborly feeling is so highly developed that even the stranger who is observed waiting for a car is invited to step in and ride! The numerous realty men have actually cultivated this practice as a means of business solicitation. The physical configuration of Corpus Christi and the newly-paved streets have also helped the automobile. Although the town is 4 miles long, there is only one outlet at each end to divide the automobile traffic.

Old Versus New Rolling Stock

The old rolling stock comprised nine two-men cars, some single and some double-truck, with motor outfits ranging from two 35 hp. to four 50 hp. per car. These cars were built over for one-man service by inclosing the rear. They all had longitudinal seats except one Narragansett-type open car. The latter was rebuilt by installing sides and screens and replacing the benches with slat cross-seats.

The regular travel, however, is now handled with eight cars purchased during 1915 from the Southern Car Company. These cars are 26 ft. over all, weigh fully equipped about 12,000 lb. and seat twenty-eight passengers. The equipment includes Philadelphia radial trucks, of 9-ft. 6-in. wheelbase and 24-in. wheels, two of the original 17.5-hp. Westinghouse "Wee" motors and National "Featherweight" compressors. The remarkable ability of the motors is attested by a case where a load of 101 soldiers (eighteen of whom were on the roof and eleven on the fenders) actually could not prevent the car from climbing a 6 per cent grade.

A typical comparison between old and new cars showed 1340 kw.-hr. for 1611 car-miles for the new one-man cars, or 0.83 kw.-hr. per car-mile, as compared to 2000 kw.-hr. for 1112 car-miles for old cars carrying two 35-hp. motors, or 1.8 kw.-hr. per car-mile. On the basis of 2 cents per kilowatt-hour for energy, the difference in cost is quite perceptible.

There is no question that the public is pleased with the new one-man cars. The number of stops per mile averages but six, and the schedule speed of 8 m.p.h. answers all local requirements. As a matter of fact, the operator has just enough to do to keep him attending to his business. Sterling fare boxes of locked type are used, for every car passes near the company office every half hour and even at night change can be secured from a local drug store.

Corpus Christi—The Residences on South Broadway Do Not Harbor Natural Street Car Users

Corpus Christi—View of Passengers in Act of Boarding New Light-Weight Car

Most of the fares are cash, as tickets are sold only on the basis of forty-five for $2.

How Service and Revenue Have Increased

The company now operates five routes with a ten to fifteen-minute service on each. Through overlapping, however, the service for thirteen squares in the heart of the town is on a five-minute basis. Since the beginning of one-man car service the gross earnings have gone up with a bound. For the first three months of 1916 they increased practically 30 per cent as compared to the first three months in 1915. The increase over later corresponding periods has been still greater, but the three months noted will serve as an index because they were for periods of 1915 and 1916, which were not complicated by extra travel due to conventions, militia encampments, etc.

During January of this period the earnings per car-mile were 11.2 cents in 1916 as compared to 13.1 cents in 1915, but the expenses per car-mile were only 9.95 cents instead of 13.38 cents. Incidentally, 22,849 car-miles were run in January, 1915, and 37,845 car-miles in January, 1916, an increase of about 70 per cent in mileage, although the power bill rose only 14 per cent. The heavy military riding in February, 1917, brought the gross earnings to 17 cents per car-mile, while the expenses amounted to 12 cents per car-mile.

Comparison of the period from July 1, 1916, to March 1, 1917, with the corresponding previous eight months shows a gain of 31.1 per cent in gross earnings and an increase of only 4.7 per cent in operating expense—the latter including the cost of building 1200 ft. of temporary track to a military camp. During this eight-month period the company carried 1,020,247 passengers with 278,900 car-miles as compared to 836,124 passengers and 241,043 car-miles in the corresponding eight months the year before. The gross earnings per car-mile were 16 cents and 14 cents respectively, and the expenses per car-mile 11 cents and 12 cents. Thus the net

Corpus Christi—Looking North on Chapparral Street, One of the Main Thoroughfares

earnings increased from 2 cents to 5 cents per car-mile.

In short, the condition has changed from practically no net to a fair return on the investment.

A Road Without Accidents or Litigation

The original company was always in hot water with the public, and some hangover suits are still pending against it. The present company has not had a single platform accident of any kind. Its only accident expense is caused by collisions with vehicles. These are due in part to the fact that the use of inclined runways at street crossings keeps traffic to the middle of the street rather than near the curb. If the manager cannot convince the automobilist that he is at fault "for bumping my street car," a modest settlement is made. The accident costs to date have been as follows: July 1, 1914, to June 30, 1915, $341.85, or 0.7 per cent of gross earnings; July 1, 1915, to June 30, 1916, $408.75, or 0.8 per cent of gross earnings, and July 1, 1916, to Feb. 28, 1917, $176.10, or 0.4 per cent of gross earnings.

Other Proofs of Good Public Relations

That the presence of enough clean, bright cars to give ample service and the absence of accidents have had a direct effect on public relations is proved also by the change in sentiment concerning tax assessments and track foundation standards. Taxes are levied separately for the city, county and schools. When the assessors come, the manager escorts them over the property and explains why this or that item should be reduced. Differences in valuation are reconciled upon the ground, no reason being left for later protests and bickerings. The 1916 assessments were from $9,000 to $13,000 less than in 1915.

In the case of track foundations, the city formerly required the use of wooden ties, a 7-in. rail and bitulithic-covered concrete to a total depth of 21 in. The railway built 2 miles of this at $7 a running foot. For the next 2 miles it was allowed to use Carnegie steel ties, which saved 3 in. of concrete and cost $6 a running foot. To-day the company is permitted to use on the outer lines a broken-stone ballast with bitumen macadam, which costs only $3 a foot. These savings are the direct result of better relations, as the railway has no choice but must follow Council regulations. The first rail laid was 70 lb.; the later rail, 60 lb. The company is also obligated to pay for the paving up to 1 ft. outside the rails. It uses Nelsonville filler and stretcher block on the inside and two wood blocks, each 4 in. wide, on the outside.

Relations with the Men Are Good

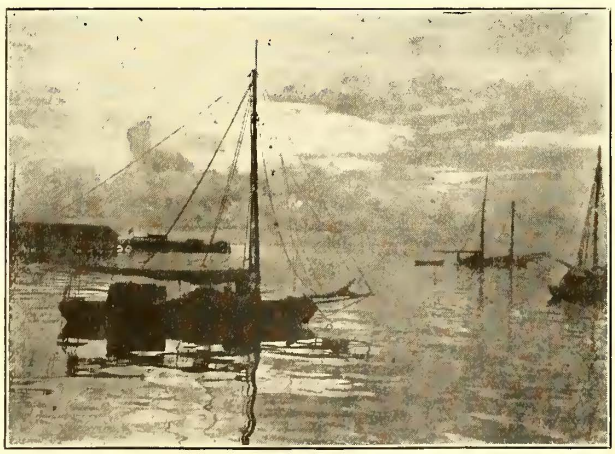
Relations with the men are as agreeable as those with the public. When the employees petitioned for an increase in 1915, they said that they knew the company was not making money, but they felt that an increase would make them better workers, as it would relieve them of financial worries. The increase was granted. That the men are satisfied appears from the fact that their average service is now four years and no new man has been fired for a year. The present wage scale follows: First six months, 17 cents an hour; second six months, 18 cents; second year, 20 cents; third year, 23 cents; fourth year, 24 cents; fifth year, 25 cents; sixth year, 26 cents. It will be noted that this scale is intended to keep off the floater, attract the country boy and hold men after they have become experienced.

Organization of Company

The present company, known as the Corpus Christi Railway & Light Company, is owned by Philadelphia capitalists. It is the successor of the Corpus Christi Street & Interurban Railway and also of the People's Light Company and the electrical end of the Corpus Christi Ice & Electric Company.

In this connection, as an additional testimonial of the effect of service upon public relations, it should be noted that the consolidation of the lighting interests with the railway passed very favorably the test of public opinion in Corpus Christi. A special enabling act of the State Legislature was secured to authorize the amalgamation, but the consent of the citizens was also required. Needless to say, it was secured. Out of about 800 votes cast, only seventeen were opposed to the company's plan.

During 1914 and 1915 three scattered power plants of the company were discarded in favor of one plant. This is equipped with one 400-kw. Buckeyemobile and two 150-kw. Diesel engines, aside from stand-by reciprocating engines. The fuel used is Mexican oil, which permits energy to be generated at a cost of less than 1 cent per kilowatt-hour.



Corpus Christi—Moonlight Boat Scene on the Bay

Operation of Frequent Service Cars in Large Cities

The Author Presents Estimates Based on Actual Cases to Show That There Is a Field for These Cars in Many Such Cities

By J. C. Thirlwall

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Schenectady, N. Y.

NO problem before the electric railway industry is so insistent for immediate solution as that of continuation in business without an early increase in rate of fare. Many companies have declared present fares impossible, and are asking their regulatory bodies for permission either to raise fares or to charge for transfers. Every means possible must be adopted to permit the electric railways to continue and extend their service, whether the means chosen is relief from certain unnecessary burdens, additional compensation or freedom to adopt new operating methods, or all three. And this permission must be given at the "sacrifice of habit" which, as a recent editorial in the ELECTRIC RAILWAY JOURNAL pointed out, is the chief obstacle to securing such relief. It is chiefly the "resistance of habit" which will delay the general adoption of the recently developed single-operator light-weight safety car. Manufacturers are always seeking new tools of greater working capacity to lower their costs of production; cars are the tools with which the railways work. The safety car is essentially a new tool with which more transportation can be manufactured for a given cost. It is the response of the brains of the industry to the demand for greater efficiency.

General Economy of Frequent-Service Cars

By way of illustration of the possible savings due to the use of the one-man car we may assume that it seats two-thirds as many people as the usual city car and costs one-half as much per car-mile to operate. Obviously then the cost per seat-mile or per seat-passenger is less. To put it in another way, assume that two usual forty-four-passenger cars carrying a full-seated load for 5 miles cost $1.70 to operate for this distance (which is fairly close to the average). Then the operating cost per passenger is 1.93 cents. Three thirty-passenger cars could carry the same number of people for $1.28, or at a rate of 1.42 cents per passenger. This estimate is based on maximum conditions, of course, because average loads equal to the seating capacity of the car are hardly ever obtained outside of rush hours or holiday traffic.

If the two forty-four-passenger cars carried only thirty people for the same distance, then the cost per passenger would be 5.67 cents, whereas two twenty-nine-passenger cars could carry them for 2.83 cents. In the opinion of the writer the average value would lie somewhere between these extremes, probably about 4.5 cents for the large car and 3 cents for the small one. The inclusion of fixed charges would increase the relative difference.

From considerations like the above it appears that the substitution of the light-weight cars should result in a reduction of at least one-third in operating costs when handling any given number of people. It is the belief of the writer that the only limitations to their universal employment on the surface lines of cities of any size will be those imposed by congestion. In other words, they can be employed advantageously on any line where their mutual interference because of short headways does not overbalance the greater speed possibilities on the non-congested portions of the run. In most cities of less than 100,000 population, and in many considerably larger, there are no lines on which these cars cannot be used advantageously. In all other cities, even up to the largest, there are many lines where such cars could be used for part of the day or all day long to the mutual advantage of the operators and of the public.

The practicability of operating these cars on lines of fairly heavy traffic, but where headways are rather long, has been demonstrated, but many operators feel that on lines with extremely heavy rush traffic, particularly where such lines run through the business section in common with other lines having a very short headway between units, the use of smaller cars with one-man operation would slow down schedules to a prohibitive degree. There are undoubtedly headway limitations, as is illustrated on lines like Broadway, New York; Fulton Street, Brooklyn; Market Street, San Francisco; Broadway, Los Angeles; State Street, Chicago, and similarly heavily congested thoroughfares in the larger cities of the country. Here a reduction in speed is caused by cars running so close to each other that each one has not only to make its own passenger stops, but many extra ones due to its closeness to its leader. This matter deserves further consideration here.

Headway Limitations

It is axiomatic that if a new type of car is adopted, and especially of a smaller size and resembling in outside appearance the "dinkies" which have been gradually disappearing, the number of seats per hour during the periods of heavy traffic must not be reduced as a result of their adoption. Therefore, in any given rush-hour period more of

the smaller cars will have to be operated. For instance, if between 5.30 and 6 p. m. sixty of the forty-four-passenger cars have been leaving the downtown district, carrying away 2640 seated passengers, at least ninety of the smaller cars will be required in the same period to avoid public complaint. This would mean relative headways of thirty seconds and twenty seconds respectively, if the entire number ran for any space along the same street, and if the common portion were short such operation would probably be practicable. A somewhat shorter headway can undoubtedly be employed with a quickly accelerating and braking car than with the usual type, the reasons for which will be shown further on. It is almost self-evident, however, that if the length of the run where extremely short headways prevail with large cars, is considerable, and if it includes a large number of heavy loading points, any shortening up of headways may mean a very serious reduction in speed. No general rule can be formulated by which we can say at just what point the use of the large cars becomes preferable, since local conditions vary so widely. A 10-second headway for a space of one block would be less serious in its effect on schedules than a thirty-second headway over a half-mile stretch.

But the impression has been so general that these small "one-man" cars are simply a "small-town" proposition that an analysis of their possibilities in the larger cities should be of interest. The writer is firmly convinced that there is a field for their use on some lines in any and every city in this country. For this study three cities having widely varying characteristics, both in physical and operating conditions, and ranging in population from 250,000 to 500,000, were selected. In all three cases the data on which the figures shown are based were secured at first hand by the writer and discussed with engineers and officials of the companies. The conclusions reached and presented later in this article were approved, in the main, by the operators. They represent, therefore, the consensus of opinion of some of the most experienced and able operators in the country.

Distinctive Features of the New Cars

Before taking up any specific problem, however, let us consider some of the distinctive and universal differences in service given with the present and new types of cars. The feature that has received the greatest prominence in most discussions of these cars heretofore is their "one-man" operation. The safety features which are an essential part of the car design, and the size and arrangement of the controlling apparatus, facilitate the operation, and by reducing the manual labor of the motorman make it far easier for him to perform additional duties without interfering with the car's movement and without sacrificing safety.

One-man operation in very small cities, or on lines of very light traffic elsewhere, in cars of ordinary design, has in many places been successful for many years past. The special features of such designs as the Birney type simply make it possible to handle heavy traffic and fast schedules with a single operator, and help to overcome a common objection of many public service bodies or of city councils to such operation, since these cars are obviously safer than the ordinary car with two men. The reduction in platform costs which can be thus secured is a very important item.

Yet great as this economy is, it is less than half of what can be secured. The ordinary cars with two-motor equipments and maximum-traction trucks used so widely in our cities weigh between 34,000 and 38,000 lb. Four-motor cars (except those brought out during the past two or three years) weigh from 44,000 to 48,000 lb. The Birney car weighs less than 13,000 lb. Hence the replacement of the heavier cars with these, even with 50 per cent more units, means a reduction of from 50 per cent to 60 per cent in the weight upon the rails. This will result in economies in power consumption, and in track, line and equipment maintenance. As a general rule these combined economies will more than equal the platform saving. To put it another way, if a reduction from 16 cents per car-mile to 9 cents per car-mile can be secured in operating costs, only about 3 cents of the reduction will be platform and 4 cents will be in economies due to weight, and in many cases the latter will be double the platform saving.

The Automatic Car a Traffic Builder

The really vital feature of difference is not the economies that can be effected through the use of these cars, but the fact that because of their low cost of operation and by reason of their greater inherent speed possibilities they enable a company to give a greatly improved service to the public, and thus they become traffic builders. They enable the railway to secure the traffic carried by private automobiles and jitneys. In fact, it is the return of these riders to the electric cars that is the most significant feature of the reports from Fort Worth, Corpus Christi, Tacoma, Seattle, Bellingham and other places, following improved service, as indicated by the increased earnings of the lines on which such service was inaugurated.

If we agree that rush-hour seating capacity with the small cars must be equal to or greater than was previously given with larger cars, it follows that with the greater number of cars on the line each will carry a smaller number of passengers and therefore make fewer stops per trip. Since the chief limitation in schedule speed is the number of stops made per mile, this one difference alone would enable a faster schedule to be operated; but in addition, the small cars can comfortably accelerate and brake at rates which are impracticable for two-motor double-truck cars, and beyond anything regularly used with standard four-motor types. In Fort Worth and in Bellingham, the average normal rate of both braking and acceleration is 2.5 m.p.h.p.s., which is 60 per cent higher than the average rate with double-truck cars. This again tends to in-

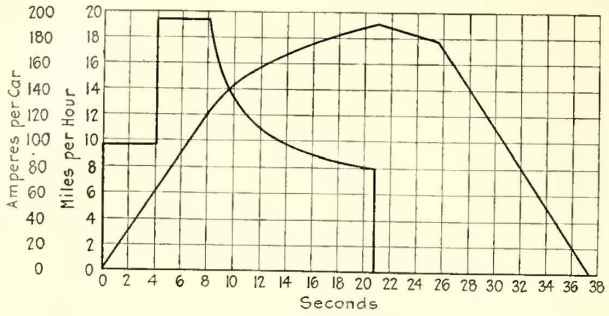


Fig. 1—Time-Speed and Time-Current Graphs for Forty-four Passenger Car Equipped with Two 60-Hp. Motors

Weight of car with thirty passengers, 40,200 lb. Average voltage at car, 515. Car coasts 20 per cent of distance. Friction with power on, 20 lb. per ton. Coasting friction, 25 lb. per ton. Accelerating and braking rates, 1.5 m.p.h.p.s. Free running speed, 25.2 m.p.h. Stops per mile, eight. Average duration, eight seconds. Schedule speed, 9.9 m.p.h. Power consumption at station, 3.4 kw.-hr. per car-mile.

crease the schedule speed considerably, and in combination with fewer stops enables a very marked reduction in running time to be made.

This should be assisted by still another factor—a somewhat higher effective voltage. Since line-loss voltage drop varies directly with the current taken, the reduced load will eliminate a considerable portion of the drop between the station and the car.

Relative Speed and Power Performances

A series of graphs have been plotted representing the relative performance as regards speed and power consumption of the small safety car compared with three types of double-truck cars, very widely used in the larger cities. The two most widely used types usually seat about forty-four passengers and are equipped either with two 50/60 hp. motors mounted on maximum-traction trucks, or with four 40/50 hp. motors mounted on M.C.B. trucks, both cars using 33-in. wheels. The performance of these two under average heavy traffic conditions, that is handling average loads of thirty passengers and making eight stops per mile, is shown on graph sheets Fig. 1 and 2, respectively.

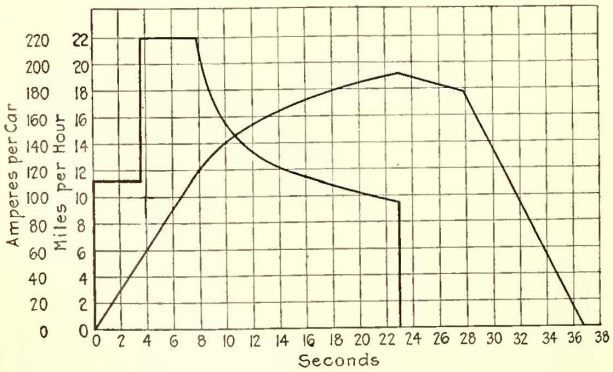


Fig. 2—Time-Speed and Time-Current Graphs for Forty-four Passenger Car Equipped with Four 40-Hp. Motors

Weight of car with thirty passengers, 48,200 lb. Average voltage at car, 500. Car coasts 20 per cent of distance. Friction with power on, 20 lb. per ton. Coasting friction, 25 lb. per ton. Accelerating rate, 1.5 m.p.h.p.s. Braking rate, 2 m.p.h.p.s. Free running speed, 27 m.p.h. Stops per mile, eight. Average duration, eight seconds. Schedule speed, 10 m.p.h. Power consumption at station, 4.34 kw.-hr. per car-mile.

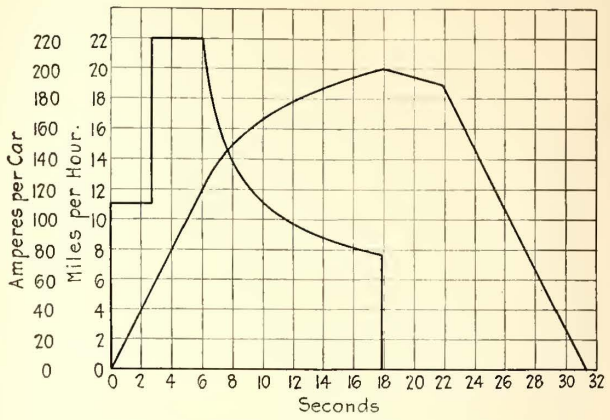


Fig. 3—Time-Speed and Time-Current Graphs for Fifty-four Passenger Car Equipped with Four 25-Hp. Motors

Weight of car with thirty-five passengers, 36,900 lb. Average voltage at car, 525. Car coasts 20 per cent of distance. Friction with power on, 20 lb. per ton. Coasting friction, 25 lb. per ton. Accelerating and braking rates, 2 m.p.h.p.s. Free running speed, 26 m.p.h. Stops per mile, nine. Average duration, seven seconds. Schedule speed, 10.4 m.p.h. Power consumption at station, 3.66 kw.-hr. per car-mile.

A more recent type, very widely adopted during the past two years, is the four-motor, low-wheeled car seating from fifty to fifty-six passengers, but with all weights cut to a minimum, designed for quick loading and unloading, and for fairly rapid acceleration and braking, the whole representing the most advanced ideas in "big-car" design. Its performance is shown on graph sheet Fig. 3. Graph sheet Fig. 4 shows the performance of the low-wheel, light-weight, small size safety car.

Some slight explanation of the assumptions made in each case may be in order. For purposes of calculation the average passenger load in each type of car has been taken at about two-thirds of its seating capacity, which by actual experience has been found to agree fairly closely with what is met with during daylight hours on most lines. For two-motor double-truck cars, the average acceleration and braking rates seldom exceed 1.5 m.p.h.p.s. because of the limitations of traction on slippery rails, and the schedules have to be based on such rates.

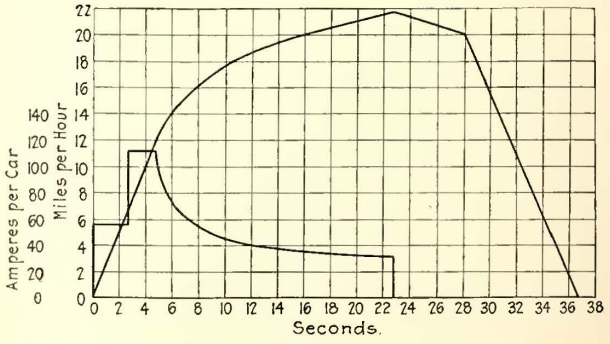


Fig. 4—Time-Speed and Time-Current Graphs for Thirty-Passenger Car Equipped with Two 25-Hp. Motors

Weight of car with twenty passengers, 15,300 lb. Average voltage at car, 550. Car coasts 20 per cent of distance. Friction with power on, 25 lb. per ton. Coasting friction, 30 lb. per ton. Accelerating and braking rates, 2.5 m.p.h.p.s. Free running speed, 25.5 m.p.h. Stops per mile, 6.5. Average duration, seven seconds. Schedule speed, 12.9 m.p.h. Power consumption, 1.29 kw-hr. per car-mile.

With four-motor equipments, rates of 2 m.p.h.p.s. have been frequently used, and such braking rates are regularly used. In the case of a very large proportion of such equipments now in service, however, non-commutating field motors are used, the commutation of which limits the rate of feeding, especially in the frequent cases where an improper gear ratio is used. The result is that with very few exceptions, the normal rate of acceleration on these cars is only about 1.5 m.p.h.p.s. I have accordingly used this rate on graph sheet Fig. 2.

For the lighter weight four-motor car, with its lower center of gravity and modern motor equipment, 2 m.p.h.p.s. has been used for both acceleration and braking, which is about as high as can be used without passenger discomfort, due to the pendulum effect of the body mounted on movable bolsters. With the extremely light-weight non-surging single-truck car, using motors which have a comparatively high internal resistance compared to that of the rheostats and so tend to smooth out the current and torque variations during rapid notching up, normal rates of 2.5 m.p.h.p.s. for both acceleration and braking can be, and are being, used without discomfort or danger to passengers.

In regard to stops and their duration: in fairly heavy service, eight stops per mile, including slowdowns, may be regarded as normal for a forty-four passenger car, and, except on those specially designed for quick loading, their average duration will vary from seven to nine seconds. With the large-capacity cars recently developed, increased average loads will tend to raise the number of stops slightly; but, on the other hand, the elimination of steps and of drop platforms, and the use of wider door openings have cut down the duration of stops, which usually average with fairly heavy riding about seven seconds. The smaller cars carrying only two-thirds as many people as the ordinary type should and do make fewer stops. This reduction has been taken at 20 per cent.

An analysis of the relation between passenger loads and number of stops per trip is contained in the American Electric Railway Association Proceedings for 1913, in the report on the Newark tests. This shows that with a reduction in average load from thirty to twenty passengers, or from seventy-five to fifty, which are the relative average and heavy loads of the forty-four and thirty-passenger cars respectively, there will be a decrease of about 20 per cent in the number of stops. So if the forty-four-passenger car makes eight stops per mile, the smaller unit on shorter headway will average about 6.5 stops.

Traffic slowdowns, resulting from vehicular interference, tend to bring the effective stops somewhat closer together, but unless a large part of the run is along a business thoroughfare the effect of such interference will not seriously impair the advantage of the small car. In a similar manner, an increase in average load on the fifty-four passenger as compared with the forty-four-passenger car, will raise the average number of stops made by 10 per cent or 15 per cent. These conclusions are borne out by comparisons between stops made on the same line, with large and small cars, in Fort Worth, New Orleans and other cities.

The advantages of the quick-loading design in the safety car, combined with the reduced number of passengers boarding at each stop, keeps the duration of stops down. In spite of one-man operation in Fort Worth the average duration is less than six seconds, and I have assumed seven seconds for the calculations.

The time per passenger boarding will obviously be somewhat longer with one-man operation if there is any considerable amount of change-making or issuing of transfers to be done. However, experience in most cities shows that once the public becomes accustomed to prepayment operation, the majority of passengers have the correct change ready on boarding the car. As to transfers, if a simplified system be used, involving no elaborate punching, the transfers can be prepared for each trip during the layover period, and handed out while the car is in motion or while passengers are alighting, which is common practice on many two-man systems.

But if there were no reduction in headway with the smaller cars, it is fairly certain that with each car carrying the same number of passengers as did the larger ones the average duration of stop would be appreciably increased and that this would to a large extent offset the increased schedule speed obtained by higher starting and braking rates. It would then be difficult or impossible to shorten running time.

Running friction has been assumed to be 20 lb. per ton for the larger cars, and 25 lb. per ton for the smaller; coasting friction as 5 lb. per ton higher. The amount of coasting in each case has been made the same proportion of the distance run.

The graphs represent comparative schedule speeds without layovers, based on passenger stops only. Traffic stops or slowdowns and layovers will affect each in a similar manner—reducing the theoretical schedule by say 10 per cent. The comparative speeds and energy consumption values, however, are relatively accurate. With the allowance for delays and layovers mentioned above, the practical schedules for the four types would probably be about 8.9 m.p.h., 9 m.p.h., 9.4 m.p.h. and 11.6 m.p.h. respectively, but the energy consumption figures would probably remain fully as high as those indicated due to the fact that the average motorman does not handle his car with 100 per cent efficiency

The energy consumption of the frequent-service car, therefore, when making the faster schedule will be about 38 per cent of that of the typical two-motor double-truck car; about 30 per cent of that of the heavy four-motor car; and about 35 per cent of that of the modern light-weight four-motor equipment. This saving alone taken at 1 cent per kilowatt-hour (which in general is a fair cost at the d.c. switchboard) amounts to from 1.3 cents to 3 cents per car-mile.

The platform savings compare about as follows:

Assume that the typical large car averages 9 m.p.h. for eighteen hours daily and 365 days a year at 60 cents per hour for crew wages. The annual platform cost is $3,950 and the cost per car-mile 6.7 cents. We will assume that the operator of the frequent-service car will be paid 10 per cent more per hour than either member of the two-men crew or 33 cents per hour. To be conservative, we will assume that the car will run at 11 m.p.h. for the same number of hours as the other, at an annual platform cost of $2,160 or a cost per car-mile of 3 cents, a saving of approximately 3.7 cents per car-mile.

Comparison of Operating Results Promised by the Light-Weight, Safety Car as Compared with Cars of Usual Types:

General Data	Usual Types	Safety Type
Weight per seat, lb.	800-1100	430
Relative schedule speed, per cent	100	120
Data on Car-Mile Basis, in Per Cent		
Energy consumption	260-330	100
Track maintenance cost	200-250	100
Equipment maintenance cost	160-180	100
Accident expense	200	100
Platform labor cost	220	100
Total operating cost, including general expense	200	100
Relative earnings	100	82
Operating ratio	66	40

Easier Operation, Better Wages

An increased wage to the operator of the safety car usually has been given as compensation for the increased complexity of the duties and the greater responsibility necessarily assumed. The manual labor is not increased, and for a motorman is less; the operation of doors and brakes by air controlled by the same valve handle, and the small size of the controller make it easy to handle the car while seated in a comfortable seat with chair back. The men who are now handling these cars seem to regard the contact with passengers, the watching of the fare box and the occasional making of change or issuing of transfers as a relief from the monotony of car running. A greater mental alertness is required, but the men of the required higher grade are attracted by the increased wage.

All Maintenance Will Be Less

As to maintenance it is obvious that the smaller weight and bulk of the new cars will reduce ordinary body and truck maintenance. The cost of painting, for instance, would be only about two-thirds as great as on a 47-ft. car; the cost of washing and cleaning would be proportionally reduced; repairs to windows, seats, flooring, etc., would show proportionate reductions. There are only four 24-in. wheels to renew, instead of eight larger and heavier ones, and the mileage of the small wheel will usually equal that of the large one according to records already available. Brakeshoe wear is, of course, much less. Two small motors in place of two or four larger and heavier, and frequently of obsolete design, mean a considerable reduction in repair cost.

All these factors combined make it fairly certain that the total cost of equipment maintenance, including carhouse expenses, inspection, car cleaning and lubrication will be materially reduced from the usual figure of 1.5 to 2 cents per car-mile. Records indicate that it will be less than 1 cent and the savings therefore will be from 0.6 cent to 1.1 cents per car-mile.

On the effect of reduced weights on the rails, roadbed and overhead structure it is more difficult to speak with certainty. Clearly with a reduction of more than 50 per cent in the daily or annual ton-miles, there will be far less wear on special work and joints. Renewals of rails could be made in many instances with lighter sections, if small cars were operated exclusively, and less depth of ballast would be required. Since trolley wire wear is due almost entirely to arcing at the trolley wheel, the smaller current carried will reduce this to a minimum. In view of these factors, some competent engineers assert that the maintenance of way and structures would be at least directly proportional to the weight carried over the rails; others say that a reduction of 50 per cent in the weight would result in not more than 25 per cent saving. The writer feels that on a car-mile basis, a reduction of 67 per cent in weight should mean a 50 per cent reduction in maintenance, or that the ordinary figure of about 2 cents per car-mile would drop to about 1 cent.

Fewer Accidents Will Occur

There should be a material saving in accident expense also. The use of folding doors and steps interlocked with the brakes completely eliminates boarding and alighting accidents, while the flush platforms and cross-seats prevent many cases of falling. Again, the extremely high rates of braking which are feasible with these cars (the writer has seen graphic records showing more than 4 m.p.h.p.s.) mean excellent control. The "deadman's" release feature in the control handle, which makes it possible to secure an instantaneous emergency application on a sanded rail simply by releasing the pressure on the handle, insures the shortest possible stop in case of emergency. These features should and will result in a very appreciable saving, say from 0.2 cent to 0.4 cent per car-mile.

Reductions in Expenses, Increases in Gross

The combined effect of all these factors is to reduce the cost of the items mentioned from about 14 cents per mile under the most favorable circumstances or 16 cents under more usual conditions, to about 7 cents or less, a saving of from 7 to 9 cents per mile. Taking an average cost for large cars of 15 cents and assuming 50 per cent more mileage with the small ones to allow for the reduced number of seats per car (although, in general, this equalization of seat-miles need only be made during

rush hours) we have for 100 miles of large-car operation a cost of $15, and for 150 miles of the small car a cost of $10.50, an average saving of 4.5 cents per mile for every mile now operated by the large cars.

But in providing 50 per cent more mileage the company will be furnishing to the public an increase in service of that amount which is a combination of higher speed and shortened headway, and this will always result in an appreciable increase in earnings. In every case in which records are available, this has ensued. In Bellingham, Tacoma and Seattle the increase was in almost direct proportion to the amount of extra service; in Fort Worth and Corpus Christi it was about 40 per cent of the amount of extra service; and records from Houston, Shreveport and Birmingham, where improved service with standard types of equipment was inaugurated, show similar results.

In view of such experience, I think it is a very conservative assumption to say that on the average line an increase of 50 per cent in service will result in at least 15 per cent increase in its revenues. Since a line with costs of 15 cents per car-mile for power, platform, maintenance and accident accounts would have to show earnings of at least 25 cents per car-mile to come anywhere near breaking even, the increased earnings on the existing mileage would amount to at least 3.7 cents per car-mile.

A figure, therefore, of about 8.2 cents per existing car-mile indicates the increased net made available by the small cars. In other words, for each all-day car displaced, assuming it makes 9 m.p.h. for eighteen hours daily, there is a prospective saving of $13.28 per day, or of more than $4,800 per year. If one and a half small cars were required for each large one displaced this amount would pay about 65 per cent on their cost. However, since 20 per cent of the additional mileage is inherent in the car itself, only 30 per cent more cars are required to furnish the extra 50 per cent of service. On this basis the replacement of all day cars would pay the cost of the new equipment in less than eighteen months, and on lines which are operated for more than eighteen hours daily, or on which the speed is less than 9 m.p.h., there would be an even higher return on the investment.

The rush-hour service is a different story. If this lasts, as in many cities, only for an hour morning and evening, or even two hours, the mileage made by the extra cars thrown on is comparatively small. If they operate four hours daily for 300 days a year, the annual mileage per car is only about 10,800 and the net increase on this amount is only $886, about 14 per cent on the cost of the cars required for replacement. On a line, therefore, which has a very heavy rush-hour service, and a comparatively small number of cars in all-day service, it will usually be found advisable to limit the use of the safety cars to the all-day operation, utilizing large-size equipments in rush hours.

Now let us consider some concrete examples of the general line of reasoning contained in the foregoing paragraphs, and in particular the application of the frequent-service cars under varying conditions of actual operation. The figures presented herewith are based on operating data secured by the writer on properties in three fairly large cities during the last year. They are substantially accurate as regards existing schedules, cost of operation, etc., except in so far as the increased costs of labor and material during the last ten months have increased the latter item.

Typical Comparison of Operating Results, Usual versus Light-Weight, Safety Types:

	Usual Types	Safety Type
Weight, tons	20	6.5
Schedule speed, m.p.h.	8.6	10.6
Cars required for 8-mile line	6	7
Daily car mileage	1,032	1,484
Cost per car-mile, including general expense, cents	15	7
Cost per day	$155	$104
Receipts per day	232	267
Difference	77	163
Annual difference		31,000
Cost of seven new cars, approximately		35,000

APPLICATION TO LARGE CITIES—CLASS "A"

We will first assume an installation in City "A" which has 400,000 to 500,000 people and about 330 miles of electric railway trackage and 1000 cars. On almost all lines are heavy grades and this has made the use of four-motor equipments quite general.

The cars seat from forty-four to forty-eight people and weigh from 39,000 to 48,000 lb. Because of these weights and the very severe grade conditions energy consumption is very high, averaging more than 5 kw.-hr. per car-mile for the system. The lightest cars, because of obsolete and inefficient motors, consume practically as much power as do the heavier ones. Energy is purchased, and the cost at the d.c. board is about 1 cent per kilowatt-hour (rather more than less on an average).

Traffic is very heavy on almost all lines. The earnings for the road average 30 cents per car-mile, but costs are also high, amounting to 20 cents per car-mile, segregated as follows:

Platform wages	6.8 cents
Power	5.2 cents
Way and structure	2.3 cents
Equipment	1.5 cents
General and miscellaneous	4.2 cents
Total	20.0 cents

Schedules are fairly fast, considering the size and type of cars operated and on the heaviest lines headways are reasonably short. The greatest handicap to economy of operation through the use of higher speeds lies in the fact that a very large proportion of the cars on all lines have to run for a long distance (from 2 to 4 miles per round trip) on a heavily congested street, resulting in headways of

fifteen to twenty seconds in more than half of this distance during rush hours. This congestion cuts the speed along this common section to about 5 m.p.h., and even less for a portion of it. Not only are the schedules slowed down but a considerable amount of traffic is lost on this section, since it is possible to walk nearly as fast as a car can carry one.

Under these conditions it would be manifestly impossible to operate along this common portion 50 per cent more units if it were desired to use the smaller cars. Their use on such lines would have to be confined to the lighter hours of the day, or as short-line trippers running back and forth from the outer terminals to the intersection of each line with the street which is the common route.

Light-Weight Car a Railway Tool

"Manufacturers are always seeking new tools of greater working capacity to lower their costs of production; cars are the tools with which the railways work. The safety car is essentially a new tool with which more transportation can be manufactured for a given cost. It is the response of the brains of the industry to the demand for greater efficiency."—J. C. Thirlwall.

Nevertheless, there are many other lines, crosstown or belt, which do not have to contend with this difficulty, and two typical ones are analyzed below. The first is a crosstown line, running for some distance along streets with small retail stores, but with not more than two or three street intersections where the number of passengers boarding or alighting is at all heavy. The same service or base schedule is provided for all hours of the day. Other lines cut in on this one at various points and run for short distances with it and then turn off, but their effect would be to prevent any material increase in schedule speed on this line, unless they, too, were equipped with the faster cars. Since, across the major portion of the run, headways due to this common service of several lines are reasonably short, no material increase in the number of passengers riding could be expected from more frequent service.

The present cars seldom carry more than twenty-five passengers except during the rush hours. Therefore, the use of a thirty-passenger car on the same headways is quite feasible, except during the rush periods. At these times, seating capacity will have to be provided for by more frequent service. Aside from this, and a very small increase in speed made on the portion of the line which is distinct from any others, the service given by cars of the two types will be very similar, and the economy of operation of practically identical service is therefore illustrated:

F & V Line

Distance round trip 10.15 miles—present running time seventy minutes. Thirty-three minutes one way and two minutes layover at each end.
Proposed running time sixty-six minutes, thirty-one minutes one way, same layovers.
Present cars seat forty-four and weigh 40,000 lb.
Proposed cars seat thirty and weigh 13,000 lb.,

	Present	Proposed
Running time, all day, round trip	70 min.	66 min.
Headways sixteen hours daily	8.7 min.	8.3 min.
Headways four hours daily	8.7 min.	6 min.
Cars required sixteen hours daily	8	8
Cars required four hours daily	8	11
Seats per hour, rush period	304	300
Car-hours per annum	58,500	62,700
Car-miles per annum	510,000	580,000

Cost Per Annum

	Present	Proposed
Platform wages at 60 and 33 cents per car-hour	$35,100	$20,700
Power at 5.2 cents and 1.8 cents per car-mile	26,600	10,450
Maintenance of equipment and way at 3.8 cents and 2 cents	19,400	11,600
General and other transportation at 4.2 cents	21,500	20,400
	$102,600	$63,150

Annual saving	39,450
Cost of twelve new cars	60,000
Return on investment	66 per cent

A study of the service on this line showed that the present cars carry on an average trip through the day a maximum load of about twenty-five passengers and make an average of about eight stops per mile of five seconds each, while during the rush hours the maximum loads are from fifty-five to sixty and the stops per mile run up to ten and eleven of about six seconds each. The running time of thirty-three minutes in each direction is usually made without difficulty, but during the rush hours it averages about thirty-four minutes. The corresponding speeds are 9.2 and 8.95 m.p.h. The smaller car, using higher rates of acceleration and of braking with even a slightly longer stop, making eight stops per mile, should be able to run in twenty-nine minutes, on the normal trip. During the rush hours, its average maximum loads would be 60/87 of sixty or forty-one passengers, this being the ratio between present and suggested headways. The stops per mile should not exceed nine, and the running time about thirty-one minutes. Under these conditions an allowance of sixty-six minutes for the round trip is conservative and permits a liberal margin for interference by other cars.

The replacement of cars in this line would be purely in the interests of economy; no change in receipts is included, though there might be a very slight increase. In "General Charges" an allowance of 0.3 cent per car-mile (on present mileage) has been made for reduced accident and depreciation charges. The savings which could be counted on with a fair degree of certainty show an annual reduction in costs sufficient to pay for the new cars in eighteen months.

Another line perhaps represents conditions more nearly the average, having a heavy rush-hour traffic, and comparatively light all-day riding. This line requires nearly twice as many cars during the maximum period as during the lightest hours. Headways are not short enough to develop traffic to

its full extent, and the use of the frequent service cars would here show their maximum possibilities.

H STREET LINE

Distance round trip 9.24 miles. Schedule time fifty-six to sixty minutes, including two minutes layover at each end.
Proposed schedule forty-eight to fifty-two minutes, including same layovers.
Present cars weigh 42,000 lb. and seat forty-eight.
Proposed cars weigh 13,000 lb. and seat thirty.

	Present Round Trip Time	Present Headway	Proposed Round Trip Time	Proposed Headway
3 hours daily	60 min.	5 min.	52 min.	3.7 min.
3 hours daily	56 min.	7 m.n.	50 min.	4.5 min.
8 hours daily	59 min.	8.4 min.	48 min.	6.8 min.
6 hours daily	57 min.	9.5 min.	49 min.	7 min.
Cars Required				
3 hours daily	12		14 (8 small, 6 large)	
3 hours daily	8		11 (8 small, 3 large)	
8 hours daily	7		8 small	
6 hours daily	6		7 small	

	Present	Proposed	
Seats per hour, maximum	576	606	
Car-hours daily	152	181	large cars 27; small cars 154
Car-miles daily	1,450	2,030	large cars 295; small cars 1,735
Increase in service		40 per cent	
Car-hours per annum	54,710	64,400	large cars 8,100; small cars 56,300
Car-miles per annum	481,000	718,000	large cars 88,000; small cars 630,000

Rush hour service 300 days yearly. Big cars not used Sundays and holidays.

COST AND EARNINGS PER ANNUM

	Present	Proposed
Platform wages at 60 and 33 cents per hour	$32,800	$23,400
Power at 5.2 and 1.8 cents per car-mile	25,000	15,910
Maintenance, equipment and ways at 3.8 and 2 cents per car-mile	18,300	15,940
General and other expenses at 4.2 cents and 4 cents	20,200	19,200
	$96,300	$74,450
Reduction in operating expenses	.....	21,850
Annual receipts at 28 cents per car-mile	135,000	.....
Increased 12 per cent on account of improved service	.....	151,000
Increase in net	.....	36,950
Cost of nine new cars	.....	45,000
Return on investment		82 per cent

The increased speed, or reduction in running time, would here be proportional to that shown on graphs Figs. 2 and 4. The schedule most difficult to maintain now is the fifty-six minutes during the morning rush. At this period the cars now carry loads of fifty to sixty people, average about eight to nine stops per mile of about five seconds each, and take from twenty-six to twenty-seven minutes actual running time in each direction. With headways reduced from seven minutes to four and one-half minutes, the average load would drop to about thirty-five and the stops would probably not exceed six and one-half to seven per mile. A schedule of 12.2 m.p.h. could be easily maintained by the small cars, or twenty-three minutes running time in each direction. The larger cars would have difficulty in making this, and would probably have to cut down their layover period to the bare time necessary to change ends—about thirty seconds.

During the lighter hours of the day, with stops per mile now of only six to seven and with more frequent headways not more than five to five and one-half, the run could be made in twenty-one to twenty-two minutes without any difficulty. During the evening rush period, twenty-three to twenty-four minutes would probably be required for the small cars and for the large ones somewhat longer, which would come out of the five-minute layover period that the small cars would have ordinarily.

The figures speak for themselves. A probable saving of more than 20 per cent in operating costs could be secured while providing 40 per cent more service, which at the lowest possible estimate should raise the receipts of the line 12 per cent. The combined effect would be to increase the net earnings more than 80 per cent of the cost of the new cars.

It is obvious that if we attempted to provide rush-hour service with the small cars exclusively, twenty cars per hour would have to be provided, which would require seventeen cars on the line, and would necessitate the purchase of nineteen to provide a normal number of spares. The saving by so doing would be increased $5,000 annually, but the ten extra cars would cost $50,000 additional and the return on the entire investment would drop to 44 per cent instead of 82 per cent.

Moreover, by utilizing six of the old cars in the rush-hour periods only six need be scrapped instead of twelve. In other words, the writing off of capital account because of obsolescence is only half what it would otherwise be. With the point in mind that when obsolete types of equipment are superseded, their book values must be charged off in a reasonably short period, the savings made by the change must be sufficiently great to cover this within a period of say four or five years, in addition to paying the fixed charges of interest, taxes, insurance and depreciation on the cost of the new cars. Assuming in this case that six old cars (which cost perhaps $45,000 ten years ago) have a book value to-day of $20,000, at least $5,000 annually of the net increase should be applied to their retirement fund. Fixed charges on the $45,000 invested in new cars would be about 15 per cent or $6,750. The total, or $11,750, deducted from the net still leaves more than $25,000 clear profit on the change.

A brief study of the service in this city indicated that about seventy-five of the small cars could be applied on these two and similar lines, with a net increase in earnings, after deducting the fixed charges mentioned in the previous paragraphs, of about $200,000 annually. The road last year had a deficit of about $100,000. Had the frequent service cars been in operation, this would have been changed to a surplus of like amount available for

Safety Features Essential in Quick-Service Car

"The safety features which are an essential part of the one-man car design, and the size and arrangement of the controlling apparatus, facilitate the operation, and by reducing the manual labor of the motorman make it far easier for him to perform additional duties without interfering with the car's movement and without sacrifice of safety."—J. C. THIRLWALL.

dividends; in other words, they would have made the difference between solvency and insolvency.

Without question, these small cars could be used at all hours except rush on any lines in the city, and if it were feasible to turn back alternate cars at the points where the heaviest lines come into the common business thoroughfare they could also be made a valuable auxiliary of the large cars during the peak-load periods. That development, however, could well wait until all independent lines and those of light traffic had been equipped.

Such lines as these offer the initial field of the frequent-service car in the larger cities.

Conditions in City "B"

A rather different situation exists in "B," a city of about 250,000 population, served by about 400 cars on more than 300 miles of track. Here trailers for rush-hour loads are used to a greater proportionate extent than in any other city in the country, fewer than two-thirds of the cars being equipped with motors. There are two standard types of motor cars used for pulling trailers, one seating forty-seven and weighing about 40,000 lb. and the other seating fifty-two and weighing 44,000 lb. Both are equipped with four motors. The trailers seat from forty-eight to fifty-four people and average about 16,500 lb. each. For rush-hour service the company therefore has available units seating more than 100 people and weighing about 60,000 lb.; so that both in weight and platform charges the rush-hour loads are carried very economically.

For lines where trailers are not required, two-motor cars seating forty-three and weighing 33,500 lb., or a larger type seating fifty and weighing 36,000 lb., are used.

For the most part the lines of heaviest traffic run through the business section on the same street and for several blocks on this street. Even with trailer operation, headways are down to thirty or forty seconds during the morning and evening peaks. Here again it would be manifestly impossible to run the small cars as units, since this would shorten the headways to ten or fifteen seconds.

But about a third of all lines in the city do not now use trailers and most of these lines do not operate through this street of heavy traffic. Several cross the business district in such a manner that they have only three street intersections where loading is heavy or where there is any considerable amount of traffic interference. These lines are well suited to the operation of the frequent-service car.

There are no jitneys in the city, but the use of private automobiles to and from the business section is unusually heavy. As much of the residential section lies close to the business district, there is also an exceptionally large percentage of walking to and from work.

Speeds are fairly high, but headways on most lines are altogether too long to develop traffic to the maximum extent. They run for the most part from seven to twelve minutes during the day and from five to seven minutes during the rush hours. Receipts per car-mile average about 26 cents. Operating expenses are about 13 cents, although for the single-car lines it would run somewhat higher and would segregate about as follows:

Cents per Car-Mile	
Power (operating costs only at 0.5 cent per kilowatt-hour)	1.9
Maintenance equipment, including carhouse expense	1.8
Maintenance of way and structures	1.4
Platform wages (single car operation)	6.2
General and other transportation	2.8
	14.1

The cost of operation on two typical single-car lines is shown in the table below, together with the estimated savings if frequent-service cars were substituted for the present type.

Now let us consider a somewhat heavier line on which it is necessary to increase the rush-hour service very considerably as compared with all day. Both types of standard two-motor cars are used; their average would be a forty-seven-passenger car weighing 35,000 lb. The line is 5.61 miles long and stops are frequent, averaging from seven and one-half to ten per mile, so that schedule speeds of 8.6 to 9.6 m.p.h. are the best that can be obtained. The duration of stops is very short, less than five seconds on an average. Data appear on the next page.

C Line, distance round trip 6.86 miles. K Line, distance round trip 8.58 miles.
Present cars seat forty-three and weigh 33,500 lb. Stops per mile run from seven to nine on K and from five to seven on C.

	C Line		K Line		Combined	
	Present	Proposed	Present	Proposed	Present	Proposed
Running time, round trip	36–40 min.	32-35 min.	50-52.5 min.	44-48 min.	....	....
Headways, four hours daily	10 min.	7 min.	7.5-8.5 min.	6 min.	9 min.	6.5 min.
Headways, ten hours daily	12 min.	8 min.	10 min.	7.3 min.	11 min.	7.7 min.
Headways, six hours daily	20 min.	16 min.	13 min.	11 min.	16.5 min.	13.5 min.
Cars required, four hours daily	4	5	6-7	8	10-11	13
Cars required, ten hours daily	3	4	5	6	8	10
Cars required, six hours daily	2	3	4	4	6	6
Maximum seats per hour	258	297	344	350	602	647
Car-hours daily	58	72	100	116	158	188
Car-miles daily	630	904	1,007	1,343	1,637	2,247
Increased service, per cent	....	44	....	34	....	37
Car-hours annually (rush service, 300 days)	20,910	26,020	36,110	41,820	56,930	67,840
Car-miles annually (rush service 300 days)	227,000	327,000	364,000	486,000	591,000	813,000

Cost and Receipts per Annum

	C Line and K Line Combined	
	Present	Proposed
Crew wages at 60 and 33 cents per hour	$34,212	$22,388
Power at 1.9 and 0.75 cents per car-mile	11,229	6,098
Maintenance equipment and way at 3.2 and 1.6 cents	18,912	13,008
General, etc., at 2.8 cents	16,548	14,800
	$80,901	$56,294
Annual saving	.....	24,607
Present receipts at 26 cents	154,000	.....
Estimated increase, 10 per cent	.....	15,400
Net increase	.....	40,007
Cost of fourteen new cars	.....	70,000
Return on investment, per cent	.....	57

Note—All terminals in City "B" have loops, so single-end cars are used. The single-end Birney-type car seats thirty-five people.

SERVICE DATA, "L" LINE

	Present	Proposed
Distance round trip, miles	11.2	11.2
Schedule time, minutes	70-78	60-64
Headway, four hours daily	6-7	4.6
Headway, ten hours daily	10	8.5
Headway, sixteen hours daily	12	10
Cars required, four hours	11-13	14 { 8 small, 6 large
Cars required, ten hours	7	8 small
Cars required, six hours	6	6 small
Maximum number seats per hour	470	515
Car-miles daily	1,420	1,885 { 250 large, 1,635 small
Car-hours daily	154	172 { 24 large, 148 small
Car-miles annually (extra cars 300 days)	506,000	672,000 { 75,000 large, 597,000 small
Car-hours annually (extra cars 300 days)	54,910	61,220 { 7,200 large, 54,020 small
Increased service	.....	33 per cent

ANNUAL COSTS AND RECEIPTS

	Present	Proposed
Platform wages at 60 and 33 cents per hour	$33,000	$20,300
Power at 1.9 and 0.75 cents per car mile	9,600	5,050
Maintenance equipment and way at 3.2 and 1.6 cents	16,200	10,750
General and other expenses at 2.8 cents	14,200	13,000
Total	$73,000	$49,100
Saving	.....	23,900
Present receipts at 26 cents	131,000	.....
Estimated increase 10 per cent	.....	13,100
Net increase	.....	37,000
Cost of nine cars	.....	45,000
Return on investment, per cent	.....	82

There are several other lines similar to the first two and several similar to the latter one. Roughly about sixty new cars would be required to equip all such lines in the city at an approximate cost of $300,000, on which could be expected a return of something like $200,000 annually. Increased fixed charges on additional capital would be $45,000. Assuming fifty old cars scrapped, with a book value of $150,000 and a scrap value of $50,000, $100,000 would remain to be written off. If $25,000 annually were applied to this, it would still leave after deducting the fixed charges, $130,000 additional for dividends. This is more than one-third of the amount available for this purpose for the whole system last year.

The use of the frequent-service cars on the remaining lines would be feasible only during the lighter hours of the day, when headways on the main thoroughfare are not too close, or by rerouting some of the lines to relieve the congestion which limits their use.

If, as seems certain, a sufficient portion of the service could be changed so as to increase the net surplus of the entire road more than 30 per cent, it is well worth making. Moreover, power costs here and the saving resulting from a reduction in power consumption are based only on the operating costs of producing the power at present with no allowance for overhead. It is obvious, however, that if a really considerable portion of the entire power output is eliminated, it will sooner or later affect the reduction in the overhead costs either by enabling some machines to be shut down; by permitting additional service without the purchase of new station equipment or more copper in the line, or by reducing depreciation on the existing apparatus through the elimination of overloads, or by all three of these factors. If the usual overload allowance for power costs were made in this case as it was in City "A," where power is purchased from an outside company, the return on the investment would be appreciably greater.

ANALYSIS OF CITY "C" CONDITIONS

We now come to City "C," where the application of the frequent service cars would appear at first glance to be attended with the greatest difficulties and where the field for its application might be thought so limited as to be not worth consideration. This city has more than 500,000 population, spread over an unusual area, and served by 400 miles of electric railway, on which are operated 1000 cars. Hauls are unusually long and receipts per car-mile low.

The standard cars used here seat forty-four and weigh about 37,000 lb. They are, for the most part, equipped with two 50/60-hp. motors, although on some cars two motors of smaller capacity are used. The bodies are not designed for rapid movement of passengers, nor with the exception of a few can prepayment of fares be used. The bodies are unusually high, and the seating and bulkhead arrangement is inefficient as regards carrying heavy loads and collecting fares. The honest conductor is likely to miss an unusually large percentage of collections, while the dishonest man has exceptional opportunities for diverting fares into his own pocket.

The frequency now given is very good. Schedule speeds (omitting layovers at ends of lines) average more than 10.5 m.p.h. during the day and better than 9.5 m.p.h. during the rush hours, and this despite a large amount of running through a business section which is as badly congested as anywhere in this country, and where interference by automobiles and other vehicles with the street car movement is probably worse than in any other city. Headways are fairly short, less than ten minutes on the average during the day, and less than five minutes during rush periods.

Yet in spite of frequent service and fairly good speed, both private and jitney automobile competition has been so severe that the revenues of the company have declined seriously and receipts average less than 22 cents per car-mile. If average costs of operation here were as high as on most roads, such a condition would have led to bankruptcy long ago. But driven by necessity, and aided by an unusually low power rate together with a fairly low consumption since the cars weigh less than those of most roads, and stops are fewer, the company has reduced its operating cost per car-mile to the very creditable figure of 13 cents. This segregates about as follows:

	Cents per Car Mile
Platform wages	5.7
Maintenance of way and trolley lines	1.2
Maintenance of car equipment	0.8
Power cost	2.2
Car cleaning, inspection and lubrication	0.65
Accident account	0.6
Depreciation	0.55
All other expenses	1.5
Total operating cost	13.20

These costs are for 1916; it is improbable that maintenance can be held to these very low figures this year, because of the advance in material and supply prices. The reasons for the low cost of power have been referred to. The comparatively low charge for platform labor is the result of speeding up schedules to the physical limit of the equipment, and in spite of the fact that extremely liberal layovers are allowed the men on all trips except during rush hours.

Even under these circumstances, which are probably the least favorable to the introduction of smaller cars, there are many lines on which they could be used to marked advantage, and on which they would show material economies. An analysis of the service and costs of operation on one of the typical lines appears opposite. This line extends about 5.5 miles in one direction from the heart of the city and about 4.5 miles in the opposite direction. Twelve-minute service is furnished all day for its entire length and much more frequent service to a point about 1 mile from the end of the longer branch. The line is shown as two divisions, though they are identical except for the extension on X.

The relative schedule speed is the most important factor here. The present cars make the long run normally in about fifty-two minutes, carrying an average maximum load of twenty-five passengers and making on an average six and one-half stops per mile. They have a layover of about eight minutes at each end. On the rush trips they take about fifty-nine minutes for the run, have three minutes layover, carry an average maximum load of sixty-five passengers and make seven and one-half stops per mile. If 10 per cent more people were carried in 30 per cent more units, the average maximum loads would drop to about twenty and fifty-three respectively, and the stops per mile to five and one-half and six and one-half. With these stops and with the higher rates of acceleration and of braking shown in graph sheet Fig. 4, running times of forty-seven and forty-nine minutes could be made. Allowing forty-eight minutes normally with a six-minute layover, we have the 108 minutes allowed for the round trip. On the rush trip fifty minutes with two and one-half minutes layover could be maintained and a round trip made in 105 minutes. Similarly the shorter run of 9.04 miles could be made in forty-two minutes and forty-four minutes, which is four to eight minutes less than at present. With an allowance of 10 per cent for layovers the round-trip times would become ninety-two and ninety-six minutes.

To furnish a very slight increase in seating

Quick-Service Car Has Wide Field

"The impression has been general that these small 'one-man' cars are simply a 'small-town' proposition. From an analysis of their possibilities in the larger cities the writer is firmly convinced that there is a field for their use on some lines in any and every city in this country."—J. C. Thirlwall.

S. P. & W. Line

Stops per mile average six and one-half during day, seven and one-half during rush hours, of about six seconds each.
Present cars weigh 37,000 lb. and seat forty-four.
Proposed cars weigh 13,000 lb. and seat thirty.

Division X—Distance 10.17 Miles

	Present	Proposed
Round trip, including layovers, two hours daily	125 min.	105 min.
Round trip, including layovers, eighteen hours daily	120 min.	108 min.
Headways, two hours daily	12.5 min.	7.5 min.
Headways, eighteen hours daily	12 min.	9 min.
Cars required, two hours daily	10	14
Cars required, eighteen hours daily	10	12
Seats per hour, two hours daily	210	240
Seats per hour, eighteen hours daily	220	200
Car-miles daily	2,010	2,755
Car-hours daily	200	244

Division Y—9.04 Miles

	Present	Proposed A	Proposed B
Round trip, including layovers, two hours daily	110 min.	96 min.	105 min.
Round trip, including layovers, eighteen hours daily	108 min.	92 min.	92 min.
Headways, two hours daily	5 min.	3.3 min.	4.2 min.
Headways, eighteen hours daily	12 min.	9.2 min.	9.2 min.
Cars required, two hours daily	22	29	10 small 15 large
Cars required, eighteen hours daily	9	10	10 small
Seats per hour, two hours daily	528	540	548
Seats per hour, eighteen hours daily	220	195	195
Car-miles daily	2,054	2,785	2,330 small 310 large
Car-hours daily	206	238	30 large 200 small

Combined Service

	Present	Proposed A	Proposed B
Minimum headways, common portion	3.6 min.	2.3 min.	2.7 min.
All-day headway	6 min.	4.5 min.	4.5 min.
Maximum number seats per hour	738	780	788
Car-hours per day	406	482	444 small 30 large
Car-miles per day	4,064	5,540	5,400
Car-hours per year (365 days)	148,000	176,000	162,000 small 10,950 large
Car-miles per year (365 days)	1,483,000	2,022,000	1,856,000 small 113,000 large
Increase in service, per cent	.....	36	31

Note: By running cars ahead of schedule in the light direction during rush hours and eliminating layovers the headways in the heavy direction are shortened so that more seats are really provided than this table indicates. This manipulation is equally possible with the small cars, giving a corresponding gain there. These figures are based on normal operation, since the relative values will remain constant.

Annual Costs and Receipts

	Present	Proposed A	Proposed B
Crew wages at 28 and 31 cents per car hour	$82,700	$54,600	$56,350
Power costs at 2.2 cents and 0.8 cent per car-mile	32,626	16,176	17,334
Maintenance way and line at 1.2 and 0.6 cents	17,796	12,132	12,492
Maintenance equipment, including car-house expense, 1.45 and 0.8 cents	21,504	16,176	16,487
Depreciation at 0.55 and 0.3 cent	8,156	6,066	6,189
Accidents at 0.6 and 0.4 cent	8,898	8,088	8,102
All other expenses at 1.5 cents on present mileage	22,245	22,245	22,245
Total operating cost per year	$193,925	$135,483	$139,199
Annual receipts (10 per cent and 8 per cent increase)	$311,000	$342,000	$336,000
Net	117,075	206,517	196 801
Increase	.....	89,442	79,726
Approximate cost forty-eight cars and twenty-seven cars	.....	240,000	135,000
Return on investment	.....	37	59

capacity with the small cars under these conditions would require a total of forty-three cars during the rush hours and would necessitate the purchase of forty-eight to allow a reasonable number of spares for shop purposes. But if the bulk of the peak riding were cared for by the present cars, and the new type utilized for all-day service, only twenty-four small cars would be needed for operation and twenty-seven would provide the necessary shop spares. Even then the increase in service would be very nearly as great in the second case as the first, and the cost of operation would be only slightly higher, since the big cars with their two-man crews would be used such a small portion of the time.

The net result shows a saving of $58,500 and an increase in net of more than $89,000 for the all small-car operation, at an expenditure for new equipment of $240,000. With the second plan the saving would be nearly $54,000 and the net increase nearly $80,000 and the expenditure necessary only $135,000. There can scarcely be any doubt as to which is preferable as long as a company has large cars which are in fairly good operating condition.

The greatest difficulty here, as in other cities, lies in a very heavy congestion during rush hours on the two main business arteries of the city.

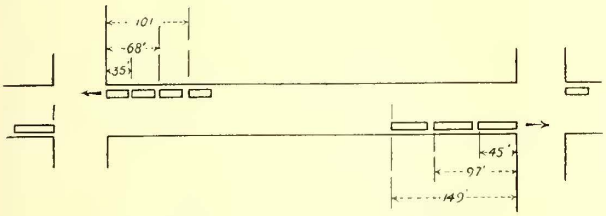


Fig. 5—Diagram Showing Car Blocking at Street Intersections

Every line in the system, with the exception of two or three crosstown or belt lines, run for several blocks through the central business district, and from 5.30 to 6 p. m. headways are down to less than forty seconds for about a mile on the busiest street in the city. Moreover, at three of four intersecting streets, traffic delays of from thirty seconds to sixty seconds are frequent. The addition of cars on this badly-congested section would, therefore, appear to be very difficult. However, a careful study of the situation shows that up to a certain large percentage of increased units of the front-entrance type, no increase in difficulty of operation or lessening of speed due to interference would be experienced. Fig. 5 illustrates the reasons for this.

The blocks on this street are 600 ft. long and the streets 60 ft. wide. Cars at present average about seventy seconds to the block during rush hours. In the mile run, they average about ten stops of an average duration of fifteen seconds, and about five slowdowns. Three or four stops are unusually long, at the intersections of crosstown lines, and it is at these points that the interference of one car with its followers occurs. There are on an average two or three cars in each block all the time, and when one is held up for any unusual period the three group themselves as shown in the diagram, with their entrances 45 ft., 97 ft. and 149 ft. from the corner. The result is that while a few people may walk back to the second car, a large number who want to board it do not, and after the first car is given a clear signal and moves away, the second car must stop again before crossing the street. The third car makes two unnecessary stops before reaching the loading berth.

Traffic Building Versus Economy

"The vital characteristic of the light-weight, safety car is not the economy that can be effected through its use. The important fact is that, because of the low cost of operation and greater inherent speed possibilities, it yields a greatly improved public service and thus becomes a traffic builder."
—J. C. THIRLWALL.

Four 28-ft. cars with front entrances take up less room on the street than the three 47-ft. cars, and their entrances when bunched at an intersecting street are 2 ft., 35 ft., 68 ft. and 101 ft. respectively from the corner. In other words, the entrances of the first two are nearer the corner than is that of one car now. Both can take on their load and move off together when the traffic signal is given, and the other two can move up together into place, making only one unnecessary stop for the third and fourth cars. Moreover, their follower has a car length longer running space than has the fourth car under present conditions. Due to the shorter average stop of a low-wheeled car, which takes on fewer passengers per stop, it can be seen why the operators are confident that they could put from 30 to 50 per cent more of the small units through this street in a given time than they can with their present cars.

Moreover, since this mile is only 8 per cent to 10 per cent of the one-way distance of most of the lines passing through it, a slight slowing down here would not offset the additional speed in the remaining 90 per cent of the run.

In this city, it seems probable that approximately 200 frequent service cars could be applied with a reasonable certainty of a return of more than $500,000 annually.

Conditions very similar to those shown in the foregoing data can be found on a fairly large proportion of the lines in all cities in this country except the very largest, and it is the writer's belief that from 20 per cent to 50 per cent of the service in almost any city could be better handled by these small cars, alone or in conjunction with standard types, than it is to-day.

Loading Operation on Converted One-Man Car of Washington Water Power Company

Spokane's Operation of Large One-Man Cars with Smoking Compartments

The Washington Water Power Company Began Remodeling Its Cars in 1915 and Now More Than Half the Mileage Is One-Man—The Spokane & Inland Empire Railroad Also Placed Three Cars in Service During the Last Year

EARLY in 1915, when the jitney craze was at its height, the Washington Water Power Company, Spokane, Wash., realized that something had to be done at once to diminish both the loss of travel and the cost of operation. It had enough well-built cars to give more service, but obviously not with two men per car. These cars were of greater length and weight than would have been selected for new cars, but the low-cost rate of electrical energy in Spokane made remodeling advisable as well as practicable.

In balancing the various factors pro and con the company decided to stick to the original cars, as they could be handled by one man just as safely as by two, and the extra cost of upkeep and track maintenance for 52,500-lb. cars would be more than offset by their extra seating capacity for peak loads. For a time conductors were used for rush hours, but experience proved this unnecessary. To-day these cars may be seen holding their own in the evening rush under a combined headway of forty seconds and less.

Reversing a Car to Convert It, and Adding a Smoking Compartment

As an article in the Dec. 18, 1915, issue of the Electric Railway Journal described the conversion of the first cars in some detail, only the leading changes will be now described. In the original single-end form each car had a front platform of 5 ft. 5½ in. and a rear platform of 6 ft. 4½ in. The overhang of the latter had been the cause of more than one fouling accident. The body of the car contained seven rows of cross-seats and short longitudinal seats at each corner. In the reconstruction the rear vestibule became the front, and the doorways were so altered that entering and departing passengers leave by way of separate doors. As these doors, which slide into a bulkhead between, are not wide enough for two people at a time, they effectively prevent crowding and consequent confusing of the car operator.

The platform steps were also lowered 3½ in. through the expedient of lowering the vestibule floor so that the rises from the street became 14 in., 13 in. and 11½ in. This change, together with the arrangement for boarding and alighting at the front end under the eye of the car operator, has absolutely wiped out step accidents to passengers. It was not found feasible to operate the step in unison with hand-controlled doors, so that the step occasionally affords a lodging to reckless boys. To avoid step accidents in the dark, a lamp is used to illuminate the step while the doors are in the boarding and the alighting positions. Likewise a vestibule lamp also burns while the operator is collecting fares and registering them on the original International registers.

Of course the control and braking equipment had to be installed at the front end. Nevertheless there is a controller on the rear platform, which can be operated on the first five points for backing up and coupling the cars, and for emergency conditions.

While turning the original front platform to the rear the company did something which made the one-man car an immediate hit with many male patrons. It enlarged the 5-ft. 5½-in. space by adding the length of two car windows, and turned it into a smoking compartment with fourteen seats separated by a sliding door from the remainder of the car. Ever since this was done patrons have been clamoring for more "buffet cars," as they have been christened. The rear location of the smoker in no wise embarrasses other riders, and it has the merit of inducing an appreciable number of passengers to go to the rear end and sit down. This section has an emergency exit which upon being opened only ¼ in. sounds a special alarm to the operator. By the time the would-be departer has the door open the car is standing still. Only in one or two instances in more than two years of operation has this occurred. The alarm bell is con-

nected to the regular signal batteries in the car, so that it is always in operating condition.

The foregoing changes, including lighting features, cost only about $300 per car.

DEVELOPMENT OF INCREASED SERVICE WITH ONE-MAN CARS

The first converted cars were put on during August, 1915. To-day the company operates regularly only thirty-one two-man, fifty-seven-passenger, 59,000-lb., 51-ft. 6-in. cars, as compared with forty-one one-man, 52,000-lb. cars. For extra service on big days the company has in reserve fifty two-man cars of the same length as the converted cars. All of these cars were in operation on July 4, 1917, to their full capacity without a single accident—a truly remarkable record.

The accompanying tabulation of the present one-man lines shows the general increases in the number of cars and the corresponding improvements in headway. The schedule speeds, which are exactly the same as with two-man cars, are rather low, but this is ascribed to grades up to 12½ per cent and to sharp curves which make speeding unsafe.

EFFECT OF ONE-MAN OPERATION ON LINES OF WASHINGTON WATER POWER COMPANY

Route	Schedule Speed (m.p.h.)	Number of Former Cars	Number of Present Cars	Old Headway (Minutes)	New Headway (Minutes)
Liberty Park and Pacific	8.8	4	6	15	10
Maxwell	8.8	5	7	15	12
Cannon Hill and North Monroe*	7.7	4	5	20	15
Tenth Avenue and North Monroe*	7.6	3	4	20	15
These lines not altered in service:					
Corbin Park and South Maple	8.5	4	4	15	15
Indiana	9.5	5	5	20	20
Fort Weight	8.0	2	2	30	30
Garden Springs shuttle	8.6	1	1	30	30
Cannon Street shuttle	7.0	1	1	15	15
North division shuttle	..	1	1	15	15
South division shuttle	..	1	1	15	15
Maxwell trippers	8.8	4	4	..	..

*As these lines overlap, most passengers get a seven and one-half-minute instead of a ten-minute service.

The one-man cars of the Washington Water Power Company handle about half the mileage on routes ranging from thirty-minute shuttle service to combination headways of forty seconds on blocks of Riverside Avenue (between Post and Howard Streets), where most of the outbound fares are collected.

To date the increased service has brought about 12 per cent more travel with a constantly increasing personally owned motor vehicle competition. This is 37 per cent below 1909, the maximum year, but at any rate the downward tendency has been checked. Still further improvement is to be expected with the removal of the jitney bus. On account of bonding regulations and increased convenience of car service the greater portion of the jitney buses have gone out of business in the last two months.

Operating expenses have shown a marked decrease since one-man cars have been put in service. Platform expenses, including a 4-cent bonus in this service, now average 35 cents an hour, a wage which attracts and holds the best men. Accidents also have been greatly cut down, and fare collection has been improved through the use of the prepayment system.

WORK OF SPOKANE & INLAND EMPIRE

The Spokane & Inland Empire Railroad did not begin converting cars for one-man operation until 1917. At present it has three cars in operation on the Rockwood line and five more are under way. It has followed substantially the plan of its neighbor, although in its case the long rear platform was open.

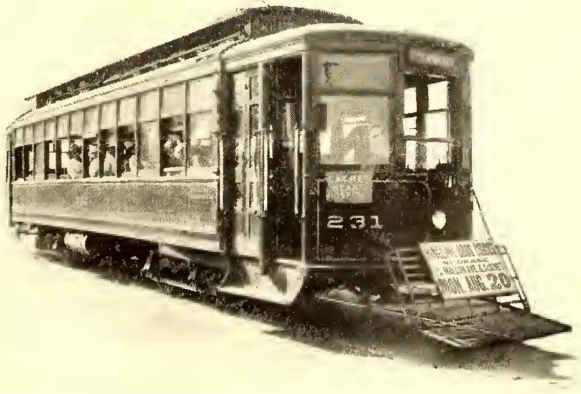
The work on the five cars now being remodeled has been considerably delayed through lack of materials, but they are expected to be ready for service within sixty days.

The tests on the three cars in operation on the Rockwood line of the company have been very satisfactory, and the cars have been operated without accidents thus far. A most favorable report on the one-man system has been forwarded to the St. Paul office of the Great Northern, owners of the system, with the recommendation that more cars be converted.

GENERAL PUBLIC PREFERS NEW-TYPE CAR

Spokane now has a greater percentage of one-man cars in operation than any other city in the United States, and is one of the pioneers in the field demonstrating the new type. The big cars have withstood the most severe traffic strains. Unusual travel of circus days, the Fourth of July and other general holidays has not created traffic congestion, and the general public prefers the one-man cars to those of the old type.

Spokane has more miles of street railway track per capita than any American city of its population with the exception of Tacoma, Wash. Statistics give Spokane an average of 1.23 miles of track for every 1000 of population.



Spokane—Converted One-Man Car Used by Spokane & Inland Empire Railroad

Mental Attitude an Important Factor in Railway Operation

Success in Railway Industry, as in Others, Demands a Conscientious Study of Conditions With a Willingness to Change Methods as Circumstances Alter

By Clarence Renshaw
General Engineer
Westinghouse Electric & Manufacturing Company

"The fault, dear Brutus, is not in our stars,
But in ourselves, that we are underlings."
—*Julius Caesar.*

A CERTAIN minister once complained to an intimate friend of the poor attendance at his services. The friend suggested that the minister's sermons were too long and advised that he make them shorter. "That's a good idea," said the minister, "but really I am so busy with my parish work that I haven't time to write short sermons."

And so it is with many railways. When one talks of the economies of quick-service cars, modern motors, train operation or any of the other innovations that have been brought out during recent years to solve the very problems with which they are now confronted, the reply is usually in effect, "Yes, that's all very nice, but we are too poor to afford such economies."

Even when one suggests analyzing conditions or effecting economies which involve the expenditure not of money but merely of thought or effort, it is astonishing how little enthusiasm one can usually arouse.

It is no doubt true that some of the railway companies are obliged to sell their goods for too low a price on the basis of present costs, but it is also true that a mere increase in fare is not likely to solve the difficulty completely, since any such increase is bound to be followed by a reduction in traffic without any corresponding reduction in expenses. In the ELECTRIC RAILWAY JOURNAL for Aug. 25, for instance, Professor Conway of the University of Pennsylvania shows that a 6-cent fare, although a 20 per cent increase in rate, results in only about a 10-cent increase in receipts in a large number of cases, owing to the reduction in passengers which it causes. What is really needed in most cases, therefore, seems to be a better passenger load factor, and this is a thing which can be obtained only by individual efforts and not by legislative enactment.

One of the hopes of the average man is that conditions in the industry with which he is connected will some day become stabilized so that the equipment he buys or the operating practices he adopts to-day will be up to date forever and he thus may look forward to a life of ease without mental effort or change of habit. Such a state of affairs is not likely to be brought about, however, in either the railway industry or any other. Many of the present operators have already seen the properties with which they are connected change from horse cars to cable cars and from cable cars to electric cars, and have also seen the original electric cars passed on to the scrap heap long before they were physically decrepid.

Even the human element has, to a certain extent, followed the same cycle, although in this case there has been a difference. The human element is not entirely fixed, like equipment of wood and iron, but a certain proportion of it possesses a wonderful flexibility that enables it, if it will, to adapt itself to changing conditions and to be better able to cope with the new conditions from its experience with the old. Each change to which the human element adapts itself, however, has a tendency to absorb a certain part of its flexibility, so that it is more difficult to adapt itself to the next change; and although the magnitude of the changes which must apparently come to the railway industry in the near future is by no means so great as some of those through which the industry has already passed, this principle is probably responsible for much of the pessimism which is now abroad in some sections.

It is a pretty safe idea for the average man to adopt, that when anything goes wrong with the work in his charge it is at least partly because of some act or some omission of his, so that he is at least partly responsible. When anything happens, therefore, or fails to happen, his first question should be, "What should I have done that I didn't do?" It is surprising what such an attitude on the part of the man in charge of a property will do in the way of effecting improvements, if it is consistently applied in a broad way, and what a spirited organization it will build up. It is much more comfortable for the average man when anything goes wrong, however, to feel that his record is entirely clear and that the fault lies elsewhere, and few have the courage to try to shatter this idea.

Where the right spirit prevails the property may not always be on a profitable basis, but if it is not the officials will surely know why and will have definite plans to put it on such a basis. At the very least, they will have specific information of the economies which could be effected by the purchase of certain amounts of up-to-date equipment or by the investment of various sums of new capital in other ways, and they will not have hesitated to make such investigations merely because the money to utilize them was not in sight.

It seems pretty certain that we shall have cities for a long time to come and that these cities must

have local transportation. It is quite probable also that this transportation can be furnished by electrically operated cars running on rails to better advantage than by any other means now known. It would seem economically desirable that the business of supplying such transportation should remain in the hands of the companies now engaged in it, provided that they can work out the necessary problems. The officials and employees of these companies are, as a rule, energetic and capable of solving their difficulties. We believe, however, that much of the success achieved in any undertaking depends on the mental attitude with which one tackles the task, and at this time, when even the bravest are sometimes discouraged, we suggest the above idea for whatever it may be worth.

The Future of the Quick Service Car

While the Exact Field of the Quick Service Car Is Not Fully Determined, It Is Well Adapted to a Large Proportion of the Roads in This Country

By G. M. Woods

General Engineer Railway Department
Westinghouse Electric & Manufacturing Company

TRANSPORTATION and railway engineering men are already familiar with the economies effected by the operation of quick service cars either through personal experience or through the numerous articles on the subject which have appeared in the technical press. The favorable impression which these cars have made on the car-riding public and the satisfaction of the car operators are results which have not been given such wide publicity, when as a matter of fact the importance of the favor with which these cars have been regarded by the public is equal to or greater than the economies.

The public satisfaction is due to several causes: First, the cars have been made attractive in appearance and easy riding. Most of the cars have been built along standard lines, and the simplicity of design and absence of "gingerbread" are pleasing to the eye. The truck springs are more buoyant than those of older single and double-truck cars, and "galloping" has been eliminated. The second cause is the more frequent and faster service usually provided by quick service cars. The average man is chiefly concerned with the total time he must spend between his home and place of business, regardless of whether the time is spent waiting for a car or riding on the car. The time of waiting for a car is reduced by reduced headway. The reduced headway also tends to lessen the number of stops. There is a tendency on the part of the operator to accelerate and brake more rapidly, and the result is decreased running time. The third cause of satisfaction is the feeling of the patrons of a line that they are especially favored by the traction company in that the newest development in car designs is operated on their line. The various safety devices and other provisions for operation by one man arouse their interest and put their minds in the proper frame to realize the actual advantages of the new cars.

The operator usually is pleased with the quick service cars, not only because most railway companies have found it profitable to raise his pay 2 or 3 three cents per hour, but also because he has a certain amount of self-satisfaction with his added responsibility. Instead of simply starting and stopping the car or collecting the fares, he is now in complete charge. The personal factor has been wisely enhanced on some roads by having a card with the operator's name placed near the entrance.

Adverse rulings by legislatures, commissions and town councils are serious obstacles in some places to the adoption of cars operated by one man. Nearly all these regulations may be traced to ignorance of the results of operation with one man and the consequent feeling that such operation is inherently unsafe. The facts that must be impressed on legislative bodies are that these cars are safer than the two-man type, because the passengers are under direct charge of one man only, and there is no chance for misunderstanding signals or other division of responsibility between conductor and motorman. The operator's mind is not inactive during stops, and hence he is kept in a condition of mental alertness.

There is no doubt that the quick service car has a very real field of application in the transportation world and will eventually be used for certain classes of service in preference to any other type. The boundaries of its field are still under discussion. Actual operating results indicate that the service met on the lines of lighter traffic in cities of any size can be handled more satisfactorily and more economically by quick service cars than by any other vehicle. It is certain, however, that the quick service car in its present form

cannot be applied successfully to all city lines. Where the traffic already is congested with large cars, the increased congestion resulting from the use of a greater number of smaller cars would be prohibitive.

It is to be expected that the development of cars for operation by one man will continue until their field of application is broadened considerably. It is difficult to foresee just what the construction of the quick service car of the future will be. Provision may be made for train operation, and improved details to facilitate boarding, alighting, collecting of fares and issuing of transfers may be devised. These problems will be met and solved by those interested in street railway transportation.

The fundamental fact at the present time is that there are now cars on the market which will effect great savings in cost of operation. There is no element of financial or physical risk in the adoption of these cars on a large proportion of the roads in this country. While prices are abnormally high at present, cost of operation is proportionately high, and it is doubtful whether prices will ever return to the low level of before the war. The railway that purchases quick service cars now is the road that will reap the harvest now and in the future.

Owing to the publicity that has been given the conservation of men and materials and the actual scarcity of labor, the present is the opportune time to introduce the quick service car to the general public.

One-Man Car Operation in Calgary, Alberta

Municipal Railway in Canadian City With a Population of 60,000 Operates Forty-two Reconstructed Cars on the One-Man Plan

By Thomas H. McCauley

Superintendent Calgary Street Railway
Calgary, Alberta, Canada

CALGARY, like other cities in western Canada, was over-constructed during the boom days of 1909 to 1913 in anticipation of continued growth. Beginning in July, 1909, with two cars and 3 miles of track the street railway system grew in five years to have seventy-nine cars and 71½ miles of track. The details of this growth and of the layout of the system after seven years of development were covered in an article published in the Electric Railway Journal of Nov. 4, 1916, page 962. Including 3½ miles of track to the Sarcee military camp, added in 1916, the total mileage is now 75 and the city owns ninety-one cars of all classes. The railway represents a total cost of $2,280,000.

During prosperous days nearly $600,000 was set aside as a sinking fund and depreciation reserve, and the railway is credited with approximately $18,000 per year interest on surplus and depreciation funds.

Inauguration of One-Man Service

In 1914 one-man car operation was tried on three outside stub lines, and in June, 1916, six additional one-man cars were placed on the "belt line." The cars were installed on this line because, in a way, it served every section of the city, and at the same time it was a slow line with a schedule speed of but 8 m.p.h. These cars were of the single-truck type. The long rear pay-as-you-enter vestibule was closed in and used as an observation and smoking compartment, and a single door at the front was used for both entrance and exit.

In January, 1917, the small cars were fitted with separate entrance and exit at the front and an emergency exit at the rear. They were received with such favor that in March they were replaced with double-truck cars similarly fitted, these cars having a seating capacity of forty passengers in the main body, and twelve passengers in the rear smoker. These, in turn, were so satisfactory that ten more were reconstructed and placed on two crosstown lines on April 22, followed by six additional cars, 46½ ft. long and seating sixty passengers, which were placed on another crosstown line. Six 32-ft. cars were also assigned to two sparsely-settled lines.

Finally, between July 1 and the present time,

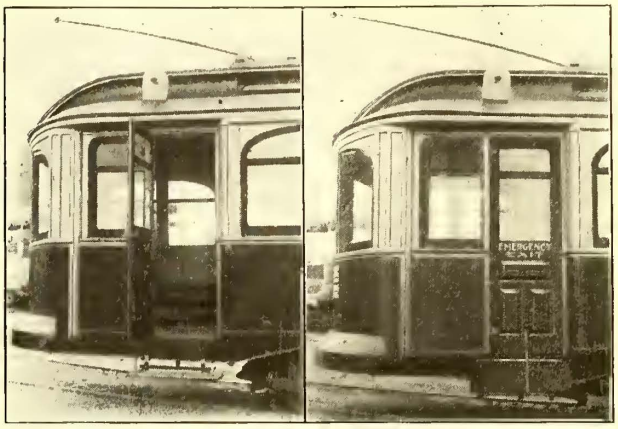
eight additional 41-ft. cars were reconstructed and placed on two lines operating on long grades of 8 per cent to 10 per cent, and other cars have been added until we now operate a total of forty-two cars of three lengths—32 ft., 41½ ft. and 46½ ft.

All of these one-man cars are operating on exactly the same schedule as when operated by two men, making from 8 to 15 m.p.h. on headway from five to thirty minutes on their respective runs. They overlap in such a way that in the city there is an average headway of from one to two minutes in each direction. Only five regular and six extra cars are now operated with two men. The latter are used to carry from 800 to 1000 employees to and from the Ogden shops of the Canadian Pacific Railway night and morning. They are at present being converted for train operation so as to seat in the trailer eighty-four passengers and in the motor car seventy passengers. They will be operated with a motorman-conductor and a trailer conductor in each train.

CAR RECONSTRUCTION FOR ONE-MAN OPERATION

The Calgary car, which was designed by the writer, had a front vestibule 4 ft. long and a rear vestibule 7 ft. long, arranged for pay-as-you-enter operation. To furnish entrance and exit at the front two-thirds of the bulkhead was removed, as was also the right-hand front panel of the front vestibule. The sliding door taken from the bulkhead was placed in this panel and arranged to swing outwardly over an extended vestibule and step. A folding step was provided with control for door and step, completing the entrance.

The former outer vestibule door was made to fold out forward or left as it was to open inwardly, depending upon the original construction, manual control being so arranged as to open or shut one or both doors with one movement and raise or lower the step at the same time. Previously some of the cars had folding doors and some had full-sized swing doors. These were utilized in making the

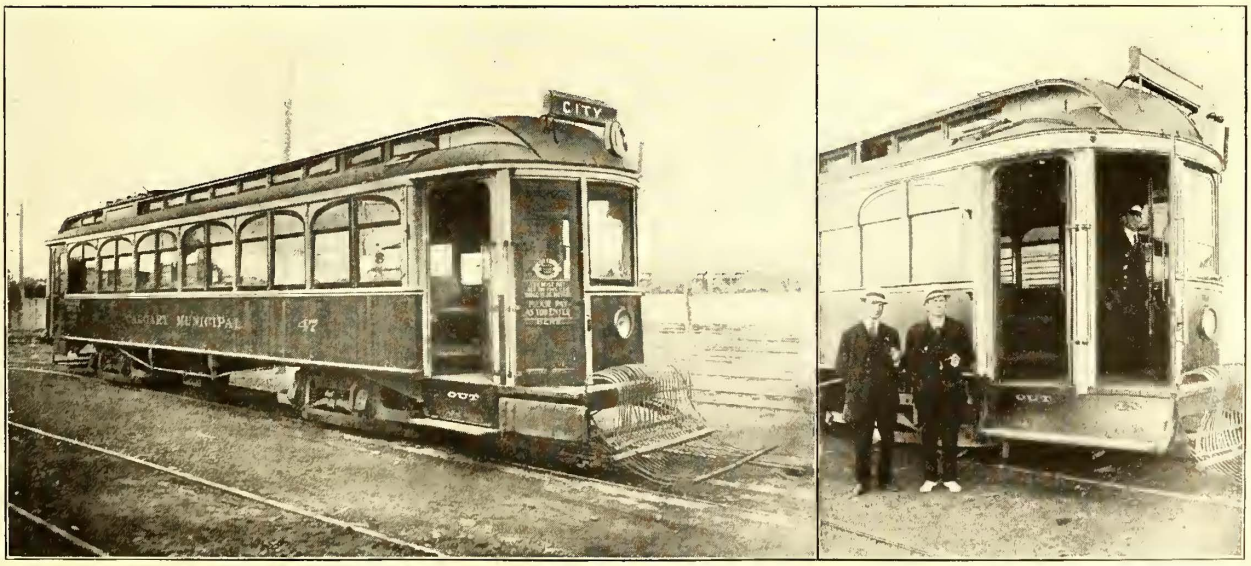


One-Man Operation in Calgary—Rear Emergency Exit Door Open and Closed

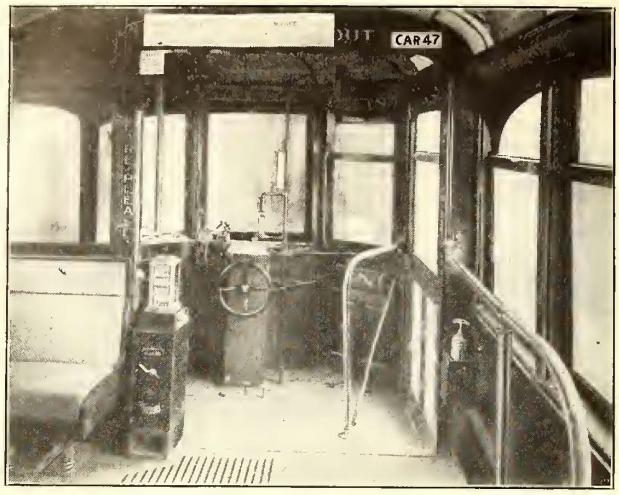
changes so that now there are three different styles of exit doors. The door preferred by the operators folds inwardly to the front of the car, an arrangement which permits both the "in" and "out" doors to swing forward on opening and backward when closing. This permits the operator to utilize the momentum of the doors, which are released just before the car starts or stops, in closing and opening.

The door arrangement described gives an entrance almost in front of the operator, and an exit at the side, as is shown best in the vestibule illustrations accompanying this article. Passengers may thus enter and leave at the same time, paying as they enter and receiving tickets and transfers as they leave, a railing being provided to separate entering and leaving passengers and furnish support for them while doing so.

The double-truck cars have both air and hand brakes, the staff and gearing of the latter being inclosed in a wooden housing, the top of which forms a small table for the motor-conductor's punch, transfers, etc. Two switch irons are carried in each car, hung through the floor for easy



One-Man Operation in Calgary—Double-Truck One-Man Car, and Close View of Entrance and Exit Vestibule



One-Man Operation in Calgary—Equipment at Front End of Car

operation. The ventilation is so designed that the operator from his location in the front vestibule can, by means of levers, open or close the ventilators to any extent desired. The single-truck cars are not equipped with air brakes but have special hand brakes designed by the writer.

On all of the cars the rear platform has been closed in and arranged with seats for twelve passengers as an observation and smoking compartment. A rear emergency door is provided, controlled by levers at front and rear. When the door is released the step is lowered, and the seat which is across the door is raised if it is not occupied. An emergency stop is also provided, the operating knob being hung over the cash box. Pulling this knob, which passenger may do in emergency, applies air and trips the circuit breakers.

The seating arrangement adopted for the one-man cars comprises one 6-ft. longitudinal seat on the left-hand side of the entrance and a similar seat on the right-hand at the rear, looking from front to back. The remainder are cross seats. The lights in the car are shaded, and a cluster is placed in the ceiling of the vestibule with a push button so that the operator may turn it off and on conveniently. A shaded lamp from the car body circuit is inserted in the car post at the fare box, reflecting its light on the receiver or trip pan. All of these details are clearly shown in the illustrations.

An automatic fender is placed under the rear vestibule so that should a car back up pedestrians will be protected. The car trucks, also, are guarded in such a manner that should a passenger stumble in front of the car he will not be injured.

The cost of converting single-end pay-as-you-enter cars, including arranging seats and emergency door in rear vestibule; removing the front bulkhead, extending the platform and placing the door in the right front panel and adding the necessary control levers; shifting the long step to the front and the short step to the rear, with other changes in location of controller and brakes; arranging the light-shading, advertising spaces and ventilating boards on the ceiling, represented an expenditure of $85 per car, not including painting, or $150 per car complete. The writer has applied for patents on the original features represented in these improvements.

Operating Features of the One-Man Cars

On our cars the fares charged are as follows: Regular fare with transfer, 5 cents; six regular tickets, 25 cents; twenty-five regular tickets, $1; work tickets, good from 6 to 8 a. m. and 5 to 7 p. m., eight for 25 cents; school and children's tickets, ten for 25 cents. Eighty per cent of our passengers use tickets. Transfers, which are issued when passengers leave the car, are designed to be as simple as possible so that the motorman-conductor can punch a number at once. If not used within a specified time they can be punched for a later hour. Transfers for each route have a distinct color to prevent abuse.

The wage schedule in Calgary calls for 32 cents per hour for the first year for motormen and conductors when there are two men on a car, and 37

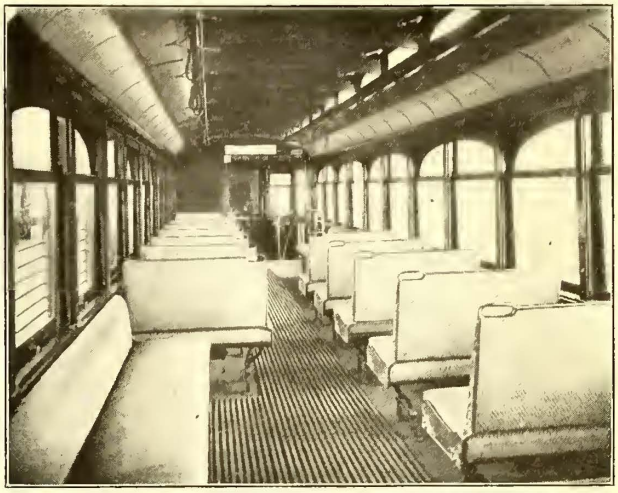
One-Man Operation in Calgary—View of Car with Exit Door Folding Outwardly

cents for the motorman-conductor with one man on the car. The rates are increased to 37 cents and 42 cents respectively for each year of service up to seven and one-half years, after which they are constant. Most of the men receive the maximum wage, so that there is a platform saving of 32 cents per hour in one-man operation. The largest number of hours operated in one day during July by one-man cars was 950, representing a saving of $304 at the rates given. It was actually more than this, however, for time and one-half was allowed on this particular day, which was Dominion Day, or July 1, so that the saving was actually $456. The average daily hours operated in July by one-man cars were 629, and the total saving for the month was about $6,400.

Our records show that the operation of one-man cars has not in any way decreased the traffic, but rather increased it. There is also less loss of fares, partly because the location of the fare box is such as to make it difficult for passengers to enter the car without paying fare. At the same time the motorman-conductor is in a conspicuous position with respect to the passengers and is thus under constant inspection.

The railway department of the city pays the power department at the rate of 1½ cents per kilowatt-hour for energy up to 400,000 kw.-hr. per month, which is 3 cents per car-mile. Above this amount the rate is three-quarters of a cent, or 1½ cents per car-mile. We find that less energy is used on the one-man cars, which fact we explain by the greater care taken in starting, stopping and coasting due to the increased feeling of individual responsibility. We take advantage of the low rate for power by sending out extra cars to relieve congestion, which we can do at 42 cents per hour for labor and 12 cents for energy.

Since we have been operating the one-man cars we have not had a single step accident and only one slight collision accident which could be attributed to one-man operation. This result has been achieved in spite of the fact that the period has been one of training of motormen and conductors to be motormen-conductors, and it has also covered that of the Alberta Provincial Exhibition, involving the operation of fifty-two one-man cars carrying 50,000 fare passengers and 10,000 transfer passengers per day.

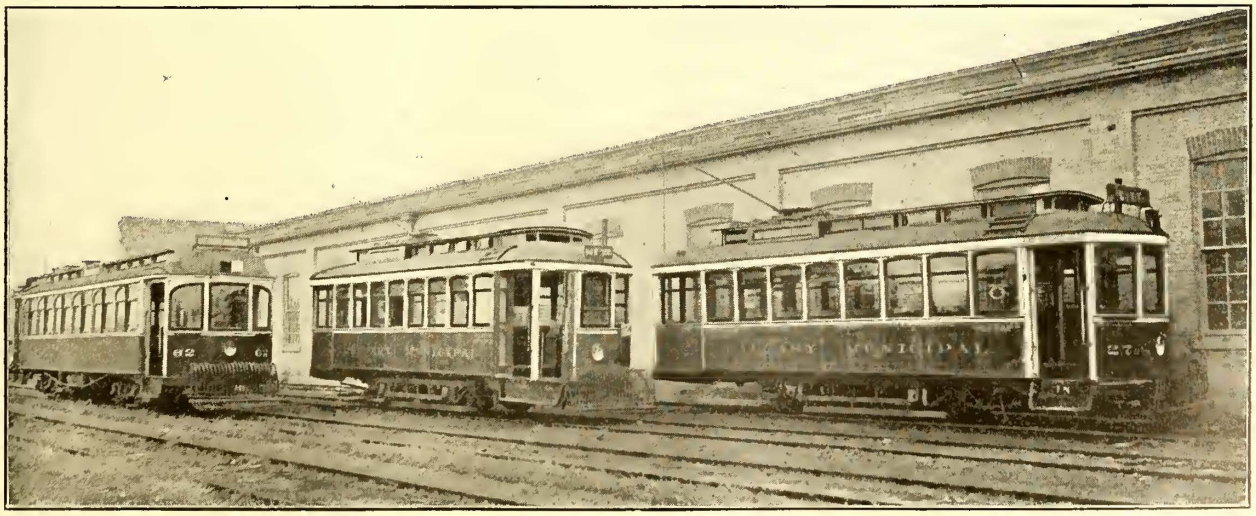


One-Man Operation in Calgary—Interior View Showing Seating Arrangement

Operating Details

We have had very few operating difficulties with the one-man cars. Operators are supplied with change-makers, and, as explained, the punching of transfers has been made as simple as possible. Fare collection is simplified also by the fact that many passengers purchase $1 books. Our cars are equipped with whistles, where compressed air is available, for the purpose of communicating with cars on intersecting lines. One whistle signal means, "Wait for transfers"; two "All clear—go ahead." One whistle signal from a waiting car means "Have you transfers?" and one in reply by the approaching car means "Yes," while two mean "No."

In order that the motorman-conductor may be



One-Man Operation in Calgary—View of Large Before and Small Car Before and After Reconstruction

able to see the fare box plainly a mirror is placed in front of him. No registers are used on the cars. All cars have electric signal bells and buttons, with a bell and rope in addition extending through to the rear smoker for the use of standing passengers. Operators are permitted to make change while the car is in motion on outside lines when they can see that it is safe to do so.

We find that the trolley wheels rarely leave the wire, but the cars are provided with trolley catchers, and trolley guards are used on all railway crossings. We find that as operators use much greater care when entering switch points than formerly, the upkeep of the latter has been reduced. For the same reason switches and broken trolley wires are less numerous than they were. As we do not operate shuttle cars the operator is only required to turn signs at the ends of the runs.

The names of streets are called by the motormen-conductors, and these are also able to render much assistance to elderly passengers and children. The carrying of baby go-carts and small buggies, which has been customary on our system, made a little extra difficulty at first, but this has been removed by suitable arrangement of the interior of the car.

We do not operate over any main line steam railroad crossings, but do cross a number of sidings or spur tracks. These crossings are protected by semaphores operated by the railway crews using the spur. When signals are set against our operators it is their duty to insure safety by leaving the car and looking in both directions.

Relations with Employees and the Public

When the one-man plan of operation was adopted some employees were naturally set back but, by the use of tact, other occupations were found for the men no longer needed for platform work. Some men were given employment in the rolling stock, track and line departments, where they were valuable in keeping down depreciation rather than spending their time standing on the rear of cars. As a consequence our equipment is kept up much better than formerly.

At first some employees did not believe that they could become successful motormen-conductors, but most of them have become experts at this work, and I am satisfied that the majority would not now care to return to former positions. In selecting men we chose alternately a motorman and a conductor according to seniority. Under the present conditions the men not only earn more money, but they state that their work is more interesting. As they are alone responsible for results they are not now dependent upon a second man for signals and can consequently avoid delays. In fact, the operator is "captain of his own ship," and it is his interest to make schedule time, to insure safety to passengers and to treat them courteously. As there are fewer men required to operate the cars it is correspondingly easier to maintain harmony among them.

At first a part of the public feared that the railway department would reduce the privileges of mothers with respect to the carrying of go-carts, etc., and an appeal was made to the local Council of Women to insure the continuation of this privilege. By some slight changes in railings and grab handles it was possible to meet the wishes of the Council and this opposition to the adoption of the one-man car was withdrawn. The Board of Trade went into the matter of the one-man operation also, and unanimously approved it; the same action was taken by the Rotary and Advertising Clubs.

The leading papers strongly indorsed the one-man car as an economic means of keeping down the fare and supplying good, safe service. As a whole, the public is satisfied that the car is safer, quite as speedy and more economical than its predecessor.

Summary and Conclusions

From our experience I am convinced that the one-man car is the only solution of the present problem of more economical operation on many lines in large cities and altogether in cities up to 75,000 population. It affords a means of meeting jitney and private automobile competition. The belief has prevailed to some extent that only small cars can be operated satisfactorily with one man. Under many conditions the light-weight car is the ideal, but with reasonably cheap power the double-truck car of medium size will, in my opinion, prove to be the most popular where the traffic warrants its use.

At first I was pessimistic regarding the operation of 46-ft. cars by one man, but experience proved them to be very satisfactory. When we began we stationed conductors on these cars during rush hours, while the motormen-conductors were being trained in their double duties, but this was shortly found to be unnecessary. I believe that any type of front-entrance and exit car could be operated by one man during slack hours, or say twelve hours per day, and two men could be used during rush hours or nine hours per day. I wish to emphasize, however, that extra wages should be paid for the one-man operation, as this encourages the operators to become competent to handle the cars alone. In making the transition, as positions are vacated in natural course or are made available by the addition of more cars, a general one-man system can be installed without inconvenience and with entire safety to the public. To avoid confusion, however, a line should be changed completely from two-man to one-man operation. I believe also that single-end cars with loops should be used, as shuttle cars require too much attention.

Finally, if operators are provided with such conveniences as to make it reasonably easy for them to operate cars alone, and if inducements are given to the public to purchase and use tickets, there is no reason why conductors should be employed. To speak generally, a motorman is idle while the car is at rest and the conductor is not fully employed when it is operating. The motorman-conductor is occupied all the time, because he is caring for his passengers when not operating the car, and operating the car when not handling passengers.

Development of Light-Weight Safety Car on Illinois Traction System

Original Light-Weight Safety Car in Service on Main Business Street, Wichita, Kan.

The Considerations Which Led to the Adoption of This Special Type of Car and Governed Its Development Are Related—The Practices of the Illinois Traction System in Operating Cars with One Man and a Description of the Latest Type of Bosenbury Car Are Also Given

IN the medium-size town the resident turns the faucet and draws water of the same pressure and as fit to drink as he would in the great metropolis. He picks up his telephone receiver and gets the operator almost immediately, just as he would in the large city. He snaps a button and his electric lights burn as brightly and as steadily. His office has all the conveniences and refinements of a New York office. It will not be in a forty or a twenty-story building, but what there is of the building, if modern, will be just as good. He may stop at the hotel in his town and have every comfort. It will not have a thousand rooms and a thousand baths, but it will provide him with a service very like that of his Chicago or Boston stopping place. With all these accommodations closely approximating in quality similar service in a metropolitan district, he naturally expects to be given approximately metropolitan service by the electric railway company.

It was in about these words that J. M. Bosenbury, superintendent of motive power and equipment Illinois Traction System, summed up the reasonableness and necessity of providing more service in the smaller cities. Under the direction of H. E. Chubbuck, vice-president executive, Mr. Bosenbury has been one of the leading spirits in the industry in developing and fostering the light-weight safety car idea, and he was the first to build cars embodying the essential features of the present safety car design.

The railway men in the medium-size towns, he went on to say, have pursued the wrong course in attempting to furnish a service comparable with that in the metropolis, for instead of providing an approximation in the way of speed and frequency, they have made use of the big city car. The electric light company and the telephone company have furnished their equivalent service by providing a plant commensurate in size with the needs of the community. The railway men, however, have installed big, beautiful, double-truck cars such as are used in the large centers, but cars entirely out of proportion to the size of the town. They have attempted to reproduce the plant rather than the service. How can this situation be remedied?

The better service generally demanded by the public cannot profitably be given with the type of car at present in common use. One of the requirements of the public is that the cars be operated at a higher rate of speed. But to operate the present cars at a higher schedule speed would increase the costs

of giving the service very materially. Any increase in costs is out of the question, for most of the roads cannot afford to give even the present standard of service. This fact then leads to the alternative of producing an electric railway car of such characteristics that the saving in energy consumption will be sufficient to warrant the building of new cars which are adapted to the better service requirements.

And thus came about the incentive which has produced the light-weight safety car and which is now forcing the railway men to look to it for relief. It has been developed not so much as the result of genius foresight as from plain necessity. One of the more startling necessities for the new type car is brought out in the statement of Mr. Bosenbury that it has been estimated with reasonable accuracy that 50 per cent of the available passengers in the medium size town are now riding in private automobiles. These are the most serious competitor the urban railway company now has. The jitney bus is not the real competitor that it was for a time thought to be, but to its advent can be credited the important lesson of higher schedule speed and greater car frequency.

Carrying passengers is an out and out power proposition, according to Mr. Bosenbury's views. The people want rapid, frequent service at all times of day. The most economical way to provide this is the one which will result in the smallest energy consumption, or, in other words, the one which will involve the least idle weight haulage. If a traffic of 500 passengers per hour originates at a certain point during one or two hours in a day, while this same point provides a load of only fifty or 100 passengers an hour during the remainder of the day, it is certainly wasteful to operate the same big unit all day long, although it may be well suited to the peak period. It is impractical to lengthen the headway between the big cars and thus make the number of passengers carried per car-mile higher, for in the medium size town, if the passenger misses one car and knows he must wait fifteen minutes for another, he walks. The most flexible arrangement to care for this common condition is the use of small car units running frequently enough so that it will be much quicker to wait for the next car than to walk, and then greatly to increase the number of these small units for the rush-hour period. By such a scheme the current consumption and maintenance charges are more nearly in proportion to the number of passengers carried than they are where the larger cars are operated with many vacant seats during a large part of the day.

After it was learned that it was unnecessary to run a heavy double-truck car and new design work had begun, it was found that with a single-end, single-truck car it was possible to provide a seating capacity larger than most of the single-truck cars in use and almost equal in capacity to the double-truck cars, and at the same time so to design the car as to realize considerable reduction in weight and consequent current consumption. Then, as the rising costs of operating a railway necessitated further economies, the next step was to operate the car with one man. City officials and the public immediately raised the objection that the cars were unsafe with only a one-man crew. This criticism was followed by the development of labor-saving and safety devices which would completely overcome this deficiency. In fact, the control which was originated for this purpose made the car with a single operator even more safe for passengers than the ordinary two-man car. The undivided responsibility, to begin with, tends to eliminate the accident hazard. Then the safety devices developed have completely forestalled any serious accident which might happen in the event of the operator's becoming suddenly incapacitated.

Mr. Bosenbury says that from observations made in service, the use of the single operator with a properly equipped car in no way retards the schedule speed. On the contrary, the light-weight safety car makes possible a speeding up of the schedule through taking advantage of the savings of fractions of seconds gained in the operation of doors, transmission of signals, etc., where there is but one mind instead of two to think. He claims it takes a second for the average trainman to think and act. Thus, with one operator, half the time consumed in giving and interpreting signals, etc., is saved. The men become very expert in the operation of their cars, and while the schedule speed is apparently slowed up on the first installation of fully equipped safety cars, it can soon be increased over the previous two-man operation.

How Much Will the Light-Weight Car Save?

Extensive use of the light-weight safety car has not yet been made on the Illinois Traction System, but this is not because of any lack of appreciation of the economic possibilities it holds forth. Mr. Chubbuck is completely "sold" on its use and says that many of this type of car will be installed on the various city properties as rapidly as is expeditious with the prevailing money and material market conditions. Quite general use has been made of cars operated by one man on light-traffic lines on some of the city properties of the I. T. S. for many years (in Ottawa, Ill., for twenty years), but these cars embody only the saving in platform expense and do not comprise the features vital to the public interest and to further economies for the company. A number of cars have also been converted for one-man operation, but this scheme does not to any great extent lighten the weight and results, therefore, in little saving in the cost of car propulsion. For instance, on one city property, the annual saving to be gained by the use of twelve light-weight safety cars as compared with twelve converted one-man cars was carefully estimated to be $19,466 in favor of the new light-weight cars. This procedure will therefore not be pursued by the company to any great extent, since it includes but part of the possible savings and does not make readily possible the improvements in service which are desired in fostering the "public-be-pleased" policy.

Mr. Bosenbury has made analyses of the operation of the eleven light-weight safety cars which the company has had in service since 1912. In general, these show that a saving in platform expense and current consumption of from 25 to 30 per cent over the similar expenditures for two-man operation can be effected. These figures include an increase in car miles over the two-man car schedules, meaning improved service of from 25 to 40 per cent. The detail figures involved in the estimate of the costs and advantages of installing new cars of the one-man, light-weight type on one complete line of one Illinois Traction city property, and on the entire system in another Illinois Traction city, were computed two years ago and showed very attractive savings. In the latter city the proposed scheme of cars and operation included a general rerouting of cars and the changing of 2650 ft. of track from one street to another in the down-town district to make possible the looping of all lines and permit the use of single-end cars. In the former city, the proposed operation showed a net annual saving over the then operating costs in favor of the light-weight safety car of 24.7 per cent, at the same time providing for a 15.4 per cent increase in seat miles per year and a 11.1 per cent increase in regular car service with a large increase in rush-hour service. In the latter city, the detail figures for the conditions and prices then prevailing showed a net saving, including the interest on the track rearrangement, investment, etc., of 23.6 per cent in favor of the safety car, at the same time providing a 28 per cent increase in car-miles per year.

More recent estimates made for another city, and including a complete change to the light-weight safety car, showed that with the purchase of thirty new cars, thus increasing the capital account $150,000, the net earnings after deducting operating expenses would be increased from 8 per cent to 11 per cent on the total investment. This did not include any allowance for increased receipts which would doubtless result from the more frequent and faster service.

Experience in Wichita and Quincy

Definite operating figures from Wichita, Kan., given below provide a concrete instance of the savings possible with the safety cars. As these were the pioneer light-weight safety cars to be built and operated by the McKinley properties, they do not show as marked a saving as later cars which have been developed and improved as the result of experience with these first ones. They weigh from 7500 to 10,000 lb. more than the later designs and hence have a correspondingly higher current consumption. The maintenance on the newer cars has also been reduced due to improvements in the control systems. In Wichita, the North Riverside-South Emporia line, on which the safety cars are now run, was formerly operated with five single-truck two-man cars, such as the one shown on this page. These cars weighed approximately 26,000 lb. and seated twenty-eight passengers. Four of these cars were run through from one end of the line to the other, while the fifth was operated on a branch stub line on a shuttle service. As each car came out to the connecting point, the conductor would leave his car and take the shuttle car to the end of the stub line and back while the motorman went on to the end of the main line and returned with the other car. Then the stub car was left standing there without attendant until the next outbound car arrived. Thus, but eight men were required to run the five cars with a fifteen-minute headway, or sixteen men for the full 19.2 hours a day service. The schedule speed was one trip an hour or 7.82 m. p. h.

Illinois Traction—Type of Single-Truck Car Replaced on Riverside Line, Wichita, Kan.

When the safety cars were installed in September, 1913, the five cars formerly used were replaced with six new ones running with a ten-minute headway and with every other car alternating on the stub line and on the main line, so that beyond this junction point, a twenty-minute service is supplied. The same schedule speed of 7.82 m. p. h. is maintained with the safety cars, since the forked line with one branch longer than the other and the alternate service complicate seriously the working out of a different time-table. Otherwise advantage would be taken of the slightly higher schedule speed possible by eliminating the short layovers and utilizing better running speed. The six cars require twelve men for the 19.2 hours a day service. They weigh 23,500 lb. and seat thirty-seven passengers.

The Riverside-Emporia line is considered one of the heavier traffic lines of Wichita. It operates from

Operating Data for the Riverside-Emporia Line, Wichita, Kan.

	Two-Man Cars Formerly Used	Light-Weight Safety Cars
Number cars in regular service	5	6
Headway, regular service, minutes	15	10
Schedule speed, miles per hour	7.82	7.82
Average energy consumption per car-mile, kw.-hr.	1.55	1.27
Energy cost per car-mile, cents	1.86	1.52
Average wage platform men, present scale, cents	28	30
Car-miles per year, regular service	199,412	314,265
Seat-miles per year, regular service	5,583,536	11,627,805
Car-hours in regular service per year	34,684	41,621
Man-hours in regular service per year	55,494	41,621
Energy consumption per year, kw.-hr.	309,088	399,116
Energy cost per year	$3,709	$4,789
Total yearly platform expense	$15,538	$12,486
Total energy plus labor cost per year	$19,247	$17,275
Saving energy plus labor cost per year	.....	$1,972

the southern section of the city, through the main street of the business section and then to the north side of the city, where it serves Riverside Park and the Municipal Bathing Beach. On Sundays and holidays the traffic to and from the park and bathing beach is very heavy, and extra service is usually provided by running two-man cars. The one-man cars carry sixty and seventy passengers each and still keep to the same schedule, and the two-man cars can do no better. Outside of the business district and parks, the remainder of the route traversed by the Riverside line is through residential districts. The population of Wichita at present is approximately 65,000. The total car-miles operated in 1916 was 2,069,864. The number of revenue passengers carried in 1916 was 1,249,891 and the gross earnings were $60,552.96.

In computing the platform expense comparison above, the present scale of wage was used in both cases. This averages 30 cents an hour, including the 10 per cent annual bonus, for the single-operator cars, and 28 cents for the two-man cars. The maintenance figures were not available for inclusion in this article, but these are estimated by A. M. Patten, assistant general manager Illinois Traction System, to be 20 per cent higher for the single-operator cars than for the old cars, owing to the large amount of special apparatus installed on these particular cars, a large portion of which is eliminated on the fifteen new light-weight cars just being placed in operation in Wichita at the time this issue goes to press.

The saving exclusive of maintenance which has been realized through these one-man cars is only $2,000 per year, and this would probably be consumed in the increased maintenance. But this is not the significant point in connection with the change to the safety car. The really important consideration is the fact that an increase in service measured by a 57.6 per cent increase in car-miles operated, 108.2 per cent increase in seat-miles provided, and a ten-minute instead of a fifteen-minute headway, were possible and were given without any increase in operating expenses. As these were the pioneer cars, the showing is not so good as would have been possible with the new cars now being installed in Wichita. These would have made possible a further energy cost saving of approximately $1,000, thus bringing the saving per year around $3,000. A marked lower maintenance also would have added still more to the net savings.

Fare Passengers and Gross Earnings by Years in Wichita

Year	Fare Passengers	Gross Earnings
1912	1,017,404	$49,055.00
1913	1,071,397	51,675.56
1914	1,076,163	51,967.85
1915	1,122,346	54,317.62
1916	1,249,891	60,552.96

These figures thus far have not taken into consideration any increase in business resulting from the better service provided. Just how much advantage can be attributed to the better service is very difficult to estimate, since so many factors take part in influencing the amount of travel on the electric cars. Perhaps the fact that the Wichita gross earnings have shown a substantial increase, as given in the accompanying table, despite the competition of jitneys and four 5-cent fare auto-bus lines, and worst of all, a private automobile for every ten inhabitants, is as good an indication as any of the value of the more frequent service.

The Quincy (Ill.) Railway has in use four of the same type cars as those on the Riverside line in Wichita. Three of these are required in the regular schedule on a cross-town factory service. The schedule speed maintained is 8.25 m. p. h. with a twenty-minute headway which can be increased to ten minutes when the traffic is heavy. W. A. Martin, general superintendent, states that these cars are saving the company amounts approximately as shown above, when compared with the older design two-man cars and same frequency of service.

Saving in Quincy Resulting from Use of Four Safety Cars

Saving in labor per car per day	$3.10
Saving in maintenance per car per day	1.06
Saving in energy cost per day	1.04
Saving in maintenance of way per day	.19
Total saving per car per day	$5.39

Developing the Light-Weight Car Design

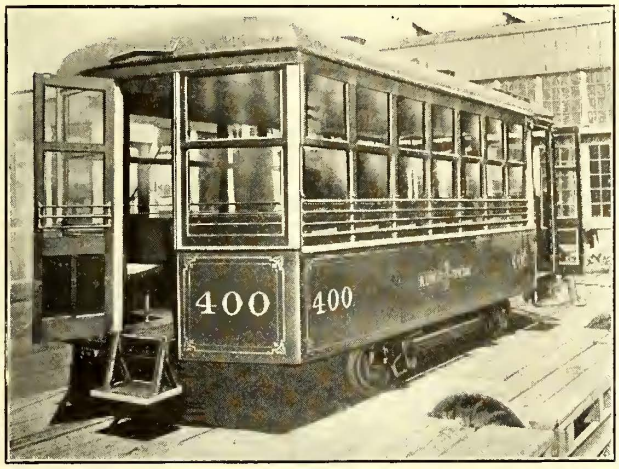
The first cars on the Illinois Traction System, and in fact the first in the country built specifically as light-weight, one-man units, included an installation of eleven, of which four have been in use in Quincy, Ill., one in Oskaloosa, Ia., and six in Wichita, Kan., since 1913. These were sufficient to equip one line complete in each of these towns. Through the downtown district in each case, they are operated over the same track as cars of other types, and they have not in any way retarded the schedule. These cars were fully described in the Electric Railway Journal for Oct. 1, 1916.

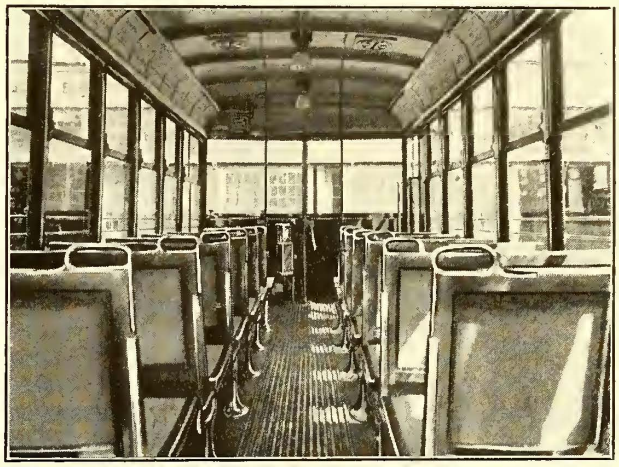
These first Illinois Traction light-weight cars weighed 23,500 lb. and furnished a seating capacity for thirty-seven people. They were arranged for single-end operation with a sliding exit and entrance door at the front, and with an emergency exit door at one side of a rear vestibule closed off from the main body of the car by a bulkhead and sliding door and used as a smoking compartment. Only longitudinal seats were installed, leaving a wide aisle which provided a standing room capacity possibly equivalent to the seating capacity. The car floor was continuous from bumper to bumper, since the omission of drop platforms greatly simplified the underframe construction and thereby reduced the necessary weight. The body was of composite construction, with steel underframe and yellow pine side posts and side sills, poplar letterboards, etc. The roof was of the plain arch type with wooden construction. The dimensions follow:

Length over all	32 ft. 4 in.
Height from top of rail to top of roof	10 ft. 9 in.
Height from rail to car body floor	28 in.
Height from rail to top of first step	14 in.
Height from first step to car floor	14 in.
Width of car over side plates	8 ft. 2 in.

These first cars were equipped with various safety appliances, including a deadman's control combined with the Westinghouse HL control, air-operated doors and steps and a pneumatically interlocked emergency rear door, all arranged so that the car could not be started when the doors and steps were open and the doors and steps could not be opened when the car was in motion. From the effort made to provide the automatic safety features for these cars, it was found desirable to make use of compressed air, and with this established, air brakes followed as a natural sequence. The air brakes and door operation were then interlocked to be operated by a single lever in a system described in the issue of this paper for Sept. 2, 1916.

It is Mr. Bosenbury's opinion that all the labor saving and safety devices of proved worth on the market to-day should be installed on the light-weight type cars. He says that the operator should be given every device possible to facilitate his work and should then be made to realize that he is a merchant with a service for sale. The use of air brakes in this connection is especially important. A 15,000 lb. car running at 20 m.p.h. has 200,400 ft.-lb. of kinetic energy which must be dissipated in bringing it to a stop. To do this work manually, where a car is making an average of six stops per mile on a schedule speed of 9 m. p. h. (which means 486 stops in a nine-hour day, or easily 500 brake applications in a day including slow-downs), is arduous, and the operator may reach a state of fatigue at some point in the day's work between the first and 500th brake application, when it will be easier to turn his head and "not see" a passenger than to stop. According to Mr. Bosenbury, it is only necessary to skip two or three passengers a day to pay the interest and depreciation on the air-brake equipment.



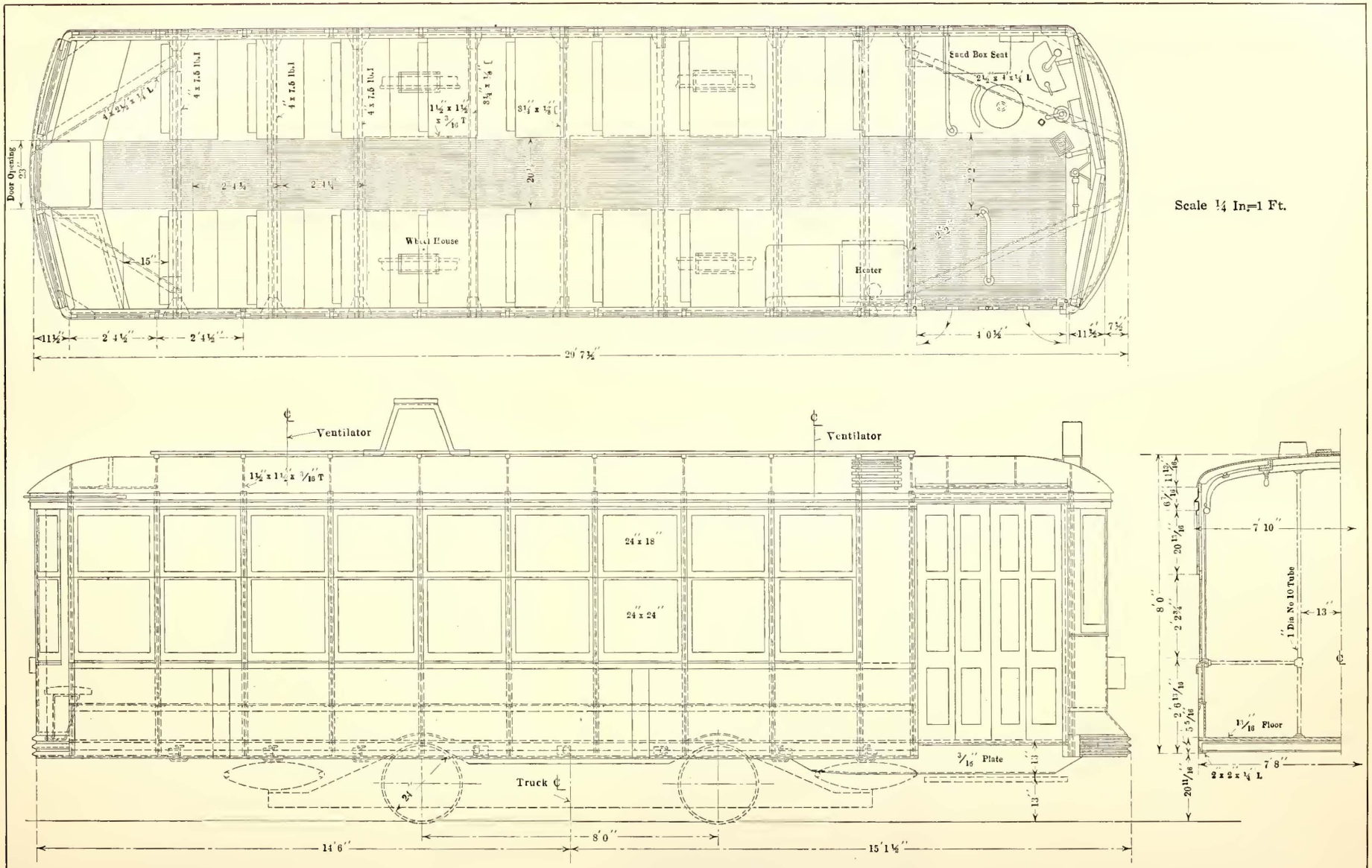


Illinois Traction—Views of the 10,000-*Lb. Safety Car,* 22 *Ft. Long and Seating Thirty Passengers*

THE 10,000-LB. SAFETY CAR, THE NEXT DEVELOPMENT

Further study in the design of the small unit type of car by Mr. Bosenbury brought out in 1916 a single-end, one-man car with a seating capacity of thirty passengers and a weight of only 10,000 lb., or 333 lb. per seated passenger. The first eleven cars of the safety type weighed 635 lb. per seated passenger. Profiting from the experience with the first design, effort was made to eliminate all things possible that did not add to the comfort and safety of passengers. This 10,000-lb. weight of the second car includes the body, truck, electrical and air-brake equipment, and the pneumatic door engines, etc., complete like the previous cars. The floor is continuous from bumper to bumper, but use is made of transverse seats instead of longitudinal seats. The main door at the front end of the car, 32 in. wide, is used for both exit and entrance purposes, in order to minimize the amount of space required and hence reduce the weight. This door is of the two-leaf, folding type and is arranged to open outwardly in such a manner that the retardation of the car has a tendency to assist in opening the door, while accelerating the car has a tendency to assist in closing the door. The door and step are operated pneumatically and controlled by the brake valve handle. The rear emergency exit door is placed directly in the center of the car. It is held securely in position by two locks, one operated pneumatically and the other manually. The pneumatic lock is unlocked automatically by an emergency application of the air brakes, which may be obtained at the will of the operator, or by an emergency cord that extends through the car, or automatically if for any reason the operator suddenly removes his hand from the controller handle. After the door has been unlocked pneumatically by any of these means, it is still in a locked position until someone releases the manually-operated lock. The latter is attached to the seat immediately in front of the door, and it is impossible to release this lock while a person is sitting on the seat. This arrangement was installed simply as a safety measure. When the rear emergency door opens, the seat immediately in front of it folds backward and down to form a step.

This 10,000-lb. car is 22 ft. 4 in. long by 7 ft. 8 in. wide, and 9 ft. 11 in. from top of rail to top of car



Illinois Traction—Plan and Elevation Details of Latest Type of Safety Car

roof. It is mounted on a specially-designed truck with 24-in. wheels which bring the height from top of rail to first step at 13½ in. with another 13½-in. step onto the car floor. In general, the car has straight sides and arched roof and is constructed of steel. This car was exhibited at the last convention of the American Electric Railway Association by the St. Louis Car Company, which built it as a sample stock car.

LATEST TYPE ILLINOIS TRACTION CAR

The fifteen new cars just being placed in operation in Wichita represent the latest type of Bosenbury car, although these are somewhat larger and heavier than the designer would build as a standard for the system. They are approximately 30 ft. long, weigh 16,000 lb. and seat forty-one passengers, giving a weight of 390 lb. per seated passenger. The hot-air heater used reduces the seating capacity to thirty-nine during part of the year. The main items making up the total weight are as follows:

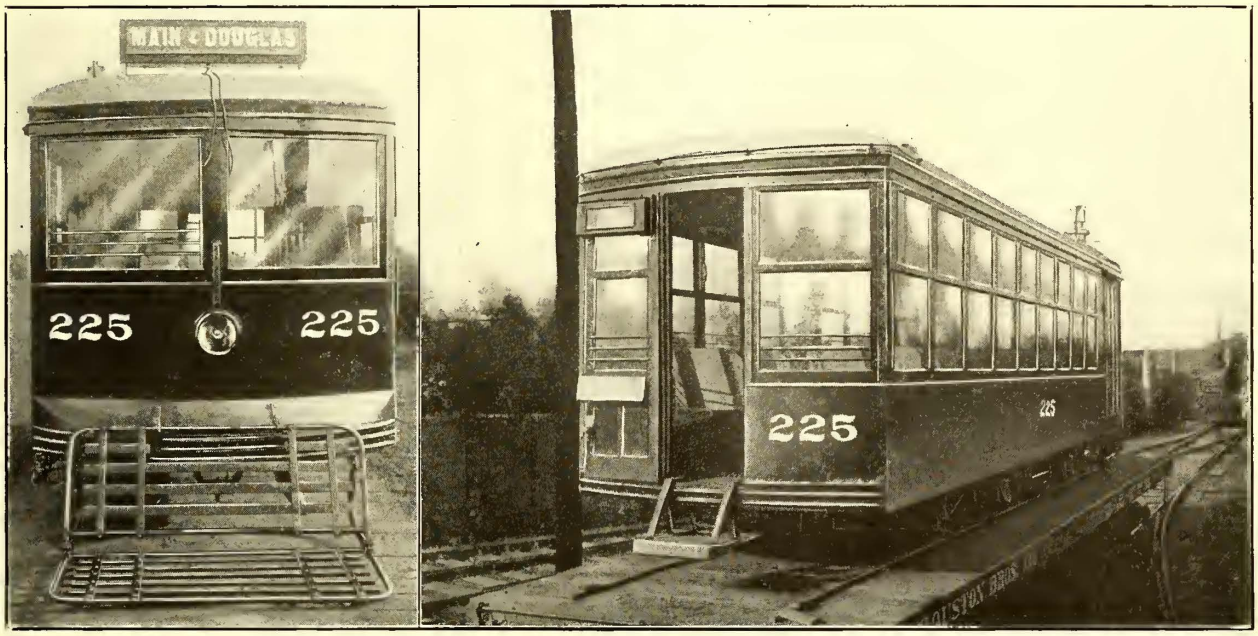
Car body	9,050 lb.
Truck	4,200 lb.
Electrical equipment	2,000 lb.
Air brake equipment	750 lb.
Total	16,000 lb.

These cars are equipped with two GE-258-A motors and K-10 control, and the Safety Car Devices Company air-operated step, door and automatic emergency control, with the Westinghouse DR-10 compressor.

The bodies of these cars are constructed of steel except for the roof structure and are built without bulkhead or platform. The seats are Hale & Kilburn cross-seats of the springless type, except for one longitudinal seat next to the front door. The rear emergency door is located in the center of the car and is double locked, mechanically and pneumatically, as on the 10,000-lb. car. Separate entrance and exit doors of the two-leaf folding type with wire glass panes in the lower halves are used. All doors are operated from the motorman's position by Safety Car Devices Company door engines and mechanism. The steps at the opening operate in conjunction with the doors and are raised and lowered through a train of bevel gears. The steps are spring counter-balanced.

The underframe is a very simple steel construction made up with pressed-steel angle side sills extending the full length of the sides of the car in combination with No. 16 rerolled, resquared, patent leveled sheet-steel side sheathing which is bent around the corner posts. The cross-sills are also of pressed steel members except for those sills which are used as truck connections, and these are 4 in. 7½-lb. I-beams. These cross-sills are connected to the side sills with pressed-steel gusset plates. The bumpers at both the front and rear ends of the car are formed from a three-ribbed pressed-steel anti-climber which extends across the end of the car from post to post in one piece. These bumpers are secured to the side-sill angles on the closed side of the car with gusset plates and with the connection formed by flattening out the flanges on the bumper and using the web for a connection angle. Bumper braces of 4-in. x 2½ in. x ¼-in. pressed-steel angles extend diagonally between the bumper ends and the first cross-sill.

The dashes are constructed of No. 18 rerolled, resquared, patent leveled sheet steel, with No. 16 gage sheet-steel bumper shields. The steel sheathing panels on the inside of the dash have been pressed with corrugations about 10 in. apart to stiffen the construction. The side posts and carlines which ex-



Illinois Traction—Pressed-Steel Anti-Climber Bumper Feature of Front End, and Rear Emergency Door Open and Seat Tipped Back to Form Step, Latest Type of I. T. S. Car

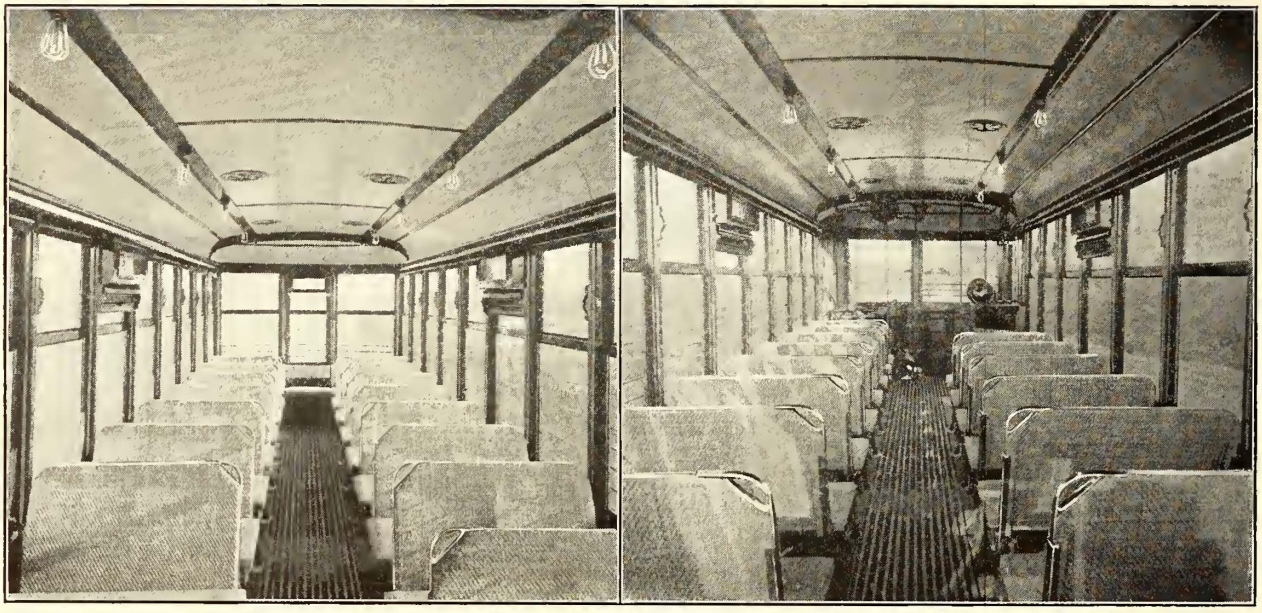
tend in one length from side sill to side sill are formed from 1½-in. x 1½-in. x 3/16-in. rolled-steel tees. A wood filler is bolted on each side of the webs of the tee posts and ash roof furring is similarly bolted to the web on the carline section of the tees. The vestibule corner posts are also formed from rolled-steel tees of heavier weight metal and are continuous from side sill to side sill.

The letterboards and drip mouldings are formed from one piece of pressed steel and riveted to each of the side posts. No. 16 gage sheet steel is used for this letterboard, and it is spliced with inside splice plates pressed to fit the shape of the letterboard and spot welded in place. The letterboard is reinforced over the vestibule door opening by a similar section of No. 16 gage sheet fitted to the inside of the letterboard. The roof is of the plain arch type with narrow tongue and grooved poplar boards fastened to the ash furring on the carlines, sills and other underframe members. Sheet-steel wheel boxes, which are made leakproof by a gasket between the floor and the box, are provided in the floor of the car to allow a lower floor construction.

The window sash are made in two parts with the upper sash stationary and with continuous rails, and the lower sash arranged to raise. The rear vestibule side sash are also arranged to be raised. The vestibule sash in front of the operator's position is arranged to drop, as is also the right-hand front window. The window guards on the sides of the car are in two sections and are formed with pressed-steel ribs and five bars of ⅜-in. rods. The fastenings which hold the window guard to the side posts are also of malleable iron.

Interior Arrangement of Car

The arrangement of the car operator's equipment at the front end of the car is clearly shown in the halftone on page 529. This equipment is so arranged at the left-hand side of the vestibule that the operator may retain his seat and be conveniently situated to collect fares or operate the car. The Woods fare box used is mounted on a stanchion in the center of the car where the passengers must pass by it as they enter and where it is under the close surveillance of the operator. Fares and transfers are recorded on a clock register by means of two foot levers at the bottom of the farebox stanchion, which are also within reach of the operator from his seat. A foot rail installed at the right of the controller and behind the piping permits the operator to straddle the piping and be in a comfortable position for operating the car or collecting fares. One feature in the installation of the control equipment which improves the interior appearance of the cars is the fact that none of the apparatus is located on the ceiling. The various apparatus carried on the interior of the car, such as



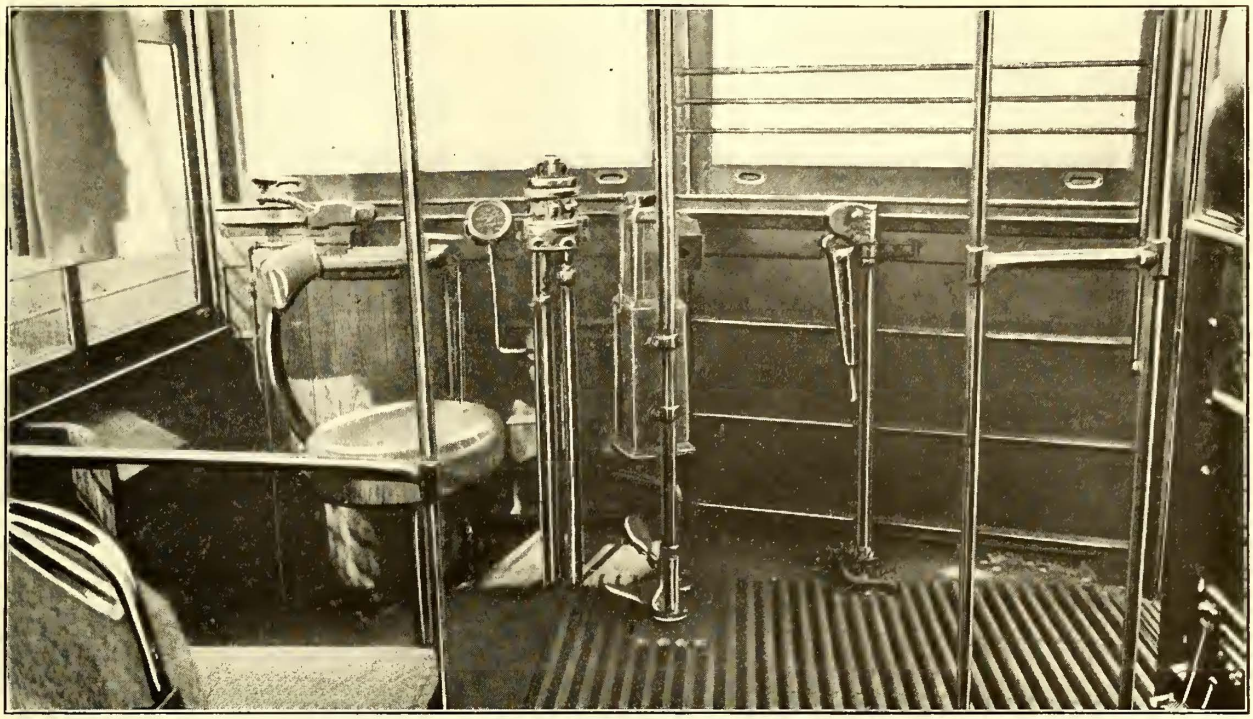
Illinois Traction—First View, Looking Toward the Rear End; Second View, Looking Toward the Front End. Latest Type of I. T. S. Car

painted with white lead and covered with No. 8 cotton duck applied in one piece.

Interior Finish and Arrangement of New Cars

The window sash, doors, moulding and general interior finish of the cars is in mahogany. The wainscoting is of mahogany veneer. The headlining is painted cream color and fitted with a double advertising card rack. The upper-deck headlining is of three-ply poplar veneer, while the lower card rack is of galvanized iron. This lower card rack extends around the ends of the car also.

The yellow pine tongue and grooved flooring beneath the seats is screwed to the ash furring which is bolted to the underframe members. The aisle floor is covered with ½-in. high x ¾-in. wide hard maple mat strips, as is also the front vestibule entrance and exit floor space. Grooves in the underside of the flooring are provided to allow the electric cables and air-brake piping to run above the cross-



Illinois Traction—Arrangement of Control Equipment and Fare Box in Newest I. T. S. Car

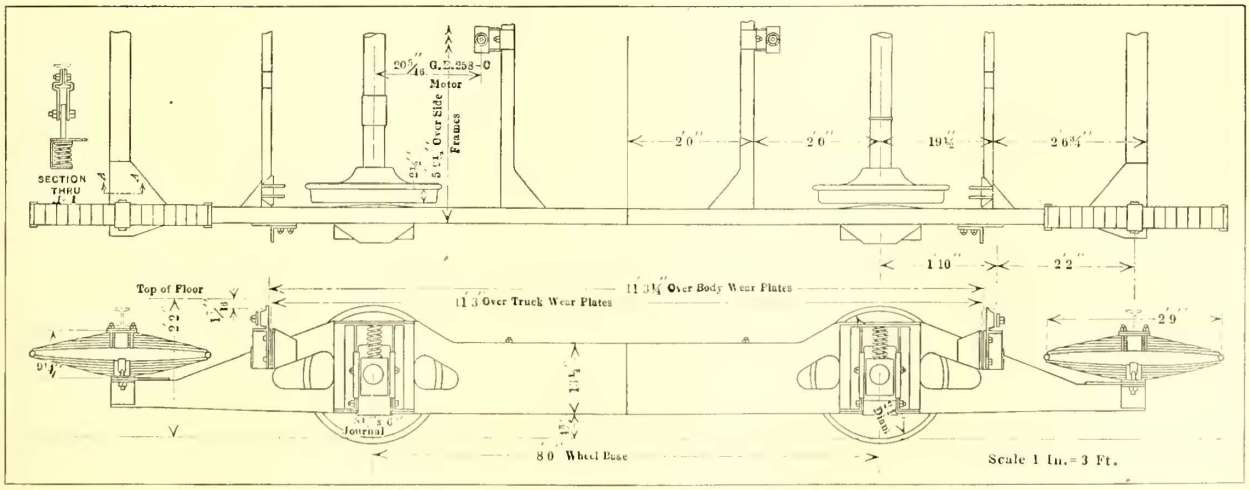
the circuit breaker, Consolidated buzzer system, resistance, switches, etc., are mounted on the side of the car at the left of the operator and below the belt rail.

Special Truck Design

The principal feature of the trucks used with these cars, which were designed by the St. Louis Car Company under the direction of Mr. Bosenbury, is that they are made up entirely of pressed-steel sections whereby it was possible to gain the maximum strength with the minimum weight. While the wheel base of the trucks is 8 ft. long, the car body is supported on four elliptic springs which are placed on cantilever supports extending beyond the wheels to bring the supporting points for the car body 16 ft. apart. The entire load of the car and truck is then transmitted to the car axles through two coil springs over each journal box which are under compression. The action of the full elliptic spring is dampened by two coil springs on each of the end cross-members of the truck which come into compression as the elliptic springs open up and thus prevent galloping. The details of this truck are quite clearly shown in an accompanying drawing.

One-Man Car Operation on Illinois Traction Properties

While the Illinois Traction System has had but eleven cars of the light-weight safety type in use up to the present time, yet ten of its city properties have been making use of from two to eighteen cars operated with one man for some time. Altogether there are approximately 100 cars being operated on the various Illinois Traction System properties with one man. The operating practices which have been



Illinois Traction—Light-Weight Safety Car Truck Built of Pressed Steel Sections

used with them will apply in large measure to the more modern type safety car and may be of interest to those contemplating the installation of cars run by a single operator. In general, cars of the single operator and two-man type are not operated simultaneously over the same line. This mixing of types of cars is sometimes done in providing extra service and through the downtown district, but in every case the local superintendents have reported that the one-man car does not slow up the schedule of the other cars in the least. It is the general aim to avoid using the two different types of cars on the same line, however, because of the confusion which would result when passengers get off and on at the front end of the one-man car and at the rear of the two-man cars. All of the one-man cars on the system have been equipped with vestibule doors, and most of these are hand operated. Practically all of the Illinois Traction one-man cars are equipped with Woods non-registering locked fare boxes and International double registers. Transfers are ordinarily punched in advance so that the operator has only to punch the time and the destination when the transfer is issued.

No rigid rule against the operator starting his car before completing all fare transactions is enforced on any of the Illinois Traction properties. Change is made and transfers are punched and issued in some instances after the car is on its way. This practice prevails more particularly in the residence district, where a comparatively few passengers are picked up, and here only when it is necessary in order to maintain the schedule. In the downtown business districts, the fare collection transfers are completed before the operator is allowed to start his car. It is interesting to note in this connection that the use of the one-man car has brought with it no new form of accidents, with the exception of the experience in Wichita and Topeka, Kan. Here it has been found that some accidents have occurred resulting from boys hanging on and stealing rides, also from some bicyclers hitching on to the rear end of the cars. These accidents did not occur with the conductor on the rear end of the car, as these trespassers would come under the eyes of a company employee. However, fewer accidents have been had with the one-man cars, including this new variety, than with the standard two-man car. The absence of the conductor from the train crew has not added any difficulty to the settlement of claims, in the experience of the Illinois Traction System.

No particular assistance is given to the operators in the way of change packages to facilitate their work. This has apparently not been found necessary in the service so far rendered. Some of the properties put nickels up in $1, $2 and $5 packages for ready issuance to operators. A wage inducement in favor of the one-man car of from 1 cent to 3 cents an hour is made on all the Illinois Traction properties except in two or three cities where all or a very large proportion of the cars are one-man cars and hence are the standard of service in that town. No difficulty has been experienced by any of the companies with either the labor unions or the public in installing the single-operator car service. The people have generally preferred this type of car because of the closer headway. Moreover, where the newer light-weight safety cars have been installed, the fact that they were equipped with air brakes as compared with the hand brakes on the former cars, made a good talking point in introducing them.

The average schedule speed of the one-man cars in the various cities is all the way from 6.2 m. p. h. to 8.5 m. p. h., but in only one city has the schedule speed of the two-man cars been greater than that of the former. In the majority of the cities, no assistance, such as a conductor through the downtown district or a fare collector at heavy loading points, has been found necessary for the operator. In Decatur, Ill., two men are used on the single-operator cars through the downtown district at all times. In Topeka and Wichita, Kan., fare collectors are supplied at busy points when traffic is unusually heavy.

The near-side stop is used without exception on all of the properties. The common practice at railroad crossings is for the operator to get off his car to look up and down the steam tracks and then board his car and cross if the way is clear. This practice is followed even with two-man cars in Wichita and Topeka, where the motorman gets off and flags his own car. The one-man cars are used on all classes of line; namely, main lines, branch lines, stub lines, etc. The extent of the use of all types of one-man cars on the various Illinois Traction properties is given in the following table:

Data from Illinois Traction System Cities Using Single-Operator Cars

City	Population	Number Single-Operator Cars	Number Two-Man Cars	Average Daily Car Miles Entire City	Average Daily Passengers Entire City
Decatur, Ill.	37,000	13	7	2,710	16,200
Atchison, Kan.	18,000	12	4	3,351	8,620
Champaign, Ill.	25,000	2	10	1,522	8,070
Cairo, Ill.	18,000	11	0	1,246	3,350
Oskaloosa, Ia.	10,400	7	0	680	2,860
Jacksonville, Ill.	16,000	7	3	814	3,000
Quincy	40,000	6	32	3,100	10,500
Jefferson City, Mo.	17,000	6	1	585	2,000
Topeka, Kan.	50,000	12	39	5,152	30,508
Wichita	65,000	18	36	5,874	33,199

The principal advantages of the single-operator cars, as summed up by the various Illinois Traction operators, is the saving in platform costs and the reduction in the number of accidents. The latter is the result partly of putting doors on the vestibules and partly to the fact that all passengers entering and leaving the car are directly under the observation of the operator. Much greater advantages than these are anticipated, as more cars of the modern type are placed in operation on the various properties. Several of these cars are now under construction in the St. Louis Car Company's plant, in addition to the fifteen which have just been shipped to Wichita from this plant. Other properties are preparing for their use. In due time, it is expected that many will be installed on the various I. T. S. properties.

Equipment of the Light-Weight, Safety Cars

Showing How These Cars Have Been Equipped for One-Man Operation by Using Special Automatic Air-Brake, Door and Step Control, and Light-Weight Motors, Controllers, Trucks and Miscellaneous Apparatus of New Design

IT is the purpose in the following pages to describe the equipment that has been developed particularly to meet the requirements of one-man safety car operation. In the design of this equipment safety, lightness and automatic operation were the three objectives. Since the reduction of the car crew from two men to one would naturally reduce the schedule speed if the equipment was not changed, it was essential to produce a car whose automatic features would be so complete that its progress over the line would not be delayed by one-man operation. From the railway's standpoint it was also desirable to relieve the operator from physical and mental strain as far as possible. This has been done by making the operating equipment so convenient and efficient that the operator's movements have been reduced to a minimum, with the result that the added conductor's duties have not been burdensome to the operator. The economy of using a light-weight car has already been so fully discussed elsewhere in this issue that comment here is unnecessary.

Air-Brake Door and Step Control

To make the operation of a car as automatic as possible the Safety Car Devices Company has devised a combination air-brake and door and step operating equipment in which the control of the air brakes and the door and step mechanism is combined in one brake valve. This valve is interlocked with the electrical control so that it is practically impossible to operate the car incorrectly without bringing into play one or more safety devices.

The Westinghouse straight air-brake equipment, with the automatic feature whereby the breaking of the air pipes or similar failure will cause an emergency application of the brake has been adopted. The air-brake system, the door and step operating mechanism and the electrical controller are so interlocked that simultaneously with an emergency application of the brakes the power is shut off, sand is

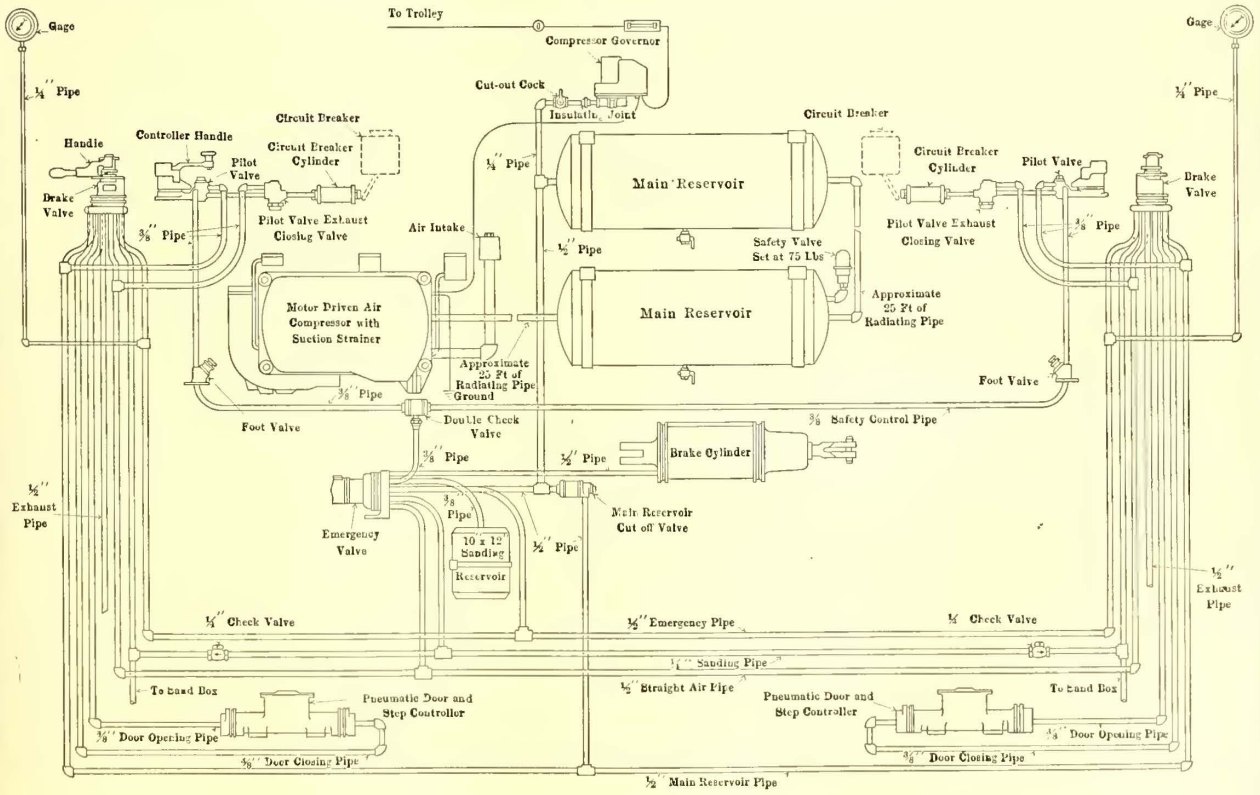
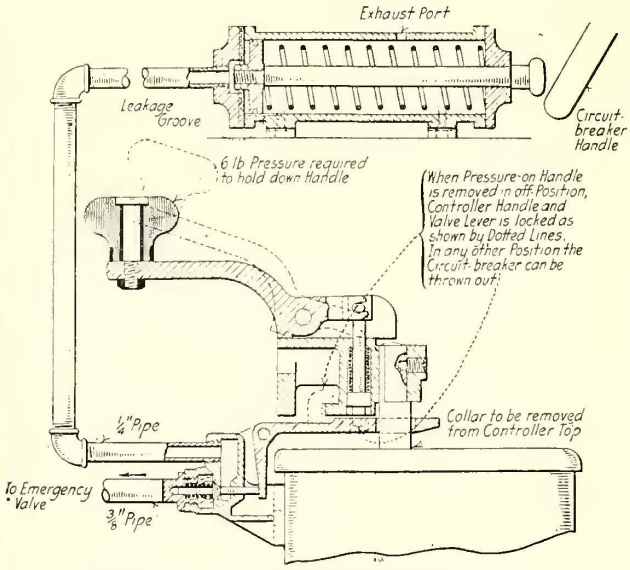


Diagram of Air Brake and Safety Control Equipment for Double-End Car

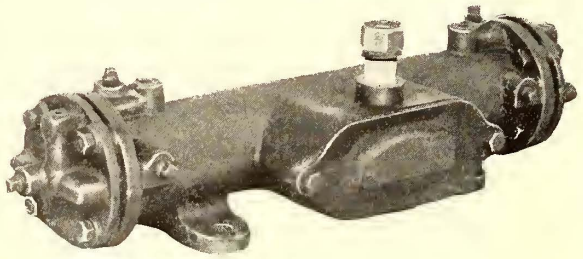
applied to the rail, the front door is opened, the steps are lowered and the rear door in single-end equipments is unlatched so that it can be readily pushed open. The car cannot be started until the steps are up and the doors closed, because the brakes cannot be released with the doors open; and owing to the deadman's handle feature on the con-



Deadman's Handle Feature of the Controller and Method of Operating Circuit Breaker

troller, if the operator takes his hand off the controller handle while the car is in motion an emergency brake application will follow. A foot valve, interposed between the controller and the emergency valve, can be pressed by the motorman to relieve him temporarily of the necessity for keeping his hand on the controller handle.

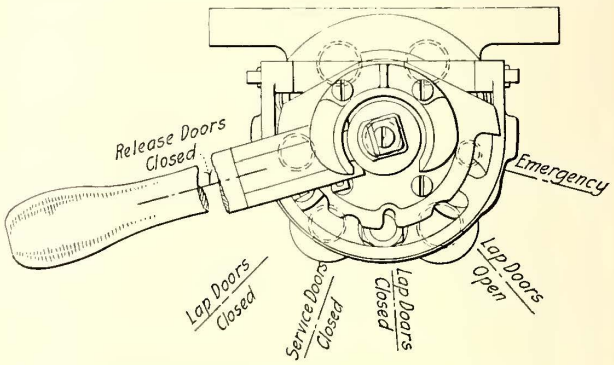
The control of the brakes, the doors, the steps and the sanding apparatus is centered in one brake valve, shown in the illustration on page 531. The six control positions are as follows: Release (doors closed); service (doors closed); lap (doors closed); lap (doors closed, brake handle off); lap (doors open), and emergency (doors open). The reasons



Pneumatic Door and Step Controller

for having three lap positions are as follows: One lap (doors closed) position is used while the car is being retarded and another is used when removing the brake controller handle. The third lap position is necessary to hold the car on a grade after a stop has been made and the doors have been opened to discharge or receive passengers. The operating handle of the brake valve is hinged and arranged so that a downward movement operates a poppet valve admitting air from the main reservoir pipe to the sand box. Thus the rail can be sanded without causing the operator to remove his hand from the brake handle.

An important part of the operating apparatus is the pneumatic door and step controller, the parts of which have been so perfected that they are absolutely interchangeable. The controller can be changed from right-hand to left-hand operation by simply moving a plug supplied for that purpose. The size and weight of the doors to be operated are often not known with sufficient exactness when the machines are ordered from the factory, but difficulties from discrepancies of this kind are readily cared for by the use of positive bushing plugs, which, when once installed, are not adjustable. This means that a uniform operation of the doors is insured. This door and step controller is supplied by the National Pneumatic Company. It is bolted to the car underframe and is designed to prevent condensation traps



Control Positions of the Air Brake and Door and Step Control Valve

which would give trouble by freezing during the winter months. It is entirely inclosed to permit central lubrication and prevent dust or wash from the street from reaching any of the working parts. The engine gives a positive cushioning movement to the door both in opening and closing.

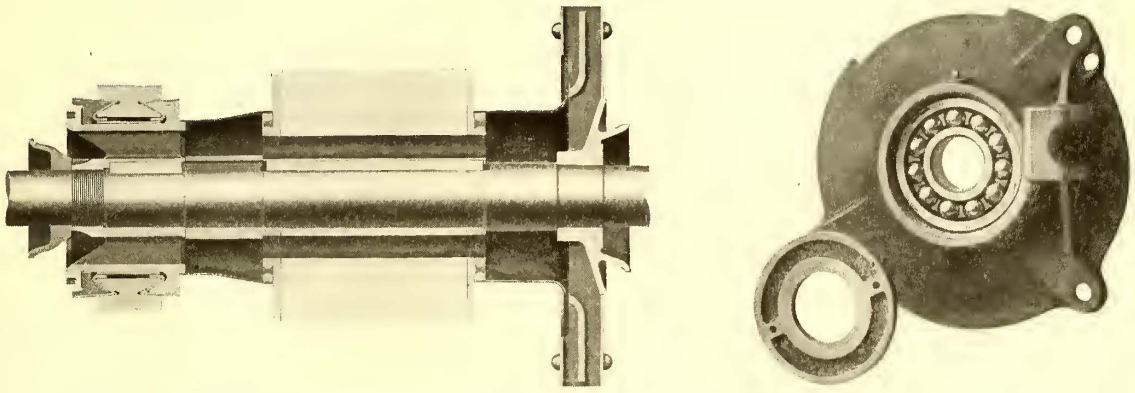
Motors

To obtain a light-weight car motor a design widely different from the old standard railway design was necessary. In the first place, the adoption of 24-in. wheels and the low car floor set rigid limitations of size, and second, reduction in the weight of the motor was an important factor in reducing the total weight of the car. Naturally the reduction in the available space both above and below the motor called for an armature of small diameter with a relatively long core, while the demand for reduction in the weight of the motor itself has resulted in the use of a higher armature speed, improvements in ventilation, ball bearings on the armature and in general in the use of a better grade of material.

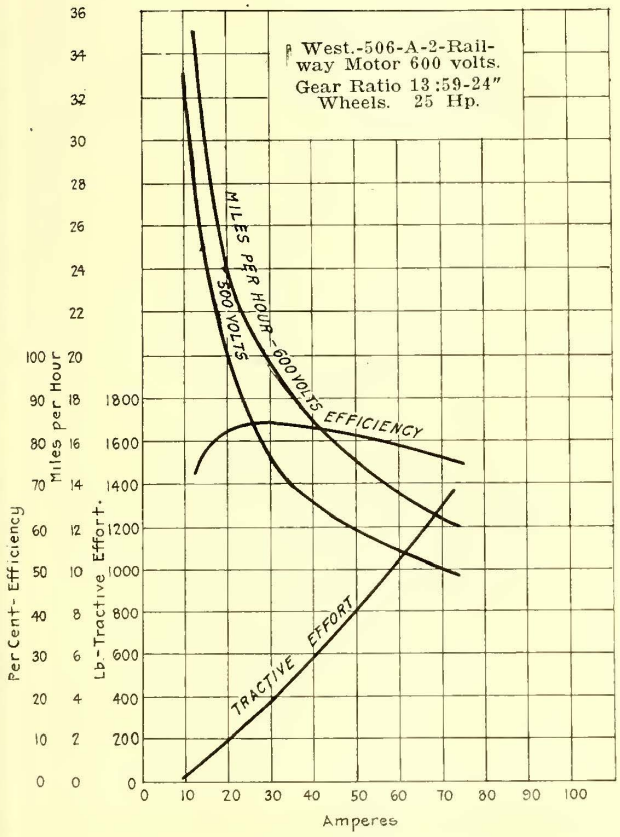
The reduction in weight has been radical. The old style standard 35-hp., 600-volt motor weighed 2000 lb., or nearly 58 lb. per horsepower, and the pioneer

low-floor car motors, rated at 35 hp. weighed 1750 lb., or 50 lb. per horsepower, while the latest motors, developed to meet the lightweight car requirements, although rated at 25 hp., weigh only 885 to 900 lb., or about 36 lb. per horsepower. Thus in the jump from the modern 35-hp. motor to the present light-weight car motor, a reduction in weight of approximately 50 per cent has been obtained with only 30 per cent reduction in power.

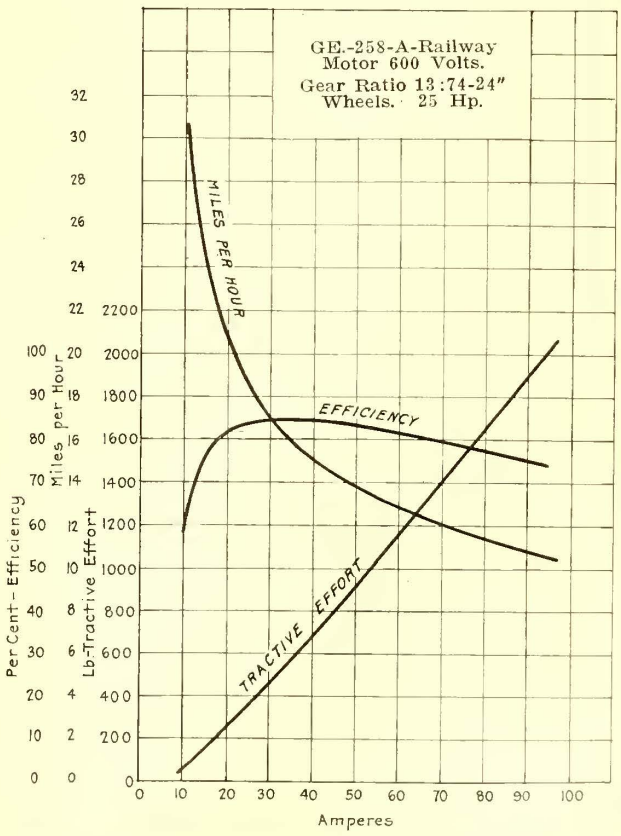
With a given amount and quality of material the most practical way of increasing the capacity of a motor is by improving ventilation, and the amount of air that can be drawn through a self-ventilated motor is mainly dependent on the armature speed. The armature speed has, therefore, been increased, and this has led to the use of ball bearings on the armature. With a small diameter of armature shaft and the limitations of space the use of the ordinary sleeve bearing would, it was thought, incur the risk of an extremely short life for both the bearings themselves and the gearing, due to the lengthening out of the gear centers as the bearings wear. The use of ball bearings seems to have solved the problem, and their adoption permits the use of a smaller air-gap than would be permissible with sleeve bearings. This, of course, increases the efficiency of the motor. Although there is still some question as to the adoption of ball bearings, the records of those which have been in service for considerable time indicate low maintenance costs for both the balls and the bearing itself. Reduction of lubrication expense and the elimination of the troubles caused by oil from



Sectional View of Armature of West.-506 Motor and Armature Ball Bearing of Same Motor



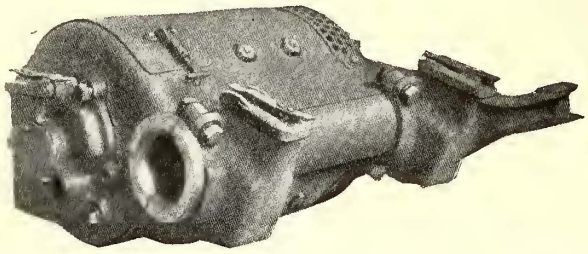
Characteristic Curves for West.-506 Motor for Light-Weight Cars



Characteristic Curves for GE-258 Motor for Light-Weight Cars

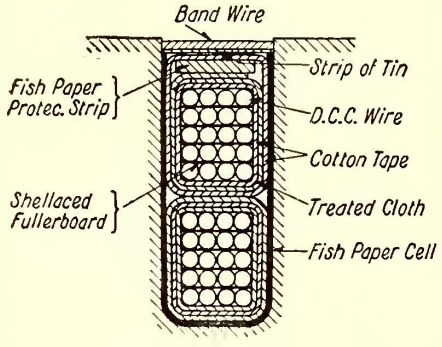
the sleeve bearings getting to the motor are additional advantages.

The Westinghouse motor developed for the lightweight safety car is known as No. 506. This design has been made to accommodate either sleeve bearings or ball bearings, so that should the maintenance of the latter prove excessive they can be replaced by some type of sleeve bearing. The motor is of the box-frame type with through cap-bolt construction, commutating poles, and other details as follows:



General View of West.-506 Motor for Light-Weight Safety-Car Service—Rating 25 Hp., 600 Volts

Rating at 600 volts	25 hp.
Armature speed (37 amp., 600 volts)	1050 r.p.m.
Weight of motor with gears and case	900 lb.
Clearance beneath gear case (24-in. wheels)	3⅛ in.
Clearance beneath motor frame (24-in. wheels)	3 11/16 in.



Cross-Section of West.-506 Motor Armature Slot Showing Method of Insulating Conductors and Coils

An interesting problem in connection with the design of these motors came up in deciding on the proper location of the motor on the trucks. The motor was so short that if the gear hub had been placed against the wheel, a very large part of the motor weight would have come on one wheel. It was finally decided to place the motor midway between the wheels. This required a special axle layout, different from the previous American Electric Railway Association axles, and resulted in the addition of two new axles suitable for such a motor mounting to the list of American Electric Railway Association standards.

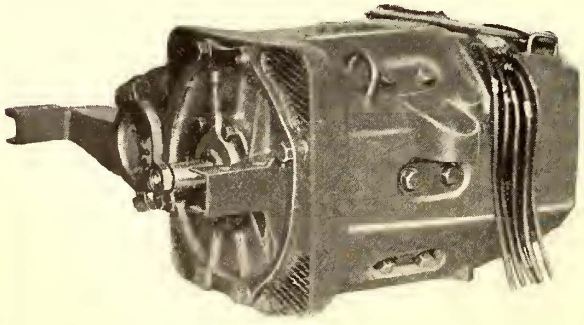
General View of GE-258 Motor for Light-Weight Safety-Car Service—Rating 25 Hp., 600 Volts

The General Electric Company's motor used extensively on the Birney and other types of lightweight safety cars is the GE-258 type. The details of this motor are as follows:

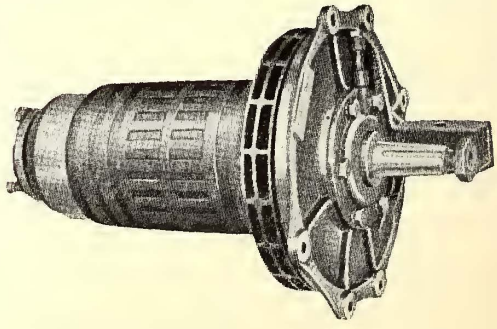
Rating at 600 volts	25 hp.
Armature speed (37 amp., 600 volts)	1236 r.p.m.
Weight of motor with gears and case	885 lb.
Clearance beneath gear case (24-in. wheels)	2¾ in.
Clearance beneath motor frame (24-in. wheels)	3 5/16 in.

The high armature speed, 1236 r.p.m. at the hourly rating (37 amp.), increases the ventilation of the motor and gives it a high continuous rating of 35 amp. at 450 to 600 volts. The high speed has also necessitated the use of a finer pitched gearing than had hitherto been standard, but from the records now available it is expected that the life of the new 4¼-pitch gearing will be equal to that of the 3-pitch and 3½-pitch gearing used on larger motors. The adoption of ball bearings on the armature is another feature which, as previously noted, was brought about largely as a result of the higher armature speed.

Two of these motors under a Birney car with the average passenger loads handle somewhat under 4 tons per motor and make unusually fast schedules. The average acceleration rate is 2.5 m.p.h.p.s. Under normal city schedules the motors have capacity enough to handle considerably more weight.



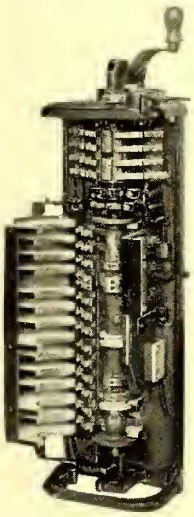
Frame of GE-258 Motor Showing Screened Ventilating Openings



Armature of GE-258 Motor Showing the Double Ventilating Fan on the Pinion End

Electrical Control

Although a large number of the cars have been equipped with type K10 controllers, a newer and an extremely light-weight design is the K63. Two of these controllers weigh 270 lb. as compared with 410 to 450 lb. which represents the weight of two controllers previously standard on motor cars. The new controller is smaller than the K10, and it has an improved type of blowout and a wooden cover. When handling the comparatively small currents taken by the light-weight cars it can be relied upon effectively to disrupt all arcs without any danger of platform explosions. The controller is said to have a capacity to handle two 40-hp. motors on 600 volts.



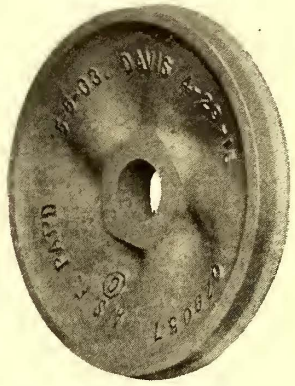
K-type Controller Light-Weight Design

In connection with the control the rheostats came in for consideration also. The resistors which were first furnished weighed with their insulators about 200 lb., and occupied a space about 48 in. long, 11 in. wide and 13 in. deep. It was found difficult to install them in the limited space on the under side of the car, and more or less trouble was experienced from breakage or from snow and water causing short circuits due to the small clearance above the track. An improved form is now being made in which grids of much smaller cross section are used, each grid being supported at three points instead of four and having pressed steel ends. This construction gives good mechanical strength to the frame and reduces vibration to a minimum. Only one frame of these grids is required per car and it occupies a space about 24 in. long and less than 8 in. deep. Its weight is only 65 lb., making a saving of 135 lb. over the previous standard rheostats. The new type is also more easily installed and is better protected from injury.

Trucks

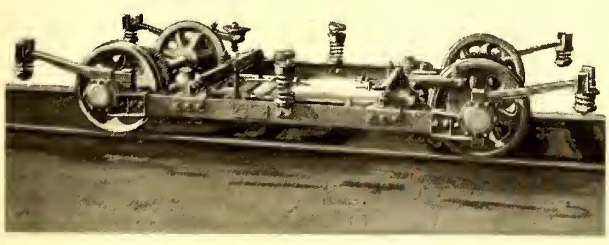
For the Birney safety cars a special type of truck known as the 78-M has been made by The J. G. Brill Company. It weighs 3300 lb. complete and has a wheelbase of 8 ft. Twenty-four-inch wheels are used except in special instances where conditions necessitate 26-in. wheels. The use of the larger wheels raises the step height 1 in. This is said to be the lightest single truck ever built. It has a spring system composed of quarter-elliptic and spiral springs of the graduated type, a spring-cushioned side easement and a spring brake link connection to take the draft.

The first truck illustration shows the location of the spiral springs at the center of the side bars and suspended at the ends of the quarter-elliptic springs. It also shows the graduated spring arrangement in which extra springs of lighter capacity than the regular body springs carry the car body when there is only a full-seated load in the car. These extra springs have their action stopped by the spring caps coming in contact with the spring seats before the springs are completely compressed. The device by which the small spiral springs are suspended from the elliptics consists of an eye-bolt which pivots in a casting on top of the elliptic springs and has an adjusting bolt on the bottom to support the spiral spring seat. This device, together with the slight torsional play of the spiral springs, provides a cushioned side easement at curves and on uneven parts of the track that is said to be effective in eliminating all harsh motion.

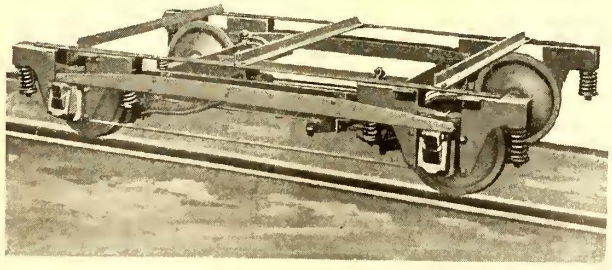


New Design for 24-Inch Wheel

As in the Brill trucks of the bolster type there is a spring friction link connection between the truck and the car body. This connection takes the draft from the springs; in other words, it prevents independent longitudinal movement between the truck and the car body, but does not hamper the side motion. With the journal boxes bolted directly to the side bars, this light-weight truck differs markedly from the other single-truck designs. The absence of pedestals results in a reduction of weight and obviates wear on the journal boxes. Although not so easy to dismount from the axles, there is less reason to do this as it is necesary to change the wheels only at long intervals. The channel cross members of the truck serve both as motor supports



Truck Designed for Birney Cars and Having Graduated Coil Springs and Quarter Elliptic Flat Springs



Light-Weight Car Truck Having 9-Foot Wheel Base and Using Semi-Elliptic and Coil Springs

and for the attachment of the brake hangers. The journal boxes are usually of the ball or roller bearing type. The standard Brill 21-E truck has also been used on some of the one-man cars.

In the light-weight car truck developed by the Baldwin Locomotive Works, and shown in the second plate, semi-elliptic plate springs in series with coil springs are used to obtain easy riding qualities. As in some other types of light-weight trucks the car-body under-frame serves also the purpose of truck side-frames, as it is bolted directly to the truck plate pedestals. The truck has a 9-ft. wheelbase, practically the maximum which can be used on 34-ft. radius curves. There is a light beam construction to support the motor suspension and inside-hung brake work.

A special light-weight radial truck, not shown, has been developed by the Philadelphia Holding Company and used on eight one-man cars operated by the Corpus Christi Railway & Light Company, Corpus Christi, Tex. As is generally known, this truck has an extended wheelbase which keeps the overhang at a value no greater than what it would have with double trucks. This steadies the car and facilitates the distribution of weight, while the evils of nosing and galloping are avoided. The character of the construction also relieves binding on curves and thus reduces flange and rail wear.

As the truck developed by the St. Louis Car Company is described in the article in this issue on the development of the light-weight car on the Illinois Traction System it is not necessary to review it here.

In connection with the light-weight trucks a new design of the Davis manganese rim wheel has been developed especially for the light-weight safety cars. This is a 24-in. wheel with six perforations in the plate, and the weight has been reduced to 186 lb. The wheels have been thoroughly tested, withstanding a static load of 25 tons with no perceptible deflection or permanent set.

Individual-Drive Car

An effort has also been made to develop a light-weight safety car driven by four automobile-type electric motors, one geared to each of the wheels. Four cars of this type were built and are in use at Tucson, Ariz., as described in the issue of this paper for Jan. 1, 1916. A new car using the same system of drive is now being built at the Brill works under the direction of the Imperial Electric Motor Company, owner of this system of drive. The car, which will seat thirty-five passengers, with overall length of 28 ft. and wheelbase of 12 ft., will weigh complete 8700 lb., of which the weight of the four motors and two-axle truck will represent 4000 lb., and the body and rest of equipment 4700 lb.

Fare Boxes and Registers

As the time of the car operator must be economized to the limit in the collection and registration of fares the advent of the one-man car has greatly stimulated the development of devices for these purposes. Fortunately much of the equipment could readily be adapted to the new requirements, thus keeping down the development costs. Two types of transfer machines have been developed. One is a combination fare box and transfer printing and issuing machine, while the other is an independent device which issues transfers properly punched but does not print them. These two machines are described in greater detail on pages 539 and 540.

The one-man cars which have been built or are under construction for the Stone & Webster properties are equipped with the Johnson fare boxes. These are made in two types, the standard registering fare box for cash fares only, and the larger size box which will register cash fares and metal tokens of two sizes. The latter type has four sets of indicating dials, one for each of the two types of metal tokens, a third set of dials for the cash fares and a fourth set for totalizing all of the fares collected.

The so-called "rapid-transit" equipment of the Ohmer Fare Register Company has been promptly adapted to one-man operation. For simple one-man operation the vertical grip is installed so that the motorman can operate it without moving from his position. The indicator and register are located in the usual position overhead at the end of the car body. Indication is made in the standard way by rotating the grip and registration by a downward pull upon it. One-man cars have recently been equipped with the Ohmer apparatus by the Wausau (Wis.) Street Railroad Company, the Menominee and Marinette Light & Traction Company, Menominee, Mich., the Southern Public Utilities Company, Charlotte, N. C., and others.

Flexibility of the transmission equipment makes it possible to equip cars readily for both one-man and two-man operation with the Ohmer devices. For this double purpose one grip can be located near the brake handle and a second at the conductor's stand. The latter may be placed for either front-end or rear-end collection, and the usual rod and cord arrangement will permit registration from any point in the car. For two-man operation the motorman's handle is locked and the conductor's handle is made operative.

On the one-man cars of the Three Rivers (Que.) Traction Company and the Moncton Electricity & Gas Company, Moncton, N. B., the Coleman non-registering fare box has been used. This box is about 5 in. square, and is suspended by two brackets from the car railing. The cash box is telescoped into the outside case, with resulting economy of inside space. The box is suitable for cash or tickets, or both.

One of the latest devices for registration of fares which has been developed with the requirements of one-man operation in mind is the coin and paper-ticket registering fare box of the American Railways Equipment Company. The apparatus has been tried out with promising results by the City Railway Company of Dayton, Ohio. The fare box is equipped with four counters, for registering re-

spectively passengers per trip, total passengers, transfers and cash. Transfers are also cancelled and delivered into a locked box automatically.

As to fare registers the Wichita Railroad & Light Company and others use the International type. This manufacturer also makes a combination coin register and fare box which differs from other makes in that the registering dials are mounted on a pipe support where they can be readily seen by the passenger. Thus the benefit of a public registration of fares is obtained, together with the convenience of the registering fare box. Extra registering dial sections permitting tickets and transfers to be rung up by hand are made for use with this equipment.

The manufacturers of the Cleveland non-registering fare box have not made any changes in their standard design in furnishing their boxes for one-man cars.

The use of the Rooke register in which the passenger makes the registration himself by inserting the fare directly into the slot of the machine is one means of removing the operator from any temptation to be dishonest. It also clears him of any suspicion of making misappropriations.

A number of railways in Massachusetts have adopted the MacDonald ticket holder for use on one-man cars. Among these is the Plymouth & Sandwich Street Railway of Plymouth. The plan is especially adapted to service on interurban or suburban lines, the procedure being for the motorman to issue a receipt as the passenger enters the car and to lift it as he leaves. This holder is a small, light affair which can be carried in one hand and which, with slight adjustment, delivers tickets with the amount of fare paid and the termini of the passengers' trips plainly indicated.

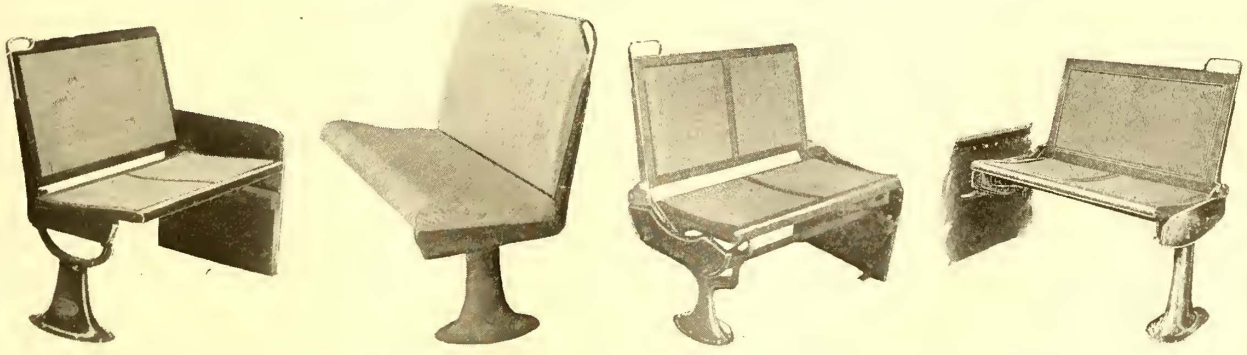
Seats

In the design of seats for the safety car, lightness again has been the chief objective, but the necessary strength and the passengers' comfort have not been sacrificed. The use of pressed steel for the pedestals and most of the other metal portions and rattan for the seating material is characteristic of the latest designs. The seats also have a hinge which permits operation substantially like a theater chair and makes it possible for the passenger next to the window to have egress without forcing the other occupant of the seat into the aisle. This feature facilitates cleaning the cushions and the car floor.

Heywood Brothers & Wakefield have developed a non-reversible seat, shown below in Fig. 1, which weighs only 24 lb., and a reversible seat of the same type weighing 42 lb. In the construction of these seats pressed steel has been used for the pedestals and for the principal parts of the supporting frames. The seat bottoms and backs have hardwood frames, paneled with cane seating. Another light-weight design which has been used extensively is the Hale & Kilburn seat in which steel is the only metal used. In one type the seat cushions and back are made of canvas-lined rattan framed with hardwood, and in a second type the concave-convex shaped cushion and back serve to increase the passenger's comfort. This type is illustrated in Fig. 2. These seats are also hinged, and where it is desirable to place them close together the back is recessed or set in, thus increasing the knee room. This seat weighs about one-half as much as the older types in which heavy iron castings and an elaborate framework and upholstering were used.

The type of seats used in the Illinois Traction Company cars and made by the St. Louis Car Company is Fig. 3 in the illustration below. This is a reversible seat, having two aisle arms, one fastened to each end of the seat back frame. There are six levers, three on the aisle end and three on the wall end, and these fasten on one end to the aisle arms and on the other end to the end plates of the seat supports. This produces a mechanism by means of which it is very easy to move the seat back forward and backward.

For the Birney cars the American Car Company has made a light-weight seat weighing 40 lb. in the reversible type and 25 lb. in the non-reversible. In both types pressed-steel pedestals and pressed-steel wall plates are employed. The reversible seat, illustrated in Fig. 4, has the Brill double-lever arrangement at each end of the back, and a sliding rocker-shaped casting supporting each end of the cushion

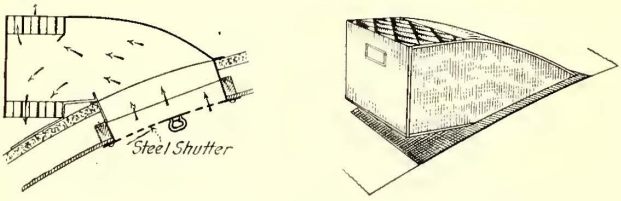


Four Types of Seats Used on Light-Weight Safety Cars. Fig. 1—A 24-lb. Non-Reversible Seat. Fig. 2—Seat with Concave Convex Cushion and Back. Fig. 3—Seat Used Extensively by the Illinois Traction System. Fig. 4—Reversible Seat Used on Birney Cars

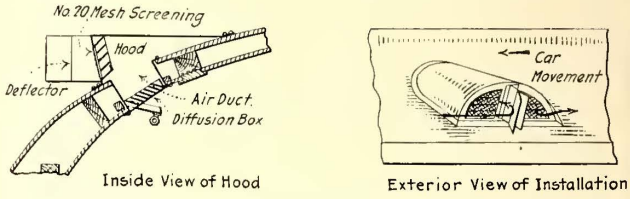
and shifting it by means of cranks made to work in unison and operated by the back levers. The non-reversible seat has a 2-in. extension on the side of the cushion, making a total width of 32 in. as against the 30 in. of the reversible type. The seat sets 3 in. out from the wall.

Ventilators

No radical changes in the standard systems of ventilation have been necessitated by the development of the automatic safety car. Obviously the old method of ventilating the car by opening the deck sashes of a monitor roof is unsatisfactory in any car, and is still less desirable where there is no conductor on the car to regulate the sash openings. In fact, any method of ventilation which passengers can regulate to suit their individual desires should be avoided. Hence the removal of all operating levers and the adoption of ventilators whose operation is entirely automatic is essential.



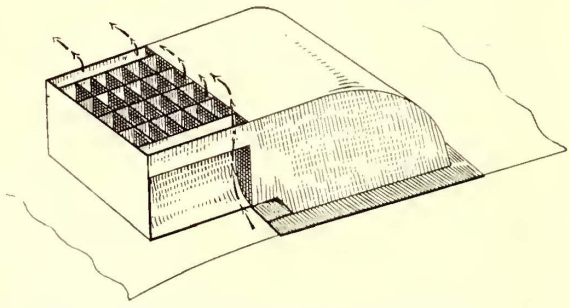
Exhaust Ventilator in Common Use on One-Man Cars



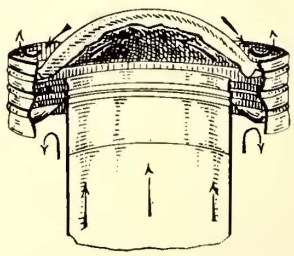
Details Showing Operation of Diffusion Type Ventilator

Following is a brief summary of the different types of ventilators which are automatic in their operation, at the same time providing against currents or direct blasts of air striking the passengers. The Railway Utility apparatus, shown above and used extensively on the Birney and other types of safety cars, depends on a current of air blowing across a honeycombed opening, thus producing a sucking action which draws the air from the car. The Garland ventilator, shown below, is somewhat similar, but a curved duct deflects the wind caused by the motion of the car so that the air passes with considerable velocity over the honeycombed exhaust passages. This draws the air from the car in a positive manner. In the Globe ventilator, also, the action of the air striking against an external hood is depended upon to produce a partial vacuum which draws the air from the car. The ventilator has a dome-shaped top the lower edge of which is turned up to form an exhaust port. In the foregoing types the construction is extremely simple, dependence being placed upon a leakage around the doors and windows for the supply of fresh air.

In the diffusion type of ventilator of the Automatic Ventilator Company the drawing in of air through the doors and windows is largely eliminated by providing a positive fresh air supply through one side of the ventilator itself. When the car is in motion the air strikes against an external deflector which directs it into the car through the diffusion box, the horizontal louvers of which send the air along the ceiling of the car. After losing its initial force the incoming air, being cooler and heavier than the impure air, descends to the breathing and floor levels. At the rear of the external deflectors a partial vacuum is set up which, assisted by the pressure of the incoming air, induces a strong exhaust of the impure air through the port behind the deflectors.



Ventilator Using a Curved Duct to Deflect the Wind and Increase the Exhaust Action



Ventilator Having Dome-Shaped Top with Lower Edge Turned up to Form Exhaust Port

Miscellaneous Equipment

In curtain materials there is no change from standard practice. The curtain fixtures also are not essentially different from standard, but the details have been adapted to the new designs of window frames. The Curtain Supply Company, whose fixtures are popular on safety cars, has made a special type of ring fixture with a smaller and lighter head or tip to fit the grooves in these cars. Window fixtures, like curtain fixtures, are not radically different. The O. M. Edwards fixture, which has been specified extensively, consists of a sash lock, a rack, a sash lift, and two anti-rattling devices for each sash. By means of these fixtures the sashes are held safely and firmly at any desired height and are prevented from rattling.

On cars having but one operator it is especially important that every surface on which passengers walk or step should be so constructed both as to

shape and material that slipping or tripping on account of the nature of the surface is impossible. Practically all of the safety cars are being equipped with some form of anti-slip tread on the steps and certain portions of the platform and floor, and to attain the full measure of safety the use of the anti-slip tread should be extended to cover every metallic surface upon which a passenger can step.

A practical way to obtain a satisfactory anti-slip metallic surface is to have an abrasive grit such as alundum or carborundum embodied in the tread surface at the time of casting. Such a surface is extremely durable and is effective against slipping even when covered with mud or slush. An abrasive metal of this nature known as "Feralun," and composed of iron with alundum cast in the wearing surface, is the material used on the majority of safety cars. The Mason safety tread is composed of rolled, unperforated steel or hard brass with alternate U-shaped and dovetailed grooves, the dovetailed grooves being filled with non-slippery, soft-metal lead or with carborundum grains. When the carborundum grains are used they are securely bound together and held to the steel base by a chemical cement. In the Universal safety tread grains of alundum are held together in a compact mass by a soft-metal binder composed chiefly of lead, the idea of using a lead binder being to prevent snow and ice from sticking to the tread. This mixture of lead and alundum is fastened to a steel base plate.

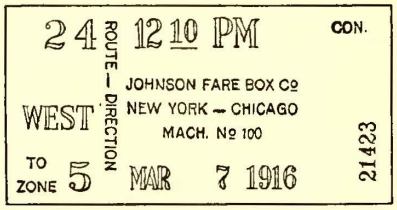
Obviously when there is no conductor on a car to watch the trolley rope when passing locations where the overhead work is in bad condition, trolley catchers are an important detail of the equipment. An efficient buzzer system is likewise essential since there is no conductor to signal the motorman when a passenger wishes to alight. For this purpose the Faraday signal system operating directly on the trolley current of 500 or 600 volts has done away with the inconvenience of handling batteries. The buzzers are wound to a resistance of 1000 ohms and are used with an additional external 600-volt resistor. Single-stroke or vibrating bells are sometimes used instead of buzzers.

Electric heaters with thermostatic control are the most suitable and commonly used equipment on the cars having but one operator. A man performing the duties of both motorman and conductor has no time to care for coal heaters, and in regard to heat regulation, experience has shown that even on two-man cars dependence cannot be placed on the crew to give this matter sufficient attention to secure either a desirable degree of comfort for the passengers or a reasonable economy in the use of energy.

Transfer-Issuing Machines

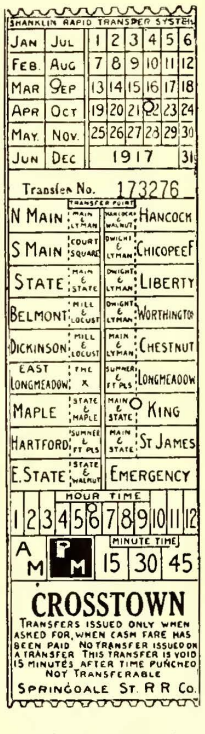
Relieving the operator of as much work as possible is one of the prime requisites of the one-man safety car equipment, and the issuing of transfers is one field in which there is an admitted need of labor-saving apparatus. Transfer printing and transfer issuing machines have been under development for several years, and there are two makes which have reached such a state of perfection that it is believed they will be a particularly practical addition to the automatic equipment of the safety car.

The Johnson Fare Box Company has developed a combination fare box and transfer printing and issuing machine which in its present form is but slightly larger than the standard Johnson registering fare box. The transfer shown above is printed by pressing a key or setting a lever to indicate the car line to which the transfer is to be issued. It is understood that this machine will be motor driven.



Transfer Printed by Combination Fare Box, Transfer-Printing and Issuing Machine

Instead of having the machine print names of car lines to which transfers are issued, the route is divided into zones of five-minute or ten-minute running time apart. When a passenger asks for a transfer to such and such line, the conductor knows that it is in the third or fifth zone and he punches the proper key or sets a lever at the proper point so that that zone number will be printed on the ticket. The time of arriving at that transfer point is automatically printed, since the conductor has previously set the starting time at the beginning of the trip and this governs the time which will be printed for each zone key. The time, the route number from which transfer is made, the direction, the zone number, and the date are the points of information which the receiving conductor should see at a glance, and these are given prominence on the transfer. The use of this machine obviously eliminates the cost of printed transfers.



Typical Transfer Properly Punched by Transfer-Issuing Machine

The Shanklin Equipment Company has made a machine which issues transfers automatically and can deliver them at the rate of sixty per minute. It also records each transfer delivered, thus placing the transfers under the positive control of the audit-

ing department, and where transfers have to be paid for, it gives an exact record of the number of transfers issued. As shown in the illustration of the machine there are a number of individual buttons on top. These represent either intersecting car lines or other transfer points, and it is necessary for the conductor in issuing a transfer to press only one of these buttons and operate a foot lever. This action delivers to the passenger a transfer punched with the month, day, hour, and line to which the transfer is issued. Transfers are supplied in the machine in rolls of 500 or 1000, in which form they are cheaper than the old transfer pads. A typical transfer issued by this machine is the lower one shown on the previous page.

The machine consists of an aluminum box 4½ in. wide, 14 in. long, and 8 in. deep. This is mounted on a pedestal with a base 8 in. in diameter attached to the platform. The height to the top of the machine is 42 in. from the floor. The box is portable so that it can be transferred from end to end of the car if necessary. The total weight of box and base is 30 lb.

Transfer-Issuing Machine in Operation

It is the intention to have this machine loaded by some one in the auditing department, and the only accessory transfer carried by the conductor should be an emergency pad for use in case the roll should be exhausted by an unexpected or unusual demand for transfers. This emergency transfer can absolutely be checked so that there is no opportunity for its misuse, as every such transfer is numbered. A conductor in using these emergency transfers must at the same time report either the failure of the machine or non-delivery of transfers.

Data on One-Man Cars

(*See pages* 541, 542 *and* 543 *for Table of One-Man Car Data*)

On the Basis of a Canvass Made for This Special Issue the Accompanying Table Covering the Salient Structural and Operating Features of the Single-Operator Car Has Been Prepared

IN order to bring out the important facts regarding the present status of the one-man car the ELECTRIC RAILWAY JOURNAL has made a direct canvass of all railways reported to have cars of this type in operation or under construction. Information was received from a large proportion of these roads in time to be grouped in tabular form and is thus presented on the three following pages.

A few additional reports were received too late to be included in this table, but, with any others which come to hand later, will form the basis of a supplementary table to be published in an early issue. If any roads operating one-man cars failed to receive a set of the data blanks sent out by this paper, the editors will appreciate information along the lines covered by the compilation. This will be included in the supplementary table.

On account of space limitations it was not possible to reproduce all of the data collected, but enough are given to indicate the principal operating conditions under which the light-weight cars are being used. Taken in connection with the articles which discuss the traffic situation with respect to these cars in a number of cities with populations covering a wide range the data furnish an impressive exhibit of the progress made in a very short period.

An important question in connection with the use of one-man cars is the effect of their introduction on schedule speed. The reported schedules for the one-man car are given in the table, but not those for the supplanted two-man cars. Comparison with the data regarding the latter indicates that in practically all cases the one-man cars have no difficulty in making as high schedule speeds as the two-man cars which they replace. The headway so far has apparently not been reduced much in many cases although, of course, the tendency is to give more frequent service with the lighter cars. A number of roads have very materially reduced headway, and the possibilities of stimulating traffic through doing so are pointed out in several of the special articles.

In any study of the table it must be remembered that many of the cars listed are reconstructed cars of various types and previous condition, so that they cannot be considered as typical of present best practice in this line. For this reason no attempt has been made to average the data, because at this early stage in the progress of the light car such averages would be meaningless.

DATA ON ONE-MAN CARS

Company	Population (1917) of Cities Served	Number of Cars of All Types Owned	Number of One-Man Cars Operated	Length Over all of Present One-Man Cars	Width of Same Over Sheathing	Weight of Same Without Load, Pounds	Single or Double End	Seating Capacity	Type of Motor	Gear Ratio	Door and Step Control Used, and Hand or Air-Operated	Are Air Brakes Used?	Do Controller and Brake have Automatic Features?	Are Fare Boxes Used?	Sched. Speed in M.p.h. with One-Man Cars	Normal Headway in Minutes, Using One-Man Cars
ALABAMA																
Selma St. & Suburban Ry.	20,000	20	7	26′	8′2″	10,000	Double	24	West. 12a	14:67	Hand	No	No	Yes	8	15
ARIZONA																
[1]Douglas Trac. & Lt. Co.	18,000	9	6	30′ (2) 40′ (4)	.....	24,000 (2) 32,000 (4)	Double	.....	G.E. 67-202	17:67	.....	Yes	No	No	10	.....
Tucson Rapid Transit Co.	20,000	9	3	27′6″	6′	20,000	Double	26	G.E. Auto Type 1063 E.I.-W.I.	1:9	Hand	No	Yes	Yes	7.5	12
ARKANSAS																
Intercity Terminal Ry.	(Has five	cars and	four auto	uses												
Ft. Smith Lt. & Trac. Co. at Van Buren	6,000	42	1	29′10″	7′2″	18,000	Double	36-40	West. 12a	14:68	Hand	No	No	Yes	10	30
Hot Springs St. Ry.	15,000	24	24	24′, 25′7″, 26′ and 36′	7′4″ and 8′5½″	.....	Double	22, 28 and 36	G.E. 52-54 West. 101B	.....	None	Yes (6 D.T.)	No	Yes	8	7-9
Little Rock Ry. & Elec. Co.	75,000	85	5	29′6″	7′8″	22,000	Double	26	G.E. 67	15:69	Hand	No	No	Yes	8	10
[2]Pine Bluff Co.	28,000	22	12	33′8″	.....	19,000	Double	32-36	G.E. 219 West. 506a	.....	Hand	No	....	Yes	10-12	5-6
Southwestern Gas & Elec. Co. at Texarkana	S.T. D.T.	20,000	24	12	30′1″ 42′	8′ and 8′6″	18,000-35,000	Double	24 and 28	G.E. 54a, 57a, 201-I, 203	14:67, 15:69, 15:71, 16:69	Hand	Yes (D.T.)	No	No	7.5	15
CALIFORNIA																
United Railroads of San Francisco	S.T. D.T.	540,000	727	12 (9) (3)	26′10″ 33′8″	8′8½″ and 9′3″	20,300 and 35,840	Double	26 34	G.E. 1,000	17:67	Hand Air	Yes (D.T.)	No	Yes	7.36	10
San José R. R.		30,000	54	13	25′8″	7′9″	24,000	Double	26	West. 58	1:3	Hand	No	No	Yes	12.5	10
Union Trac. Co. at Santa Cruz		10,000	17	5	..... 30′-36′	7′6″	17,000	Double	32-34	G.E. 80	19:67	None	Air & rope	No	No	11	15
COLORADO																
Greeley & Denver R. R.		10,898	6	3	29′	8′	17,500	Double	28	G.E. 200K, 800	14:67	Hand	No	No	No	11	10
[3]Trinidad Elec. Trans. Ry. & Gas Co.		14,000	8	8	5—30′ 3—40′	.....	22,000 and 50,000	Double	.....	West. 68C, 101B, 93a	18:64	None	Yes (Int.)	No	Yes	9	City 20 Int. 60
GEORGIA																
City & Suburban Ry. at Brunswick		16,000	7	7			40,000	Double	50	.....	.....	None	No	No	Yes	12	10
[4]Columbus R. R.		23,000	43	.....	27′9½″	7′8½″	12,300	Double	28	G.E. 258a	13:74	Air	Yes	Yes	Yes	10-12	12
[5]Rome Ry. & Lt. Co.		16,000	22	.....	30′	8—8′6″	22,000-25,000	Double	28 and 32	G.E. 67, 219 West. 101B	14:68-16:68	Hand	No	No	No	8	10 and 20
ILLINOIS																
Sterling, Dixon & Eastern Elec. Ry.		20,000	7	7	32′	8′4″	20,000	Single	28	G.E. 78, 70	14:69, 15:71	Hand	No	No	No	10	20
[6]East St. Louis & Suburban Ry. at Belleville		25,600	151	5	37′	8′1½″	33,933	Double	.....	G.E. 67	15:69	Hand	Yes	No	Yes	15	20
Illinois Northern Utilities Co. at Freeport		20,000	12	8	31′11″	8′3″	.....	Double	30	G.E. 247, 70 West. 12a, Allis-C. 501	15:71, 14:68	Hand	Yes	On 1 car only	Yes	8	15
Kankakee Elec. Ry.		20,000	10	10	32′	8′2″	12,500	Single	32	West.	.....	Hand	Yes	Yes (1)	Yes	.....	....
Central Ill. Pub. Service Co. at Mattoon and Charleston		23,000	5	5	30′10″	7′8½″	16,000	Double	25	G.E. 800, 80, West. 49	14:67, 15:71, 14:68	Hand (1)	No	No	Yes	10	10, 15, 20
Chicago, Ottawa & Peoria Ry. at Princeton		4,131	....	1	20′ S.T.	(Also having one modern car built similar to I.T.S. car used at Quincy, Ill.)											
Northern Illinois Lt. & Trac. Co. at Ottawa		12,000	8	6	31′	.....	.....	Double	.....	.....	.....	None	No	....	No	12	.....
Quincy Ry.		40,000	38	6	30′	8′2″	23,400	Single	30	West. 328	14:49	Air	Yes	Yes	Yes	8.25	20
INDIANA																	
Union Trac. Co. of Ind. at Marion		25,000	350	7	29′4″, 30′, 32′6″, 32′10″ and 33′8″	7′3″, 7′5″ and 7′6″	24,000	Double	31 (Aver.)	West. 92	3.6, 4.6	Hand	No	No	Yes	9.5	15
Central Ind. Ltg. Co. at Columbus		11,000	6	3	30′9″	7′6″	21,000	Double	26	G.E. 1000	17:67	Hand	No	No	Yes	8	30
IOWA																	
Iowa Ry. & Lt. Co. at Marshalltown		1,800	14	14	26′-32′	.....	16,000-24,000	Double	24	G.E. 54, West.	14:68	Hand	Yes (6)	No	No	8	15
Cedar Rapids & Marion City Ry.		(Intends	to opera	te one-man	cars by No	v., 1917)											
Charles City Western Ry.		7,000	4	2	28′	8′3″	20,000	Double	34	G.E. 217B	15:66	Hand	No	No	Yes	10	30
Clinton St. Ry.		27,000	32	5	31′	8′8″	24,000	Double	32	G.E. 52	14:67	Hand	Yes	No	Yes	9	15
Tri-City Ry. Co. of Iowa		(Operati	ng one or	dinary sing	le-truck car	in Davenp	ort. Contempla	ting use of	one-man cars in	Muscatine)							
Iowa City Elec. Ry.		13,000	10	5	26′	8′6″	19,000	Double	32 and 34	G.E. 54, 800	14:67	Hand	No	No	No	8.5	20
Keokuk Elec. Co. at Keokuk and Hamilton, Ill.		42,000	21	3	32′	7′8″	24,000 & 13,000	Double	28	G.E. 258a	13:74	Air	Yes	Yes	Yes	9	15
[7]Mason City & Clear Lake R. R.		22,000	39	5	30′9½″	8′	18,000	Double	28	West. 506a	13:59	Air	Yes	Yes	Yes	10	15
Waterloo, Cedar Falls & Northern Ry.		33,097	59	27	31′	9′	24,200	Double	32	West. 323a	15:69	Steps, none Doors, ha'd	No	No	Yes	15	6

[1]One-man cars operated daily until 2 p. m.

[2]Company has not had a platform accident with one-man cars in fourteen months of operation.

[3]Cars are of two-man type but operated one-man.

[4]Eight one-man cars ordered—To be delivered about Nov. 1.

[5]Converting single-truck cars for one-man operation by installing vestibule doors and folding steps and modifying fare-register system—To have been ready about Sept. 15.

[6]Use two men during rush hours.

[7]Cars purchased for delivery about Oct. 1.

CONTINUED ON PAGE 542

DATA ON ONE-MAN CARS—Continued from page 541

Company	Population (1917) of Cities Served	Number of Cars of All Types Owned	Number of One-Man Cars Operated	Length Over all of Present One-Man Cars	Width of Same Over Sheathing	Weight of Same Without Load, Pounds	Single or Double End	Seating Capacity	Type of Motor	Gear Ratio	Door and Step Control Used, and Hand or Air-Operated	Are Air Brakes Used?	Do Controller and Brake have Automatic Features?	Are Fare Boxes Used?	Sched. Speed in M.p.h. with One-Man Cars	Normal Headway in Minutes, Using One-Man Cars
KANSAS																
Kansas Elec. Utilities Co. at Lawrence	15,000	17	8	33′	8′6″	30,000	Both	32	Allis-C. 35R	16:68	Hand	No	No	Yes	8	10 and 12
Manhattan City & Inter. Ry	8,000	5 (City)	5	28′, 30′ and 36′	.....	18,000 and 32,000	Double	30 and 40	G.E. 1000, 54, 57	.....	None	No	No	No	6	.....
Topeka Ry S.T.	50,000	50	11	.....	.....	.....	.....	.....	.....	.....	Hand	No	No	Yes	8.3	15
D.T.		28	1													
KENTUCKY																
Henderson Trac. Co	11,000	13	7	18′ and 20′	8′	20,000	Double	.....	G.E. 54,800	14:69	None	No	No	Yes	7	15
Louisville Ry	223,928	....	.....	16′–18′	.....	(Operate small	cars with o	ne man as "owl	cars" between m	idnight and 5 a.	m.)					
Owensboro City R. R.	20,000	36	12	29′4″	7′10″	15,000–17,200	Double	30	G.E. 800 West. 68	14:66	None	No	No	Yes	10	10
LOUISIANA																
Baton Rouge Elec. Co	23,000	9	6	31′	8′8″	30,000	Double	32	G.E. 80	15:71	None	No	No	No	8.2	12
MARYLAND																
[8]Hagerstown & Frederick Ry	25,000	43	6	31′6¾″	7′11″	11,420	Single (2) Double (4)	30	G.E. 88	.....	Hand	Yes	No	Yes	12	15
Towson & Cockeysville Elec. Ry. at Towson, Southerville and Timonium	4,426	1	1	26′1½″	.....	18,312	Double	24	G.E. 1027	15:93	Hand	No	No	No	15	.....
MASSACHUSETTS																
[9]Bay State St. Ry. at Boston	745,439	2130	.....	Rec. 31′5″	7′6½″	21,540	Double	28	G.E. 1000	16:63	Air	Yes	Yes	Yes	.....	.....
				S. & W. 27′10″	7′8″	15,440	Double	28	G.E. 258	13:74	Air	Yes	Yes	Yes	.....	.....
Worcester & Warren St. Ry. at No. Brookfield	2,947	....	(One car o	rdered to b	e same as f	or Stone & Web	ster proper	ties)								
[10]Brockton & Plymouth St. Ry. between Brockton and Plymouth	Pop. served 26,600	28	2	27′9½″	7′6″	13,500	Double	31	G.E. 258a	13:74	Air	Yes	Yes	Yes	.....	.....
MICHIGAN																
Detroit United Lines at Ann Arbor	15,000	....	11	31′	7′4¼″	20,500	Double	30	West. 68	14:68	Hand	Yes	No	Yes	7.5	10
Menominee & Marinette Lt. & Trac. Co. at Menominee and Marinette	25,117	23	23	28′ (2), 30′6″ (12), 32′ (8), 36′4″ (1)	7′6″ (22) and 8′6″ (1)	16,000 aver. (1–24,000)	Double	30 aver.	West. 323a G.E. 52, 54	14:67	Hand	No	No	No	8.5	12
MINNESOTA																
Duluth St. Ry	100,000	99 (Duluth)	2	37′7″	8′4¾″	40,200	Double	38	G.E. 67	15:69	None	Yes	No	No	13.89	30
Wisconsin Ry., Lt. & Pwr. Co. at Winona	20,000	14	7	35′	8′3″	22,000	Double	32	G.E. 54, 258	15:69, 15:98	Hand	Yes	No	No	9	12
MISSISSIPPI																
Delta Lt. & Trac. Co. at Greenville S.T.	15,000	7	4	14′	6′8″	14,500	Double	32	West. 12a	14:47	Hand	No	No	Yes	8	15
D.T.		4		24′												
Hattiesburg Trac. Co	15,000	13	6	33′	.....	23,000	Double	28	G.E. 80, 81, 54, 67, West. 323a, 49	.....	Hand	No	No	Yes	10	.....
Jackson Lt. & Trac. Co	30,000	21	10	25′	7′9½″	15,000	Double	30	G.E. 247 West. 505X	15:58, 14:68	Hand	No	No	No	12	15 and 20
[11]Meridian Lt. & Ry. Co	25,000	25	15	33′8″	8′2″	20,000	Double	28	G.E. 67, 80, 81 West. 323a	15:69	Hand	No	No	No	12	10
Pascagoula St. Ry. & Pwr. Co. at Moss Point and Pascagoula	7,300	3	3	29′	8′4″	20,000	Double	28	G.E. 219b	15:79	Hand	No	No	Yes	12	30
Vicksburg Lt. & Trac. Co	25,000	20	4	32′	8′7″	19,500	Double	32	.....	13:75	.....	No	No	Yes	8	20
MISSOURI																
Cape Girardeau-Jackson Inter. Ry	14,000	6	4	31′	.....	.....	Double (3)	40	West. 12a	14:68	Hand (2)	No	No	Yes	6	.....
City Lt. & Trac. Co. of Sedalia	25,000	40	8	31′	8′	14,500	Double	34	G.E. 258	13:74	Air	Yes	Yes	Yes	10	10
MONTANA																
Great Falls St. Ry	35,000	23	23	39′9″ (19) and 29′6″ (4)	8′2″	34,500 (12), 30,500 (7) and 16,200 lbs. (4)	Double	40 (19) and 26 (4)	West. 323 (7) G.E. 80 (12), G.E. 54 (4)	16:81 (7), 15:71 (8), 14:67 (4) 17:69 (4)	Hand	Yes (19)	No	No	8–9	7.5 and 15
Helena Lt. & Ry	15,000	29	7	33′–38′	7′8″	20,000–36,000	Double	32–38	G.E. 52, 80	17:69 or 14:67	Hand	Yes	Yes	No	9.5	20
Missoula St. Ry	18,000	13	11	40′	8′2″	36,000 & 50,000	Double	32–48	G.E. 219	15:71	Hand	Yes	Yes	Yes	9–12	20
NEBRASKA																
Lincoln Trac. Co	55,000	79	2	26′	8′2″	17,000	Double	28	G.E. 54	14:67	Hand	No	No	Yes	8.5	15 and 20
Omaha, Lincoln & Beatrice Ry	55,000	5	1	27′9½″	7′2″	12,500	Single	28	G.E.258a	13:74	Hand	No	No	No	8.5	15
NEW JERSEY																
Public Service Ry. at Kearny	25,000	2586	7	29′4″ & 31′	7′6″ & 7′8″	19,000 & 24,800	Double	26 and 28	West. 68	14:68	Hand	No	No	Yes	.....	.....
NEW YORK																
Buffalo & Lake Erie Trac. Co	(Ope	rates on	e-man car o	n one mile	of line havi	ng very light tr	affic)									
International Ry. at Lockport	20,000	8	8	31′3½″	8′1½″	22,000	Single	36	G.E. 200	14:67	Hand	Yes	No	Yes	9.51	15

Ogdensburg St. Ry.	15,000	15	7	30′	9′	20,000	Double	29	West. 323a	16:81	Hand	No	No	Yes	10	12
Putnam & Westchester Trac. Co. at Peekskill	15,000	....	2	30′	.....	17,000	Double	30	G.E. 101b	.....	Hand	No	No	Yes	.....	.....
NORTH CAROLINA																
North Carolina Public Service Co. at Greensboro	30,000	33	(Intended to put twelve one-man cars in operation about Sept. 1)													
OHIO																
[12]Toledo, Bowling Green & So. Trac. Co. at Findlay	18,000	30	5	28′	8′9″	30,000	Double	36	G.E. 88, 58	23:60	None	No	No	Yes	.....	12
OKLAHOMA																
Tulsa St. Ry.	48,000	25	15	30′	8′	20,000–24,000	Double	32	G.E. 54, 80, 200	14:67 & 15:71	Hand	Yes (2)	No	Yes	.....	7½, 8 & 12
PENNSYLVANIA																
West Penn Rys. at McDonald and Oakdale	5,200	3	2	32′11″	8′3″	20,000	Double	32	West. 56	18:64	Hand	No	No	Yes	8	30
[13]Northwestern Penn. Ry. at Meadville	18,000	45	9	28′ and 32′	8′ and 7′6″	14,000 & 20,000	Double	28	G.E. 258A 1000	13:74, 17:67	Hand and air	Yes	Yes	Yes	9	20
Citizens' Trac. Co. at Oil City	15,657	Three one-man cars ordered.			Expected to be in operation about Nov. 15											
SOUTH CAROLINA																
Southern Public Utilities Co. at Anderson	9,654	6	6	29′	8′6″	12,900	Double	28	"Wee" 506 Y	16:64	Hand	No	No	No	4.5 & 16	15
SOUTH DAKOTA																
Aberdeen Railroad Co.	14,000	12	12	26′	8′8″	14,000	Double	26	G.E. 258a	13:74	Hand	No	No	No	8	10 and 20
TENNESSEE																
Jackson Ry. & Lt. Co.	22,500	20	14	33′	.....	.....	Double	32	West. 12a, 92a, 323a	.....	Hand	No	No	Yes	10	15
TEXAS																
Amarillo St. Ry.	17,000	12	5	30′ and 33′	.....	.....	Double	32	G.E. 54, 1,000 West. 323a	14:67	Hand	No	No	No	8.5	.....
Austin St. Ry.	45,000	44	7	30′1″	7′10″	18,000	Double	32	G.E. 258a	13:74	Air	Yes	Yes	Yes	10	15
Corpus Christi Ry. & Lt. Co.	14,000	14	8	26′	7′9½″	12,000	Double	24	West. "Wee" 505	.....	Hand	Yes	No	Yes	8.5	15 and 20
Northern Texas Trac. Co. at Fort Worth	90,000	227	10	27′9½″	7′8″	13,400	Double	31	G.E. 258C	13:74	Air	Yes	Yes	Yes	10	10
Greenville Ry. & Lt. Co.	14,000	7	4	32′	8′	23,000	Single	24	G.E. 216	.....	Hand	No	No	Yes	7.5	.....
Paris Transit Co.	12,469	(Operating with one-man single-truck double-end cars)														
Texas City St. Ry.	3,500	4	2	30′	8′	22,000	Double	24	West. 323a	16:81	Hand	No	No	Yes	12	15
UTAH																
Salt Lake & Utah Railroad Co.	10,000	....	1	(This car makes but three or four short trips a day)												
VIRGINIA																
Charlottesville & Albemarle Ry.	15,000	12	7	31′	8′	18,000	Single	36	G.E. 200	1:5	Hand	Yes	No	Yes	12	5
WASHINGTON																
Puget Sound Trac., Lt. & Pwr. Co.:																
[14]Bellingham Div.	29,700	39	18	27′9½″	7′6″	13,500	Double	32	G.E. 258a	13:74	Air	Yes	Yes	Yes	11.2 max. & 9.2 min.	10
Seattle Div.	280,000	418	2 (1 new & 1 remod.)	22′10″ (new)	7′6″	10,000	Single	30	G.E. 258a	13:74	Air	Yes	Yes	Yes	8	6.6
Lewiston-Clarkston Transit Co. at Clarkston and Lewiston, Idaho	12,500	5	3	26′6″	8′6″	17,500	Double	26 and 38	West. 505X	16:64	Hand	No	No	Yes	8	20
Puget Sound International Ry. & Pwr. Co. at Everett	30,000	21	11 (4 new & 7 remod.)	22′10″ (new)	7′6″	10,000	Single	30	G.E. 258a	13:74	Air	Yes	Yes	Yes	9	7
[15]Yakima Valley Transp. Co. at North Yakima	20,000	20	8	39′10″	8′2″	32,000	Double	38	G.E. 80a	17:69	Hand	Yes (4)	No	No	9	30
[16]Washington Wtr. Pwr. Co. at Spokane	130,000	191	44 (36 regular)	44′10″	8′8″	.....	Single	42	G.E. 80	15:71	Hand	Yes	No	No	9	7.5, 10, 12, 15, 20 & 30
Tacoma Ry. & Pwr. Co.	88,000	100	5	31′	7′8″	22,000	Double	29	G.E. 58	17:67	Air	Yes	Yes	Yes	8.8 & 7.9	12
WISCONSIN																
Wisconsin Trac., Lt., Ht. & Pwr. Co. at Appleton	16,000	19	3	26′7″	7′7″	24,000	Double	24	West. 12a	14:67	None	No	Yes	Yes	6	.....
Janesville Trac. Co.	15,000	8	4	30′1″	8′4″	25,000	Double	30	G.E. 200	14:67	Hand	No	No	Yes	7.74	20
La Crosse & Onalaska St. Ry.	36,500	1	1	26′	8′2″	12,000	Double	20	G.E. 80	15:67	Hand	.....	....	No	20	
[17]Wisc. Valley Elec. Co. at Wausau and Merrill. S.T.	28,000	12	12	33′	7′6″	24,000	Double	28	G.E. 81a	14:67	Hand	Yes	No	No	12⅔ (Int.)	15
D.T.				43′	8′	48,500		48	West. 101B2	15:69					11 (City)	
CANADA																
Calgary Munic. Ry.	60,000	85	42	32′, 41′6″ and 46′6″	8′ and 8′6″	22,000, 38,000 and 40,000	Single	28, 40 and 48	West. 101B, G.E. 80	15:69, 17:67 and 17:69	Hand	Yes (41′6″ & 46′6″)	No	Yes	8–10	5, 10, 15, 20, 30
Letbbridge Munic. Ry. S.T.	11,000	10	9	32′	8′6″	20,000	Both	31–40	West. 101B2	15:69	Hand	Yes	Yes	Yes	12	12
D.T.				41′		40,000						(D.T.)				
Brandon Munic Ry.	16,000	20	7	34′	7′	27,000	Double	34	West. 101B2 G.E. 80	15:69 17:69	Hand	No	Yes	Yes	8.5 (Aver.)	10
[18]Port Arthur Munic. Ry.	15,000	26	3	33′	8′4″	20,000	Single	38	West. 101B2	16:66	Hand	Yes	No	Yes	12.5	20–30–40
Sherbrooke Ry. & Pwr. Co.	21,000	20	7	29′–32′	7′–8′6″	14,000–20,000	4 single & 3 double	22–32	West. 101B2	15:69	Hand	No	No	Yes	9	10
[19]Three Rivers Trac. Co.	22,000	12	12	23′6″ (3) 33′2″ (9)	8′ (3) 8′6″ (9)	12,000 (3) 27,800 (9)	11 single & 1 double	32	West. 506a (3) West. 101B2 (9)	.....	Air (3) Hand (9)	Yes	Yes (3)	Yes	9	5

[5]Without electrical equipment or trucks.

[9]Owns two one-man cars, one made from two-man car, the other of Stone & Webster type. Has never operated with one man. Petition now before Public Service Commission for permission to operate nineteen one-man cars on fifteen routes in seventeen cities and towns.

[10]Cars were to be in operation about Sept. 15.

[11]Has successfully operated with one man during summer seasons four double-truck, fifty-six-passenger cars with air brakes and hand-operated door mechanism.

[12]Has operated one-man cars since 1887, using at first the ordinary 16-ft. car.

[13]Recent fire destroyed most of one-man car equipment. New Birney cars on order. Data for both old and new cars are given.

[14]Six cars were built in company's shops with body design of Birney type and using old trucks and equipment. Rush hour service consists of trippers, double or triple heading regular service.

[15]Three lines overlap on main street making headway there 10 min.

[16]Rush-hour headways are as follows; 6 min. on line using 12 min. regularly. All others same. With two-man cars headways were 5 min. on line using 12 min., 10 min. on line using 15 min. while 10 min. line remains the same.

[17]On suburban line two men are used from 6 to 8.30 a. m. and from 2 to 8 p. m.

[18]One-man cars used on belt line only.

[19]During rush hour two cars are operated on schedule of regular car.

Companies under Stone & Webster management have under order a total of 246 safety cars of Birney type. These are to be 27 ft. 9½ in. long over all and 7 ft. 8 in. wide over sheathing. Cars to weigh without load 13,000 lb. (single-end) and 13,500 lb. (double-end) and to seat thirty-two and thirty-five passengers respectively. Controllers and brakes to have automatic features and door and step control to be air-operated. Fare boxes will be used. Motors to be G. E. 258C and West. 506AN2, 306ON2 and 306AN2. Gear ratio 13 : 74.

AMERICAN ASSOCIATION NEWS

Speakers for Oct. 9 Conference

Program Is Now Practically Complete—Speakers of Prominence Have Been Secured to Lead Discussions on Topics Vital to the Industry

Supplementing the preliminary announcement appearing in the issue of this paper for Sept. 8 regarding the program for the New York conference, to be held on Tuesday, Oct. 9, Secretary E. B. Burritt has announced a nearly complete list of speakers. The topics and names of those who have accepted invitations to discuss them are as follows:

1. "General Survey of Present Electric Railway Problems," L. S. Storrs, president the Connecticut Company, New Haven, Conn.

2. "Is the 'War Bonus' Practicable as a Means of Wage Adjustment in the Electric Railway Industry?" E. G. Connette, president International Railway Company, Buffalo, N. Y.

3. "Female Substitutes for Male Employees," F. W. Brooks, president and general manager Detroit United Railway, Detroit, Mich.

4. "Pending Applications for Fare Increases in New York State," J. K. Choate, vice-president J. G. White Management Association, New York, N. Y.

5. "Topical Discussion on Various Methods of Increased Fares." (a) "Charge for Transfers," Frank Hedley, vice-president and general manager Interborough Rapid Transit Company, New York, N. Y., leader; (b) "Increases in Flat Rates for Present Zones," leader to be announced; (c) "Shortening Present Single Fare Zones," Edwin Gruhl, statistician Milwaukee Electric Railway & Light Company, New York, N. Y., leader.

This conference, which is to be of an informal character, will take the place of the usual annual convention of the association. It will be held the day after the meeting of the executive committee. President Storrs extends a cordial invitation to all operating railway men and manufacturers who can be spared from other duties to attend the conference, for the topics to be discussed relate to matters vital to the welfare of the industry. The conference will be held in the building of the United Engineering Societies, 29 West Thirty-ninth Street, New York City, opening promptly at 9.30 a. m.

Atlantic City Company Praised

Despite Unprecedented Rush at Seaside Resort, Atlantic City & Shore Railroad Makes Notable Record

The Atlantic City & Shore Railroad, Atlantic City, N. J., of which A. J. Purinton is general superintendent, was the subject of the leading editorial in the Atlantic City *Gazette-Review* of Sept. 13. Under the caption "Breaking a Time-Honored Precedent" the paper said:

"With a full realization that it is violating all former ethics of local newspaperdom and running directly at cross purposes to popular sentiment hitherto prevailing in regard to local trolley service, the *Gazette-Review* dares to congratulate the management of the Atlantic City & Shore Railroad for its handling of the enormous traffic demands made upon its resources during the summer season. We'll concede at the beginning that the service rendered was far from perfection, but it must be remembered that the crowds here at times reached proportions approximating the 400,000 mark, and three lines of trolleys instead of one would have been necessary for a strictly first-class service.

"The Atlantic City & Shore Railroad utilized the resources at its command to the best possible advantage and left but little opportunity for fault finding to its fair-minded patrons. One of the features of the service that stood out prominently during the unprecedented rush of visitors was the unfailing courtesy of trolley crews. The consideration shown by conductors and motormen to age-enfeebled patrons, the care that they exercised in the handling of unaccompanied children and their polite attitude toward all patrons evoked widespread comments of approval on all sides, particularly among visitors, many of whom found the demeanor of the local railway employees in glaring contrast to the abrupt treatment accorded them by men engaged in the transportation business of their home communities.

"There was also a notable lack of accidents during the entire season, showing that the employees on all lines running through the resort and across to the mainland were as careful of the safety of their passengers as they were courteous in their treatment of them."

Status of Electric Railway Labor

A Volume of More than 1100 Pages of Statistics in Regard to Electric Railway Employees Has Just Been Issued by the U. S. Department of Labor

The Bureau of Labor Statistics of the United States Department of Labor has just issued bulletin 204 containing 1131 pages of statistics in regard to wages, hours of labor and working conditions in electric railway operation in this country. The data were gathered in the latter half of 1914 and the early part of 1915. A more extended review of this report will probably be published in an early issue of this paper. A few facts are given now, however.

The first chapter of the report is devoted to the wages of trainmen, the data being given by companies. The total shows that in 1914 10 per cent of the motormen on the surface lines earned less than 24 cents per hour, 24 per cent less than 26 cents, 43 per cent less than 28 cents, 61 per cent less than 30 cents, 85 per cent less than 32 cents, and 98 per cent less than 34 cents. The wages of conductors are not quite so high. Of the regular conductors, 13 per cent earned less than 24 cents per hour, 33 per cent less than 26 cents, 51 per cent less than 28 cents, 67 per cent less than 30 cents, 88 per cent less than 32 cents, and 99 per cent less than 34 cents. Figures are also given for extras, the practice followed in regard to reckoning of time, time allowances, guaranteed wage to extra men, overtime, snow service, etc.

The second chapter relates to the time of runs. These are divided into three classes, namely, Monday to Friday runs, Saturday runs, and Sunday runs. A tabulation of 30,438 Monday to Friday regular runs on surface lines shows 3 per cent were runs of less than eight hours on duty, 5 per cent between eight and eight and one-half hours, 11 per cent between eight and one-half and nine hours, 19 per cent between nine and nine and one-half hours, 23 per cent between nine and one-half and ten hours, 22 per cent between ten and ten and one-half hours, 9 per cent between ten and one-half and eleven hours, 4 per cent between eleven and eleven and one-half hours, 2 per cent between eleven and one-half and twelve hours, and 2 per cent of twelve hours or over. These figures relate to the time on duty. The statistics for the hours within which these 30,438 regular runs are completed show that the outside time of 1 per cent was less than eight and one-half hours, 3 per cent between eight and one-half and nine hours, 6 per cent between nine and nine and one-half hours, 7 per cent between nine and one-half and ten hours, 7 per cent between ten and ten and one-half hours, 5 per cent between ten and one-half and eleven hours, 6 per cent between eleven and eleven and one-half hours, 8 per cent between eleven and one-half and twelve hours, 10 per cent between twelve and twelve and one-half hours, 10 per cent between twelve and one-half and thirteen hours, 10 per cent between thirteen and thirteen and one-half hours, 11 per cent between thirteen and one-half and fourteen hours, 5 per cent between fourteen and fourteen and one-half hours, 3 per cent between fourteen and one-half and fifteen hours, and 7 per cent over fifteen hours.

Besides other statistics of trainmen and other electric railway employees, the report contains a history and copy of the constitution of the American Electric Railway Association and of the Amalgamated Association, as well as a chapter on agreements between employers and employees. A charge of 75 cents is made by the Department of Labor for copies of this report.

News of Electric Railways

Traffic and Transportation

Financial and Corporate | Personal Mention | Construction News

Puget Sound Arbitration Begun

Men Engaged in Putting in Their Case—Much Technical Testimony—Cost of Living Data Presented Men Cross-Examined

Arbitration of the questions at issue between the employees of the Puget Sound Traction, Light & Power Company, Seattle, Wash., and the company began Sept. 10, before a board consisting of Dr. Henry Suzzalo, chairman, C. J. Franklin, representing the company, and James A. Duncan, representing the men. The questions involved are those of hours and wages and they affect both the Seattle and Tacoma lines. Attorneys A. J. Falknor and F. D. Oakley represented the company and C. A. Reynolds the men. Dr. Carlton Parker is secretary of the board.

Plea for American Standard of Living

The employees set up a general theory of the case to the effect that the company is obliged to pay a wage and establish hours that will maintain an American standard of living according to present acceptance of what constitutes such standard. The company contends, or will contend, when its side is reached that the wage paid is such as will enable the men to live as well as any other men engaged in similar work requiring as high a degree of skill. The company makes schedules as nearly as possible on a basic ten-hour day. The working hours for swing runs are almost invariably ten hours and the elapsed time is made as short as is consistent, the companies contend, with efficient and satisfactory service. The men ask for a basic eight-hour day and the elimination of the swing run practice.

For the first two days all of the testimony was concerned with the cost of living, the purpose of the men being to establish as a fact that the wages paid will not permit the employees to live as they should. Witnesses were introduced to produce expert testimony on this subject by the submission of budgets on food, clothing and other necessaries of life. The various experts agreed that an American standard of living can be maintained on an average monthly budget for a family of five for a sum ranging from $126 to $133 a month gained from an eight-hour work day. The arbitration board will be asked by the men to make an award to that effect.

What the Cross-Examination Disclosed

Cross-examination of the witnesses introduced by Mr. Reynolds from among the men to testify to their conditions of work and earnings brought out that the present hours of work average ten a day; that the earnings of regular and swing and relief run men range from $90 to $119 a month; that under the system of seniority they choose their own runs; that they do not wish to have the seniority system disturbed; that almost universally they remain in the service because they like the work, and that their earnings are better than in any other class of employment in which they had previously been engaged. Their complaint is not in reality against the employing company, but against harder living conditions. The evidence introduced was based on earnings under a wage scale approximately 14 per cent lower than that which has been in effect since July 1, or for a period dating back to two weeks preceding the strike.

The board heard considerable testimony on runs and schedules on the second day. This had to do in large part with the intricate and technical side of operation, and in order to get a better understanding of the methods and operating conditions practically all of Sept. 13 was spent by the arbitrators in the carhouses and the shops.

The presentation of the testimony of the employees will probably not be concluded for several days.

Amalgamated Convention Ends

Mr. Mahon Re-elected President—One-Man Car Question for Locals to Decide—Resolution on Seniority Adopted

William D. Mahon, Detroit, Mich., was re-elected international president of the Amalgamated Association of Street & Electric Railway Employees of America at the closing session of the fifteenth biennial convention of the society held in Providence, R. I. Chicago was selected as the place for the convention of 1919.

Officers Elected

The convention in Providence lasted nine days and was concluded during the week ended Sept. 15. It was pronounced one of the most successful ever held. A feature of the final meeting was the presentation of a chest of silver to Mr. Mahon from the delegates at the convention. The officers elected are as follows: International president, William D. Mahon, Detroit; vice-presidents, William B. Fitzgerald, Troy, N. Y., William S. McClenathan, Chicago, Ill., J. P. O'Brien, Springfield, Mass., Benjamin Bowbeer, Oakland, Cal., Joseph Gibbons, Toronto, Ont., Fred A. Hoover, Vancouver, B. C., George A. Dean, Stockton, Cal., Frank O'Shea, Buffalo, N. Y., P. J. McGrath, Pittsburgh, Pa., and Thomas F. Shine, Boston, Mass.; treasurer, Rezin Orr, Fort Wayne; members of general executive board, R. L. Reeves, Pittsburgh, Pa., E. D. W. McMorrow, Chicago, Ill., Magnus Sinclair, Toronto, Ont., P. J. Shea, Scranton, Pa., C. J. Colgan, Chicago, Ill., John H. Reardon, Worcester, Mass., Allen H. Burt, Salt Lake City, Utah, William F. Welch, Wheeling, W. Va., and J. B. Lawson, Shreveport, La.

It was voted to remit all dues to members in the service of their country. These men, however, will not be entitled to benefits during their service. By a vote of more than two to one the clause on compulsory arbitration was kept in the constitution although delegates from East St. Louis made an attempt to have it removed. President Mahon and the leaders of the Chicago delegation favored retaining the clause.

Some of the Questions Settled

The convention decided that the one-man car question should be a matter for decision by local boards.

Heaters in the vestibules of cars were indorsed by the convention. This measure was directed especially at the Boston Elevated Railway, but a clause was added making the request apply to all electric railways.

A resolution was passed by the convention pledging financial support to the men of the United Railroads, San Francisco, Cal., who are now on strike.

A resolution was adopted relating to the seniority of members who lose their positions temporarily. It was as follows:

"Whereas, In the past a motorman and conductor of experience having had the misfortune to lose their positions on roads where employed are compelled to seek employment with other roads, and as our rate of wages is of the graduated scale, these men are compelled to start in the new positions at the lowest rate of wage of the graduated scale then in force on that road;

"Resolved, That we insist that all future contracts and agreements entered into between local divisions of this association and their employing companies shall include a clause stating that a man who can show three years of service on one line which has been performed during four years preceding time of applying for position shall have his rate of pay start according to his years of service with former employing company."

Line to Camp Dodge Completed

Des Moines Inter Urban Railway Adds More Than Ten Miles of Line to Serve Cantonment Near That City

The Inter Urban Railway, Des Moines, Iowa, on notice of only sixty days must provide passenger and freight facilities to a city of between 45,000 and 50,000 people at Camp Dodge, the cantonment for the thirteenth division of the United States conscript army. Troops from Iowa, Illinois, Minnesota and North Dakota will be trained there. Camp Dodge will make a city as large as the third largest city in Iowa.

On June 27 Camp Dodge was formally chosen a cantonment location. It is 11 miles from Des Moines, the capital and principal city of Iowa. Sixty days ago the Inter Urban Railway operated twenty-eight single-car trains on its Perry division, carried 2000 passengers a day and employed thirty trainmen. Since that time 8 miles of track have been completed within the camp proper and 2½ miles have been built on the main line. Ninety-seven trainmen are now on the payrolls. The company is now operating fifty-eight passenger trains of from one to twelve cars each per day and is carrying 10,000 passengers daily.

Since the construction of the camp was started the company, in addition to its track construction work and passenger traffic, has carried over its single track 5000 cars of freight in and out of the camp. Each day between 2000 and 4000 workmen have been carried to and from the camp and only twice has this part of the work been delayed. On one of these occasions a dense fog made fast running impossible.

The Inter Urban is the only railroad with direct connections to the camp. Three depots have been built at the camp. They are equipped with turnstiles so that three ten-car trains can be loaded at one time. At the terminals within the city of Des Moines facilities have been provided to permit of loading two ten-car trains at the same time. All fares will be collected at the turnstiles so as to relieve the conductors. The company has placed orders for additional equipment, including five locomotives.

So well has the company done its work that the Greater Des Moines Committee, the principal commercial organization of the city, has written an indorsement of the handling of the work by the company.

M. J. Gormley of the American Railway Association, who has charge of the transportation end of six army cantonments, was in Des Moines recently and after going over the Camp Dodge situation carefully, he advised the camp quartermaster and the local commercial association that the service furnished to Camp Dodge was the best of any of the six camps over which he has supervision. One day while Mr. Gormley was in Des Moines the company operated eighty-nine trains over its road to Camp Dodge.

State Control of Subway Opposed

It is reported in Cleveland, Ohio, that Newton D. Baker, Secretary of War, will oppose the proposed subway commission advocated by Mayor Harry L. Davis of that city. Mr. Baker's principal objection, it seems, is that it may take the control of the electric railways from the city and place it with a board appointed under a State law. Friends of Secretary Baker believe he will exert himself to keep the control of the railway in the hands of city officials, because of his advocacy of home rule. He may make an address on the subject during the campaign. The people will have an opportunity to express themselves on the matter at the fall election.

A committee of the Hayden Avenue Improvement Association, East Cleveland, recently consulted with J. J. Stanley, president of the Cleveland Railway, on the possibility of a satisfactory settlement of the franchise trouble in that place. It is said that Mr. Stanley intimated that a 7-cent fare might be demanded for the Hayden Avenue line. At present a large part of the territory in the Hayden Avenue district has nothing but a shuttle service every twelve or fifteen minutes. This is entirely inadequate to the needs.

The extensions to the Madison Avenue and the East 156th Street lines were put into operation on Sept. 16.

Municipal Line to Be Extended

Council of Seattle Has Passed Bill for Purchase of Existing Suburban Property or the Construction of an Extension Paralleling It

The City Council of Seattle, Wash., at a recent meeting, passed a bill introduced by Councilman Oliver T. Erickson, authorizing the issuance of street railway utility bonds to provide for the purchase of the Loyal Railway, Ballard, owned by Harry Whitney Treat in Ballard, or the construction of an extension to the present municipal railway paralleling the Ballard line. The ordinance calls for the construction and furnishing of approximately 2 miles of railway, to be paid for by the earnings of the municipal railway. The city engineering department has estimated the cost of extending Division A from its present terminus at Thirteenth Avenue West to Leary Avenue and Market Street at $28,542. For this extension the Council has authorized a loan of $25,000 from the light fund.

The cost of an extension from Market Street and Leary Avenue to the north city limits, along the streets occupied by the Loyal Heights line, will be about $100,000, according to estimates of A. L. Valentine, superintendent of public utilities of the city. This estimate was made about two years ago. Since then there has been an advance of from 25 to 50 per cent in the cost of the materials that would enter into construction of the proposed line.

It is expected that H. W. Treat, owner of the Loyal Heights line, will offer that property to the city, as the bill authorizing the purchase of the line or the construction of an extension paralleling it was introduced, considered by two committees, and passed by the Council without a request from the engineering or utility departments for an estimate of the cost of the proposed extension. Mr. Treat offered the line to the city of Seattle about three years ago for $90,000, but the Council took no action in the matter.

St. Louis Civic League on Franchises

A meeting of the public utilities committee of the Board of Aldermen of St. Louis, Mo., was held on Sept. 13 to hear attorneys from the St. Louis Civic League, which is opposed to the two ordinances now under consideration looking toward a settlement of the differences between the United Railways and the city. Letters from the Civic League attacking both ordinances were read to the committee. In its letter attacking the so-called partnership ordinance, the league committee wrote that the ordinance would enact a new franchise. In the letter opposing the non-partnership ordinance, it declared the ordinance would be a renewal of existing franchises.

At the conclusion of the meeting on Sept. 13 members of the public utilities committee of the Board of Aldermen are reported to have expressed the opinion that the several public hearings on the United Railways franchise ordinances have aided them little, if any, in reaching a conclusion. It was said that few speakers attempted to analyze either of the two proposed ordinances and that most of the speakers showed prejudice and dealt in generalities. Other public hearings may be held, but the sense of the meeting was that the committee will glean facts upon which to base a preliminary report to the Board of Aldermen from attorneys for the Civic League and the United Railways and from C. E. Smith, consulting engineer for the city.

On Sept. 16 Charles E. Smith, consulting engineer for the city, issued a formal statement to explain his method of arriving at $60,000,000 as the valuation of the United Railways. Mr. Smith's valuation is recognized in each of two pending bills looking to a settlement between the city and the corporation. The explanation, Mr. Smith announced, is a summary of the analysis that he will present orally to the public utilities committee. The Civic League, the Central Trades and Labor Union and other organizations have contended that the Smith valuation was guesswork, and they hold that a careful appraisal of the properties should be made by experts as the first step in readjusting relations between the city and the company and in guaranteeing adequate service in the future.

Mediation Proposed in Chattanooga

On Sept. 15 John B. Colpays, United States mediator, submitted a proposition in writing to F. W. Hoover, vice-president of the Chattanooga Railway & Light Company, Chattanooga, Tenn., for the settlement of the strike of the trainmen of that company declared on Sept. 7. The text of the proposal was not made public, but the plan in general terms is understood to provide for recognition of the union, the reinstatement of the men who are now out and arbitration of the question of whether or not the thirty or forty men against whom the company had a special grievance should be reinstated or discharged.

In a full page advertisement in the issue of the Chattanooga *Times* of Sept. 13 the company said that one of the demands submitted by the union was that the company remove the Rooke registers which had recently been installed. A complete audit was made recently by the company of all transfers and a close check was kept of the numbers issued to conductors. In this manner it was determined how many transfers were being held over and substituted for cash fares during the following month. It was found that the company was losing approximately $250 to $300 a day. The management realized that it had been derelict in leaving a way open for the men to be dishonest. It was decided not to discharge the men, but to adopt a plan which would remove temptation. For this reason it adopted the Rooke system. Immediately following the installation of the register, the officials of the union demanded its removal. This demand the company declined. The company said in the advertisement that it "leaves it to its patrons to decide what they would do under similar circumstances."

Serious Coal Shortages

One System Forced to Suspend—Another Within a Few Hours of Having to Suspend

Because of the priority order from Washington by which all coal was to be sent by lake to the Northwest many industrial and utility plants in Ohio have been running very short. A few days ago the Lake Shore Electric Railway, Cleveland, found itself with a supply that would last only two or three days. The coal company which was supplying the railway did not dare to divert a supply from the lake trade to take care of the needs of the railway. The Lake Shore then wired the Public Utilities Commission of Ohio that it would be forced to suspend operations unless coal could be secured at once. The commission instructed the coal company to send a sufficient supply to keep the power houses running and a little later the Washington authorities so far revised the order as to allow coal companies to supply industrial coal where it was needed. It will be impossible, however, for consumers to stock coal for the winter months until navigation on the Great Lakes closes.

How the Kentucky Company Was Affected

Exhaustion of the supply of coal on Sept. 17 resulted in an enforced suspension of operation of the interurban lines of the Kentucky Traction & Terminal Company, Lexington, Ky., from 8 o'clock to 11 o'clock a. m. Two hours after bulletins were posted giving notice of the suspension of service, several cars of coal were obtained from yards and from other consumers in Lexington better supplied and it was possible to resume operations. S. H. Dailey, general manager of the company, made the statement, however, that unless the company received a sufficient shipment of coal within forty-eight hours it would be necessary to suspend service all over the system. The city lines and the local lighting plant were not included in the temporary shutdown. Coal for Lexington consumers has been obtained from West Virginia and southeastern Kentucky fields. Part of the southeastern Kentucky field has been tied up for six weeks by a strike of the mine workers and this has seriously reduced the supplies, besides increasing the demand on adjacent fields for coal. Mr. Dailey wired Coal Administrator Garfield at Washington, describing the state of affairs in Lexington and asking that some emergency relief be extended to the company.

Increase in Wages in Des Moines

The Des Moines City Railway and the Inter Urban Railway, Des Moines, Iowa, announced on Sept. 11 an increase in wages of 1 cent an hour to all trainmen who are working under a wage contract. The increase is retroactive to Sept. 1. The increase is voluntary on the part of the companies as the present agreement with men does not expire until March 1, 1918. In announcing the increase Emil G. Schmidt, president, stated that it was in appreciation of the efficient service rendered and to take care of the greatly increased cost of living. On the Inter Urban Railway passenger motormen and conductors will now receive 37 cents an hour. Freight motormen and conductors will receive 35½ cents. Brakemen will get 29½ cents. First year men on the city division will receive 28 cents an hour, second-year men will get 29 cents and third-year and older men will get 33 cents. It is estimated that the increase will cost the Inter Urban Railway an additional $1,000 a month, and the city railway nearly $2,000 a month.

Dallas Negotiations May Fail

It now seems likely that C. W. Hobson and J. F. Strickland, to whom the city of Dallas, Tex., granted franchises for electric railway and lighting privileges, will be unable to comply with the terms of such franchises and will forfeit them when the present extension expires on Sept. 27. The franchises granted to Messrs. Hobson and Strickland provided for a service at cost with a sliding scale and fixed returns on an agreed valuation of $8,500,000 for the consolidated electric railway properties. They also called for expenditures of $4,000,000 on interurban and city railway extensions, and for $2,000,000 on lighting work.

Messrs. Strickland and Hobson have spent thousands of dollars in obtaining these franchises, and the city of Dallas has been to much expense in employing experts to make valuations of the properties and prepare and pass the franchises. Extensions to Sept. 27 have already been granted and legal opinion is that the city of Dallas cannot grant additional time. In that event Messrs. Strickland and Hobson must forfeit their franchises and the transportation problem of Dallas will be just where it was when Mayor Lindsley took office three years ago.

The progress of the franchise negotiations at Dallas was followed closely by the Electric Railway Journal. Under the franchises as adopted it was proposed to organize two companies with Dallas capital, one by Mr. Hobson to take over the city railways and the other by Mr. Strickland to take over the electric light plant.

Public Service Increases Wages

The Public Service Railway, Newark, N. J., has announced an increase in the wages of its motormen and conductors to take effect on Oct. 1. Thomas N. McCarter, president, has issued the following statement:

"The Public Service Railway has decided to increase the wages of its motormen and conductors because of the increased cost of living due to war conditions. That household expenses are greater now than they were one year ago is patent to everybody. Nor are the increases in cost confined to household commodities. This company knows from its own experience how materials of all kinds have risen in price since the war started.

"Nevertheless it has been the company's policy from its organization to treat its employees as liberally as conditions would permit, and the company might be said to be straining a point in giving an increase at this time, but it feels that as the cost of living is so abnormal it wants to help its men bear the burden. Incidentally the action of the company will be a surprise to the employees, who had made no demands and had no idea that a raise was contemplated."

The new scale of wages starts at 28 cents an hour instead of 25 cents and increases the maximum rate of pay from 32 cents to 34 cents, with like increases for the intermediate steps. Overtime work will be paid for at the rate of 40 cents an hour. The increases will add about $300,000 a year to the company's payroll. The last previous raise in wages was made by the company in July, 1916.

Cincinnati Interurban Plans Presented

At a meeting of the Rapid Transit Commission of Cincinnati, Ohio, on Sept. 7, Frank S. Krug, chief engineer, presented two separate plans for interurban and loop subway stations in the heart of the city. One of them provides for an interurban subway station under Government Square, with a subway station for the loop on Walnut Street, and subway down Main Street to connect with the original line at Pearl Street.

The other plan was made with a view to the construction of a combined interurban and loop station under Fountain Square and Government Square for the entire distance between Vine and Main Streets. This would necessitate a change in the original plans by the construction of a subway on Vine Street betwen Canal and Fifth Streets, instead of on Walnut Street. No action was taken on either plan, as the comparative costs have not yet been worked out.

Plans and estimates of costs have been made for diverting the loop line from the canal bed from Mohawk Place to Brighton, as it is believed the original line runs too close to the hillside, and the expense of supporting the earth would be too great.

Engineer Krug reported that right-of-way plats from Canal and Plum Streets to Third and Whittaker Streets have been completed and records of deeds for all property between Canal and Plum Streets and South Road in Norwood have been obtained. This includes the entire east side of the loop.

A revised line along the hillside above Columbia Avenue has been completed. It is now so located that the concrete trestle will be as close to the hillside as practicable.

Strike-Ridden San Francisco

Strike of 30,000 Metal Workers Adds to the Problems of the United Railroads in Restoring Service

The plans of the United Railroads, San Francisco, Cal., for restoring full night service on its lines on Sept. 17 were canceled owing to acts of violence that day, said to have been the worst the company has experienced since the strike began. The situation for the railway was made worse by the strike of the workers in the metal trades. In this protest by organized labor are included twenty-five unions numbering 25,000 to 30,000 workers. Their going out affected the United Railroads in that the men who left the Union Iron Works proceeded to make a demonstration against the railway by stoning cars and attacking the men who were operating them. About a dozen motormen and conductors were treated in hospitals, but others slightly injured refused medical attention. Considerable damage was done to the property of the company. The police succeeded in quelling the disorder before it reached the stage of serious rioting. Many arrests were made. Fifty police machines patrolled the United Railroad tracks on the night of Sept. 17 until the last car reached the carhouse. On Sept. 18 about ninety machines each carrying two policemen performed similar service until 8.30 p. m. With the police thus on the alert few disturbances occurred.

At 11 a. m. on Sept. 17 all cars south of Market were withdrawn, except those of the Mission, Valencia and Third and Kearney lines. On some lines north of Market Street cars had to be turned back before they reached the end of the run, owing to disturbances. The so-called Municipal Special, operated by the city to the Potrero district, has been discontinued for the period of the ironworkers' strike, but the new municipal service on the Ocean Shore Railroad to Daly City was started on Sept. 18. This line will reach districts heretofore without adequate service.

The Board of Supervisors passed to print on Sept. 17 an ordinance which if finally adopted will remove practically all present restraint on jitney bus drivers and leave such regulation as there may be in hands of chief of police. The Supervisors also made an appropriation of $10,000 from the funds of the Municipal Railroad to be used by the board of public works for operating buses in the Bay View, Sanbruno, Visitacion Valley and Park Hill districts. This fund was necessary to make up the difference between the probable revenues and the cost of operation, the expectation being that these buses will have to be operated at a loss.

Quiet was restored in San Francisco on Sept. 20. Cars were being run without interruption, but the police were patrolling the lines.

The Railroad Commission has notified the Supervisors that it will comply with their request made in the resolution calling for an investigation into the financial status of the United Railroads, but that its jurisdiction does not empower it to "ascertain whether the refusal of the company to arbitrate or grant the demands of striking employees is justified on financial grounds"; nor to "ascertain if the operation of the system of the United Railroads would justify the city in giving the same wages and hours as are now maintained on the Municipal Railway if the city should conclude to buy out the interests of the present stockholders of the United Railroads." The commission addressed a letter to Mr. Lilienthal, president of the company, asking his assistance toward hastening the investigation.

New Power Plant for Kansas City

The Kansas City Light & Power Company, Kansas City, Mo., supplied now in part with energy from the plant of the Kansas City Railways, is proceeding with the immediate erection of a central station on twenty-five acres of land in the east bottoms of Kansas City, Mo., near the Missouri River. A contract has been let to the General Electric Company for two 20,000-kw. turbines, which are to be delivered in May and June, 1918. It is said that the company was able to get this equipment on the date mentioned because of the deferring of pending contracts for turbines by Milwaukee. The Kansas City Company is negotiating on contracts for boilers and for foundations. The plans provide that the unit of the central plant on which work has begun shall be completed by Nov. 1, 1918. Frederick Sargent, of Sargent & Lundy, Chicago, engineers for the new plant, was in Kansas City during the week ended Sept. 15, conferring with Joseph F. Porter, the new president of the Kansas City Light & Power Company, on the work.

Strike in Edmonton Settled.—The strike of the employees of the Edmonton (Alta.) Radial Railway, operated by the city, was settled on Sept. 11. At an informal meeting of the Council on that date the Aldermen agreed to reinstate as many men as possible, giving them their old standing if they returned at once. Many of the men decided to accept these terms and 125 men are said to have signed up before the close of the day.

Chestnut Hill Electrification by Jan. 1.—Officials of the Pennsylvania Railroad have announced that, due to labor conditions and lack of necessary material, work on the electrification of the Germantown and Chestnut Hill branch of the Pennsylvania Railroad will not be completed before Jan. 1. It is expected by that time the line will be in full operation. There are now sixty-six trains to and from Chestnut Hill, all of which will be operated by electricity. The wires and the poles are in position over the whole line. It is the work of eleiminating the grade crossings that is preventing the completion of the work of electrification this fall.

Rochester Men Opposed to Use of Interurban Men Within the City.—Union platform employees of the Rochester lines of the New York State Railways have rejected the 2-cent-an-hour wage increase voluntarily offered to the men provided that the union would permit crews on the Rochester, Syracuse & Eastern Railway and the Buffalo, Lockport & Rochester Railway to operate into the city terminals over the city lines. The crews of the interurban cars are members of the Railway Brotherhood and are not affiliated with the American Federation of Labor. The men on the Rochester city lines have a three-year agreement with the New York State Railways. Crews are changed now at the city limits.

Arbitration of Strike in Monroe.—The strike of the employees of the Monroe (La.) Municipal Street Railway will be arbitrated. The men went out on Aug. 31 and returned to work on Sept. 13. The strike was a protest on the part of the union against the action of the city government in voting to adopt one-man cars for use in Monroe. The men

contended that their contract with the city called for a motorman and a conductor on each car. Pending arbitration of whether the intent of the contract between the city and carmen is for two men on each car, service was resumed on the one-man plan. Also pending arbitration, the men will receive a flat rate of 30 cents an hour, instead of 22 to 27 cents as heretofore. All strikers are reinstated with seniority rights.

Provision of Tulsa Franchise To Be Contested.—The Supreme Court of Oklahoma will probably be asked to decide whether a provision in the franchise granted by the city of Tulsa, Okla., to the Tulsa Street Railway to the effect that no electric railways could be built on streets included in the franchise but not availed of prior to April 5, 1917, can prevent the extension of a line on any of the streets thus specified. A test case has been brought in the courts at Tulsa and it will be appealed to the higher courts. C. H. Bosler, president of the Tulsa Street Railway, believes the city's construction of the franchise, to the effect that the extension of lines cannot be built on these streets, will not stand the test of the courts. He will probably attempt to build extensions on some streets in Tulsa thus affected.

Increase in Wages in San Diego.—William Clayton, vice-president and managing director of the San Diego (Cal.) Electric Railway, has announced increases in the wages of the employees of that company and the other so-called Spreckels companies in that city. Platform men have been receiving 27 cents an hour the first year, 28 cents the second year, 29 cents the third year, 30 cents the fourth year and 33 cents the fifth year and thereafter. The increase is a flat one of 3 cents an hour for each of the periods mentioned. The companies affected are the San Diego Electric Railway, Point Loma Railroad, San Diego & South Eastern Railway, San Diego & Coronado Ferry Company, Coronado Beach Company, Coronado Water Company, Mission Cliff gardens employees, all power house employees, carhouse and machine shop employees and track men.

Kansas City Viaduct Matter Still Unsettled.—City officials of Kansas City, Mo., and Kansas City, Kan., have been trying to devise a means of securing municipal ownership of the inter-city viaduct, which, besides the roadway, bears electric railway tracks, and was formerly used for electric railway traffic. The Kansas City Railways has refused so far to be a party to the purchase of the viaduct. Recently cognizance has been taken by city officials of the condition of the Kansas City Railways overhead structure through the west bottoms, which is declared to be unsafe. It is supposed that the condemnation of the elevated structures at this time would force the railway to use the inter-city viaduct. The plans of the company for traffic to the west bottoms provide for eliminating the elevated structure eventually, but definite legal arrangements for this course have not been made. The elevated structure connects with the Central Avenue Bridge and viaduct now in course of construction, and on which the railway is paying $260,000. The company also is paying $250,000 for the Twenty-third Street viaduct and bridge, a mile to the south over the Kaw River. The company owns its bridge over the Kaw at James Street, north of the Central Avenue viaduct, and a few hundred feet south of the inter-city viaduct. The inter-city viaduct extends between the two cities over the Kaw River and through the west bottoms. Its owners are asking $2,350,000 for it. The city officials have agreed to make an offer of $1,500,000, though if the street railway can be made to bear a share of the cost the city's offer might be increased.

Program of Association Meeting

Investment Bankers' Association

As a month will be devoted to the Liberty Loan campaign between Oct. 1 and Nov. 1, the governors of the Investment Bankers' Association have considered it advisable to postpone the time for holding their convention until the loan is effectually out of the way. This action will permit the members of the association to devote their energies to the Liberty Loan drive. The sixth annual convention, in Baltimore, will therefore be held around Nov. 12, instead of Oct. 1, as was originally planned.

Financial and Corporate

Annual Report

Montreal Tramways

The statement of income, profit and loss of the Montreal (Que.) Tramways for the year ended June 30, 1917, follows:

Gross earnings	$7,725,498
Operating expenses	4,601,771
Net earnings	$3,123 727
City percentage on earnings	$491,431
Interest on bonds and loans	858,542
Interest on debenture stock	800,000
Taxes	98,400
Total	$2,248,373
Net income	$875.353
Dividends	337,880
Surplus for year	$537,473
Transfer to contingent renewal account	350,000
War tax (estimated)	110,000
Balance to general surplus	$77,473

The gross passenger earnings amounted to $7,374,295 in the year ended June 30, 1917, as compared to $6,443,309 the year before, an increase of $930,986 or 14.45 per cent. The operating expenses, however, increased $894,718 or 24.14 per cent. The operating ratio the last year was 62.40 per cent as compared to 57.53 per cent the year previous.

The sum of $792,848 was expended for maintenance and charged to operating expenses in 1917 as compared to $583,894 in 1916. This amount, together with $567,082 charged to renewal account, made a total expenditure of $1,359,930 in 1917 as compared to $897,470 in 1916. During the last year there was expended on capital account the sum of $1,509,488, the amount in the preceding year having been $320,872. From the sale of $3,000,000 of bonds the company has remaining a balance of $1,063,985 for extensions and improvements.

The revenue passengers carried in 1917 totaled 179,974,549, with transfers numbering 63,451,272. The car earnings per revenue passenger were 4.10 cents and per total passenger 3.03 cents.

New Officers for Lehigh Navigation

Following the sale of the stock of the Lehigh Navigation Electric Company to the newly formed Lehigh Power Securities Corporation, Allentown, Pa., announced some time ago, new officers and directors were elected for the Lehigh Navigation Electric Company, The Harwood Electric Company and for a number of subsidiary companies.

The following changes took place in the Lehigh Navigation Electric Company: S. D. Warriner, president, resigned, his place being taken by G. E. Claflin. Henry H. Pease, secretary and treasurer, was succeeded by C. M. Walter. Bayard Henry, John S. Wentz, Henry P. McKean, R. Dale Benson, Erskine Hewitt, Richard Y. Cook, C. S. W. Packard, George H. Frazier, Rodman Wanamaker and E. W. Clark resigned as directors, their places being taken by G. E. Claflin, P. B. Sawyer, S. Z. Mitchell, C. M. Walter, J. B. Crane, E. K. Hall, E. W. Hill, William Darbee, R. J. McClelland and E. P. Summerson. S. D. Warriner and L. A. Riley remain as members of the new board.

The following changes took place in The Harwood Electric Company: S. D. Warriner, president, was succeeded by P. B. Sawyer; Henry H. Pease, secretary and treasurer, was succeeded by C. M. Walter; R. H. Wilbur, H. F. Baker, William J. Turner, Henry H. Pease, E. M. Reynolds and Frank Silliman, Jr., resigned as directors, their places being taken by P. B. Sawyer, J. B. Crane, G. E. Claflin, E. K. Hall, William Darbee and C. M. Walter. S. D. Warriner, L. A. Riley, Edwin Ludlow, W. W. Hepburn and John S. Wise, Jr., remain as members of the board.

Corresponding changes were also made in the subsidiary companies.

British Columbia Purchase Denied

At the office of the Chicago, Milwaukee & St. Paul Railway in New York denial was made to the ELECTRIC RAILWAY JOURNAL of the newspaper reports from the West to the effect that the Chicago, Milwaukee & Puget Sound Railroad was planning to take over control of the British Columbia Electric Railway's entire system, extending from Sumas, Wash., to New Westminster, B. C., and also to Chilliwack, B. C. For some time there has been a traffic arrangement between the companies. According to the unofficial report the deal was reported to have been made with British holders of the securities of the British Columbia Electric Railway, the Milwaukee company thus gaining control of a system that would give it excellent entrance into Vancouver, B. C., bring it as far south as Sumas, Wash., and thence, by means of the Bellingham & Northern line, into Bellingham. In any such deal the company would gain control of one of the most important water-power and electric generating plants on the Pacific Coast.

State Board Decides Tax Appeal

The New Jersey Board of Taxes & Assessment on Sept. 11 filed a memorandum sustaining the action of the Mercer County Tax Board in fixing the assessment of the Trenton & Mercer County Traction Corporation for 1916 at $2,069,903. The city of Trenton and six other municipalities in which the company operates had fixed the original assessment at $2,189,440, but the company asked that it be reduced to $1,041,972.

The State board stated that its duty under the law was to ascertain the market value of the property as of May, 1916, and that in dealing with the class of property concerned it would consider original cost, reproduction cost, depreciation, etc., as elements in estimating market value. The board said that its chief engineer had appraised the physical property at $1,500,851, and that a reasonable allowance for going value, or "that value which attaches to the property as the result of the unity of its ownership and use and its established system of successful operation," would be $569,052, the difference between the value fixed by the county board and the physical value.

Bristol (Tenn.) Traction Company.—B. L. Dulaney, president of the company, and associates purchased the property of the Bristol Traction Company on Sept. 15 at the sale made to satisfy claims on bonds amounting to $165,000. The price paid by the Dulaney syndicate was $70,000. The property sold included 15 miles of electric railway, equipment, pavilions and franchises.

Catskill (N. Y.) Traction Company.—George W. Holdridge, receiver of the Catskill Traction Company, conferred recently with the Board of Trustees of Catskill with respect to the future of the road. He read a letter from representatives of the bondholders in which the statement was made that they were averse to extending further financial aid to the company. The Hudson *Republican* in reviewing the affairs of the company said: "In view of the fact that already $30,000 of Catskill money has been sunk in the road, Mr. Holdridge ventured the opinion that no more funds could be secured there and that after about Oct. 15 the electric railway at Catskill will be a thing of the past. The sale of the road will take place about that time and if junk people purchase it the sum paid for the property will go toward paying the holders of receivers' certificates and the cost of the sale." The company operates 5.5 miles of road and has eleven cars.

Duluth-Superior Traction Company, Duluth, Minn.—A dividend of 1 per cent has been declared on the $3,500,000 of common stock of the Duluth-Superior Traction Company for the quarter ended Sept. 30, payable on Oct. 1 to holders of record of Sept. 15. This is the first distribution on the common stock since July 1, 1915, when a semi-annual dividend of 1 per cent was paid.

Gary & Interurban Railroad, Gary, Ind. — Five bidders bought the lines, rolling stock, real estate and all other assets of the Gary & Interurban Railroad at receiver's sale on Sept. 18 for $475,000. The Chicago, South Bend & Goshen division was bought by Philip E. Poe, Baltimore, Md., for $60,000; the Gary City division and Hammond Line was bought by Carl M. Owen, New York, for $200,000; the Valparaiso division including the line from Gary to Valparaiso for $40,000; Gary Connecting Railways was bought by H. J. Unger of Philadelphia for $50,000; the East Chicago division, including Gary & Indiana Harbor line, was bought by Edwin Poe, Baltimore, for $125,000. The Gary & Interurban Railroad was incorporated in January, 1913, as a consolidation of the Gary & Interurban Railway, Gary Connecting Railways, Valparaiso & Northern Railway and the Goshen, South Bend & Chicago Railroad. It owns the entire capital stock of the East Chicago Railway and operates the property under lease. In all the system comprises 85 miles of line, of which forty-one are over private right-of-way. In October, 1914, the company defaulted on the bond interest then due. In October, 1915, Charles E. Davison was appointed receiver.

Kansas City (Mo.) Railways.—The stockholders of the Kansas City Railways met in Kansas City, on Sept. 13, and re-elected the board of directors, the board re-electing the officers of the company, including Philip J. Kealy, president; Clyde Taylor, vice-president, and James E. Gibson, general manager. Mr. Kealy was given further leave of absence. He is serving as colonel of the Third Regiment, Missouri National Guard. Two of the five directors representing the city on the board were re-elected, their nomination having been confirmed by the Court of Appeals. These are D. M. Pinkerton and Frank C. Niles. The Court of Appeals recently decided that the franchise provision that the Mayor "may" send to it the name of a retiring director as one of his three nominees was mandatory on him. Mayor Edwards had not included the name of Frank C. Niles among the three which he suggested to the Court of Appeals from whom the successor of Mr. Niles was to be named by the court. Following the court's decision Mayor Edwards submitted a new list, including the name of Mr. Niles, and the nomination was made by the court. Election of the nominee by the court is mandatory on the stockholders.

New York State Railways, Syracuse, N. Y.—The regular quarterly dividend of 1 per cent on the common shares of the New York State Railways has been passed by the directors. This rate had been in effect since last December, when it was reduced from 1¼ per cent. The company paid 4¾ per cent in 1916; 4 per cent in 1915; 5 per cent in 1914; 6 per cent in 1913, 1912 and 1911, and 4½ in 1910. A letter has been sent to the stockholders by Horace E. Andrews, president of the company, stating that the directors consider it wise to defer the dividend at this time on account of higher operating charges, the difficulties of obtaining new capital and the uncertain economic conditions. The company will have earned about 4 per cent on the common for the year ending Dec. 31, 1917, and has already paid 3 per cent on the common for the current year.

Oakland, Antioch & Eastern Railway, Oakland, Cal.—The California Railroad Commission has authorized the Oakland, Antioch & Eastern Railway to renew $435,853 of short-term notes, part of which are secured by bonds pledged.

Pottstown & Phoenixville Railway, Pottstown, Pa.—A block of the first and refunding mortgage 5 per cent gold bonds of the Pottstown & Phoenixville Railway is being offered for subscription at 87½ and interest by Fincke, Bangert & Company, Philadelphia and Boston. The bonds are dated June, 1912, and are due June, 1942, but are subject to redemption at 100 and interest on any interest date on sixty days' notice. The Norristown Trust Company is trustee of the issue. The company has all of an issue of $500,000 of stock outstanding and has $350,000 of an authorized issue of $1,000,000 of the first and refunding mortgage bonds outstanding. The funds from the bonds now offered are to reimburse the company for completing the line from Sanatoga to Spring City, including the bridge over the Schuylkill River. Two hundred thousand dollars of the total issue are reserved to pay off bonds of leased lines at maturity.

Public Utilities Company, Evansville, Ind.—The Indiana Public Service Commission has received a petition from the Public Utilities Company in which the company asked authority to issue $2,000,000 in such amounts as might be

needed of short-time obligations in lieu of and secured by thirty-year bonds formerly authorized by the commission. The company's petition said a purchasing company had been unable to sell the bonds formerly authorized at a fair price. The Union Railway, Gas & Electric Company, it was set out, has bought and paid for $1,284,000 of an issue of $3,951,000 of bonds authorized by the commission to be sold by the Public Utilities Company last March, the proceeds to be used in buying other utility companies and extending the properties of the Evansville company. Because of financial conditions it has been impossible for the purchasing company to market the remainder of the bonds at what it regards as a fair price, but the petitioning company believes short-time obligations can be sold at a fair price.

San Antonio (Tex.) Public Service Company.—The San Antonio Public Service Company, the incorporation of which under Texas laws was noted in the ELECTRIC RAILWAY JOURNAL of July 21, page 121, has in accordance with its purpose announced then taken over the San Antonio Gas & Electric Company and the San Antonio Traction Company, both controlled by the American Light & Traction Company. The change is in the interest of intercorporate simplicity. The directors have authorized an issue of $20,000,000 of 5 per cent first and refunding mortgage gold bonds. Of these, the company is about to issue $2,641,000. The company will also issue $4,700,000 of stock.

Southern Cambria Railway, Johnstown, Pa.—The directors of the Southern Cambria Railway are reported to have under consideration the matter of creating a bond issue as a means of providing for the settlement of claims against the company growing out of the accident of Aug. 12, 1916. Claims would be settled on the basis of the claimant accepting bonds for the amount of the claim as allowed.

United Gas & Electric Corporation, New York, N. Y.—The United Gas & Electric Corporation has declared a dividend of 1 per cent on the common stock, the first payment this year, and comparing with 5 per cent paid in 1916 and 4 per cent in 1915.

United Railways & Electric Company, Baltimore, Md.—The stockholders of the United Railways & Electric Company on Sept. 11 ratified the proposed issue of $3,000,000 of five-year 6 per cent convertible gold notes recently offered by a banking syndicate and also approved the increase in the authorized capital stock from 480,000 shares to 700,000 shares, the new stock to provide for the conversion of the notes. As noted in the ELECTRIC RAILWAY JOURNAL for Sept. 1, page 372, the plan of issuing notes was adopted to make provision for the purchase of new cars, for various extensions and improvements to the lines and for betterments and improvements to service during the next four years. The notes are convertible into the common stock of the company at $30 per share for the stock during the first two years, $32 per share during the third year, $34 per share during the fourth year, and $36 per share during the fifth year of the life of the notes issued. The notes will be dated Aug. 15, 1917, and will be due on Aug. 15, 1922.

Electric Railway Monthly Earnings

ATLANTIC SHORE RAILWAY, SANFORD, ME.

Period			Operating Revenue	Operating Expenses	Operating Income	Fixed Charges	Net Income
1m.,	Aug.,	'17	$24,863	$12,408	$12,455	$430	$12,025
1 "	"	'16	53,860	29,350	24,510	650	23,860

AURORA, ELGIN & CHICAGO RAILROAD, WHEATON, ILL.

1m.,	July,	'17	$220,802	*$143,462	$77,340	$35,790	$41,550
1 "	"	'16	209,030	*129,436	79,594	36,117	43,477
7 "	"	'17	1,218,890	*885,051	333,839	250,385	83,454
7 "	"	'16	1,155,862	*771,002	384,860	254,627	130,233

GRAND RAPIDS (MICH.) RAILWAY

1m.,	July,	'17	$113,390	*$75,897	$37,493	$16,348	$21,145
1 "	"	'16	113,948	*73,043	40,905	19,173	21,732
12 "	"	'17	1,302,532	*868 007	434,525	208,316	226,209
12 "	"	'16	1,263,820	*835,117	428,703	171,907	256,796

REPUBLIC RAILWAY & LIGHT COMPANY, YOUNGSTOWN, OHIO

1m.,	Aug.,	'17	$426,115	*$274,715	$151,400	$85,282	‡$73,167
1 "	"	'16	335,578	*183,147	152,431	69,033	‡85,930
12 "	"	'17	4,444,721	*2,847,949	1,596,772	939,531	‡701,590
12 "	"	'16	3,748,882	*2,190,485	1,558,397	778,986	‡794,180

*Includes taxes.
‡Includes non-operating income.

Traffic and Transportation

Portland Fare Hearing Under Way

Commissioner Suggests Temporary Six-Cent Fare and Further Operating Economies

The Public Service Commission of Oregon is considering the problem of allowing the Portland Railway, Light & Power Company to increase its electric railway fare from 5 to 6 cents, to care for increasing cost of operation and in a measure cover increases in wages asked by the trainmen. The commission states there is no desire by it to increase fares if any other solution can be found to dispose of the troubles of the company. The commission has considered such possible methods of economy as reduction of service, return to the skip-stop plan, using fewer cars and running faster, etc. None of these, however, has been decided upon.

Franklin T. Griffith, president of the company, testified at a recent session of the commission that it is no longer possible to give up-to-date service for a 5-cent fare. The 5-cent fare was made years ago when cost of material, labor, maintenance, operation and the like were very much cheaper than at present. Mr. Griffith stated that the property of his company could not be reproduced for less than 175 per cent of the physical valuation placed on it by the commission.

COMMISSIONER COREY FAVORS AN INCREASE

H. H. Corey of the commission said that he believed the problem created by the request of the company for a 6-cent fare, in order that it might increase the wages of its employees, could be solved by granting the company a temporary 6-cent fare permitting it to reduce the service wherever practicable and allowing it to issue ticket books to working men, giving twenty rides for $1, and ticket books to children, giving them twenty-five rides for $1. He said:

"I will suggest to the commission a reduction in the service where practicable, and a temporary six months' trial increase of fares to 6 cents, 1-cent transfer charge; workingmen's tickets at twenty rides for $1, the same absorbing the transfer charge and being a straight 5-cent fare, such tickets to be used only from 5 to 7 a.m., and 5 to 7 p.m., and school tickets at twenty-five rides for $1. This will not grant all the company requested, but will aid in the payment of increased wages to the employees.

"We find that the rider of Portland not only fails to pay for the cost of the service to the company, but that a substantial part of his fare goes to the taxpayer for the privilege. As an illustration, bridge rentals and franchise taxes in Portland aggregate $114,000 for the year 1918 and maintenance of improved streets, $120,000. Improvements to the streets have already cost the company $2,000,000. The elimination of the paving renewals, bridge tolls, franchise taxes and other forms of municipal imposts, such as the $16,000 lost annually to the company by reason of transportation to the city employees, would decrease the burden of the car rider. This question presents itself to me: Are not low car fares of more value to large property owners and merchants of Portland than to riders from the outlying districts, and should they not bear part of this burden?"

Among briefs filed with the commission relative to the application of the company to increase its fares is one by the City Council of Portland opposing the increase. This brief argues that the company by reducing its service can make such profit that may be necessary. It is also pointed out that the company's revenues will be increased by the elimination of the jitney under recent legislation.

Attorney General Brown of Oregon on Sept. 13 began probing into the question as to whether or not the Public Service Commission has jurisdiction over the application of the company for permission to increase its fares. Various attorneys have challenged the commission's jurisdiction on the ground that there is now on the statute books a law forbidding a higher fare than 5 cents in cities of a population of 50,000 or more.

Seattle Four-Cent Tickets Go

Public Service Commission Sanctions Their Elimination at Once—$150,000. More Revenue a Year Likely as a Result

By a recent ruling of the Public Service Commission of the State of Washington the further sale of twenty-five car tickets for $1 by the Puget Sound Traction, Light & Power Company in Seattle has been eliminated. In an order signed by all three members of the commission, the company is authorized to put into immediate effect a straight 5-cent fare schedule, except that the rate of 2½ cents for school children, during the school year, will be continued. W. H. McGrath, vice-president of the company, on Sept. 12 announced that the sale of tickets had been stopped by the company, thus making the order of the commission effective at once. All tickets which were then outstanding, however, will be accepted by the company under the terms that applied when they were purchased.

City to Appeal Finding

Corporation Counsel Hugh M. Caldwell, who with Assistant Corporation Counsel Walter F. Meier appeared for the city at the hearing held before the commission, announced after the ruling that he would seek a writ of review in the Superior Court of Thurston County on the grounds that the commission had never valued the properties of the company and that the Public Service Act itself does not prohibit the issuance of commutation tickets.

Through its order eliminating 4-cent tickets, the commission takes jurisdiction over rate schedules fixed by municipal regulations. Its statement on this point follows:

"This commission is charged with the responsibility of seeing that all the rules, regulations, practices, equipment, appliances and facilities of service of any common carrier in respect to transportation of persons or property are just, reasonable, safe, proper, adequate and sufficient. We are also charged with the responsibility of determining that rates, fares or charges shall be just, reasonable and sufficient. We do not believe that under existing conditions a 4-cent rate in the form of a commutation ticket or otherwise is sufficient in the city of Seattle, but that a 5-cent rate, except for school children, is a reasonable rate of fare.

$150,000 a Year More Revenue for Company

"This commission has never determined the value of the company's railway system in Seattle. One of the general officers of the company testified at the hearing that his company was at large expense to determine the actual money which has gone into the system, exclusive of the power plant, and that the net amount which has gone into the system (exclusive of power) as in use is approximately $15,000,000. In Seattle the company for the first six months of 1917 received an average fare per revenue passenger of 4.67 cents, while the average revenue received from all passengers was 3.46 cents. We find the average length of line in Seattle is 5.16 miles. The longest haul for 5 cents is 17.953 miles, the longest haul for 4 cents is 9.837 miles. Late increases in trainmen's wages amount to $130,000 a year. A reduction in the working day from nine to eight hours in the shops and power houses amounts to $2,000 a month, or $24,000 a year. (The eight-hour day is one of the problems which the arbitration board now in session will settle.) A reduction from nine to eight hours in track and paving work amounts to $1,100 a month, or $13,200 a year. The elimination of the 4-cent ticket and the substitution of a straight charge of 5 cents will increase the revenues of the company approximately $150,000 a year."

In his brief protesting against elimination of the 4-cent ticket, Corporation Counsel Hugh M. Caldwell quoted extracts from the company's franchises and pointed out that the issuance or use of commutation tickets was not interfered with in an express provision written into the law. He said that the commission should complete its own valuation of the property before permitting any increases in the rates. Mr. Howe, counsel for the company, had no copies of the memoranda presented by him to the commission that could be consulted by the correspondent of the ELECTRIC RAILWAY JOURNAL.

Six-Cent Fares in Connecticut

Connecticut Company Intends to Charge This Rate After Oct. 1—Alarming Increase in Cost of Performing Service

Official announcement was made on Sept. 19 by the Connecticut Company, New Haven, that, dating from Oct. 1, the rate of fare on all its lines throughout the State will be increased from 5 cents to 6 cents. The increase of 1 cent, or 20 per cent, it was estimated, would net the company an annual additional revenue of $1,730,000, based on its revenue from passenger fares during the last year. The company's statement follows:

"Effective Oct. 1, 1917, the rate of fare will be increased to 6 cents. To relieve passengers of the necessity of carrying the coins necessitated by this change in fare, seventeen tickets will be sold for $1 at the local office.

"This increase is necessary because of the alarming increase in the cost of performing transportation service as well as the need for increased revenue to enable the company to finance the increasing demands for improvements of all kinds.

"The cost of electric railway transportation has been increasing for a long time, and with the tremendous increases in the cost of all fuel, materials and supplies used in the operation and upkeep of the property at this time, the income is not sufficient to meet the needs and obligaitons of the company and supply sufficient funds to enable the officers to finance the growing requirements for improvements of all classes, the heaviest of which is the requirement of the State and various municipalities for new pavements.

"The conditions at present confronting the company show that the present rate of fare is no longer reasonable, and it is clearly the duty of those charged with the conduct of the business to establish a reasonable rate of fare, which, after careful consideration, has been decided to be 6 cents.

"It is not only the Connecticut Company that is confronted with this lack of sufficient revenue. It has been found necessary to establish the 6-cent fare on many other electric railways, the most important of which is the Bay State Street Railway, operating in the cities and towns north and south of Boston."

Some time ago the Connecticut Company announced that it intended to cancel the practice of giving six tickets for 25 cents in Waterbury, and following a protest by the city, which held that the cancellation of the tickets was actually an increase in the rate of fare, the case was taken to the Superior Court. The court ruled that the company had a right to cancel the practice of selling the reduced-rate tickets. Its decision was reviewed briefly in the ELECTRIC RAILWAY JOURNAL for Aug. 11, page 227.

All Day Express on New York "L"

Problem Being Studied by Commission's Experts—Hearing on Sept. 24

J. P. H. DeWindt, chief of the transit bureau of the Public Service Commission for the First District of New York, has for several months been working on a plan which, if its adoption is found to be feasible, would provide for express service on the Third Avenue elevated line of the Interborough Rapid Transit Company continuously downtown until about 1 o'clock or shortly thereafter in the afternoon, when the express trains would be reversed and run northbound until the close of the evening rush hour. or perhaps a little later.

The question of improving service on the Second and Third Avenue elevated lines in New York will come before the commission at a hearing on Sept. 24. It is probable that at this hearing a suggestion will be made that one express train in every three be turned back at Canal Street and the Bowery, instead of continuing through to the City Hall, there being considerable congestion at the City Hall terminal on the Third Avenue line.

The transit bureau also is considering the possibility of operating express trains downtown during all hours of the day on the Third Avenue line and northbound on the Second Avenue line. This would make possible a continuous express

service all through the day, while, if the all-day express service was confined to one line—these two lines being only third tracked—it would necessitate a stopping of the express service at the starting point uptown for at least a period of an hour and a half in the middle of the day.

The operation of express trains downtown via the Third Avenue line and northbound via the Second Avenue line would make it necessary to rebuild the elevated structure in the vicinity of Chatham Square. Whether the transportation benefits to be gained by such service would outweigh the expenditure necessary is being studied by the commission's experts.

Recommendations to Shore Line

John F. Trumbull, chief engineer of the Public Utilities Commission of Connecticut, has completed his examination into the causes and circumstances connected with the collision which occurred on Aug. 13 on the Shore Line Electric Railway near North Branford, and in his report to the commission suggests the following for the company's consideration: (1) Installation of a modern system of automatic block signals on all portions of the line where high speed is maintained; (2) improvements in the present system of dispatching cars, issuing train orders and recording car movements; (3) printed working time tables for the information of employees; (4) adoption of a rule requiring conductors and motormen to exchange signals when approaching a meeting point; (5) enforcement of the company's existing rule prohibiting the fastening down of automatic release controller handles.

As a result of the collision nineteen persons were killed and thirty-five injured. The findings in connection with the inquiry into the causes of the accident were reviewed in the ELECTRIC RAILWAY JOURNAL for Sept. 1, page 372.

Safety Film for Public Service

A very comprehensive motion picture made for safety educational purposes has just been completed for the Public Service Corporation of New Jersey, Newark. It was shown for the first time on Sept. 17 and will be released soon for use in connection with the safety work of the corporation. It comprises about 3000 ft. of film, the scenes of which are laid in various parts of the Public Service property. Many trainmen appear in the pictures as well as other employees and the actors and actresses who take the leading parts.

The story is entitled "The High Cost of Hurry" and deals with the misfortunes of the "Hurryup Family." It embodies a romance in which the comparison between the principles of safety and those of carelessness are clearly portrayed. The film will be used by A. J. Van Brunt, director of safety education, to illustrate his next semi-annual lectures to Public Service employees in the several cities of the State. Later it will be placed in general circulation.

Georgia Jitneys Lose Again

The jitneys in the State of Georgia lost for the third time when the Supreme Court held recently that the Atlanta ordinance regulating jitneys and requiring them to have bonds is valid. The ordinance was passed in April, 1915. The jitneys at one time appealed to the court against the Railroad Commission taking jurisdiction, but the court held that since the commission had enacted no regulations there was nothing to decide. It is said that this may prove to be the final defeat of the jitney bus in that State.

The jitney men have expressed their determination to carry the fight against the ordinance to the Supreme Court of the United States. Fifty members of the Atlanta Jitney Bus Association have pledged their support to a scheme by which 150 jitneys could supply transportation for soldiers at the Camp Gordon cantonment. The traffic committee of the association has proposed the organization of the People's Transportation Company to operate trains of motor trucks from the camp to a terminus in the city, each truck to carry eighteen people and to draw four trailers carrying twelve people each.

More Complaints Against Scranton Increase. — The borough of Taylor has added a complaint to those of the city of Scranton and several organizations against the proposal of the Scranton (Pa.) Railway to increase its fare to 6 cents. The Public Service Commission has suspended indefinitely the effective date of the increase.

Long Island Increases Suspended.—The Public Service Commission for the First District of New York will soon decide upon the request by the Long Island Railroad for an increase in its passenger tariff rates. Pending this decision, the commission has further suspended from Sept. 15 to Sept. 25 the revised tariff filed by the company several months ago.

Ohio Fare Increase Suspended.—The new fare schedule of the Cleveland, Southwestern & Columbus Railway, Cleveland, Ohio, which was to have gone into effect on Sept. 14, has been suspended for thirty days by the Public Utilities Commission of that State. The company proposed to place its fares on a basis of 2½ cents a mile, instead of 2 cents as in the past, and to charge a minimum fare of 10 cents.

Bridgeton Fare Hearing.—The New Jersey Public Utility Commission, after a hearing on the petition of the Bridgeton & Millville Traction Company, Bridgeton, for the right to discontinue selling tickets in strips of six for 25 cents, has decided to take the case under advisement. As noted previously in this paper, the commission has suspended the effective date of the increase until Nov. 6, unless it makes a decision earlier in favor of the company.

Test Case for Louisville Traffic Ordinance.—That a headlight is a "glaring headlight," when it is strong enough to "dazzle the eyes," and therefore unlawful, is the statement made by Judge Samuel Boldrick to the police of Louisville, Ky. This was the ruling in a test case in which the vice-president of the Automobile Club offered himself as the defendant. He was assessed a fine of $50 and will take the case to the Court of Appeals so that the police officials will have an interpretation of the law to stop the use of such headlights.

Many Unused Transfers in Providence.—Interesting figures as to the use of transfers on the lines of the Rhode Island Company, Providence, R. I., have been compiled by M. C. A. Babcock, comptroller of the company. During the month of July more than 2,253,000 slips were distributed, while only 1,557,000 were taken up by conductors, leaving 696,000 unaccounted for. The company has sixty-seven varieties of transfers, divided into five classes, for use in Providence, Pawtucket, Woonsocket, East Providence and on the suburban lines.

Jitneys Lose in Vancouver.—Jitney interests in Vancouver, B. C., have lost their case in an attempt through the courts to compel the city to reissue to driver McKay a license which the Council had canceled upon his refusal to run his car on a specific route. McKay had been assigned the route from Twenty-fifth Avenue to English Bay, but he had shortened it by running between the Bay and the post office, and challenged the right of the Council to compel him to keep to a certain run. His application for a mandamus requiring the city to give back his license was refused in a judgment handed down by Justice Murphy, who held that the city has full power to route jitneys.

Big Demand for Electric Express.—The electric express service recently inaugurated by the Reading Transit & Light Company, Reading, Pa., is proving a great convenience to shippers, especially in view of congested conditions on the railroads, and there is a growing demand for the shipping facilities which it offers. The company has been giving particular attention to the development of the electric express branch of its service and now it has a well-established business from Reading to Lancaster, Allentown, Pottstown, Norristown, Philadelphia and intermediate points. Freight stations have been established at terminal points. Electric express is being largely depended upon to market the fruit crops.

Accident Statistics for New York City.—During the month of July, 731 cases of personal injury were recorded which resulted from accidents in and around the surface cars of New York. Three hundred and seventy-four people were hurt in getting on or off cars before they had come to a full

stop, or by carelessness in alighting. Five were struck by passing vehicles. Twenty were injured in putting their arms or head out of car windows. Ninety-one pedestrians were struck by cars. Thirty-five people were hurt when they tried to enter cars after the conductors had started to close the doors. In collisions between cars and vehicles seventy-two passengers of vehicles and thirty-five car passengers were injured.

Springfield Jitneys Test New Ordinance.—Jitney drivers of Springfield, Mass., who have made a test case on the constitutionality of the new jitney ordinance requiring them to file a bond of $1,000 and accept passengers for only the seating capacity of the cars, were defeated recently in police court. They opposed the bond requirement and demanded permission to carry running-board passengers during rush hours. The new ordinance was intended to eliminate objectionable features of an ordinance passed last year. Judge Hendy in his decision declared the present ordinance to be constitutional and that none of its features was unreasonable or prohibitive. When the amended ordinance went into effect more than 200 drivers retired from business for the time being because of their inability to procure the required bond. They were operating along the line of the Springfield Street Railway.

Harrisburg Jitneys Defy Commission.—The Harrisburg Jitney Association has announced that it will contest the ruling of the Public Service Commission of Pennsylvania requiring the jitneys to observe fixed routes or cease operating. In accordance with the commission's order directing the jitney men to file with it amended petitions for certificates of public convenience, setting forth the routes over which they propose to operate, George W. Shoffstall has asked for the approval of a route through the heart of the city. Shoffstall was the only one to comply with the order within the time specified. Seventy of the 178 jitney men in the city have ceased operating because of the order. All of them were reimbursed by the city for the money they had paid into the jitney accident fund after having given a bond in twice the sum received. The commission has imposed a fine of $100 on each of two drivers for operating without certificates. This is the second time the commission has taken such action.

Commission Bans Excess-Fare Rule.—The Public Service Commission of Pennsylvania has decided that the rule requiring a passenger without a ticket to pay an excess fare is "unjust and unreasonable" and has ordered the Buffalo & Lake Erie Traction Company, Buffalo, N. Y., operating in Erie County, Pa., to amend its tariff relating to the additional fare charged passengers who pay a cash fare in excess of 10 cents so that it shall not apply to those passengers who board cars at non-agency stations. The complaint against the company was filed by Representative H. P. Shunk of Erie County. The company contended that the additional fare was not demanded in order to increase revenue, but to insure all cash fares being properly accounted for. The commission held that the rule places on such a passenger the burden of presenting his receipt for the excess fare at an agency station in order to have it redeemed because, through no fault of his own, he had not provided himself with a ticket.

Jitney Regulation in Winnipeg.—The general public, recognizing the unfairness of the unregulated jitney competition in Winnipeg, has brought pressure to bear upon the City Council with the result that a by-law amendment relating to cabs and vehicles for hire has been passed. According to the terms of the amendment, an applicant for a license to drive an automobile or motor bus for hire and all those having licenses for the current year shall take out an insurance policy or furnish a bond "in the sum of $1,000 against personal damage to any one person, in the sum of $200 against property damage, and in the sum of $5,000 against personal damage in any one accident." It was predicted that a large number of the jitneys would cease operating when the new law went into effect, Sept. 20. The Winnipeg Electric Railway has felt severely the effect of the unfair jitney competition in Winnipeg and was considering the matter of bringing suit against the city to recover damages to the extent of the injury to its earnings suffered from the jitney.

Personal Mention

C. S. Jenner, vice-president and assistant general manager of the Porto Rico Railway, Light & Power Company, San Juan, P. R., has resigned to engage in private business.

C. W. **Witherow** has resigned as master mechanic of the Cleveland & Erie Railway, Girard, Pa., to become foreman of the P Street shop of the Washington Railway & Electric Company, Washington, D. C.

Inghram D. Hook, secretary of the Kansas City, Clay County & St. Joseph Railway, Kansas City, Mo., now at Camp Funston, has resigned his office. W. S. Tuley, treasurer and assistant secretary, is acting in his stead.

Andrew S. Macreadie, electric railway superintendent of the Cape division of the Cumberland County Power & Light Company, Portland, Me., has recently been commissioned captain in the Quartermaster's Reserve Corps and assigned to Camp Dix, New Jersey.

Robert B. Chalmers, superintendent of the Salem division of the Bay State Street Railway, Boston, Mass., has resigned. George H. Gray, general superintendent at Lynn, will have charge of the Salem division until a successor to Mr. Chalmers is appointed.

C. S. **Colburn**, who resigned recently as general superintendent of the Norfolk and Berkley divisions of the Virginia Railway & Power Company, has accepted a position as Southern representative of the Railway Audit & Inspection Company at Birmingham, Ala.

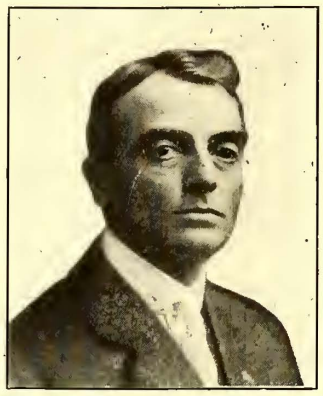
Thomas J. Dawson, of the purchasing department of the Boston (Mass.) Elevated Railway, has been appointed superintendent of supplies for the city of Boston. Mr. Dawson is a native of Cambridge, Mass., and has been in the employ of the Boston Elevated for thirteen years, having spent the entire period in the bureau of purchase.

A. J. Earling has retired from the presidency of the Chicago, Milwaukee & St. Paul Railway. Mr. Earling has held many other important positions with the St. Paul system. He started with the company as a telegraph operator at the age of seventeen. He has been president since 1899, during which time the road was extended to the Pacific Coast. He will become chairman of the board.

H. E. Byram, vice-president of the Chicago, Burlington & Quincy Railroad, has been appointed president of the Chicago, Milwaukee & St. Paul Railway to succeed A. J. Earling. Mr. Byram has held important positions with the Great Northern, the Rock Island and the Montana Central railroads. He began his career with the Burlington system and returned to its employ in 1904. He has been in charge of operation since January, 1910.

Edward J. Cooney, who was recently appointed executive assistant to the president of the Rhode Island Company, Providence, R. I., and is to conduct a weekly newspaper for the company and its employees in addition to handling general publicity work, has had wide experience in advertising and publicity matters. Mr. Cooney is forty years old. From 1902 to 1906 he was manager of the *Chronicle*, North Attleboro, Mass., in which place he has always lived. For the next six years he was editor of the Providence *Visitor*, the official Catholic paper of the State. In 1916 he became advertising manager for Dimond's department store, Providence. Later he conducted an advertising agency in Worcester, doing special work for the Worcester *Telegram* at the same time. He gave up that work to become assistant sales manager of the Screw Machine Products Company, and was occupying that position when offered the place of executive assistant just created by the Rhode Island Company. Mr. Cooney was press agent for a large amusement park for four years, handled publicity work for candidates for Governor of Rhode Island and Mayor of Providence, assisted in the organization of the Catholic Press Association of the United States and was for two years president of that association. He is one of the leading spirits in the Town Criers, a State organization of advertisers and publicity men.

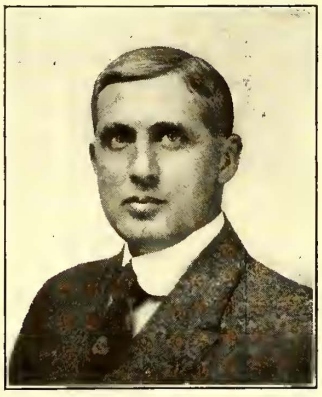
William Clapper, traffic manager of the Inter Urban Railway, Des Moines, Iowa, as noted recently in the ELECTRIC RAILWAY JOURNAL, has been appointed general manager of the company. Mr. Clapper became head of the traffic department on March 1, 1915, succeeding C. T. Chapman, who resigned to accept a similar position with the Dan Patch Air Line, Minneapolis and St. Paul. He has been engaged in railroad service since June, 1899, when he became clerk to the commercial agent of the Minneapolis & St. Paul Railroad at Minneapolis, Minn. In January, 1900, he returned to Des Moines, his native city, to accept a similar position with the Wabash Railroad. In 1904 Mr. Clapper was appointed contracting freight agent of that company, with headquarters at Des Moines. Three years later, upon the resignation of the division freight and passenger agent, Mr. Clapper was promoted to succeed him. In that capacity he had charge of all of the company's freight and passenger business in the State. As general manager he will retain charge of the traffic department.



WILLIAM CLAPPER

Amos R. Baxter, chief accountant of the Indianapolis & Cincinnati Traction Company at Rushville, Ind., has been appointed acting auditor as the successor to F. T. Loftus. Mr. Baxter has been with the company since 1908, serving in the positions of agent, cashier, bookkeeper and chief accountant and has been considered very capable in each of the several capacities. He is a member of the Central Electric Railway Accountants' Association.

John L. Livers, vice-president and general manager of the Charlottesville & Albemarle Railway, Charlottesville, Va., has been elected president of the Charlottesville Chamber of Commerce. Mr. Livers was born in Gettysburg, Pa., in 1878, and started his electrical career as lineman at the age of eighteen. After an experience of several years in various lines of construction work, he entered the operating and contracting field, and during a period of twelve years constructed more than 100 electric light and power plants. In 1912 Mr. Livers took charge of the Charlottesville electrical property, which he quickly transformed from an obsolete plant to one of the most economical and best equipped small railway and lighting plants in the country. An account appears on another page of some of the operating methods of Mr. Livers and of his public service relations with the community which his company serves. As this article shows, Mr. Livers has the happy faculty of proving to all sorts and conditions of men the goodness of his intentions and his ability to fulfill them.



J. L. LIVERS

F. T. Loftus, who has been auditor of the Indianapolis & Cincinnati Traction Company at Rushville, Ind., since 1911, has resigned from electric railway service to take a position with the Remy Electric Company, Anderson, Ind. Mr. Loftus has been prominent in electric railway affairs in that district, he having served on various committees of the Central Electric Railway Accountants' Association, as secretary for 1913 and 1914, as first vice-president during 1915 and as president during last year. He was born in Anderson, Ind., in 1881. In 1898 his family moved to Chicago, where he found it necessary to secure employment. There he attended night school, took up a general business course and specialized in accounting. He held several positions in this field until 1907, when he accepted the position of passenger and freight agent of the Indianapolis & Cincinnati Traction Company at Shelbyville, Ind. The following year he was promoted to cashier and a year later was made general bookkeeper. In August, 1910, he was appointed acting auditor of the company to succeed W. B. Wright, and soon afterward was made auditor, the position he has held until the present time. Mr. Loftus will be succeeded by Amos R. Baxter, who was his assistant in all the capacities in which he has served the company.

Obituary

William H. Ayers, assistant chief clerk in the office of J. M. Waldron, signal engineer of the Interborough Rapid Transit Company, New York City, died recently. Mr. Ayers had been in the service of the Interborough for thirteen years, the first six of which he was in the operating department.

David R. Morrison, one of the promoters of the Stark Electric Railway, Alliance, Ohio, died at his home in Cleveland on Sept. 12, at the age of sixty-nine years. He was a prominent real estate man and had served as city director of charities. He was also active in the establishment of the city's park system.

Robert K. Young, recently appointed a member of the Public Service Commission of Pennsylvania, but never able to assume the duties of the office, died at the Blossburg Hospital, Harrisburg, where he had been confined since last June on account of a fractured thigh. Mr. Young served two terms in the State Legislature and had held successively the offices of auditor general and State treasurer. Mr. Young was formerly president of the Wellsboro (Pa.) Electric Company.

Francis B. H. Paine, a member of the firm of Paine, McClellan & Campion, electrical and consulting engineers, New York and Philadelphia, died on Sept. 13. Mr. Paine was a son of the late Charles Paine, a noted civil engineer and railroad executive. He acquired his early engineering education with the Westinghouse Electric & Manufacturing Company, and later was engineer of construction for the Ontario Power Company. Mr. Paine spent two years in Japan and other Far Eastern countries, following the year 1899, to study foreign trade conditions, and in 1911 he went to Europe to make studies of public utilities. He was a member of the National Electric Light Association and a fellow of the American Institute of Electrical Engineers. He had served on committees of the American Electric Railway Association and on other important engineering committees.

Osce Goodwin, vice-president of the Texas Electric Railway (Consolidated Strickland Lines), Dallas, Tex., died recently at the Presbyterian Hospital in Chicago, where he had been about two weeks. His death was caused by heart failure, superinduced by asthma. Mr. Goodwin was fifty-six years of age. He had been in ill health for about four years. He was one of the organizers of the Texas Traction Company, which built the interurban line from Dallas to Denison and Sherman, and later was one of the organizers of the Southern Traction Company, which built the lines from Dallas to Waco and Corsicana. He was born in Louisiana in 1861 and received his education at the University of Texas. Soon after his graduation he became cashier of the First National Bank of Waxahachie. Later he went to Dallas and, associated with J. F. Strickland and M. B. Templeton, organized the Texas Traction Company, which began operation in 1907, and in 1914 they organized the Southern Traction Company. These two companies were consolidated last January into the Texas Electric Railway with Mr. Strickland as president and Mr. Goodwin vice-president. Mr. Goodwin was equally prominent in the organization of the Texas Power & Light Company, Dallas, which operates plants throughout the north and central parts of the State, and of which he was vice-president at the time of his death. He was also president of the Dallas Securities Company. Mr. Goodwin was identified with the Dallas Chamber of Commerce and was prominent in many public enterprises which had for their purpose the upbuilding of the city.

Construction News

Construction News Notes are classified under each heading alphabetically by States.

An asterisk (*) indicates a project not previously reported.

RECENT INCORPORATIONS

Stroudsburg (Pa.) Traction Company.—Incorporated to maintain and operate the Stroudsburg Passenger Railway and the Stroudsburg, Water Gap & Portland Railway. Capital stock, $200,000. Harry E. Sweeney, treasurer.

FRANCHISES

Santa Ana, Cal.—The Pacific Electric Railway has accepted the terms imposed by the Board of Supervisors in regard to the granting of the fifty years' franchise for the construction of an extension from Tustin to Irvine.

New Albany, Ind.—The City Council of New Albany has adopted resolutions rejecting the offer of the Louisville & Northern Railway & Lighting Company and the Louisville & Southern Indiana Traction Company, subsidiaries of the Middle West Utilities Company, to surrender their franchises and operate under the State Public Service law.

Cedar Rapids, Iowa.—The Iowa Railway & Light Company has received permission from the Board of Railroad Commissioners to erect and maintain electric transmission lines on certain roads and highways in Greene County.

Niagara Falls, N. Y.—The City Council of Niagara Falls has granted the petition of the International Railway for permission to lay tracks across a public alley between Riverway and Prospect Street so as to increase its switching facilities at the Riverway carhouse. The company will acquire additional property adjoining the carhouse and will increase its storage track facilities. Formal application has been made to the City Council of Buffalo by the company for permission to lay a single track loop around the Soldiers' Monument in Lafayette Square so as to connect with the Broadway car line. The company would remove the Broadway line from Washington Street in the congested retail shopping district and loop it around the monument. This recommendation was made in the recent report of Inspector Barnes of the Public Service Commission. The Council will probably grant the application and the franchise will have to be approved at a general election.

Akron, Ohio.—The Northern Ohio Traction & Light Company has received a franchise from the City Council to construct extensions to its lines in Akron.

Petersburg, Va.—At the request of the Petersburg & Appomattox Railway, the City Council of Petersburg will receive bids until Oct. 1 for the company's franchise over certain streets in the eastern section of the city. The company has received a franchise from the City Council for the use of Bollingbrook Street from Second Street east to the corporate limits.

TRACK AND ROADWAY

Pacific Electric Railway, Los Angeles, Cal.—An extension will be built by the Pacific Electric Railway from Redlands to Yucaipa, about 13 miles.

Municipal Railways of San Francisco, San Francisco, Cal.—A contract has been awarded to the United States Steel Products Company, San Francisco, for furnishing and delivering track special work for the Market Street line at a cost of $61,525.

***Grand Junction, Col.**—It is reported that plans are being contemplated for the construction of an electric railway from Grand Junction up into the Uintah Basin via Mack, Col., Ouray, Duchesne and Myton to Helper or Colton, via Indian Canyon or the Strawberry Valley, to connect the lines of the Colorado Midland Railroad and the Utah Coal Route, which will take over the line of the Denver & Rio Grande Railroad between Helper and Provo. C. M. McNeill, vice-president Colorado Midland Railroad, Colorado Springs, may give further information.

Capital Traction Company, Washington, D. C.—According to an announcement by the Public Utilities Commission, work of installing the big cross-over switch at the intersection of Fifteenth Street and New York and Pennsylvania Avenues, to carry Fourteenth Street cars over Pennsylvania Avenue west of Fifteenth Street, will be begun in a few weeks. Under plans approved by the commission, a signal tower will be erected at the northwest corner of Fifteenth Street and Pennsylvania Avenue. As soon as the cross-over is installed the company will begin the work of its Potomac Park extensions. The first extension will be south from Pennsylvania Avenue over Nineteenth Street to connect with existing tracks on F and G Streets. This will make possible the operation of a loop in this section and will afford better transportation facilities for those in the government buildings in the vicinity. The next extension will continue the tracks down Nineteenth Street to Virginia Avenue, whence they will turn into Eighteenth Street and proceed northward to F Street, to connect with existing facilities.

Jacksonville (Fla.) Traction Company.—This company will construct an extension to the proposed State Fair grounds in the Brentwood section.

St. Petersburg-Tampa Railway, St. Petersburg, Fla.—George S. Gandy, president of the St. Petersburg-Tampa Railway, has filed a bond for $25,000 with the State of Florida to guarantee the construction of the proposed line from St. Petersburg to Tampa, 18 miles, including a bridge over Old Tampa Bay to cost $1,000,000. It is expected that contracts will soon be let. Address care Wayne Trust Company, Philadelphia, Pa. [Nov. 18, '16.]

Alton & Jacksonville Railway, Alton, Ill.—A petition has been filed by the Alton & Jacksonville Railway with the State Utility Board for permission to discontinue its service between Alton and Jerseyville and also to dispose of the road.

Wichita-Walnut Valley Interurban Railway, Wichita, Kan.—The Public Utilities Commission of Kansas has issued a permit to the Wichita-Walnut Valley Interurban Railway for the construction of its proposed line from Wichita to Eldorado, Augusta, Douglas and Winfield, and construction work will be begun on Oct. 1. Charles Payne, secretary. [Sept. 15, '17.]

South Covington & Cincinnati Street Railway, Covington, Ky.—This company is considering the construction of a loop line to connect its Fort Thomas and Southgate lines.

Shreveport (La.) Railways.—This company is double-tracking its line in Marshall Street, and repaving same, at an estimated cost of $40,000. The improvement will complete a double track from the Fair Grounds to Gladstone Park.

United Railways & Electric Company, Baltimore, Md.—An extension will be built by the United Railways & Electric Company from Stone House Cove probably to Masonville, Fairfield and Wagner's Point, about 1 mile.

Detroit (Mich.) United Railway.—Work is progressing rapidly on the new Linwood Avenue line of the Detroit United Railway and it is expected that the line will be completed before next winter. Grading work is now under way on the Epworth Boulevard line and this is also being rushed forward as speedily as conditions permit.

St. Louis, Mo.—Two applications were considered by the Municipal Bridge Commission on Sept. 17 for the operation of cars over the Free Bridge at St. Louis. The two companies making application were the St. Louis & East St. Louis Interurban Railway, operating a line between St. Louis and East St. Louis, and the St. Louis & Illinois Railway, represented by John D. Downman, St. Louis, and Eugene Sweeny, East St. Louis, which has a franchise to operate a line in East St. Louis.

Interborough Rapid Transit Company, New York, N. Y.—U. J. Slander & Company, New York, were low bidders for constructing Shaft No. 2 of Route 26 of the Queensboro subway, to be located on the northerly side of East Forty-second Street between First Avenue and East River.

New York (N. Y.) Railways.—The Public Service Commission for the First District of New York has taken preliminary steps under the act of the Legislature passed last year

looking to the removal of the surface car tracks on Central Park West from the east side to the middle of that thoroughfare. Complaint has been made to the commission by Mayor Mitchel, as required by the legislative act mentioned. The commission will now determine whether the tracks as present located constitute a menace and danger as preliminary to action by the Board of Estimate and Apportionment. The Mayor's complaint will be considered by the commission at a hearing on Sept. 27.

New York State Railways, Utica, N. Y.—This company will construct new tracks in Lafayette Street, west from Genesee Street.

***Toledo, Ohio.**—It is reported that Henry L. Doherty & Company, New York, have under consideration the construction of an electric railway from Toledo, Ohio, to Fort Wayne, Ind., via Waterville, Grand Rapids, Napoleon, Defiance and other cities.

Ardmore (Okla.) Street Railway.—As the result of a disagreement with the City Council of Ardmore, the Ardmore Railway has sold its trackage on C Street northwest, and will abandon its franchise there. The disagreement arose over paving on this street. The company contended that asphalt should be used in laying paving, while the City Council demanded that vitrified brick be used. The company has asked for a franchise granting the right to lay its tracks on another street, extending northwest toward Electric Park.

Portland & Oregon City Railway, Portland, Ore.—Stephen Carver, president of the Portland & Oregon City Railway, has notified the Public Service Commission at Salem that the company contemplates extending its lines from Baker Bridge to Viola in Clackamas County. The company asks that the commission pass on the number of crossings necessary in the extension of the road.

Harrisburg (Pa.) Railways.—Plans are being made by the Harrisburg Railways for the construction of a line direct to Steelton, via South Second Street.

Philadelphia, Pa.—Two additional contracts have been signed by the Keystone State Construction Company for a section of the Broad Street subway from South Street to South Penn Square, amounting to $3,336,400, and a section from Filbert to Buttonwood Streets, amounting to $2,815,490. The awards accepted by the Keystone State Construction Company now total $10,200,000. The company has announced that work upon the subway loops on Arch and Locust Streets will begin before Oct. 1. Orders have been placed for 3,000,000 ft. of timber. The Philadelphia Subway Construction Company, Philadelphia, has refused the Broad Street tube contract, aggregating $2,000,000, and Smith, Houser & MacIsaac, New York, have refused the loop contract for $2,250,000, awarded last month by the transit department.

Pennsylvania Railroad, Philadelphia, Pa.—Officials of the Pennsylvania Railroad have announced that work on the electrification of the Germantown and Chestnut Hill branch of the road will not be completed before the first of the year, owing to labor conditions and lack of necessary material. It is expected by that time the line will be in full operation.

South Carolina Light, Power & Railway Company, Spartanburg, S. C.—This company contemplates the construction of an extension to Camp Wadsworth.

Petersburg & Appomattox Railway, Petersburg, Va.—This company, which is constructing a line to Camp Lee, will extend the line on through the camp to Prince George Court House.

Virginia Railway & Power Company, Richmond, Va.—If the necessary permit is received from the City Council the Virginia Railway & Power Company will operate its cars over the Bay Shore viaduct and over such of the Bay Shore and Atlantic Terminal tracks as are necessary and will construct tracks on Omohundro Avenue and Twenty-fifth Street in order to facilitate traffic between Norfolk and the naval base at Pine Beach.

Norfolk & Western Railway, Bluefield, W. Va.—A contract has been awarded by the Norfolk & Western Railway to the Union Switch & Signal Company, Swissvale, Pa., to furnish the necessary material for the extension of the signaling on its electrified division near Welch, Va.

SHOPS AND BUILDINGS

Kansas City, Mo.—The interurban freight station at Fourth and Wyandotte Streets, Kansas City, will probably be put into operation early in October, by which time the permanent board will be named, and contracts made with the interurban railways which will use the station. The Kansas City, Clay County & St. Joseph Railway plans to abandon its present freight station in Kansas City and will use the new one.

New York Municipal Railway, Brooklyn, N. Y.—The Public Service Commission for the First District of New York is readvertising for bids for the construction of station finish for Sections 1 and 2 of the Gravesend Avenue or Culver Rapid Transit Line in Brooklyn and will open bids on Oct. 26. Bids were recently received upon this contract, at which time the Mortenson Wood Working Company, Inc., Brooklyn, was the low bidder at $666,188.50. An award was made of the contract to that company, but investigation subsequently showed that the company would experience great difficulty in carrying out the contract. Thereupon at a recent meeting of the commission the award was rescinded and the decision reached to call for new bids as above stated at the new date named. Provision will be made in the new contract that the work must be speeded to completion so that the delay caused by readvertising will not retard the completion of the line.

Piedmont & Northern Railway, Charlotte, N. C.—This company will erect a new station at the army site at Camp Wadsworth.

Mahoning & Shenango Railway & Light Company, Youngstown, Ohio.—Several acres of land have been leased by the Mahoning & Shenango Railway & Light Company at Covers Corners, East Youngstown, and the company is laying switches and tracks to take care of cars that have been stored at the old power house of the company in West Federal Street.

POWER HOUSES AND SUBSTATIONS

McComb & Magnolia Light & Railway Company, McComb, Miss.—Work is progressing rapidly on the construction of the power plant of the McComb & Magnolia Light & Railway Company in Fernwood. This plant will supply energy to operate the car line from McComb City to Magnolia, a distance of 7 miles, as well as for lighting both cities. The electric generating plants at Magnolia and McComb City will both be closed down upon completion of the local plant.

Interborough Rapid Transit Company, New York, N. Y.—Plans are being made by the Interborough Rapid Transit Company for a power supply connection between its power houses at East Seventy-fourth Street and West Fifty-ninth Street to permit an interchange at any time. Property at Nos. 150 to 154 West Sixteenth Street, adjoining Seventh Avenue, has been acquired by the company, on which, it is said, it will erect a transformer station to supply electricity to operate the Seventh Avenue subway. The company will build similar stations 2 miles above and below that point.

Youngstown & Suburban Railway, Youngstown, Ohio.—This company has recently purchased a light plant in Salem and is refitting it to furnish power for its line. The equipment is now being installed in the plant and substations. As soon as this is completed it is reported that half-hour service will be established between the cities of Youngstown and Leetonia.

Harrisburg (Pa.) Railways.—Work has been begun by the Central Construction Corporation, Harrisburg, on the construction of a substation at Reily and Marion Streets for the Harrisburg Railways. The structure will be 32 ft. x 43 ft., one-story high and will be used as a small power plant to increase the power on all city lines. The structure will cost about $5,000.

West Virginia Traction & Electric Company, Morgantown, W. Va.—This company is considering the erection of a new 13,000-volt transmission line, 11 miles long, to furnish energy in the Morgantown coal districts.

Eastern Wisconsin Electric Company, Sheboygan, Wis.—A contract has been awarded by the Eastern Wisconsin Electric Company for the construction of an addition to its power plant to cost $25,000.

Manufactures and Markets

Discussions of Market and Trade Conditions for the Manufacturer, Salesman and Purchasing Agent

Rolling Stock Purchases Market Quotations Business Announcements

Manufacturing the Quick-Service Car

The Effect of Standardization on Economy of Production and on Deliveries—Cost May Be Amortized

Much has been said elsewhere in this issue on the effect of the one-man car on transportation. But what will be the effect on the car manufacturer of the standardization of car construction, which has been a characteristic of the development of the one-man car up to this time, and how far will the purchasing department of an electric railway company be warranted in purchasing equipment, even of proved great efficiency, in these days of inflated prices?

The opinion of one car builder on the first of these questions is given in the article by Mr. Heulings of The J. G. Brill Company on page 489 of this issue. Another manufacturer of cars interviewed by a representative of this paper expressed himself along similar lines. He said, in part:

"There is no doubt that if the railway companies will order cars which in all essential details are precisely alike, the cost of construction would be materially reduced and the speed at which these cars could be turned out would be considerably increased. I should say, in general, that we could save at least 10 per cent in purchasing our raw materials for the construction of these cars, and that the saving to be obtained from an increase in shop capacity would amount to double this figure, or 20 per cent. All in all I should think that the saving in cost of construction to the car builder would reach as high as 25 per cent, a saving which would, of course, be reflected in the price which he would have to charge to the railway company for the completed product. I estimate also that under the new conditions there would be a saving of 30 per cent in the time required to make deliveries. These figures are based on the present prices of the materials used in car construction, although the percentages would still practically hold with normal prices. Owing to these high prices the cost of car construction at present is about 50 per cent higher than it would be in ordinary times."

Can a Railway Afford to Buy These Cars?

The second part of the query raised at the beginning of this article was whether a railway company can afford to purchase new one-man cars at the prices now prevailing. This seems to be answered in part by the fact that it is estimated that a total of about 600 cars of this type have been ordered since the first of this year. This number includes 246 cars now under order by Stone & Webster for railway companies under their management.

In commenting on this situation a railway man said recently to a representative of this paper:

"There is undoubtedly a large saving, even at present prices, in favor of the light-weight one-man car as compared with the two-man double-truck car on properties where the former car is suitable. The extent of this saving has not been definitely determined. Its principal item is labor, but there is also the reduced energy costs, reduced wear on the track, possibility of using lighter track construction, etc. Car for car, this saving ought to represent at least $2,000 a year. If we assume the cost of a safety car under the present market conditions to be, roughly, $6,000, as compared with $3,500 two years ago, the cost above normal is $2,500. If the conditions on the property are such that the installation of these cars at their normal price would be warranted the excess price now should not act as a bar because it would be amortised during the fifteen or eighteen months of use. This does not include the increase in traffic which comes from the use of a more frequent service, but as the comparison is on a car basis, I have not included that."

Looking Ahead in Fare Collection

W. P. Butler Sees a Transfer Issuing Fare Box in Use on the Light-Weight Safety Car in the Near Future

Knowing that the manufacturers of fare boxes are working toward a considerable further development and refinement of the whole subject of fare collection methods, a representative of the Electric Railway Journal called on W. P. Butler, president and general manager of the Johnson Fare Box Company, to learn if possible what the future held in store as the ultimate one-man car fare collection system. Study and test work are being pushed on the fare-box development for all classes of cars, but the more general adoption of the light-weight safety car is emphasizing the need for a system which will reduce to the very minimum the attention which the single operator must pay to fares.

In the general aspect of the problem, Mr. Butler says that no matter how complete the fare collection system may become, it will always involve the human element. There is no prospect ahead of a scheme which will ever completely eradicate the need to check up on the conductors by the usual means in order to weed out the dishonest ones, who will also always be with us. The sooner, then, that the American associations provide a bureau or committee made up of the most capable men the industry affords to take up this important subject and devise a systematic country-wide handling of this problem, just that much sooner will the present generally conceded large leaks in revenue be stopped.

Obviously, what is felt to be the most immediate need in the fare collection system for the one-man car is a fare box which will combine the functions of cash, ticket and transfer handling in a single machine. At present, fare boxes are available which will handle both tickets of the metal variety and coins of several denominations, counting both and returning them to the conductor for reuse so that he does not need to start out on his run loaded down with sufficient change and tickets to last all day. The development of the metal ticket came after a long experimentation with the paper ticket canceling and counting boxes which could not be freed entirely of trouble, due to certain inherent weaknesses of the ticket itself. The metal ticket may be counted and registered in the fare box and used again and again. In a sense, it is, therefore, simply another coin added to the legal tender. With these two functions already included in the present fare box, there remains only the transfer problem to be solved to fulfill the immediate needs. And this is very evidently a vital need for the one-man operated car and the whole electric railway industry as well. Mr. Butler feels confident that a solution of this problem is nearing readiness to be placed at the disposal of the railways. A single box which will combine a transfer issuing function with the present box seems now to be a practicability.

One of the principal features of such a machine, in Mr. Butler's opinion, should be its universal character. In all his fare-box development he has insisted on a box the adoption of which could be universal. The advantages of this feature stand out more prominently than ever in connection with the transfer device, for here, if any attempt were made to fit it to the local transfer conditions on each property, the number of disks and tools and multiplicity of parts required of the manufacturer, would increase so rapidly that the cost would be prohibitive. The advantage of this type of construction to the railways, permitting as it does the manufacture of large quantities of boxes to standard drawings and patterns, jigs, dies and tools, is obviously one of markedly less cost for the device.

These developments may be anticipated as practical products of the near future, according to Mr. Butler, and then beyond that, still other schemes for further reducing the work of the light-weight safety car operator may be looked for. Indeed, the dream of a fare box which will also automatically make out the trip report has taken definite form and will probably be a part of the transfer issuing fare box.

Obviously the development of a transfer-issuing box involves large expenditures of time, pains and money and is necessarily slow. But if it will eliminate the abuse of transfers by passengers, the expense and waste of transfer printing and, on one-man cars, valuable time in their issuance, this expenditure, in the opinion of the manufacturer quoted, will be worth while.

Copper Price Announced

The President has approved the price of 23½ cents per pound for copper, f.o.b. New York, which was fixed by agreement between the War Industries Board and the leading copper producers. This price is subject to revision after four months, if evidence is presented to show that it should either go up or down.

Three important conditions were imposed by the board. First, that the producers would not reduce the wages now being paid; second, that the operators would sell to the Allies and to the public copper at the same price paid by the government, and take the necessary measures, under the direction of the War Industries Board, for the distribution of the copper, to prevent it from falling into the hands of speculators, who would increase the price to the public, and third, that the operators pledge themselves to exert every effort necessary to keep up the production of copper to the maximum so long as the war lasts.

A formal statement was issued saying that the proper departments would be asked to take over mines and plants of recalcitrant producers.

Copper Wire the Market Barometer

General Conditions Underlying Present Demand for Wire, with Certain Indications of Tendencies Now Prevalent

Copper wire is one of the electrical commodities which in normal times are probably the best barometer of business in the electrical industry. Wire shows which way the wind blows. If business is good, the demand for wire is proportionate, and vice versa. Besides, if the complexion of the market changes, the sale of wire clearly indicates it.

To-day the market for electrical supplies is at its height; never has it been greater. However, the demand is not created by the regular buyers of normal times, but rather by those trades the business of which has been greatly stimulated by war conditions, the industrials. Building operations in most sections have fallen to a minimum. Government operations have been on a large scale.

This is the character of the market for electrical goods and in like manner for wire. Wire is one of the first of the commodities to feel the effect of local conditions. In Chicago, for instance, at the present time the wire market is very uncertain because of the wiremen's strike. Demand is quiet. There is, however, a ray of hope because certain of the contractors have obtained some large contracts and are anxious to begin operations, and it is believed in some quarters that they may effect a compromise.

In neighboring cities in the Middle West, however, where local conditions are better, the wire market is responsive and business is reported as fairly good. In New York, on the other hand, where realty interests find it difficult to obtain money at a satisfactory price, the market is quiet.

Another indication of the sensitiveness of the wire market is the present condition brought about by the government's hesitation in fixing a price for copper. The wire market is very uneasy, and orders are more of the hand-to-mouth nature. Many contractors are holding off with the belief that copper may be placed at a lower figure and therefore the wire base fall. In this connection it has been hinted that even if wire base does drop a couple of cents the net price of wire will not vary because the discount may be pared sufficiently to make up the difference.

The drop in the cotton market had no apparent effect on insulated wire. For some time it has been pretty generally understood that the big controlling factor in the price of insulated wire was no longer copper. Cotton has had a very important part. However, manufacturers have laid in large stocks of cotton or have contracted for futures at high prices, so that any break in the cotton market makes no impression on insulated wire prices.

Coal Production During August

According to averages taken of weekly ratios of tonnage produced to full-time capacity, the figures prepared by the United States Geological Survey show that for the period in the month of June for which figures were available, the ratio amounted to 72.1 per cent. During July the ratio increased to 76.5 per cent, but decreased during August to 69.5 per cent. There has been a steady decline reported weekly since July 14, when the production percentage reached 78.1. Car shortage and labor troubles are chiefly responsible for the decreased production during August, which occurred principally in Illinois, eastern Kentucky and Tennessee.

Production for the week ending Aug. 18 was the lowest that has been recorded to date, namely 62.5 per cent. Since that time it has increased gradually, gaining 6 per cent for the week ending Aug. 25 and 3.5 per cent for the week ending Sept. 1. Improvement was most marked in Illinois, where the return of striking miners to work brought up the index for that State to 76 per cent, the highest point attained since July 28. Indiana and western Pennsylvania also recorded increases.

The United States Steel Corporation's orders on hand on Aug. 31 amounted to 10,407,049 tons, which is a decrease of 437,115 tons as compared with orders on July 31. Unfilled orders have been shrinking gradually since the announcement was made that steel prices would be fixed by the government, although the labor shortage, conscription and repairs to plants have been additional causes of reduced production.

NEW YORK METAL MARKET PRICES

	Sept. 13	Sept. 20
Prime Lake, cents per lb.	25½	26¼
Electrolytic, cents per lb.	25½	26¼
Copper wire base, cents per lb.	36	36
Lead, cents per lb.	9¾	8
Nickel, cents per lb.	50	50
Spelter, cents per lb.	8¼	8⅜
Tin, Straits, cents per lb.	61⅜	61¾
Aluminum, 98 to 99 per cent, cents per lb.	43½	42

OLD METAL PRICES

	Sept. 13	Sept. 20
Heavy copper, cents per lb.	24	24¼
Light copper, cents per lb.	20½	20½
Red brass, cents per lb.	18½	19
Yellow brass, cents per lb.	15¾	16¼
Lead, heavy, cents per lb.	8½	8
Zinc, cents per lb.	6	6
Steel car axles, Chicago, per net ton	$42 00	$42.00
Old car wheels, Chicago, per gross ton	$33.50	$33.50
Steel rails (scrap), Chicago, per gross ton	$41.00	$41.00
Steel rails (relaying), Chicago, per gross ton	$55.00	$55.00
Machine shop turnings, Chicago, per net ton	$18.00	$17.50

RAILWAY MATERIALS

	Sept. 13	Sept. 20
Rubber-covered wire base, New York, cents per lb.	36	36
No. 0000 feeder cable (bare), New York, cents per lb.	36½	36½
No. 0000 feeder cable (stranded), New York, cents per lb.	33¾	33¾
No. 6 copper wire (insulated), New York, cents per lb.	33½	33½
No. 6 copper wire (bare), New York, cents per lb.	36	36
Rails, heavy, Bessemer, Pittsburgh	$38.00	$38.00
Rails, heavy, O. H. Pittsburgh, per gross ton	$40.00	$40.00
Wire nails, Pittsburgh, per 100 lb.	$4.00	$4.00
Railroad spikes, 9/16 in., Pittsburgh, per 100 lb.	$7.00	$7.00
Steel bars, Pittsburgh, per 100 lb.	$4.00	$4.00
Sheet iron, black (24 gage), Pittsburgh, per 100 lb.	$8.85	$8.85
Sheet iron, galvanized (24 gage), Pittsburgh, per 100 lb.	$10.05	$9.55
Galvanized barbed wire, Pittsburgh, cents per lb.	4.85	4.85
Galvanized wire, ordinary, Pittsburgh, cents per lb.	4.65	4.65
Cement (carload lots), New York, per bbl.	$2.22	$2.22
Cement (carload lots), Chicago, per bbl.	$2.31	$2.31
Cement (carload lots), Seattle, per bbl.	$2.65	$2.65
Linseed oil (raw, 5 bbl. lots), New York, per gal.	$1.23	$1.22
Linseed oil (boiled, 5 bbl. lots), New York, per gal.	$1.24	$1.23
White lead (110 lb. keg), New York, cents per lb.	12¾	13
Turpentine (bbl. lots), New York, cents per gal.	44	44

Gear Manufacturers Meet at Chicago

The American Gear Manufacturers' Association held its semi-annual session in Chicago on Sept. 13, 14 and 15 at the Edgewater Beach Hotel. The association numbers among its members practically all of the prominent gear manufacturers in the country. The Chicago session was the largest of any yet convened. Pittsburgh was the scene of the last meeting—held in May.

Special importance was attached to the present meeting because of the members' desire to effect as much standardization in gear products as possible—this in common with the government's desires for all industry, now that the war is making special demands upon all manufacturers and users of materials.

F. W. Sinram of the Van Dorn & Dutton Company, Cleveland, president of the organization, opened the sessions on Friday morning at 10 o'clock. A paper on "Advertising Don'ts" was then read by J. C. McQuiston, advertising manager Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. This was followed by a talk on the "Heat Treating and Hardening of Gears," by W. H. Phillips of the R. D. Nuttall Company, Pittsburgh.

In the afternoon the convention men were the guests of Chicago members. An automobile trip of about 75 miles through Chicago's park system was a feature much appreciated. In the evening a dinner, music, monologs, lantern-slide caricatures and the like provided entertainment for the visitors.

On Saturday a paper by B. S. Waterman of the Brown & Sharpe Manufacturing Company on "Inspection of Gearing" was read. This was followed by a paper by H. E. Eberhardt, of the Newark Gear Cutting Machine Company, on "Spur Gearing by the Rotary or Disk Cutting Process," and one by F. Schneider of Van Dorn & Dutton Company, Cleveland, on "Spur Gears by the Shaper Method." These completed the program.

Electric Railway Equipment Needed at Turin, Italy

Manufacturers exporting material will be interested to learn that the interurban electric railway connecting the cities of Turin and Trofarello is to be extended to the town of Poirino, where it will subdivide, one section running to the town of Canale and the other to Villanova d'Asti. Both of these towns are about 20 miles from Turin. Correspondence from those interested should be in Italian or French and addressed to the tramway company as follows: Societa Belga Tounese, 114 Corso Regina Margherita, Turin, Italy.

ROLLING STOCK

St. Joseph Railway, Light, Heat & Power Company, St. Joseph, Mo., has ordered eight one-man cars from the American Car Company.

TRADE NOTES

Underwriters' Laboratories, Chicago, Ill., announces the election to the board of directors of Charles L. Case of New York and Sheldon Catlin of Philadelphia.

J. K. Hoffman, formerly with the Chicago office of the Hale & Kilburn Company, has been transferred to the Detroit office in the Garfield Building.

H. E Hilts, formerly district engineer at San Francisco for the Portland Cement Association, has been elected by the board of directors of that body to succeed the late J. P. Beck as general manager.

Woodmansee & Davidson, Inc., Chicago, Ill., announce a change in name to Woodmansee-Davidson Engineering Company. The Milwaukee office has moved from the Wells Building to the First National Bank Building.

Sloan, Huddle, Feustel & Freeman, consulting engineers of Chicago and Boston, announce the removal of their general offices in Madison, Wis., and their local Chicago office in the Peoples Gas Building, to the Conway Building, Chicago, Sept. 15. William F. Sloan has assumed personal charge of the Eastern office at 14 Kilby Street, Boston, as resident partner.

Standard Steel Works Company, Philadelphia, Pa., a subsidiary of the Baldwin Locomotive Works, announces that Alba B. Johnson has been elected president to succeed William Burnham, who has been made chairman of the board. Mr. Burnham succeeds William L. Austin. Samuel Vauclain has been made senior vice-president, Robert Radford has been made vice-president and treasurer, and W. H. Pugh has been made secretary.

Baldwin Locomotive Works, Philadelphia, Pa., has made the following changes in its organization: Samuel M. Vauclain, vice-president and manager, has been made senior vice-president; James McNaughton, formerly with the American Locomotive Company, has been made consulting vice-president; Grafton Greenough, sales manager, has been made vice-president in charge of sales, and John P. Sykes, general superintendent, has been made vice-president in charge of manufacturing.

Elbert F. Norton, sales engineer with the Standard Underground Cable Company's Chicago office, has received a commission as major in the Engineers' Reserve Corps, U. S. Army, and has left for three months' training at Fort Leavenworth, Kan. Mr. Norton is a graduate of Purdue University in electrical engineering, and is well known in the electrical field. He has been with this company about five years, and previous to this employment was an erecting engineer of electric and steam power plants.

Norman R. McLure, for the last three years chief engineer of the Phoenix Iron Company, Phoenixville, Pa., has resigned to take a position with the Taylor-Wharton Iron & Steel Company, High Bridge, N. J. For the time being Mr. McLure will assist in the construction and operation of the extension to the plant of the Tioga Steel & Iron Company, a subsidiary in Philadelphia in which will be executed the ordnance contracts recently taken by the company for the United States Navy Department.

Berger Manufacturing Company, Canton, Ohio, announces the appointment of H. J. Richardson as works engineer. His new work includes supervision of the power plant, new construction, maintenance and repair of manufacturing equipment and buildings. Mr. Richardson recently was connected with the New England Westinghouse Company, where he was manager of the gage department. Previous to this he was acting chief engineer of the ordnance department of the Crucible Steel Company, Harrison, N. J. and prior to that for a long time he was with the Commonwealth Edison Company of Chicago, the last seven years of this service having been in the engineering department.

NEW ADVERTISING LITERATURE

B. F. Sturtevant Company, Boston, Mass.: Catalog No. 236 of its steel-plate, multivane and turbovane fans.

A. F. Daum, Pittsburgh, Pa.: Illustrated pamphlet describing various types of Daum refillable cartridge fuses.

Titanium Bronze Company, Inc., Niagara Falls, N. Y.: Illustrated booklet on Titanium aluminum bronze die castings.

General Electric Company, Schenectady, N. Y.: Loose-leaf binder containing five of its latest bulletins on wires and cables, as follows: Bulletin 49,300—Armored Cables; 49,301—Varnished Cambric and Paper-Insulated Cables; 49,302—Wires and Cables, General; 49,303—Splicing Materials and Junction Boxes; 49,304—Conductors Insulated with Vulcanized Rubber Compound.

Bridgeport (Conn.) Brass Company: Thirty-six pages, Bulletin No. 10, printed in colors. Pages 3 to 6 give a short review of the methods of choosing trolley wire during the early days of electric railroading, and then give the reasons for the present wide adoption of "Phono-Electric" trolley wire on congested city routes, on curves, for general city use, for suburban and interurban railways and on heavy electrifications. Page 7 contains illustrations and descriptions depicting the actual results obtained in the use of copper and Phono-Electric trolley wire. The rest of the pages are filled with a large number of illustrations showing installations in various classes of service in every section of the United States. Installations in Canada, England, Scotland and Ireland are also shown. A short description accompanies each illustration to give a "nutshell" idea of the conditions which led to the use of Phono-Electric wire.