Street Railway Journal

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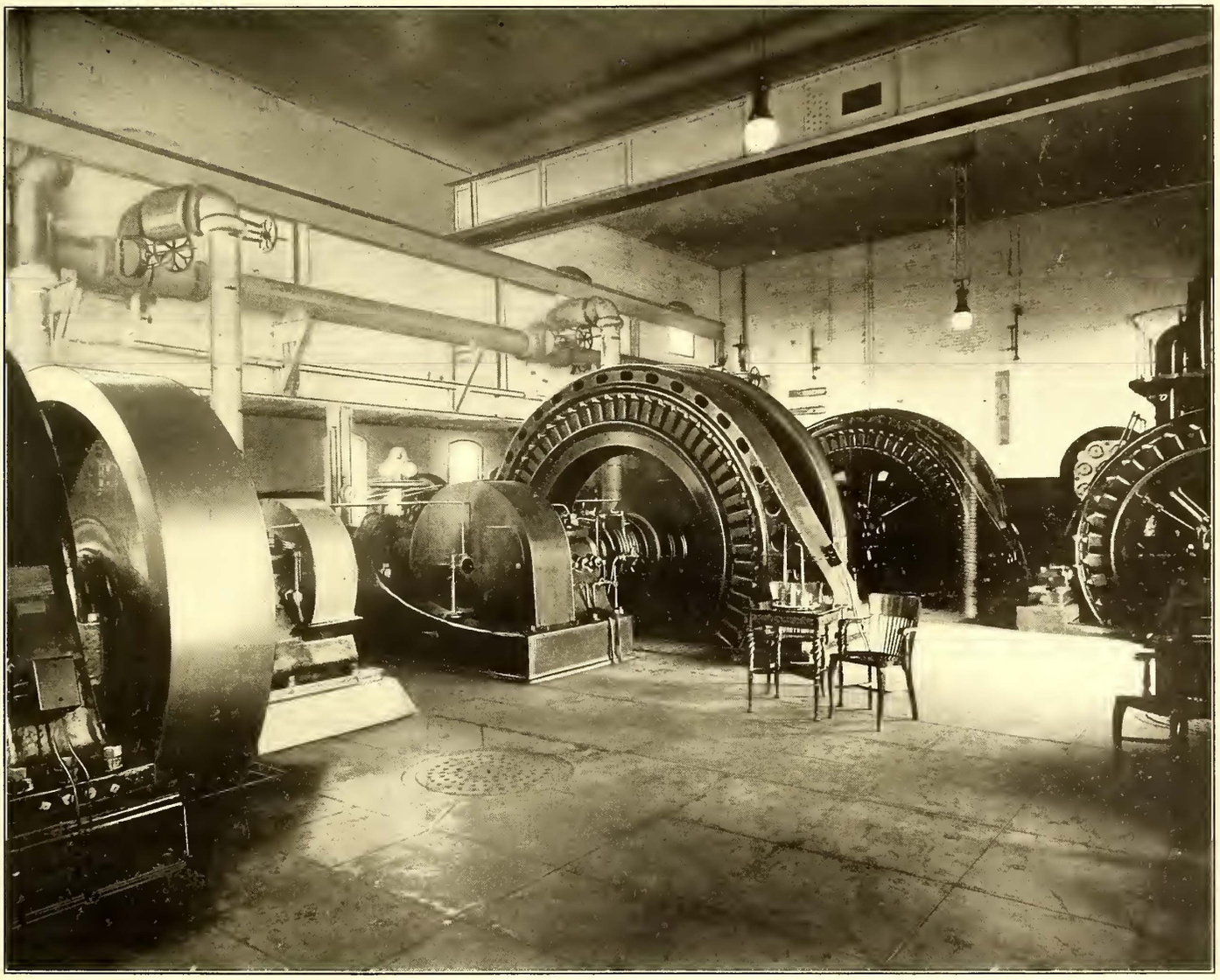
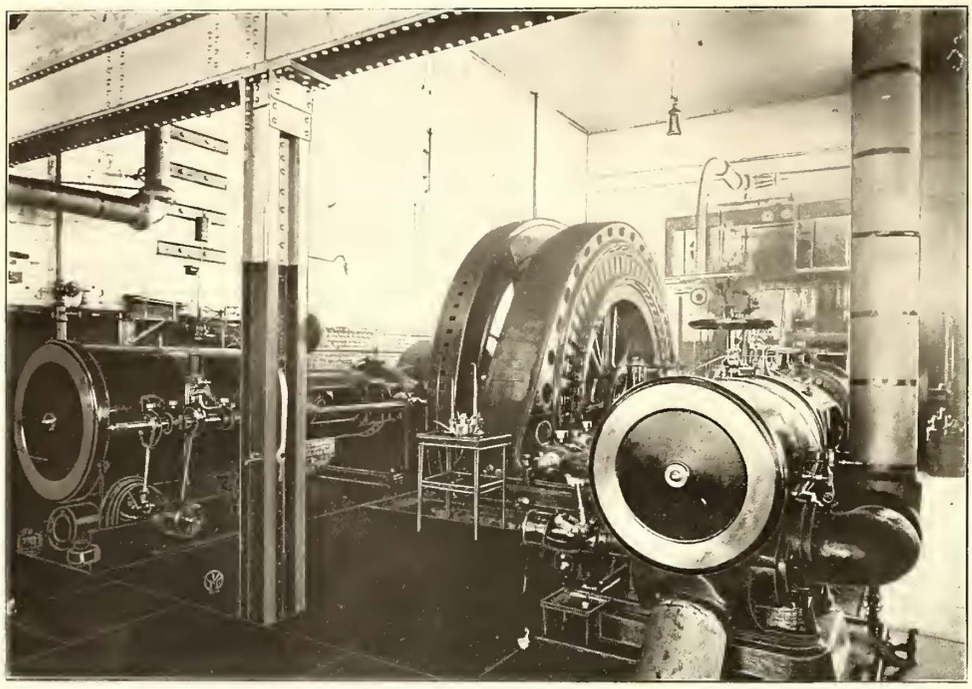
THE SYSTEM OF THE YOUNGSTOWN-SHARON RAILWAY AND LIGHT COMPANY

An excellent example of modern electric interurban railway construction in this country is shown by the road recently completed near the State lines of Ohio and Pennsylvania. The Youngstown-Sharon Railway & Light Company was incorporated under the laws of the State of New Jersey a year or two ago, and has combined as one property, by buying up all the securities of the Youngstown Consolidated Gas & Electric Company, the Youngstown-Sharon Street Railway Company, the Sharon & Wheatland Street Railway Company, the Shenango Valley Light Company, the Sharon Gas & Water Company, the Sharpsville Electric Light Company and the Valley Street Railway Company. To these it has added the Sharon & New Castle Railways Company by the purchase of all the stock of that property. This combination owns and controls, therefore, all of the electric lighting business and manufactured gas lighting business in Youngstown and its suburbs and in the neighboring towns of Sharon, Sharpsville and Wheatland. The street railway portion of the property consists of the local system in Sharon, which runs to Sharpsville, and is known as the Valley Street Railway, and a smaller local system from Sharon southward to Wheatland; an interurban line connecting Sharon with Youngstown, and a branch from the central portion of this interurban line extending to New Castle. The total length of single track is about 40 miles, exclusive of turnouts. The companies originally operated, before consolidation, some five electric power houses, but since



GENERAL VIEW IN MAIN POWER STATION

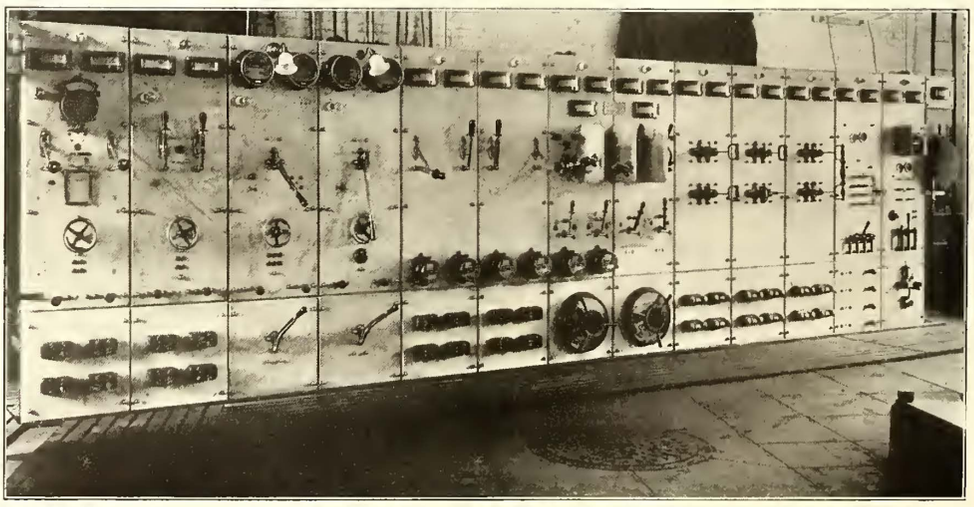
control has been obtained by the Youngstown-Sharon Railway & Light Company a single power house in Youngstown has been substituted. This new central station has a capacity of over 2000 kw, and generates two-phase, 60-cycle alternating current, at 2250 volts, which supplies the entire territory for lighting, power and the railway purposes. The acompanying map gives an excellent idea of the district served by this undertaking, showing not only the railway lines, but the territory covered by the lighting circuits of the company.



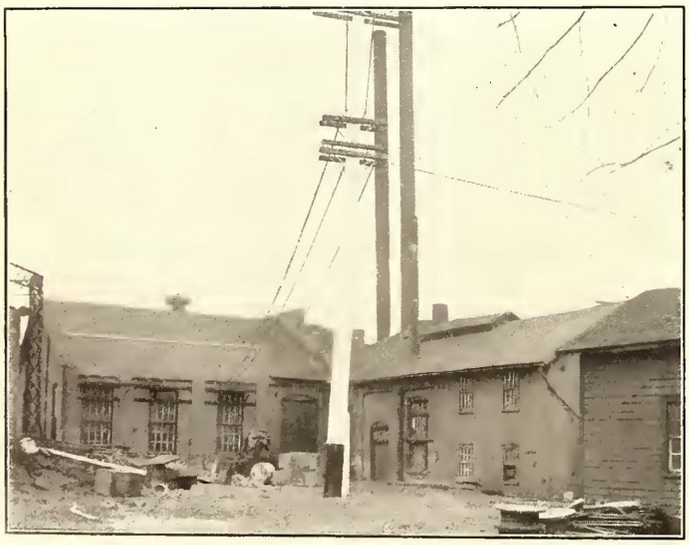
ONE OF THE CROSS-COMPOUND DIRECT-CONNECTED UNITS

POWER STATION

The new power station is located on North Avenue, Youngstown, and is an L-shaped brick structure, 194 ft. long by 90 ft. wide. It is divided into two sections by a brick fire wall. The smaller one is 94 ft. x 69 ft. 6 ins., and the larger, 98 ft. x 86 ft. 3 ins., the latter being used as a boiler house and the other as an engine and dynamo room. The building is built on concrete foundations, and this same material is used in the foundations of the boilers and generating units. The roof is of steel girder construction, upon which 2-in. planking is laid with tar and gravel covering. This building has been completed only a short time. The boiler house contains six 400-hp water-tube boilers, supplied by the Babcock & Wilcox Company, of New York, and equipped with Rooney stokers, made by Westinghouse, Church, Kerr & Company, of New York. Natural draft is obtained by a self-supporting steel stack, 180 ft. high by 10 ft. in diameter. The coal and ash handling is all done by machinery, the conveyors having been supplied by the Link Belt Engineering Company, of Nicetown, Philadelphia. Coal can be brought to the yards by either the Erie or the Lake Shore Railroads, both of which systems have connections with the power house switch. The normal steam pressure carried is 150 lbs. Water for boiler purposes is obtained from the city mains. The engines are now run non-condensing, but the plant is so designed that it can readily be put on a condensing basis if it is thought desirable.



SWITCHBOARD IN MAIN POWER STATION



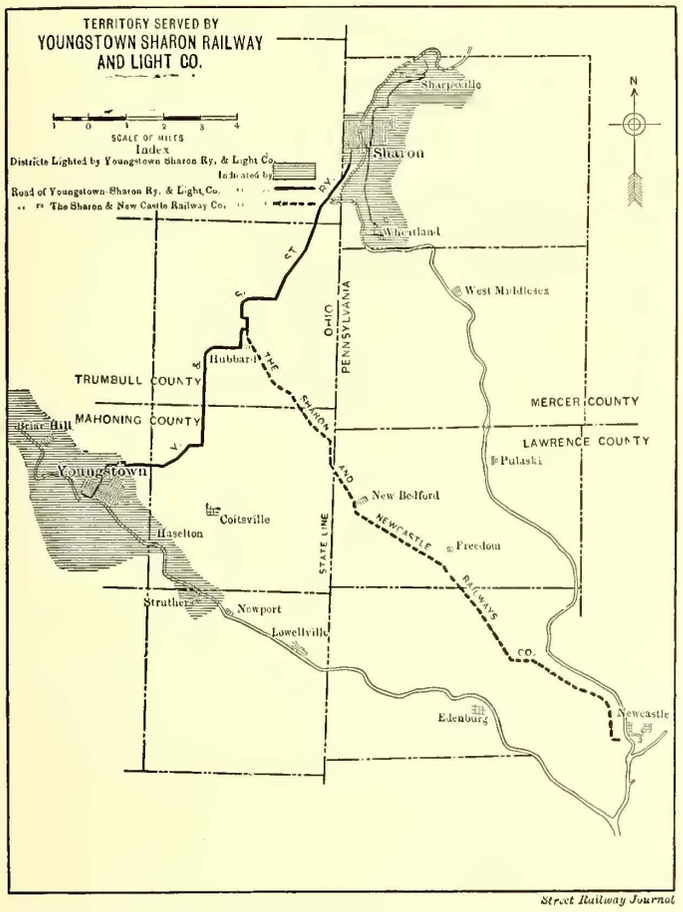
EXTERIOR OF POWER HOUSE

In the engine room are four direct-connected units. Two of these are horizontal cross-compound engines, 23 ins. and 40 ins. x 36 ins., built by the International Power Company, of Providence, R. I., each direct connected to a 600-kw, 2-phase, 60-cycle generator. One is a horizontal cross-compound engine, 22 ins. and 36 ins. x 26 ins., built by the Harrisburg Foundry & Machine Company, and direct connected to a 400-kw, 2-phase, 60-cycle generator. The fourth is a vertical Williams cross-compound engine, 17 ins. and 30 ins. x 20 ins., built by William Tod & Company, of Youngstown, Ohio, direct connected to a 350-kw, 2-phase, 60-cycle generator.

The generators are of the revolving field type, 2200 volts, 2-phase machines, and were built by the Westinghouse Electric & Manufacturing Company, of Pittsburgh, Pa. The switchboard, which is of marble, was furnished in part by the Westinghouse Electric & Manufacturing Company,

and in part built on the premises, and carries instruments of Westinghouse, General Electric, and Wagner make.

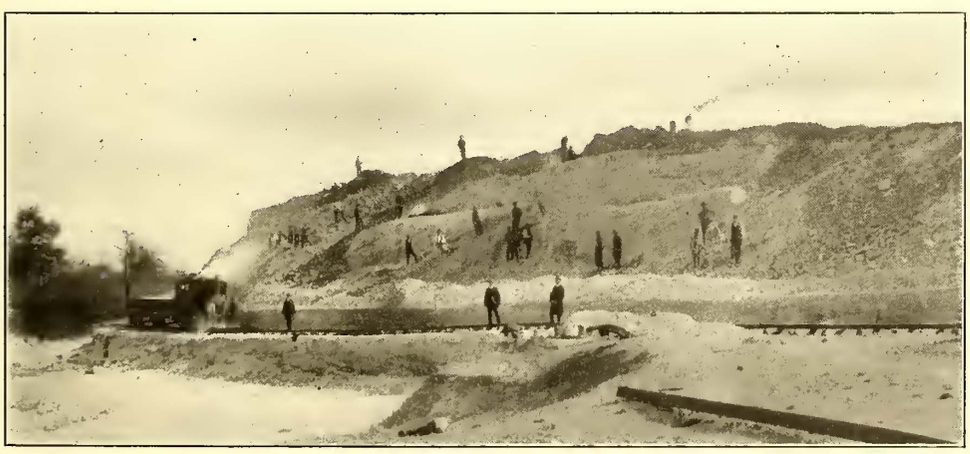
The engine room is traversed for its entire length by an overhead traveling crane, which was furnished by the Cleveland Crane & Car Company, of Cleveland, Ohio.



MAP OF SYSTEM, SHOWING TERRITORY SERVED BY TRACTION AND LIGHTING CIRCUITS

The business of the company has so far exceeded the estimates originally made and has grown so rapidly that the management are contemplating the installation of additional boilers and another generating unit, of probably 1000-kw capacity.

About 35 tons of coal are required, at the present time, per day for the operation of this plant, and the daily output, including lighting and power, is approximately 20,000 kw



OBTAINING FILLING FOR GRADING THE ROAD

hours. The fuel used is, in general, bituminous slack. All the units are operated in parallel, in times of heavy load, to carry the lighting, power and railway business, and this together with the introduction of storage batteries at the sub-stations gives a very satisfactory load diagram. At times, when the load is comparatively light, better results

LONG BRIDGE CROSSING STEAM RAILROAD TRACKS

are obtained by operating the lighting separately from the railway and power currents.

Situated on the power house lot, about 100 ft. from the

CONSTRUCTING THE OVERHEAD LINE WITH OLD CAR

main building, is a brick building containing the step-up static transformers. Current is supplied to them at 2200 volts, 2-phase, and is raised to 10,000 volts, 3-phase, for transmission. There are installed four 375-kw and four 150-kw oil-cooled transformers for this purpose, furnished by the Westinghouse Electric & Manufacturing Company. The current is transmitted by two three-wire circuits, of No. 4 copper, to the static transformers at the rotary sub-stations. Ample protection from lightning is afforded by Westinghouse low-equivalent lightning arresters. The two transmission circuits are so arranged that they may be operated independently or in parallel, as the conditions demand.

SUB-STATIONS

There are three sub-stations. No. 1 is situated at McGuffey Street, in Youngstown, a little over a mile from the terminus of the road. In this sub-station there are installed two 200-kw rotary converters, with the necessary step-down transformers to reduce

the voltage from 10,000 volts, at which it is transmitted, and a storage battery consisting of 288 type 9-F chloride accumulator cells, having a capacity of 160 amp.-hours, with a differential motor-driven booster. Sub-station No. 2 is located in Sharon, has two rotaries and a storage battery similar to those described above, excepting that the

COMBINED SUB-STATION AND CAR HOUSE

storage battery has thirteen type F cells, having a capacity of 240 amp.-hours. Sub-station No. 3 is on the Newcastle division, and has two 200-kw rotaries, but no storage batteries.

Each rotary has mounted on one end of its extended shaft an alternating-current starting motor, and on the other end a differential booster, which supplies current to a feeder running from the sub-stations, about 5 miles before it is tapped into the trolley and feeder lines. This arrangement insures the maintenance of not less than 500 volts under all conditions of service. The rotaries are normally operated at 650 volts, direct current.

TRACK AND OVERHEAD CONSTRUCTION

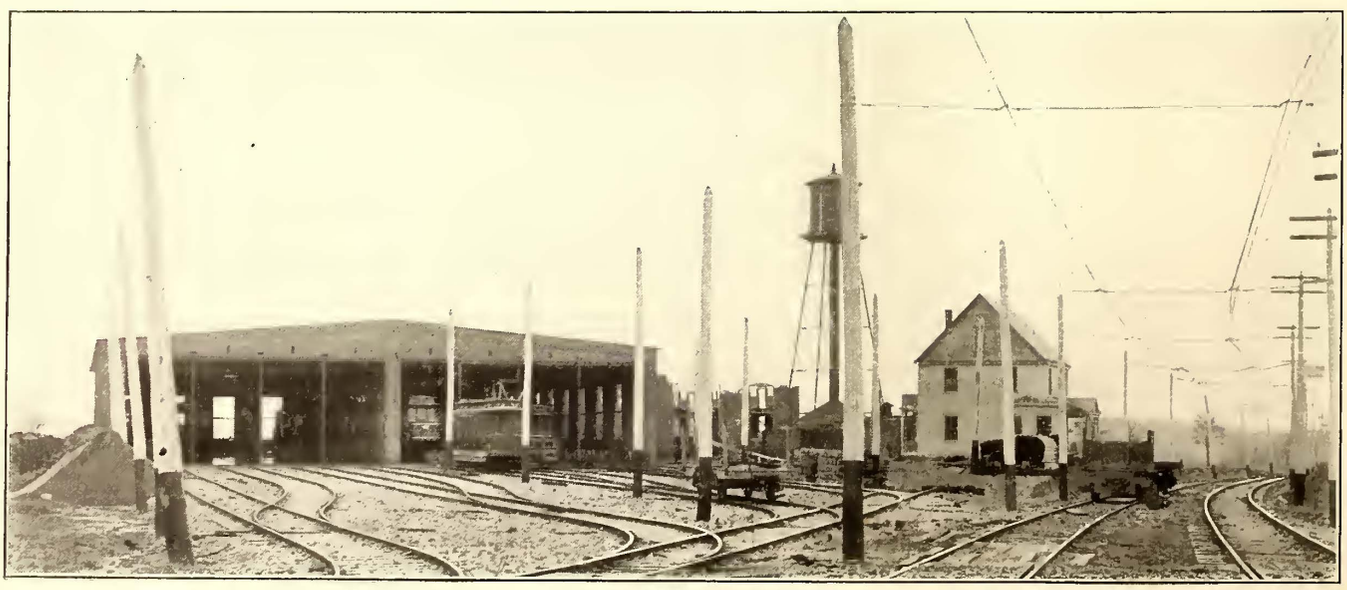
The terminus of the line in Youngstown is in the center of the city, and after passing over the streets for a few blocks, goes upon private right of way, crossing by subways under the tracks of two steam railroads, and a little further on crosses over some fifteen steam railroad tracks

VIADUCT CROSSING STEAM RAILROAD

by a viaduct furnished by the bridge department of the United States Steel Company. Almost immediately there-

ONE OF THE BRIDGES

after the line goes upon private right-of-way, and except when passing through the village of Hubbard, and in one



CAR HOUSE AT SHARON

or two other places, the major portion of the interurban line is entirely out of the streets. On approaching Sharon the line again enters the highway and passes up the principal streets to the center of Sharon, where transfers are given to the cars operated on the local system. The line is single track thoughout, turnouts being located at intervals of about 3 miles on the interurban line.

In the streets of the towns 95-lb. girder rail is used, and on the private right of way the track is constructed of 70-lb. T-rail, A. S. C. E. section, the rail joints being furnished by the Continuous Rail Joint Company of America, to make the roadbed equal to standard steam railroad construction. All railroad crossings at grade were avoided by the use in Youngstown of three under-crossings and one viaduct, above referred to, and in Hubbard by a viaduct over the tracks of both the Erie and Lake Shore roads.

Double trolley wire is used throughout; the wire being 00 gage, Fig. 8 section. In Youngstown steel poles with span wires are generally used, and in Sharon and Hubbard similar construction with chestnut poles. Elsewhere bracket construction is used, the chestnut poles being 35 ft. long, with 7-in. tops as a minimum. In addition to the

A GOOD EXAMPLE OF THE TRACK CONSTRUCTION

Newark, N. J. Under the plates at each joint are placed two 0000-protected railbonds; cross bonds being used every 500 ft. The special work was furnished by the Pennsylvania Steel Company, Steelton, Pa.; the Lorain Steel Company, Lorain, Ohio, and the William Wharton Company, of Philadelphia, Pa. The rails are laid so that they break joints at one-third and two-thirds of their length, this method of laying preventing any tendency on the part of the cars to teeter laterally. The rails are laid on oak and chestnut ties, placed 2 ft. from center to center, and resting on 6 ins. of crushed stone or broken blast furnace slag ballast. The maximum grade is 5 per cent, but this is for a very short distance, being at one of the points where the tracks cross under the Erie Railroad. The sharpest curve is 45 ft. radius, and is in the street in the center of the village of Hubbard, at a point where the cars make regular stops. The roadbed is an example of the most up-to-date methods of railroad construction, and is a most important feature; no legitimate expense having been spared

trolley wires the road is amply provided with feeder of 250,000, 300,000 and 500,000-circular mils. capacity.

CAR HOUSES

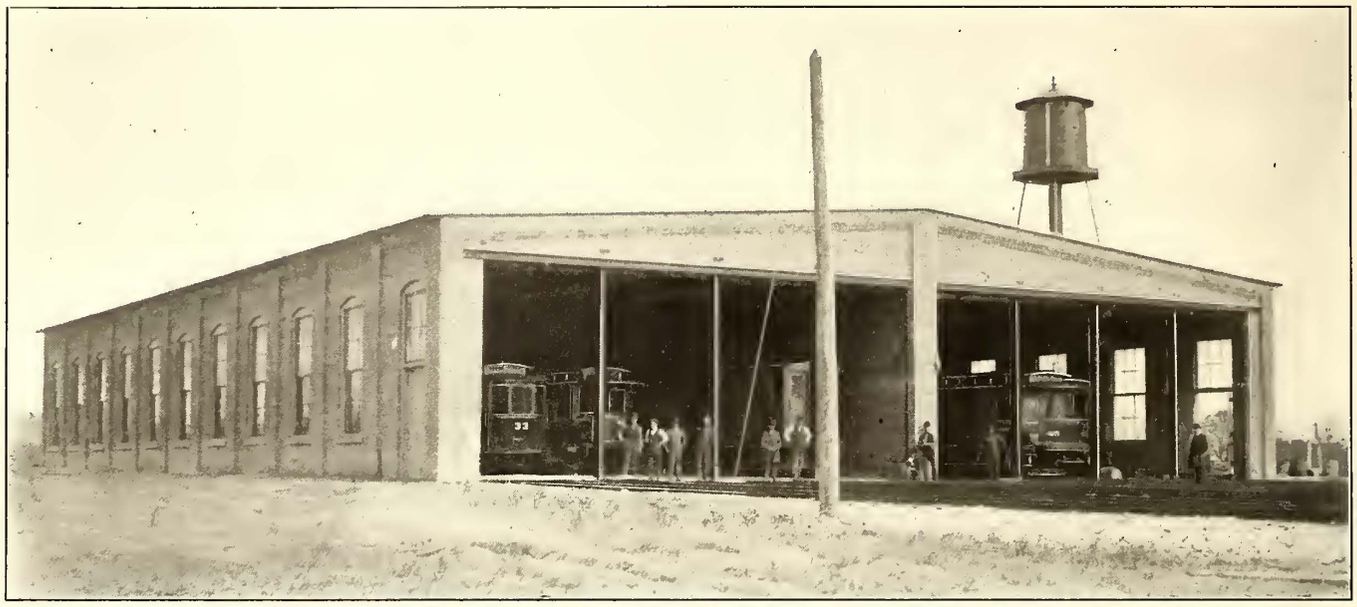
There are two car houses situated near Sharon; one of these is 150 ft. x 100 ft., and the other 150 ft. x 50 ft. There is also in the sub-station at McGuffey Street, in Youngstown, a shed which is large enough to hold two of the large cars of the company, which are left there after the last night trip, to be used for the first morning trip, thus saving much empty car mileage. Like the power station and sub-stations the car houses are constructed of brick with steel roof trusses. There is a water tower, containing a tank of large capacity, placed near the car houses and connected by water mains to hydrants and hose distributed through the buildings. Chemical extinguishers are also provided to give further protection against fire. The car houses are heated by steam.

Adjoining the car houses is the repair shop, 150 ft. long

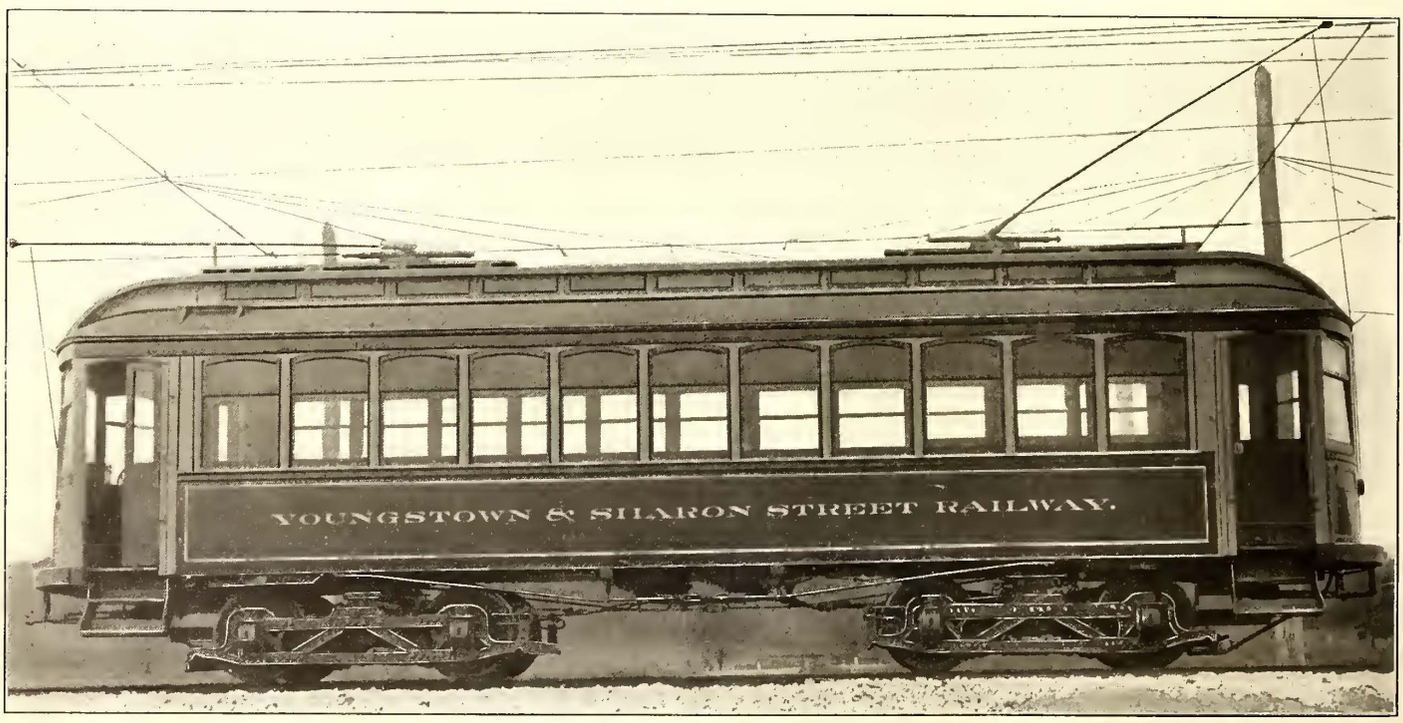
by 30 ft. wide, containing a complete equipment of machine shop and wood-working tools for making all ordinary repairs to the rolling stock.

ROLLING STOCK

The road operates twenty-one closed and eighteen open cars of various types. These were built by the Jewett, Wason, Jones and Stephenson Companies, and are equipped with trucks made by the Peckham Manufacturing Company. The largest cars, which are 50 ft., vestibuled interurbans, weigh 25 tons, and, as seen from the accompanying illustration, are first-class examples of the modern heavy electric railway car. There are also 30-ft. vestibuled cars. The open cars are of various sizes, having 10, 12 and 15 benches apiece. There are 16 4-motor equipments for the larger cars, consisting of Westinghouse-56 motors. The remainder of the motor cars all have 2-motor equipments, Westinghouse 12-A motors being used for the smaller and No. 56 for the larger cars. The closed cars are equipped with electric heaters, made by the Consolidated Car Heating Company, of Albany, N. Y. The interurban cars have registers, made by the Ohmer Car Register Company, of Dayton, Ohio, and the city cars have registers made by the New Haven Car Register Company, of New Haven, Conn. The Ohmer register is so arranged that several different classes of fares can be rung up, and includes in its mechanism a device by means of which a printed record of all the business done by the car can be made at the end of each trip on a roll of paper contained in the case and a slip which is torn off at the end of the day contains this record.



CAR HOUSE AT SHARON



STANDARD INTERURBAN VESTIBULED CAR

The cars which are used in the city service have in addition to the usual brakes, a Peckham emergency brake, operated by a wheel mounted on a concentric brake staff immediately below the ratchet handle. Twelve of the interurban cars are equipped with the Price momentum friction brake, supplied by the Peckham Manufacturing

Company, New York, and four with air brakes and motor-driven compressors, built by the Christensen Engineering Company, of Milwaukee, Wis. There is one freight locomotive, built by the Wason Manufacturing Company, of Springfield, Mass., mounted on Peckham trucks and equipped with four No. 56 Westinghouse motors, and Westinghouse independent motor-driven air brakes. It has standard hose and couplings, and can couple to and handle a number of standard steam railroad freight cars. This locomotive is supplied with detachable noses, so that it can be used as a snow plow. In addition, there is a Wason shear plow, equipped with 12-A Westinghouse motors.

GENERAL REMARKS

The cars are operated within the city limits at from 12 miles to 15 miles per hour, but on the interurban lines a maximum speed of 45 miles per hour is frequently attained. The regular running time for the interurban cars from the center of Youngstown to Sharon, a distance of about 15 miles, is 50 minutes. The average car mileage per day is from 2000 to 2500, but this will shortly be considerably increased, as it is expected that the Newcastle branch will commence operation this month. All the lines of the company pass through a rich, well-settled and prosperous country, and are doing a very large amount of business at the present time. The interurban line between Youngstown and Sharon commenced operation about Nov. 1, and the earnings thus far prove that the estimates originally made were exceptionally conservative. The engineers for the property, who have had general charge of construction since its inception, and who, it is understood, are in control of the entire properties, are Sanderson & Porter, of New York. The officers of the road are: President and general manager, Randall Montgomery; vice-president, Charles S. Fairchild; secretary, Leighton Calkins; treasurer, O. W. Bright, and superintendent of railway department, Godfrey Morgan.

The Bridgeton & Millville Traction Company, of Bridgeton, N. J., has accepted an ordinance giving it the right to extend its line from Cedarville to Bivalve. The road now reaches Cedarville, and, when the extension is completed, will be 25 miles long, paralleling the Port Norris branch of the New Jersey Southern Railroad.

Results of the Tests on the Berlin-Zossen Experimental High-Speed Line

The best information which is at present available concerning the results of the tests made last fall on this celebrated German experimental line, is contained in a paper

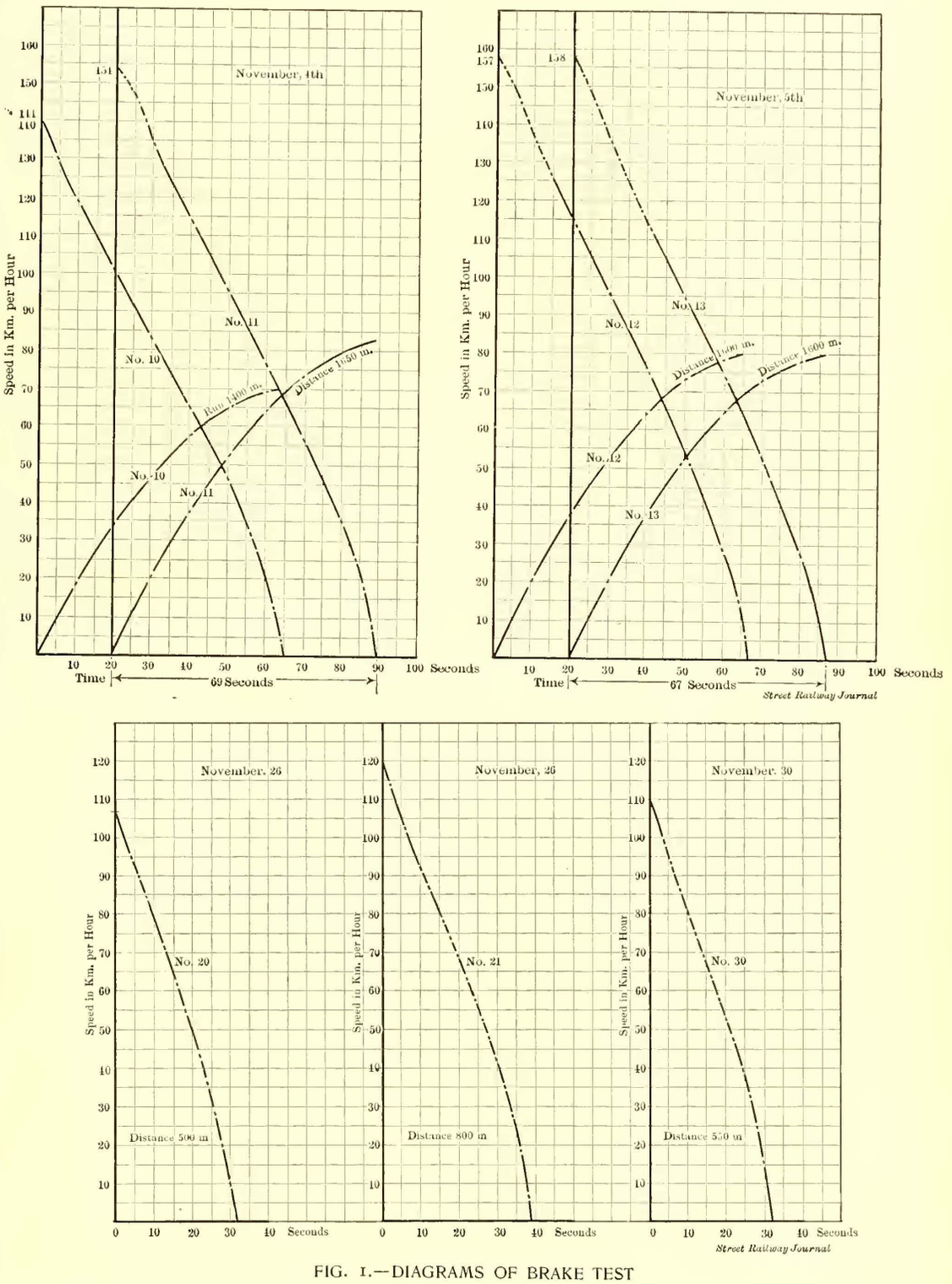


FIG. 1.—DIAGRAMS OF BRAKE TEST

read by Geheimer Baurath Lochner, on April 8, 1902, before the Berlin Society for Railroad Engineering, which was printed, with several valuable diagrams, in Glaser's Annalen, May 15 and June 1.

In the first half of the paper the author gives the programme, according to which the trials were made, and describes the construction of the old roadbed which proved unsatisfactory at the higher speeds, and notes in what respect it will be improved; he also describes the measuring instruments used in the tests, and the whole electrical

equipment of the line and the two cars. In this part of the paper the author scarcely gives anything that is new to the readers of the Street Railway Journal. A large amount of new information, which has not before been published, is, however, contained in the second half of the paper, in which he sums up the results.

The two motor cars have run, altogether, 3000 km (1860 miles). In the first trials the minimum speed was 100 km (62 miles), which was then increased to 130 km (80 miles) per hour. The voltage was 6000 to 8000 and the frequency, 25 to 30 in these trials, which were made for the purpose of determining and examining the methods of measurements and of getting data on starting and braking. Afterward the voltage was increased to 10,000 and up to 13,500, while the frequency was also varied up to 48. These later trials were made to determine the highest

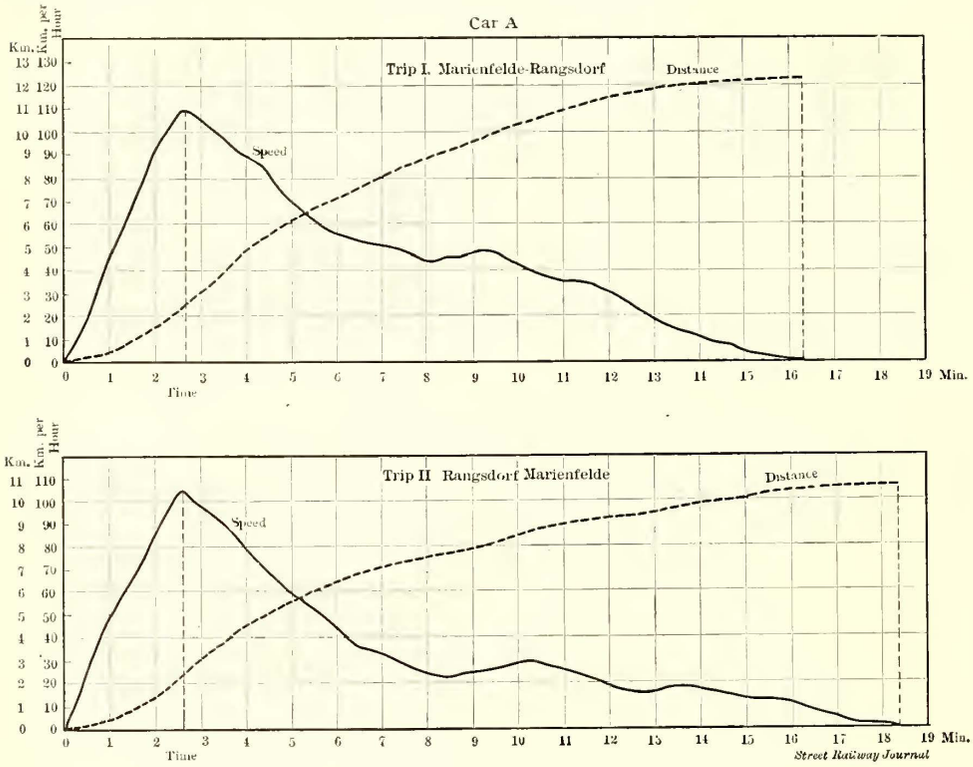


FIG. 2—DIAGRAMS OF COASTING CURVES

possible speed. The speed was gradually increased from 135 km (83 miles) to 160 km (100 miles); the measurements of the speed were very carefully made by means of automatic recording apparatus. At a speed of 140 km (87 miles), the cars began to roll and vibrate irregularly, and at higher speeds the conditions became worse, and the rails were considerably bent. It thus became necessary to make the last tests at a speed not higher than 130 km (80 miles). In these last tests data were obtained on the consumption of electrical energy.

MAXIMUM ACCELERATIONS

A speed of 100 km (62 miles) was obtained within 2000 to 3200 meters (1.2 to 2 miles) in 138 to 220 seconds. This corresponds to an average acceleration of 0.13 to 0.2 meter (5 to 8 in.) per second per second. Without any doubt, much higher accelerations would have been possible, as the motors can give about 3000 hp for a short time, while this acceleration required only 700 to 1000 hp. Higher accelerations than 0.2 meter per second per second were, however, not tried, because the generating sets in the power station were not adapted to rapid variations of load. Moreover, a very high acceleration is not of great importance for long distance, high-speed railroads without many stopping places.

BRAKING

Of much greater importance is the possibility of rapid and effective braking, because the safety of operation greatly depends upon this. Both motor cars were provided with Westinghouse air brakes, with hand brakes, and with counter-current brakes. The motor car of the Allgemeine Elektricitäts-Gesellschaft also had a special electric brake for which a storage battery on the car was provided.

At an air pressure of 6 atmospheres in the brake cylinders, the pressure upon each of the 24 brake-shoes was about 6000 kg, hence the total pressure upon all of the brake-shoes was 144,000 kg, or 156 per cent of the weight of the car. When the force acting on each handle of the hand brake was 40 kg, the pressure upon each brake-shoe was 3640 kg, giving a total pressure upon the brake-shoes of 87,360 kg, or 95 per cent of the weight of the car.

In order to be able to regulate the air pressure in the brake cylinder of the air brake at will, according to the different speeds, a "pressure regulator" was provided which could be set for different pressures within certain limits. Besides this a pressure-reducing valve was used to reduce the pressure in the brake cylinders during the time of braking, according to the decreasing speed.

Careful measurements were made of the air pressure, the time of braking and the distance within which the car was stopped. The first brake tests were unsatisfactory, as the distance in which the car could be stopped was much greater than had been expected from former experience with air brakes. Different means were, therefore, tried to secure a quicker increase of the air pressure in the brake cylinders at the beginning of the braking. For this purpose the valves were altered somewhat. Nevertheless the pressure-reducing valves could not be set to act quite as promptly as the decrease in speed required. The diagrams, given in Fig. 1, show some of the brake tests with different initial speeds. Mr. Lochner lays great stress on the importance, if maximum braking efficiency is to be obtained, in removing, so far as possible, all difference in pressure between the air pipe and the brake cylinder, and in arranging the pressure-reducing valves so that the decrease of air pressure in the brake cylinder during the time of braking depends upon the decrease of the speed. In this way the friction between the brake-shoes and the wheels could be kept at the point of greatest braking effect without becoming so great as to skid the wheels.

It was also found that both the brake-shoes and the wheel tires became very hot when the brake was repeatedly applied. Experiments were therefore made with hollow brake-shoes filled with water for artificial cooling. The heating of these brake-shoes and the wheel tires then become less, but was still considerable, and might be so much greater at higher speeds that there would be danger that the tires might slip. For this reason Mr. Lochner suggested that the brake be so arranged that the shoes should not act directly upon the wheels, but upon especially provided brake discs mounted on the axles.

The author then gives the following formula:

$$f\,D + W + g\,M\,a = p\ \ (M + R)$$

where f the coefficient of friction.

D the total pressure upon the brake-shoes.
M the mass of the car.
R the rotating mass, referred to the wheel circumference.
W the resistance of the car, including air friction.
a the grade of the road.
g the acceleration of gravity.
p the retardation in meters per second per second.

In the present case $M = 9300$ and $R = 790$. The total pressure D upon the brake-shoes is different for different speeds on account of the decrease of the air pressure in the brake cylinders, due to the pressure-reducing valve; he gives the following values of D:

for $v =$ 20 km per hour, $D =$ 100,000 kg
for $v =$ 60 km per hour, $D =$ 110,000 kg
for $v =$ 100 km per hour, $D =$ 120,000 kg

The resistance, W, at these speeds is so small, compared with the resistance obtained by braking, that it is of no great importance how W is calculated. If the usual formula is employed, viz.:

$$W = (2.5 + \frac{v^2}{1300})\ \frac{Mg}{1000}$$

then the brake tests give the following results:

$v = 20$, $p = 1.7$, and $f = 0.17$*
$v = 60$, $p = 0.75$, and $f = 0.064$
$v = 100$, $p = 0.6$, and $f = 0.042$

As these examples show, the calculations give smaller values of the coefficient of friction than those found by Gaston and Westinghouse in 1878 and 1879, and by the careful experiments of Wichert in 1887 and 1888.

It is possible that the actual brake pressure was not fully up to that calculated, and this may have caused a discrepancy. Besides this, the material of which the steel tires and brake-shoes are made affect the value of the co-efficient of friction.

The hand brakes fulfilled what had been expected of them. At an initial speed of 100 km (62 miles) the car could be stopped within about 720 meters (2360 ft.) in 42 seconds, which corresponds to an average retardation of 0.66 meter (2.2 ft.) per second per second.

With the car of the Allgemeine Elektricitäts-Gesellschaft experiments were made repeatedly with the counter-current brake, but no great effect could be accomplished thereby. It is expected that this brake will act in a more effective way at higher speeds. However, this method of braking should only be used in an emergency, as its operation entails risk of damaging the motors.

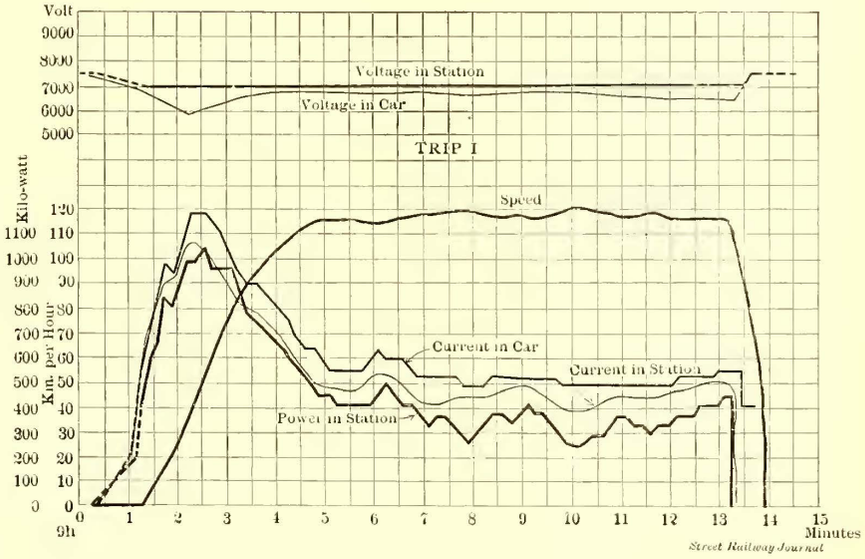
Attention is called to two experiments, made on Nov. 28, with the car of the Allgemeine Elektricitäts-Gesellschaft, the car being allowed to come to a rest without an application of the brakes. The results are given in Fig. 2. When the current was cut off the speed was 109 km and 106 km per hour, respectively. The experiment was made first on the trip from Marienfelde to Rangsdorf, and then repeated on the return trip. The distance which the car ran before it came to rest was 9600 m the first time, and 8300 m the second time. The corresponding time was 817 seconds and 952 seconds. The wind (11.4 m. per second) had such a direction that the air resistance was greater during the return trip than on the first trip.

He takes the mean values of the above figures:

$v =$ 107 km per hour
$t =$ 885 seconds

and assumes that the speed decreases uniformly; he thus finds that the retardation is constant

$$p = \frac{v}{t} = 0.033 \text{ m per second per second.}$$



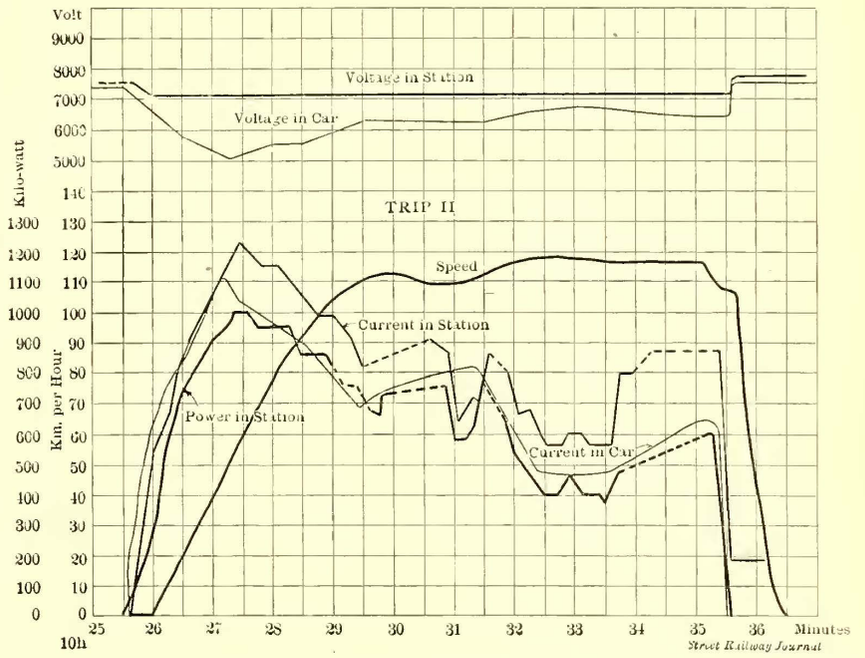


FIG. 3—SPEED, CURRENT, VOLTAGE AND POWER OF CAR "A" IN ZOSSEN TESTS

The resistance of the car, which is assumed to be constant, then becomes

$$W = p\ \ (M + R) = 0.033 \times 10{,}090 = 333 \text{ kg.}$$

For 1 ton of train load he then finds

$$w = 3.6 \text{ kg.}$$

He says that this value seems small, if compared with the value calculated by one of the usual resistance formulas. From the formula mentioned before

$$w = (2.5 + \frac{v^2}{1300})\ \frac{Mg}{1000}$$

he gets

$$w = 5.4 \text{ kg}$$

which is 50 per cent greater than the above value 3.6. In this resistance formula the figure 2.5 may be assumed to be

* The author says $v = 20$, $p = 1.7$, and $f = 1.7$. But this is evidently a misprint. The above value, $f = 0.17$, has been calculated from the above formulas, under the supposition that $p = 1.7$ is correct.—[EDS.]

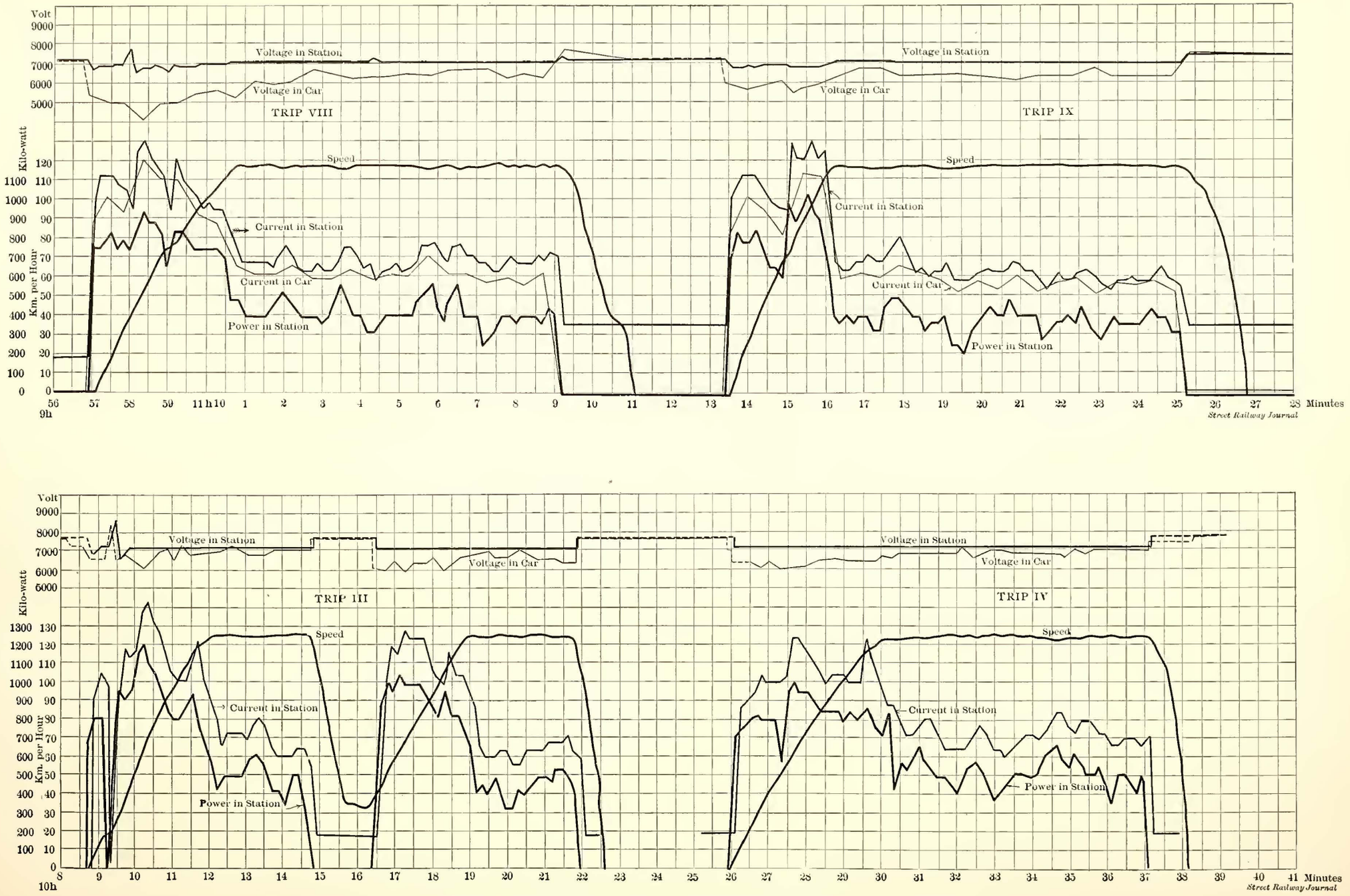


FIG. 4.—SPEED, CURRENT, VOLTAGE AND POWER OF CAR "S" IN ZOSSEN TESTS

correct, and the discrepance can only be due to the second term $\frac{v^2}{1300} - \frac{Mg}{1000}$. The discrepancy may be explained when one considers that the car is very heavy and that the air resistance (to which the term $\frac{v^2}{1300}$ mainly refers) depends less upon the weight than upon the volume of the car. The volume is the determining factor and should be taken into account in calculating the resistance. It has been known before that the above formula gives too high values for high-speed trains with heavy cars.

TOTAL POWER CONSUMPTION

Very careful measurements of the power consumption were made on the motor cars, as well as in the central station. The latter were more reliable, as, in the readings of the instruments on the cars, there could be errors due to the vibrations. In starting with an acceleration between 0.1 and 0.2 meter (0.3 to 0.7 feet) per second per second, the power consumption in the car was between 400 kw or 544 hp and 740 kw or 1000 hp. In runs at uniform speed, the power consumption in the car was 184 kw or 245 hp at a speed of 140 km (87 miles). The power consumption increases very rapidly with increasing speed, owing to the increasing air resistance. It is expected that at a speed of 200 km (124 miles) the power consumption will probably be above 1100 hp, which value had been calculated from the preliminary experiments.

In the diagrams, Figs. 3 and 4, curves are given for speed, voltage, current, and power. These diagrams are self-explanatory. The efficiency of the whole installation was poor, because the power plant was situated at a distance from the road, so that the drop of voltage in the line from the plant to the road was greater than that along the whole road. The power factor of the motors was very poor—between 0.5 and 0.6—the motors being never fully loaded.

AIR RESISTANCE

The results given concerning the air resistance are identical with those published in the STREET RAILWAY JOURNAL of June 7.

The principal measurements were made on the front of the train. Pipes of different diameters were passed through the front wall of the car and were connected to pressure gages. An investigation was first made as to whether the form and length of these pipes had any influence upon the reading of the pressure. For this purpose one of the pipes was provided with a funnel, this funnel was bent to the side, the length of the pipe was varied, etc. It was found that the form and position of the pipe had no influence upon the reading, as long as the pipe was not longer than about 3.4 m. This indicated that a uniform cone of compressed air was pushed ahead in front of the car, and that this cone had a length of about 3.4 m.

Other results were obtained at the sides of the car. The air pressure was then considerably smaller than at at the front end, and depended mostly on the direction and pressure of the wind; it was nearly independent of the speed. Under certain conditions of the wind a considerable suction action was observed.

At the rear end of the car a very considerable suction action had been expected, but it was found to be only small and to increase only a little with increasing speed.

The curves obtained in these tests have already been given in our issue of June 7, and the author does not give anything more in this respect.

The air pressure increases with the speed, according to the formula

$$p = 0.065\ v^2$$

where v is the speed in meters per second and p the pressure in kilograms per square meter-surface perpendicular to the direction of the train. At least this relative holds approximately good up to pressures of 150 km per hour (93 miles per hour).

The Studien Gessellschaft intends to investigate in tests to be made in the future what will be the best form of the front end of the car. It is certain that this form has a greater influence upon the air resistance than is generally supposed.

SAFETY PRECAUTIONS

The author describes the special safety devices and signals. He states that at higher speeds—above 120 km (75 miles) per hour—the signals could not be recognized in time to bring the cars to a stop before the signal with the available brakes. This was the case when the sky was clear, and it was much worse when there was fog or rain. In rain the water trickling down the window-pane made it impossible for the eye to penetrate more than 200 or 300 m (660 or 990 feet) ahead on the track. It is suggested to make the signals very large and clear, and to provide optical and acoustic signals (electric bells) which are set in operation automatically in the car itself.

CONCLUSIONS

The author sums up the results briefly as follows:

The method of supplying high-tension alternating currents from the trolley wires, through the contact bows to the cars at high speed, has proven so thoroughly successful that there is no doubt that it can also be used successfully at higher speeds than those which have been tried up to the present.

There are no practical difficulties in using polyphase motors for high-speed runs; by cooling with air, dangerous temperatures of the motors can be prevented.

The tests do not allow a decision as to what is the best method of mounting the motors on the cars; or what type of rheostat is preferable.

The braking arrangements have proven to be insufficient; alterations of the present brakes and the introduction of an effective electric brake are necessary.

The measurements of the air resistance at different speeds are not yet complete; exact information is still missing concerning the air pressure on the sides and the rear part of the cars.

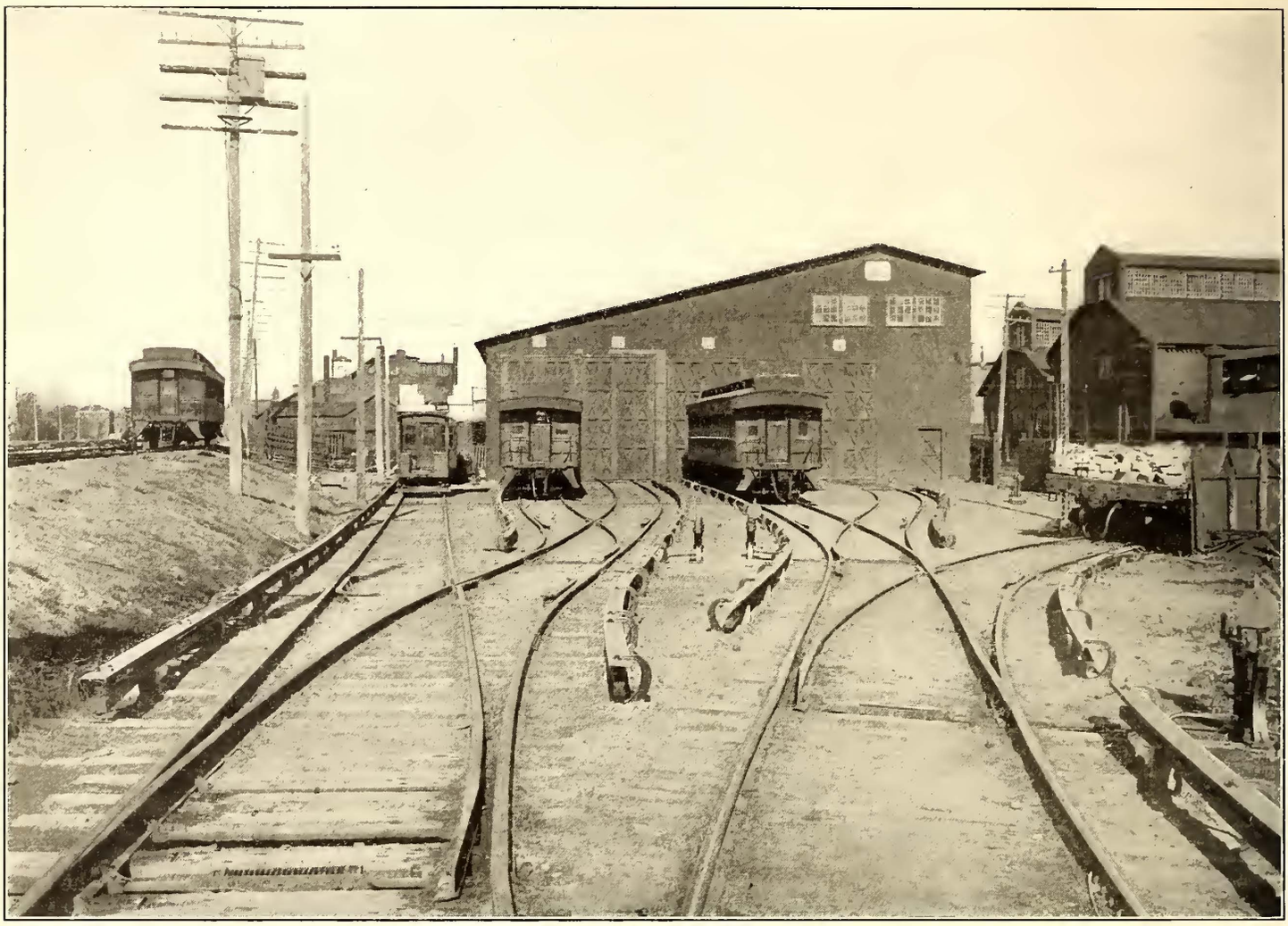
The measurements of the power consumption are not sufficient to base upon them exact estimates on the economy and cost of electric high-speed traction.

Mayor Low was not disheartened by the action of the Board of Aldermen in rejecting the Pennsylvania Railroad tunnel contract, which had been approved by the Rapid Transit Commission, but he proceeded immediately to pave the way for an amicable understanding. Several conferences were arranged between the city officials and railroad representatives, and, as a result, it is again announced that the contract, slightly modified, will be approved by the aldermen. It is said, however, that some of the members will insist upon having incorporated in the contract the following provisions: (1) Eight hours must constitute a day's work on the tunnel. (2) Laborers must be paid $2 a day. (3) New York workmen must be employed on the New York section of the work. (4) Instead of paying the city a fixed rental, which in the rejected contract was about $100,000 a year for twenty-five years, the railroad must pay into the city treasury a percentage of its gross receipts.

The Electric Third Rail

BY W. B. POTTER

The third rail as a means of conducting current to the car is a simple, unobtrusive method, easily installed and inexpensive to maintain. In yards and terminals and for high-speed or heavy service it is generally preferable to the overhead trolley, the absence of superstructure and its large section both for conducting and collecting the current making it particularly suitable.



RAILROAD YARD, SHOWING PROTECTED THIRD RAIL

While in some cases there may be no objection to its installation without a protection, there are places where a guard or protection is advisable as a safeguard to employees and others from accidental contact, or the liability of being burned by short circuits, caused by careless handling of track tools.

It is especially desirable that this guard be of such form as to protect the third rail from ice and sleet, as ice on the top of the third rail is a very troublesome feature and difficult to remove.

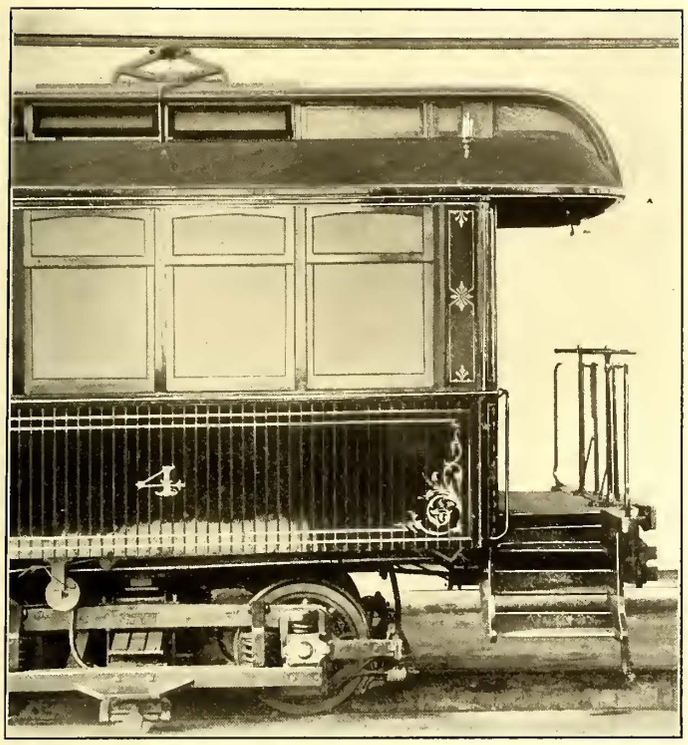
The third-rail protection which is here described is simple in construction and very effective for every purpose for which protection is needed. The protection consists of a channel iron or plank supported by brackets directly over and about 2½ ins. above the third rail, as shown in cuts of end view and side elevation. A slight gap is left between the ends of each length of the protection when of metal, to separate them electrically.

As it is often essential that steam locomotives should run over the same tracks, the distance and height from the running rail as shown is recommended as providing the necessary clearance for even the large low-pressure cylinders of compound steam locomotives. The center of the third rail is 28 ins. from the gage line, and the top 3 ins. above the top of the running rail. It is not advisable to locate the third rail lower than 3 ins. below the top of the track rail,

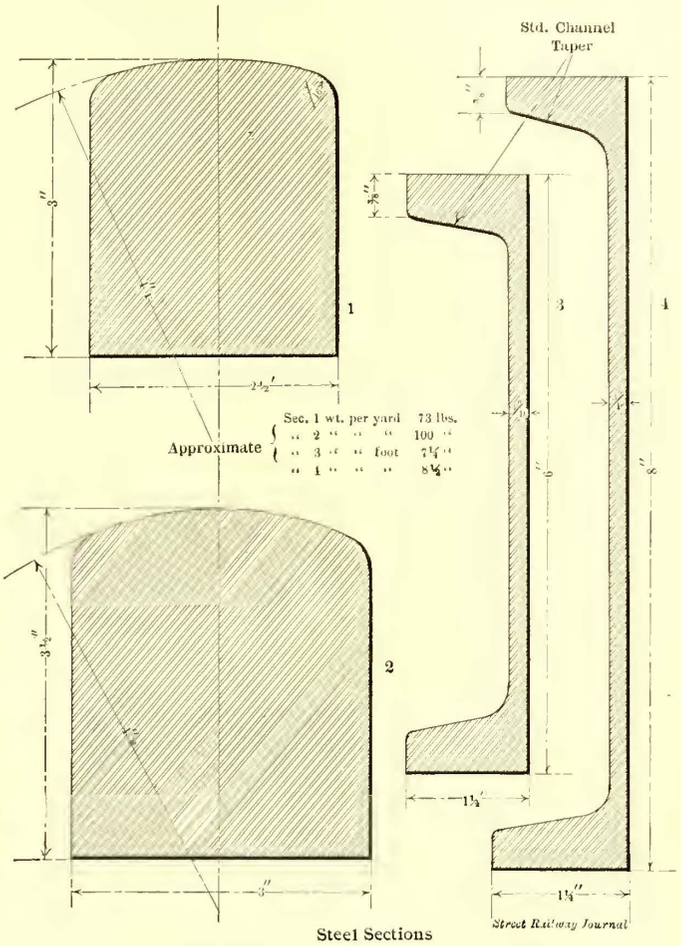
CONTACT SHOE ENTERING PROTECTED THIRD RAIL

for, if lower, the contact shoe, which ordinarily drops 1 in. lower than the third rail, would be in danger of touching the track rails at frogs and switches, causing a short circuit.

The third rail being so low, and the maximum distance to ground being desirable for insulation, it is advantageous to use a section giving the maximum conductivity. There being no special advantage in using the standard T-rail section, a rectangular section with rounded top is recommended. This section is convenient to bend and bond, and can be easily aligned by a fish-plate on the bottom.

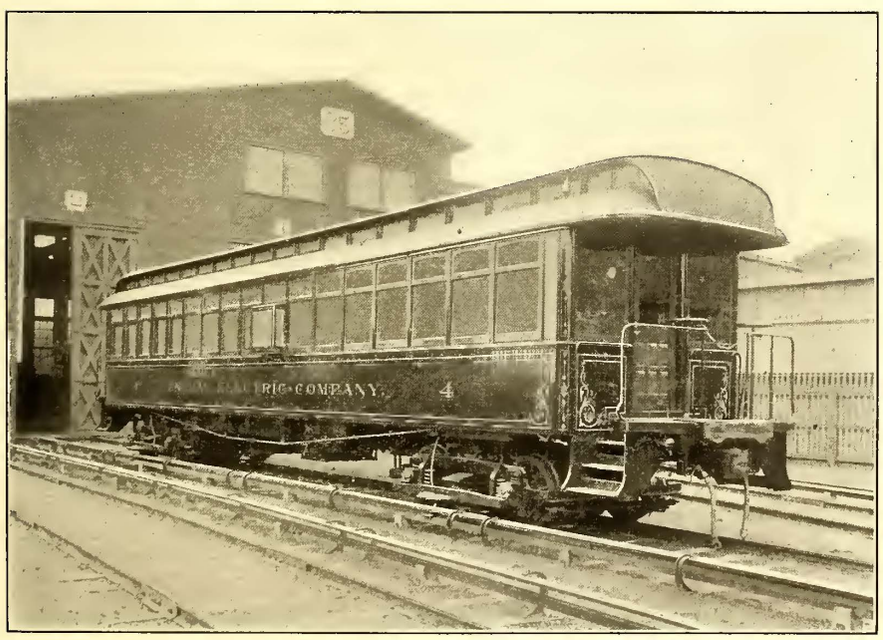


CAR EQUIPPED WITH OVERHEAD CONTACT SHOE AND SHOE FOR PROTECTED THIRD RAIL



SUGGESTED SECTIONS OF THIRD RAIL AND CHANNEL IRON PROTECTION

It is advisable to use a special composition of rail, containing a relatively small amount of carbon and manganese, in order to obtain high electrical conductivity. The main consideration with steel rails for ordinary use is to obtain long life in service, and they are usually made as hard as is consistent with the toughness necessary to withstand shocks and strains, while in a third rail there are no strains and the wear amounts to practically nothing. Manganese appears to be the element most affecting the conductivity, carbon being next. The resistance of an ordinary track rail high in carbon and manganese will often be found to be twelve or thirteen times that of copper for the same section.



MOTOR CAR ON PROTECTED THIRD RAIL

The following composition for a third rail is suggested as not being difficult to obtain commercially, while providing a reasonably high conductivity:

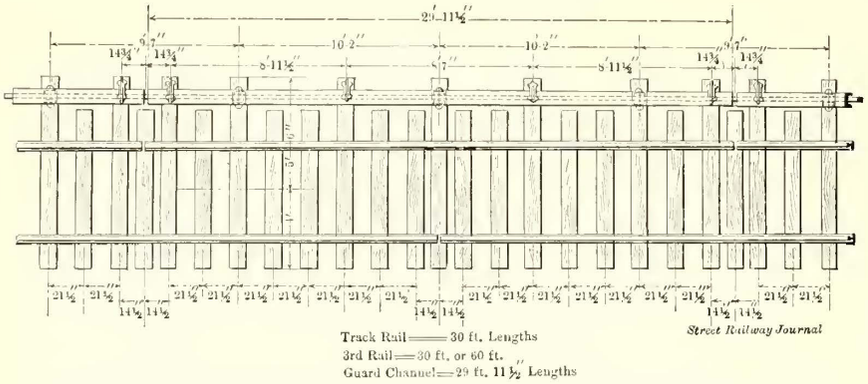
	Per cent
Carbon, not to exceed.....	12
Manganese, not to exceed...	15
Phosphorus, not to exceed....	10
Sulphur, not to exceed.....	05

The electrical conductivity of a third rail of this composition will be about 60 per cent higher than that of an ordinary running rail of the same cross section; that is, a third rail of this special composition would weigh only 63 per cent of a track rail of ordinary composition for the same conductivity, and would have about 7.5 times the resistance of copper.

The third-rail insulator here shown is a block of wood or vitreous material with a slot in the top into which the third rail is laid, no clamps or bolts being required to hold the rail in place.

The third-rail shoe used with this form of protected

third rail is a plate of cast-iron hinged at the point of support and carried by brackets adjustable for height to allow for wear of the wheels. These brackets are bolted to an insulating timber attached to the truck journal boxes. A guard or protection of wood may be placed over the shoe and support, preventing accidental contact with the shoe on the side opposite the third rail.



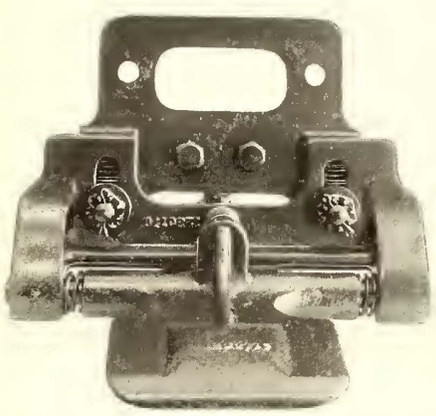
SUGGESTED HEIGHT OF RAIL AND GUARD, AND SPACING OF SUPPORTS

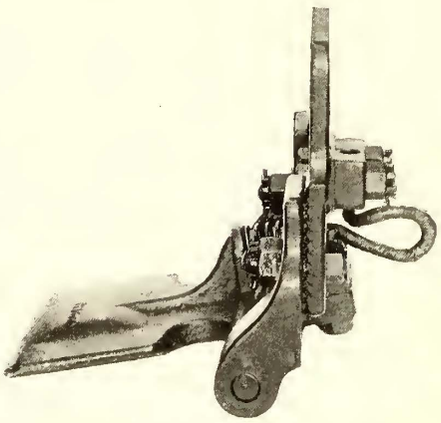
This form of protected third rail as installed on the yard and tracks of the General Electric Railroad has been operated with marked success during the last winter, with less trouble from sleet and snow than previously experienced with any other form of third rail tried. The protected third rail, as with the ordinary form of exposed rail, is located on either side of the track as convenient. Gaps in the continuity being necessary at switches and crossings, each car is equipped with four shoes, one midway, each side of both trucks.

In specially complicated slip-switches it may be found difficult to locate the third rail so that the gap may be spanned by the shoes, and in such cases a short length of rail or wire may be installed overhead, a length of 50 ft. being generally sufficient. Current from this overhead section may be collected by a low pantagraph shoe mounted on top of the car.

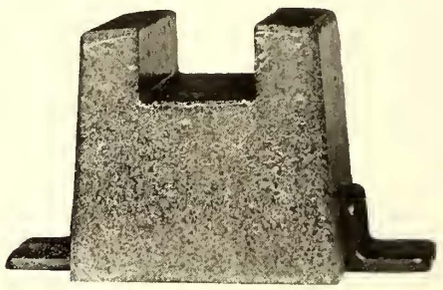
The location of the third rail with reference to the track rails is a detail deserving careful consideration. Uniformity in this respect is as desirable as any standard, particularly if cars of different companies are likely to operate over each other's lines. Some of the variations in third-rail location are shown by the following partial list of third-rail installations, which include some of the most interesting examples in this country and abroad:

	From top of third rail to top of track rail	From track gage line to center of third rail
General Electric Railroad, Schenectady...	3″	28″
Met. West Side Elevated, Chicago.....	6¼″	20⅛″
Lake Street Elevated, Chicago.....	6½″	20⅛″
South Side Elevated, Chicago.....	6¾″	20⅛″
Northwestern Elevated, Chicago.....	6½″	20⅛″
Brooklyn Elevated, Brooklyn.....	6″	22¼″
Manhattan Elevated, New York	7½″	20¾″



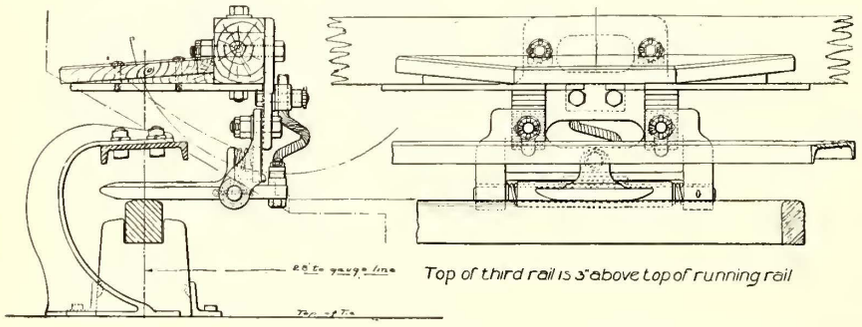


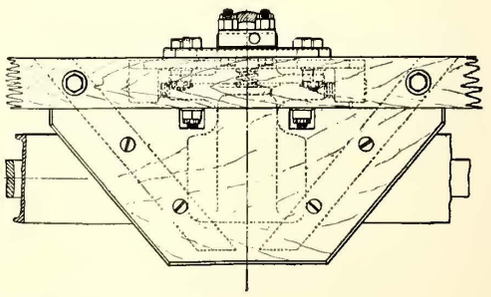
FRONT AND SIDE VIEW OF CONTACT SHOE FOR PROTECTED THIRD RAIL



THIRD-RAIL INSULATOR

Albany & Hudson, New York.....	6″	27″
Boston Elevated, Boston.....	6″	20⅜″
Aurora, Elgin & Chicago, Illinois.....	6 5-16″	20⅛″
Columbus, Buckeye Lake & Newark, Ohio.	6″	27″
Columbus, London & Springfield, Ohio...	6″	27″
B. & O. R. R., Baltimore.....	2¾″	24″





PLAN AND ELEVATION OF CONTACT AND PROTECTED THIRD RAIL

N. Y., N. H. & H. R. R., Connecticut....	1½″	Center
Central London, England.....	1½″	Center
Paris-Orleans, France.....	7⅞″	23⅝″
Gallarate, Italy.....	7½″	26⅝″

Local conditions may in many cases influence the location, but the ultimate advantage in the interchange of

service is such as to warrant the early adoption of what may at least be called the standard location for a third rail.

The cost of a protection for the third rail will vary, depending upon the material or weight of channel used and the price per ton. The cost of the conductor rail would also depend upon its weight and price per ton.

The following estimated costs, which are based on the weights and prices given, may be of interest:

APPROXIMATED ESTIMATED COST OF 1 MILE OF SINGLE TRACK OF PROTECTED THIRD RAIL

6″ Channel Iron Protection.

5260′	—75-lb. 3″ x 2½″ conductor rail at $43 per ton (66 tons)	$2,840.00
528	—Reconstructed granite insulators, clamps and lag screws at 40 cents per set	211.00
352	—No. 0000 GE 9″ Form B bonds at 38 cents	134.00
		$3,185.00
5280″	—31½-lb. 6″ channel iron guard for conductor rail at $45 per ton (27.71 tons)	$1,248.00
792	—Malleable iron guard rail supports at 36 cents	286.00
176	—Malleable iron fish-plates and bolts at 25 cents	44.00
		$1,578.00
	Approximate labor for installation, including drilling rails and channels	$900.00
	Total cost	$5,663.00

8″ Channel Iron Protection.

5280′	—75-lb. 3″ x 2½″ conductor rail at $48 per ton (66 tons)	$2,840.00
528	—Reconstructed granite insulators, clamps and lag screws at 40 cents per set	211.00
352	—No. 0000 GE 9″ Form B bonds at 38 cents	134.00
		$3,185.00
5280′	—48-lb. 8″ channel iron guard for rail at $45 per ton (42.24 tons)	$1,900.00
792	—Malleable iron guard rail supports at 36 cents	286.00
176	—Malleable iron fish-plates and bolts at 25 cents	44.00
		$2,230.00
	Approximate labor for installation, including drilling rails and channels	$900.00
	Total cost	$6,315.00

8″ Wood Protection.

5280′	—75-lb. 3″ x 2½″ conductor rails at $43 per ton (66 tons)	$2,480.00
528	—Reconstructed granite insulators, clamps and lag screws at 40 cents per set	211.00
352	—No. 0000 GE 9″ Form B bonds at 38 cents	134.00
		$3,185.00
5280′	—Ash plank 1½″ x 8″ at $48 (M board feet) in the rough, 5280 board feet	$253.00
792	—Malleable iron guard rail supports for wooden guard plank at 39 cents	308.00
176	—Malleable iron fish-plates and bolts at 25 cents	44.00
		$605.00
	Approximate labor for installation, including drilling rails	$750.00
	Total cost	$4,540.00

It is said that a syndicate has secured the lease of the Cincinnati, Lebanon & Northern Railway, a steam road operated by the Pennsylvania Company, which will afford an entrance to Cincinnati from Lebanon to complete the line now practically complete from Columbus to Lebanon. The steam road is in fine condition and the electrical equipment could be installed so that the through line could be in operation this year. The acquisition would afford fine terminal facilities in Cincinnati. In steam railroad circles the reported lease is discredited, as it is claimed the Pennsylvania some time ago placed a price of $8,000,000 on the property, which is figured to be almost prohibitive for traction purposes.

Failure of Municipal Ownership in England

BY HON. ROBERT P. PORTER.

PART I.

The timely and instructive article by "A City Auditor," printed in the STREET RAILWAY JOURNAL of April, and analyzing the accounts of ten municipal tramways in Great Britain, gives anything but a flattering picture of the financial working of municipal enterprise in England. In their anxiety to convince the ratepayer of the wisdom of municipal ownership of public utilities the British officials have been guilty of reckless financiering, and in many cases, as shown in the accounts of these enterprises, have used tramway revenue in aid of taxes which was in no sense real profit. It is not the intention of this article to examine into the individual budgets of British cities and towns, but rather to give a brief history of a movement which has been inaugurated in England in opposition to municipal ownership—or municipal trading, as it is termed there—a movement which bids fair to give us considerable valuable information on a subject of great importance to the people of the United States. There can be no doubt that after twenty-five years of experiments in municipal trading, in which the city and town officials have had a free headway with the ratepayers' money, the British public has awakened to the fact that the extension of municipal trading is prejudicial to the interests of the country. The awakening came in a variety of ways. About four or five years ago private enterprise promoted some large power-distributing companies for the purpose of utilizing waste coal in the great coal districts and by the aid of electricity proposed to distribute cheap power to large districts in several parts of the United Kingdom. The promoters of these enterprises, some of which have subsequently been authorized by Parliament, found themselves strongly opposed by the town clerks of the municipal corporations which the companies had proposed to supply with power, on the ground that the price per unit proposed by private enterprise—less than one-half of the rate which the municipalities were as a rule charging—would seriously handicap "municipal enterprise." In consequence, municipalities organized a relentless, bitter, and, from the American point of view, unlawful, opposition, and by concentrating municipal political influence in Parliament for a time defeated all progress along these lines. The contest over these power bills in Parliament may be said to have inaugurated in England the campaign against municipal trading, which at last took a new and more permanent form, in the shape of the first public meeting of the Industrial Freedom League, an association recently formed in England "to free private enterprise from undue interference and rate-aided competition." The contest over the power bills in 1898 brought out an address by Dixon H. Davies, a well-known jurist, before the London Society of Arts, in which he presented the issue with so much strength and brilliancy that his paper must always remain the earliest classic in the literature against municipal trading. That address, together with the Royal Statistical Society's exhibits showing an alarming increase of local indebtedness due to the epidemic of municipal trading, had much to do with the appointment of a select joint committee of the two houses, who have commenced an inquiry. The supporters of municipal trading are afraid of the light and have prevented the continuation of the inquiry. The volume of testimony taken and already published gives valuable data on the subject, though we may have to wait some time for the completion of the inquiry and the final report of the committee. The testimony taken by the joint select committee of the British Parliament on municipal trading has developed important

facts in relation to tramways and other industrial enterprises worked by the local authorities of the United Kingdom. It has also very clearly demonstrated that the backward condition of the electrical industry in England is in a very large measure due to the operation of the tramway act of 1870, which enabled municipalities to come in at the end of twenty-one years of operation by private enterprise and practically confiscate the property. That some of the municipalities have succeeded in making this sort of one-sided municipal trading pay is not a matter of surprise when we ascertain the conditions under which they gain control of the property. For example, where, as is often the case, a municipality has become possessed for half its capitalized value of a tramway undertaking that has been worked for twenty-one years by private enterprise and has been brought to a high state of development and highly organized, it would be strange indeed if it could not make it profitable.

In the preparation of this article for the STREET RAILWAY JOURNAL I have read with care the entire volume of testimony taken by the select committee of both houses. In submitting a summary of it to your readers I have endeavored to classify it under the several heads of tramways, electric power distribution, electrical lighting, gas undertakings and other enterprises which English municipalities have undertaken to promote. There was much testimony given before the committee on the increase of local debt and taxation on account of these trading propensities of the English municipal corporations, but I have preferred to take the more recent figures on this branch of the subject under discussion as brought forward at the meeting of the Industrial Freedom League, held in London April 22, 1902.

TRAMWAYS.

The official returns made about a year ago on which parliamentary testimony was based indicate that, including the County Council of London, the municipalities of the United Kingdom owned about 240 miles of tramways. An expert witness before the committee, William Martin Murphy, in speaking of London alone, said: "I maintain that if the tramway act was not there to block the way or if the municipalizing of all these undertakings was not dominating the situation there would be room for 500 miles of profitable tramways to-day worked by electricity." A superficial glance at the situation in England shows that the electrical tramway mileage for the whole of the United Kingdom should be at least ten times greater than it is at the present moment.

With the purchase act hanging over them a few years ago all the tramway enterprises of the kingdom were in a moribund condition. They could do nothing themselves, because their time was running out. The municipal corporations having got possession on "structural value terms" of all the profitable ones did not take the action that would have been taken had individual effort been allowed full play. The effect of this naturally retarded greatly the development of electrical enterprise and progress of electrical manufacture in the country. It is impossible to make comparisons in England with municipal tramways and tramways run by private companies, because the private companies have nearly all been absorbed by the municipalities in the way here described. To find a good illustration we may go to Dublin, as the general act of 1870 fortunately did not apply to Ireland. In consequence of this the Dublin United Tramways, consisting of the amalgamation of four old horse-car companies, came under one control and proceeded to electrify the railway much as we would have done in the United States. It is said they had a great struggle to overcome the prejudice and secure the consent of the municipality which cost them two years of delay, but the company finally secured the necessary power and went to work. The whole of the city is now equipped with an up-to-date electric traction system which has been running nearly three years. The street car company compromised with the city and agreed to sell to the Corporation of Dublin the whole undertaking at the end of forty-two years on the terms of the tramway act of 1870, with 33 per cent added for good will. In the meantime they are required to pay the local authorities about $50,000 a year as a way leave. In fact, the agreement gave individual effort a chance, and the result has been satisfactory. Fares have been reduced more than half, while the passengers are carried double the distance for the lower fare. The number of cars has been doubled and speed greatly increased, ten minutes being saved every half hour. Dublin is the only place in the United Kingdom where electric tramways have been worked on a large scale by a private company in this way, because it is the only large city in the kingdom outside of Bristol in which the tramways are in the hands of a private company.

The British public, whether represented by municipal corporations or by private street railway companies, will never understand the difference between English and American street railway business until they grasp the idea of uniform rates and low fares for the long haul. It has been adopted on the Central London Railway, running from the Bank of England to Shephard's Bush, and is perhaps one of the reasons for the phenomenal success of that enterprise. If the American capitalists now shaping to such an extent the transportation facilities of the metropolis only have the courage of their convictions on this point they will teach the British a useful lesson and reap a bountiful harvest. London abounds on all sides with beautiful suburbs, but the cost of getting in and out is almost prohibitory to the workingman. A uniform fare of 5 cents, or 2½d., would indeed be a boon to London. The following table, taken from an official report by S. Allen Baker, of the London County Council, shows the fare and distances carried on the street railways of the larger cities of the United Kingdom:

TRAMWAY FARES AND DISTANCES IN ENGLAND

City and Fare	Miles Carried
Glasgow, 6 cents	5.37
Liverpool, 10 cents inside or 8 cents outside weekdays, 12 cents inside and outside on Sundays	6
Dublin, within city limits 2 cents; 10 cents	8
Birmingham, 2 cents for stages of about 1 mile each.	
Belfast, 6 cents	5
Edinburgh, 14 cents	8
(Workingmen's fares, limited to certain hours, are 2 cents for 2 miles and 1 cent every additional mile.).	
Manchester, 16 cents	8
2 cents inside or outside	1⅞
4 cents inside, or 2 cents outside	2½
London, Moorgate to Wood Green 4 cents; round trip 6 cents.	7
Moorgate to Highgate, 4 cents; round trip 6 cents	4¼
Blackfriars Bridge to lower Tooting, 6 cents	6½
Leeds, 2 cents	1 11-12
1 cent (charged on same basis for distance)	1

Compare these fares and distances with the following table of street railways in the United States:

FOR A FIVE-CENT FARE

Cities	Miles.
Brooklyn	22
New York	18
Chicago	15
St. Louis	15
Buffalo	13.75
Cincinnati	13.44
Minneapolis	12.94
San Francisco	12
Philadelphia	11.75
Denver	11.75
Boston	10
Cleveland	10

From the foregoing it will be seen that long-distance traveling is much cheaper in the United States than in England. The municipalized tramways have not entered into the spirit of the American street railway, which is to relieve the congested parts of the city, carrying the population out as far as possible for a low fare and building up health-giving suburbs. That is a broader problem and one which the English municipalities will be many years, if ever, in solving, because to do so in England one municipality must be common carrier for other local divisions. For example, there is an electric street railway system centering in Boston which radiates by connections and arrangements through three States and probably sixty or seventy subdivisions, carrying throughout a great industrial district of New England the boon of cheap and quick transportation. Such extension would be impossible under the system of municipal ownership. Manchester and Glasgow are having a hard time of it extending their railway enterprises into a few of the towns in their respective localities. An enterprise such as the one referred to in Massachusetts, which probably comprises half a hundred minor companies, is, on the contrary, economically and satisfactorily worked by one great private company, receiving its powers direct from the State and contributing largely in the taxes it pays and in other ways to the public exchequer for rights of way and franchises.

In England, attempts on the part of municipalities and private companies to extend electric tramways into districts outside their local area have met with stupendous obstacles, and yet to limit street railways to the municipal area of one town and not to allow extension to the suburbs creates great inconvenience. The jealousy existing between adjoining authorities, though sentimental, is a real obstacle. It is difficult to get them to discuss joint schemes and more difficult to get them to carry them out. There will be differences about routes and even about the types of cars to be adopted. There is a case in which four local authorities held up an enterprise of this sort on the last question alone —that of the car to be adopted—and the Board of Trade had to interfere and settle the matter. Then the matter of gage is embarrassing. Private enterprise has forethought enough to see that the gage shall be the same, because electric traction is capable of vast extension. Yet we find Leeds, Bradford, Halifax and Huddersfield, all of which are adjacent towns and should form part of a large system such as the Massachusetts combination already mentioned, each with a different gage. Each of these cities insists on its own gage, and enterprise must wait and wait and wait.

Another source of delay for these large enterprises is the fact that the franchises for the small sections of tramways expire at different times, and thus extensive consolidation schemes are blocked by cities refusing to negotiate for these leases before expiration. None of these municipalities has any comprehension of the potentialities of electric traction and few of them ever look beyond their own district. The terms insisted upon by some of these municipalities, such as the purchase of electric power at an exorbitant rate of the municipal corporation and of other arbitrary demands, often breaks off negotiations with private enterprise and make improved transportation impossible.

GAS DISTRIBUTION

Important and interesting testimony was taken by the select Parliamentary committee on municipal trading in relation to the operation of company, or private, and corporation, or municipal, gas plants in England. The claim of the advocates of municipal ownership in the United States has persistently been that municipal gas works not only produce better and cheaper gas, but that reduction in price and many other advantages—including reduction of rates by the profits of those industrial undertakings—flow from municipalization of gas supply. A careful perusal of the testimony, however, shows that, with the exception of two or three exceptionally well-managed municipal gas plants, the British corporation plants are neither so well nor so economically managed as the private plants, nor do they serve the public as advantageously. In the first place, it was shown that, according to Field's Enlarged Analysis of Gas Accounts, the average reduction in the price of gas made between 1883 and 1899 in the case of companies is a trifle over 12 cents per 1000 cubic feet of gas, but the average reduction made in the case of municipal gas works is hardly 8 cents per 1000 cubic feet. These comparisons were made upon an adequate scale and were not controverted by the town clerks of the cities included in the calculation.

In England, private enterprise still controls considerably more of the product than municipalities. The latest available returns, those of 1899, show 439 private gas companies dealt with selling 80,077 million cubic feet, and there are 222 local authorities owning gas works selling 47,287 million cubic feet. While the reduction in price of gas made by private companies in England has been as great, if not greater (as we have seen in the only comparisons practicable), the price charged by companies under similar conditions is less than the price charged by municipal corporations.

There is no reason why municipalities should not sell gas cheaper than private companies, but the facts show that they do not. Taking all these corporations in Field's Analysis for 1899 we find the charges for interest and depreciation and sinking fund in the case of corporations 8.79 cents per 1000 ft. sold, and for English provincial gas companies it is 14.92 cents for interest on capital, so that the municipalities have an advantage of over 6 cents. With this advantage municipal gas should cost less, not more, than gas supplied by private enterprise. The fact is, the municipalities, once entrenched and able to keep out all newcomers, veto all schemes for cheaper light, whether gas or electric, and have really no inducement as companies have to supply the public at the cheapest rate. They are simply influenced in fixing their price by comparison with the prices of companies and other corporations in their immediate neighborhood. If the companies in their vicinity are selling gas at a much lower price than they are they will try to come down to the companies' price, because otherwise unfavorable comparison might be made. As the corporations always have the ratepayers' money and credit at their back they can, of course, reduce if necessary. For instance, the consumers in Leeds might say, if the Leeds corporation were charging much more than the company in Sheffield, "Why are we paying more than in Sheffield?" That would be a stimulus for the corporation to come down to the company's price. This inquiry established the fact that in England the private companies set the pace in enterprise, quality of gas and in price. It was shown that all enterprise in this industry has come from companies, not corporations, because the companies have greater motive for enterprise.

Looked at from whatever point of view we please, whether in gas, electric lighting or tramway service, the vigorous life of private enterprise does not exist in these municipally managed undertakings. They may follow private enterprise; they have never been known to lead. So far in England the municipalities have pounced upon profitable and well-organized and managed enterprises just as the franchise expired and have carried on the work, excluding absolutely all competition. In many cases they have employed the same manager. With a capital cost for producing gas one-half of that paid by private individuals and the right to tear up the streets at will, and even stop

up thoroughfares for the purpose of laying or preparing gas mains, it would seem strange if the results were not equal to that of private companies. Yet the testimony before the select committee demonstrates the results are not so good. In England, even handicapped as the companies are at present, with the higher charges of capital, they can, as we have shown, generally beat the municipal corporations. The claim that companies are more likely to tear up the streets than corporations was also disposed of by the testimony, because it was shown that the London County Council devoted three weeks to street work which an ordinary contractor would be compelled by the local authorities to perform in one-third of the time. In short, the inconvenience to the public is less under company than under corporation management. The companies as a rule are held to strict accountability by the local authorities, whereas the local authorities have no restriction and often close whole streets.

ELECTRIC LIGHTING

Having disposed of the claims of the advocates of municipal ownership and trading in respect of the manufacture and supply of gas in England, it is proposed to take up the subject of electric lighting, of which one of the chief advocates in the United States, Edward W. Bemis, says: "In the case of electric lighting, the superiority of public ownership is remarkable." Let us examine some of the facts upon which Mr. Bemis bases his somewhat sweeping assertions both as to gas and electric lighting. Mr. Bemis seems to have taken for the foundation of his article a return submitted to the House of Commons last session of the accounts of different trading undertakings in the hands of the boroughs. As a test of the efficiency or otherwise of municipal management the figures of the gas works taken over by the boroughs are not of great value, for these reasons: the municipalities devoted to gas wait before taking over a gas works until the concern has been shown by long experience in private hands to be one of established success, so that a process of selection is at work which picks out the plums for the municipalities and saves them from all risk in such enterprises. In all these claims for municipal gas works with which we have been deluged in America the corporations have simply taken over old-established businesses already worked up and which have as nearly as possible attained finality. It therefore needed nothing further than that the existing organization should be kept going upon the old lines—a task perhaps within the resources of British officialism. Then so long as the corporation controlled the development of electric light, as unhappily it has done in England, the gas supply enjoys a monopoly, and therefore in this case also the consumer is compelled to purchase at a non-competitive price, with the result that in any surplus it is impossible to distinguish between business gains and what is merely a disguised form of indirect taxation. The return from which Mr. Bemis derives his facts has been carefully examined by a committee of the London Chamber of Commerce, and this committee has afforded me the opportunity of examining the results of its labors—results, by the way, which point to precisely opposite conclusions from those claimed by Mr. Bemis in the extravagant statement quoted.

In the course of its labors this committee took out the figures in the return relating to electric lighting undertakings for the purpose of ascertaining the "net profits;" that is, it endeavored to show what the ratepayer received in return for the risk he takes in guaranteeing the undertaking. The report of the London Chamber of Commerce committee begins with a summary which for electric lighting gives us the interesting facts found in the following table:

Totals and Averages for all the Boroughs in England and Wales

Total capital inclusive of borrowed capital provided by corporation	$17,083,555
Amount of capital borrowed	15,542,565
Amount of capital borrowed which has been paid off	542,240
Balance of capital borrowed which was outstanding at March 31, 1898	14,952,910
Amount in sinking fund, or loans fund at March 31 1898, in respect of capital borrowed	508,210
Average annual income for the five years ended March 31, 1898, (or, if the undertaking commenced during that period, from date of commencement)	1,522,495
Average annual working expenses from the period mentioned in preceding item	843,775
Average annual net profit for the same period	686,600
Average annual amount paid during the same period in respect of principal and interest on capital borrowed	633,295
Average annual amount set apart for depreciation	18,735
Financial result—Average annual surplus	53,305

It will be observed that the average amount allowed for depreciation ($18,735) is about one-eighth of 1 per cent per annum and that the average annual margin of surplus, inclusive of this $18,735, is only equal to one-third of 1 per cent per annum on the total capital expended. What have our municipal ownership friends to say to this statement of facts? Is there anything "remarkable" in such meager results? As we have seen, the case of electric undertakings is somewhat different from gas, because the electric industry has not yet reached conditions so far fixed as to enable it to be conducted on a strict system of routine without the combination of push and caution which is the essential feature of private trading. Taking the figures of the electrical trade thus given we see that the surplus receipts over the whole of the municipal electric stations of Great Britain amount to an average annual sum of $53,305. Of this they put the miserable sum of $18,735, or about one-eighth of 1 per cent, to depreciation account, and the ultimate balance of profit is only equal to one-third of 1 per cent per annum on the total capital expended. Even this beggarly result would be wiped out if it was not for certain little tricks of accountancy, such as charging the law expenses and accountant's fees to other heads in the corporation budget. Of course, such an item as the amount of taxes relinquished by the municipalities by reason of becoming their own capitalists is never included in the comparisons. If it was we should have an actual loss instead of a tiny profit.

As to Mr. Bemis' calculations of the comparative cost of making gas by public as compared with private plants, these conclusions are absolutely controverted by competent statisticians in England who gave their testimony before the joint select committee of Parliament. The conditions of one gas works as compared with another render any generalization through such figures wholly worthless on one side or other of the controversy. The same criticism of course applies to any attempted comparison of the cost of electric light production. Everyone who has studied the subject of electric light production knows that the great element is the extent to which the average utilization of the machinery can be brought up to the maximum reserve necessary to be kept in store—the "load factor," as it is called. The same process of selection which gives a corporation the most remunerative water and gas works of course also gives them the highest load factor for their electric works. But what controversalists like Mr. Bemis will not see is that all these arguments on relative cost of private against public production do not touch the fringe of the objection which is entertained by the economists and by the commercial classes in England to the employment of public funds in trading concerns. The sum you pay for municipal enterprise is not so many millions of debt or so

much in the dollar on the rates, but a price which is much more serious, namely, the stagnation of commercial development, which inevitably results, and which impoverishes all classes of the community. You cannot have a more complete and deplorable exemplification of the stagnating tendency of municipal enterprise than the case of the electric industry in England. Up to the beginning of the eighties the British municipalities had been gradually buying up the gas works all over the country. They had ousted private enterprise, and numerous officials were congratulating themselves upon having established themselves in various snug little berths in the purchased undertakings. They were thrown into a terrible state of consternation by the discoveries made about that date which rendered the distribution of electric light a practical success. The municipal trader in England can never face competition, but whenever such a possibility arises goes whining to Parliament and begs for a monopoly. So when electricity came along the gas-owning municipalists got serious and said, like the man in the parable, "This is the heir; come, let us kill him and the inheritance will be ours." They therefore proceeded to pass what is known as the electric light act of 1882. This act purported to codify the conditions on which local authorities and private traders should obtain electrical concessions, but it provided that if in any particular locality two applications came forward, one from a private source and the other from a local authority, the local authority should always be preferred. Further, it provided that a private trader wishing for a concession must give notice in June, but a local authority might give notice in November, and notwithstanding that the two applications should be considered as contemporaneous. The result, of course, was that no private trader was allowed to have a "look in." Local authorities played the dog in the manger, and absolutely nothing was done in England in electrical matters for five or six years. Then the backward condition of the country became such a scandal that a royal commission was appointed, and Parliament passed another act less restrictive on private enterprise but still leaving local authorities every possible advantage, including the right to buy up the concern of any electric lighting company without any allowance for the cost of educating the consumers or for good will.

The result is shown in the return to which Mr. Bemis has alluded. A few undertakings have been started in almost every case by private enterprise and the municipalities have gradually bought them up, and the returns show that the total undertakings of the boroughs of Great Britain in 1899 represent a capital of under £3,500,000 sterling, or about $17,500,000. This ridiculously inadequate provision for the electrical needs of the most densely populated industrial communities in the world is a flagrant example of the paralysis which results from the system of municipal ownership. In a discussion in the House of Commons this state of things was admitted by both sides. Mr. Ritchie, then president of the Board of Trade, told the House that "the electrical enterprise of Great Britain was in an exceedingly backward condition. It was inferior both in regard to light and conveyance of power to many European countries, and it was greatly inferior to North America and Canada. It might almost be said that there were villages in North America which were in possession of advantages in connection with electricity which some of our largest towns did not possess." Mr. Brice, the president of the Board of Trade in the last Liberal government, concurred with Mr. Ritchie, and stated that "of all manufacturing countries we are nearly at the bottom in the matter of electrical supply, and that was an injury to the amount and cost of production which affected the prosperity of all industries."

The present president of the Board of Trade, Gerald Balfour, reiterated these sentiments last month (July, 1902) at the opening of the International Tramways and Light Railways Exhibition, and his remarks, I have no doubt, were reported in America.

That the House at large concurred in these opinions, and in attributing this disastrous condition to the interference in the industry of the municipal authorities, was sufficiently proved by their passing (as they did without a division, in spite of the hysterical protests of the municipal traders) the four electric power bills of private companies, which were a direct departure from the municipal control at present existing. Mr. Bemis himself appears to admit the want of enterprise in municipal undertakings in England, but puts it down to the fact that "Great Britain is far less progressive than Yankeedom." I think that is so; but are the English less progressive than the continental countries of Europe, such, for instance, as Spain, which is far ahead of England in electrical matters? This stagnation, as pointed out in a recent number of Engineering, is a condition of affairs that has scarcely ever obtained in England before. "British engineers and mechanics," says that journal, "build the early railways, gas works and waterworks, in all countries of the world, having first gained their knowledge in similar enterprises at home. We have to go back a couple of hundred of years to find instances of foreign engineers coming to England to undertake work which we could not do ourselves. But now we meet them or their agents at every turn. American and German companies are established here, and orders for hundreds of thousands of pounds' worth of machinery are being sent abroad, and many more must follow. On the other hand, British exports of electrical machinery are quite insignificant even to the colonies."

The fact that the municipal officials were so unperceptive of this most serious condition of things as not only to sit still and do nothing, or practically nothing, to keep up to date this important branch of industry which Parliament had so unwisely committed to their hands, but to go further and to strain every nerve of political interest which they possessed and to spend public money like water in order to stop private traders providing facilities for lack of which many trades in England are going to the dogs, is surely the most damning evidence of the pernicious effect of municipal trading, evidence compared with which ingenious compilations of figures such as those of Mr. Bemis fade into worthless insignificance.

In the last debate in the House of Commons on this important question, a debate which ended in a parliamentary defeat for the municipal traders, Mr. Seton-Karr said "that he strongly supported the bill. He had not the slightest personal interest in the bill beyond the fact that he was a member of the House, a member of a large industrial body which the bill affected and a British citizen concerned in the industrial progress of the country. Lancashire contained thirteen county boroughs, eighteen boroughs, eighty-six urban districts and twelve rural districts. Of these local authorities only sixteen had electric works in operation and supplied electricity only on a small scale and at high charges. In ninety-one districts, or something like two-thirds of the area affected by the bill, no step had been taken with a view to obtaining powers to carry out such works. This year there was not a single application for a provisional order to erect electric works from Lancashire. It was therefore probable that if the people had to wait for the local authorities to supply them with electricity the day of judgment would see them without it. The private speculator had been sneered at in the course of debate. Was it the private speculator or the municipal corporation that had founded our railways? Private speculators had established

and carried on the industrial prosperity of this country. In his opinion the supplying of electricity in bulk was far too large an undertaking for municipal corporations. Local authorities could not afford to sink the ratepayers' money in such works. It required the generation of a large amount of electricity and the distribution of it over a large area to make the undertaking pay. In America, which was a hundred years ahead of us in the supply of electricity, the average charge was one half-penny per unit. In Manchester the charges for electricity were 5d. per unit for lighting, 1½d. for motive power and 2d. for public lighting. Yet the corporation of Manchester was using the ratepayers' money to prevent electricity from being supplied at something like the American rates to Manchester. The only compulsory power sought for by the bill was the power to go through a non-consenting district in order to reach a consenting district. Was it reasonable that a consenting district should be deprived of the advantages of a supply of electricity because an intervening non-consenting district objected to have their streets torn up? The opposition of the Association of Municipal Corporations to this bill was very largely a question of officialism, he ventured to think. He was entirely hostile to municipal trading except in certain limits. It would be most dangerous to the prosperity of the country if they allowed the municipalities to go outside their proper province and usurp the functions of private enterprise. It was impossible to exaggerate the advantages which would accrue from cheap electricity, and it was because he believed that the principle of this bill was one of enormous importance to the industrial development of the country by its means that he asked the House to pass the second reading."

Returning to the report of the committee of the London Chamber of Commerce of these electric lighting returns, it may be well to quote its exact language, after having carefully examined all the facts: "On the face of the summary it appears that, as the result of incurring a debt of $15,500,000, the ratepayers generally, over the whole of the undertakings, have a surplus of only $53,300 when they have divided for the payment of interest, etc., on their loan capital. That is to say, the amount distributable in aid of the rates is about one-third of 1 per cent only. A cursory inspection of the returns will show that the surpluses are earned in every case in the very big towns and that the general result among towns of moderate size must have been a deficit met out of the rates, while as for small towns, the results are even more unpromising."

This is a liberal way of looking at the question, and it is doubtful whether there is even this small profit made by large towns in electric lighting. It all turns upon whether the gradual paying off of the loan capital is sufficient to more than make up for the depreciation of the machinery. It is claimed by some that the life of an electric plant is ten years. The period for which the loans are contracted ranges from ten to forty-two years, the average about twenty or thirty years. At this session of Parliament these municipal trading influences actually tried to increase this period in some classes of loans to one hundred years. If it is true that the plants need renewing in ten or fifteen years the sinking fund does not balance depreciation. "It is evident," says the London Chamber of Commerce committee, "that this at once disposes of the argument which is so frequently heard that the result of a corporation undertaking electricity supply itself is to present the borough about twenty-five years hence with a central station, etc., gratis. It is clear, as a mere matter of accountancy, that an item cannot be carried to two places at once, and that if the sinking fund is applied to balance the depreciation account it cannot also be carried to capital account as an increase of valuable assets." The question therefore of validity of even counting as profits ridiculously small surpluses earned in the larger towns really turns upon whether the debt is paid off before the machinery and plant requires renewal or whether the reverse is the case.

The fact is there exists a convenient looseness of finance in dealing with those trade municipalities that makes exact comparison impossible. There is no possibility of a corporation's accounts getting into the hands of whatever would be the municipal equivalent of the "official receiver," that is, so long as there remain any ratepayers from whom a rate can be collected to bolster up these disastrous speculations with the public funds. In a recent Parliamentary hearing on the question of local indebtedness a witness, to show that examples of "vanishing assets" are by no means uncommon in municipal accounts, cited from a table of the electric light investments of sixty English towns in each of which a loss was made upon the working for 1901, notwithstanding the generally high rates charged for current, as stated in the table. This loss aggregates, after due allowance for depreciation, $1,364,170 in the year.

THE TELEPHONE

The backward condition of the telephone industry of England has been a hindrance to commerce, a source of annoyance to private communication, the subject of investigation by Parliament and a topic of endless discussion and controversy by those interested in both sides of the problem of municipal ownership. The advocates of municipal trading and of State appropriation of public utilities have vociferously maintained that the cause of this lack of enterprise may be traced to the fact that until recently the telephone service was wholly in the hands of a private company. On the other hand, the friends of the company declare with equal force and a strong array of facts that the real cause of the trouble comes from the unreasonable interference and unjust demands of the British Government, which have made it impossible for private capital and enterprise to push ahead, apply the latest inventions and increase the service by reduction of price and extension alike of public and private exchanges. A glance at the history of the telephone in England strongly indicates that the government has played a fast and loose game with those who have undertaken to establish it, with the result that its progress has been retarded because the company never quite knew where it stood. In the first place, the learned electric savants of the postoffice declared the telephone, after it was in full operation, an ingenious toy but of no value for commercial purposes. Later on, when its establishment between such large centers of industrial energy as Liverpool and Manchester began to make inroads into the Postal Telegraph revenues, the postoffice department interfered, and it was decreed by the courts that the telephone was a telegraph and that telephones worked for public purposes came under the telegraphs act and that therefore the government had a monopoly of them.

This was naturally a severe blow to the National Telephone Company and one calculated seriously to impede its enterprise. As the government was not prepared or not sufficiently sure of the financial success of the telephone to take it over bodily as it had done the telegraph, it licensed the National Telephone Company to work under the telegraphs acts at a 10 per cent royalty on the gross receipts. The licenses were restricted because they were contingent upon the consent of local authorities who could place obstacles in the way and prevent the laying of wires and otherwise obstruct the system's installation. For some years the telephone people seemed to have struggled along, having little faith in the final outcome, until in 1892 the government of the day came to a general arrangement in reference to the telephone business of the country.

STREET RAILWAY ACCOUNTING

CONDUCTED BY J. F. CALDERWOOD, ASSISTANT TO THE PRESIDENT BROOKLYN RAPID TRANSIT COMPANY, AND MEMBER INSTITUTE OF SECRETARIES OF LONDON

Growing Necessity for Reserve Fund

The discussions on the matter of a reserve fund which have been going on in this department recently are of such vital importance and are so closely related to the welfare of the entire electric railway business that consideration of them should extend beyond the accountant's office, and they should be thoughtfully taken up by the manager, the president, the director, and the stockholders. The question of how much of a reserve and sinking fund should be set aside to insure the future safety of the stocks and bonds of an electric railway company is a matter upon which there is considerable variety of opinion and practice. It is, perhaps, the natural tendency of human nature to provide too little for the future rather than too much. The desire to get rich quick at the expense of the future is probably stronger in America than in any other country, and this characteristic crops out everywhere in connection with American financial methods.

The papers that have already been presented upon the subject have treated of several features, most of them closely connected with the accountant's side, but there is a broader view that should appeal to those entrusted with framing the policy of street railway companies, and directing the management of these properties. With the rapid development of the industry new problems have come up, the conditions have materially changed, and the importance of the properties has increased in proportion to the advance in values. Consequently the entire situation has changed, and it is still changing, and because of this fact the matter requires serious study. Therefore, everything considered, there is no subject which needs a more thorough discussion at this time than the creation of reserve and sinking funds.

There are those who go so far as to assert that no street railway company in the United States would be, to-day, making money if a proper amount was set aside for depreciation and reserve funds after paying operating expenses and the interest on bonds. This, of course, represents the extreme pessimistic view of the situation. That investors generally do not share this view is demonstrated by the prices at which street railway securities are sold on the stock exchange. While market prices of securities are not, by any means, absolute indications of their real value, they, nevertheless, represent the consensus of opinion of a large number of investors, and, consequently, are probably nearer the truth than the opinions either of the extreme pessimist or optimist. If street railway companies are guilty of paying out in dividends that which should be laid aside for reserve fund, the same thing might be said of almost any other industry carried on by corporations in America, including the steam railroad companies. We have not yet arrived at the conservative way of conducting financial matters that prevail in older countries. Economic conditions here have not required it, because the country is comparatively new and the rapid growth of business, in the majority of cases, has compensated for many actions which would be financial folly under more settled conditions. The usual American financial method is to pay out in dividends to the stockholders all of the profits over and above operating expenses and fixed charges, less, perhaps, a sinking fund to pay off the bonds at maturity and a nominal reserve to meet extra expenses. The day comes when the property becomes sufficiently run down physically to require a thorough overhauling, but in the meantime extensions must be made, for the business has grown until the old equipment, even if made new, could not begin to take care of it. Probably by this time, also, if it is an electric railway, the old power houses, cars and tracks have become obsolete as well as nearly worn out, and no one would think of replacing the track and rolling stock with duplicates of what was purchased when the road was new, even if a reserve fund had been created to do it. The progress of the art calls for new modern equipment, new and larger power houses, larger and more comfortable cars, and heavier rails. In other words, there must be a thorough physical reorganization of the property, along with extensions of lines, so as properly to adapt the system to the increase both in mileage and traffic which should belong to it. Perhaps, too, consolidations have materially changed the situation. Now the common American method of procedure is to reorganize the company or increase the capital stock, or both. In any event additional securities are issued and the improvements are made from the proceeds. The property is, therefore, loaded with liabilities in the shape of stocks and bonds, covering not only the first cost of the road but costs of renewals and general overhauling. If a reserve fund could have been created of sufficient size to cover all or a part of the costs of all these improvements and replacements, there would, of course, be no necessity to issue more securities save for the cost of extensions, but the places where this was practical in the past were, doubtless, few.

There are very few railway properties in the United States where a reserve fund large enough to pay for all of these replacements, together with a sinking fund to provide for stock and bondholders at the expiration of the franchises, has been maintained for any considerable length of time, though a notable effort is being made now in that direction in many quarters. Wherein lies the essential difference between "the reserve fund method" as against "the pay dividends as you earn them" method? The reserve fund method pays the stockholder handsome dividends after a long period of unproductiveness. In the case of new companies and new and growing territory, it may be that many years would elapse before any dividend should be paid out, but when once the time arrived where something over and above the proper reserve fund was earned, it is evident that the dividends will be much larger than on a recapitalized property, because of the lower capitalization upon which interest must be paid. It must be remembered, however, that, in order to make a fair comparison, compound interest must be figured on the dividends in one case and on the reserve fund in the other. Were it not for the great load of liabilities which the common American financial methods lay upon a property, the two plans would probably be but little different in the long run. In one case the stockholder is paid his dividends as fast as they are earned and has the money for immediate use, and is, furthermore, given the first and most profitable chance to pay what he has received in dividends back into the property whenever there is an increase into the capitalization. In the other case the company keeps the money, as a trustee for the stockholders, as it were, until such time as it shall be needed for improvements. The average Ameri-

can stockholder likes to see quick dividends, however, and the average investor will give more for a dividend-paying stock with a very uncertain future than a stock which gives no promise of dividends for many years, but upon which good returns are assured, if the stockholders will only wait long enough for them. Few directors have the moral courage to pass dividend after dividend for the sake of future generations of stockholders, provided the company is earning anything at all available for dividends. The future is thus left to take care of itself, and the notable thing about business operations in America in the past has been that the future has, in most cases, taken care of itself remarkably well, and this has led capitalists to invest blindly in securities of all kinds which are paying well at the present time, without inquiring into their future. That thousands of enterprises of all kinds in this country have not come to financial grief as a result of periodical reorganization and increase of capital liabilities every time extensive overhaulings of a property become necessary, is due simply and solely to the fact that the growth of business has usually been large enough to enable these enterprises to carry the additional burdens put upon them, and it has only been when promoters have over-reached themselves in discounting the possibilities of a property and loading it too heavily with securities that disaster has come.

The excellent showing that was made by several street railway companies in Massachusetts when it was proposed to permit savings banks to invest in this class of securities is convincing proof of the wisdom of adopting and pursueing a conservative course in the matter of dividends and reserve funds.

Americans are noted for the creation of scrap heaps by the throwing away of obsolete machinery and the introduction of modern methods and apparatus. It is undoubtedly a fact that the natural increase of business and improvements in economy brought about by the creation of the scrap heap have counterbalanced the cost of high-priced scrap heaps in this country, and to these things the prosperity of its industries and railway companies is due. As conditions become older and more settled, and as the limit of population and traffic, and the limit in the reduction in operating expenses in electric railways is reached, the necessity for different financial methods will become apparent, and it is for this reason that the various notes of warning have been sounded in the columns of this department as to the coming of a time when a larger reserve fund will be necessary. It is evident that with the shorter time franchises that are now becoming popular with city governments and with the expiration of franchises now enjoyed, there is reason for more and more serious attention to the creation of funds for either paying off the securities at the expiration of franchises or reconstructing extensively under new grants, as the case may be. Not only do the stability and prominence of street railway investments require this, but it is due to the welfare of the business in general that the profits be not represented as larger than can reasonably be maintained. Now, that street railway companies are being so heavily taxed, and large compensation is sometimes being asked for renewals of franchises, it is of no benefit to anyone but the stock speculator, with securities to unload, to have it advertised far and wide that the profits of street railway operation are two or three times what they really should be were proper maintenance, reserve and sinking fund deducted from the earnings.

The Utility of Reserve Accounts

BY A. O. KITTREDGE, C.P.A.

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The penny-wise and pound-foolish policy is nowhere more strikingly demonstrated than in the crippled physical condition of certain railroads. The payment of dividends at the expense of maintenance has brought several of the great steam railway systems to bankruptcy, and even in these days of general prosperity numerous street railways are failing to provide for the stormy days that are bound to come. The depreciation of plant and equipment is something which must be duly considered in railway accounting, and the maintenance of adequate reserves is, therefore, a matter of vital consequence.

THE PRINCIPLE OF RESERVES

The principle of reserve accounts may, perhaps, be most clearly illustrated by considering them in connection with their antitheses, commonly called suspense accounts. A suspense account is a record of expenses paid or incurred in one fiscal period, the cost of which in equity belongs to one or more subsequent periods. For example, insurance premiums are usually paid yearly in advance. Any business conducted on the plan of monthly fiscal periods would, therefore, not charge the entire premium to the first month but prorate it over the twelve months of the year. In other words, a suspense account, called Insurance Premiums, would be opened, which would be debited with the whole amount of the premium paid. Thereafter, this account would be credited each month with the periodical prorata, which amount would be charged into current expenses.

Reserve accounts are the antithesis of suspense accounts and are maintained to receive periodical credits offsetting payments made at some later date. If the amount of such later date payments could be definitely determined in advance, reserve accounts would be as simple as suspense accounts, being merely a matter of prorating over two or more fiscal periods; but as reserve accounts are largely matters of estimate, opportunity is offered in connection therewith for the highest type of business judgment.

The operation of the reserve principle may be shown in the matter of taxes, which are usually paid at the end of each year. It would be manifestly unfair to any business to have the taxes for a whole year charged to the individual month in which payment is made. The logical plan is to charge each month, assuming again that the business is conducted on the plan of monthly fiscal periods, with its prorata of the year's taxes. Since no bill is rendered, nor can one be obtained until the taxes are due, it is necessary to estimate the amount in the light of experience and to charge the proper prorata monthly to general expenses, and credit the same to the reserve account provided for taxes. When the time comes for the actual payment of the taxes thus provided for, an amount will have accumulated equal to the amount of the taxes, and the tax reserve account hitherto credited with such accumulation is thereupon debited with the payment made.

ESSENTIALS OF MANAGEMENT

In the foregoing remarks it is presumed that the business is conducted on the plan of short fiscal periods—preferably monthly in the case of a railroad—as on no other basis can be brought before the management the facts essential in formulating plans of operation. Accounting statistics must be up-to-date in order to be of any practical value, and comparisons are most urgently desired with the business of the month immediately preceding and with the corresponding months of previous years. Such informa-

tion can only be obtained through the maintenance of reserve accounts, which fact gives added value and interest to the form as well as the substance of this feature of accounting. The continuous wear and tear of machinery and equipment which will ultimately result in considerable outlay for repairs and final replacement must, therefore, be added to costs of operation. Wear and tear are cumulative costs which begin the moment power and equipment are put in motion. The time of making repairs may be early or late, as necessities determine, but depreciation begins at the very beginning, and substantial provision should be made accordingly. Reserves for repairs and ultimate replacement are, therefore, primary considerations, and in any plan of accounting intended to furnish facts essential to management, such reserves should be separate and distinct, complete and up-to-date at the end of each monthly period, and at all times and under all circumstances liberal.

RESERVES FOR REPAIRS

Reserves for maintenance naturally divide into two general classes, reserves for repairs and reserves for depreciation or replacement. These two general accounts may be subdivided as much or as little as may be desired for purposes of management. Repairs are not always or even generally made when the wear and tear actually occur, but rather during some moderation of business or when the wear and tear have progressed to such an extent as to render further postponement of repair work impossible. In some cases repairs are put off for financial reasons. The necessity for repairs, however, beginning with the introduction of any new building or piece of machinery or equipment and increasing in a progressive ratio, is an ever present operating cost, and it is only fair that each fiscal period should be charged with its due proportion of this accruing expense. A charge for repairs should, therefore, go into each period from the outset, based upon an estimate of the actual wear and tear of the property.

In the subdivision of reserve accounts for repairs where different classes of motive power are employed, it is desirable to maintain separate and distinct records of each. It is, likewise, desirable to maintain a distinction between repairs of track and roadway, and repairs of equipment. Buildings, fixtures and various other forms of plant may also be entitled to separate repair accounts, and reserves should be maintained accordingly. An examination of the cost of repairs in the past will afford a basis for the respective reserve accounts. Subsequent observation of actual costs for repairs, as contrasted with the reserve amounts provided therefor, will show whether the estimate, as provided, is too large or too small.

RESERVES FOR DEPRECIATION

In addition to repairs, provision must also be made for the ultimate replacement of most of the physical assets of a railroad. No matter how much they may be repaired, the time comes, sooner or later, when they must be replaced by something more modern, and sufficient money should be periodically set aside to meet the inevitable expense of replacement when it comes. A story is told of an old lady who insisted that she never needed any new stockings, for the reason that she knitted new feet upon her old ones every fall and new legs upon the old feet every spring. Such a theory of repairs may be applied for years to street railway buildings, tracks and roadways, but radical inventions and changes of methods will some day require new feet and legs at the same time. The displacement of cable systems by underground trolleys is a case in point. Such a change scarcely comes under the head of repairs.

In equipment inevitable change is even more conspicuous. From bobtail horse cars to the ponderous electrical vehicles of modern systems is a radical change, but it is an evolution as well as a revolution. The history of street railways during the last ten years abundantly illustrates the necessity of liberal reserves for maintenance, and who will venture to say that the next ten years will record any less degree of material progress? Progress is a good thing, but mighty expensive, as many can testify.

If the life period of power plants, tracks and cars were positively known in advance, it would be an easy matter to write off at the end of each fiscal period a sufficient amount to balance the account at the end of the time limit. The fact is, however, that such life periods can only be estimated. Some estimates will be too long; others too short.

LIFE AND REPAIR HISTORY

While the life period of any individual piece of machinery or equipment is uncertain, this very uncertainty is worthy of record in the light of its duration and cost of repairs. Depreciation and repairs are taken care of through general reserve accounts, made up of classes of units rather than the individual units themselves, yet it is often desirable to maintain subsidiary accounts for the purposes of management. Therefore, the record of the life and repair history of important machinery in power plants and the similar history of cars or classes of cars becomes of considerable importance. This can only be done through a reserve account for each article or class of articles. The first entry in the account of life history would be the inventory value, which would, of course, be a debit. The credits would be the reserves for depreciation. In the repair record the credits would be the periodical reserves for repairs and the debits the actual costs of repairs as made. Similarly, in the depreciation record the credits would be the reserve for depreciation, and the debits the cost of actual replacements as made.

RESERVES FOR EMERGENCIES

While reserves for repairs and depreciation must be based upon estimates, the facts are obtainable to make such estimates sufficiently exact for practical purposes. There are other expenses, however, in the nature of emergencies, which cannot be estimated with very satisfactory approximation, but which must, nevertheless, be taken into account. Accidents and damage suits are something which every railroad must, sooner or later, face, and it is the part of wisdom to make due provision for such emergencies. From the viewpoint of logical accounting, it would be manifestly unjust to charge to any single period the cost of a destructive accident or to charge to subsequent individual periods the expenses of any damage suits that might happen to be decided therein against the railroad. Such a course would derange the statistical history of the company for purposes of comparison and management.

The more reasonable and satisfactory way of providing for emergencies is through a reserve account which would be credited month by month with such an amount as might be deemed sufficient to meet such extraordinary expenditures. The offsetting charge would be to operating expenses. According to this plan proper charges to the expenses of operation would be made as time passes and a fund thereby accumulated with which to make good the value of property when destroyed by accident, and also to pay claims for damages as adjusted.

The very idea of an accident is that it is something unexpected, and while any estimate covering such emergency must of necessity be vague, due provision must be made therefor. The disastrous Johnstown flood was certainly not anticipated in any specific way by the Pennsylvania Railroad. There could scarcely be a better illustration, however, of the wisdom of the Pennsylvania's policy in maintaining large emergency reserves, for the enormous expense resulting from the Johnstown disaster had no appreciable effect upon the resources of the railroad.

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That the city of Chicago is in earnest in its endeavor to settle upon some solution of its rapid transit problem and one which will be satisfactory to the citizens of that city and just to the present railway companies is evinced by the action of the city in sending a delegation of its Aldermen to inspect other cities and report upon their transportation systems. This committee, which visited New York, Boston and a few other cities last month, was composed of some of the leading business and professional men of Chicago, who, while in New York, devoted themselves to a thorough and intelligent study of the transportation conditions in this city. The report of the committee and its engineer will, of course, not be presented for several months, but, whatever the decision reached, the action of the city and that of the Aldermen in personally investigating in other cities the transportation methods which they consider adopting, is a very creditable one. It is too often the tendency, especially with municipal bodies, to attempt to solve all questions relating to local transportation with no more data or information than is available without leaving their own city, and with often a very incomplete knowledge of the subjects upon which their decision is required. The results of this policy are usually to defeat the very objects which the city wishes to secure. Chicago has followed the opposite policy, although the only one which would be adopted by any private corporation in planning an important piece of work, and we trust that this example will be followed by other public bodies in any important action affecting public service corporations and public service.

One of the most annoying troubles in electric railway maintenance is the wear of the motor bearings. These bearings in wearing away allow the armature to approach the pole-pieces and are usually condemned after a certain distance limit is reached, for if this limit is exceeded there is danger of the armature striking the pole-piece and injuring its structure so severely that rewinding will not repair the armature. Many devices are used at present to detect the wearing away of motor bearings and keep track of the armature clearance, which, of course, is made as great as magnetic conditions will permit. The modern railway motor design has provided armatures with large teeth which are stronger and will not be so seriously injured by striking the pole-piece, and in general the design of the railway motor has been perfected to such an extent that from an electromagnetic standpoint but little more can be done with reference to the dimensions of the iron parts to minimize the trouble.

The motor bearings, however, have not been given as much attention. They have, of course, been designed with a view to maximum length and permanency, and when newly sent out are filled with a first-class quality of bearing metal which frequently lasts longer than any subsequent bearing lining which is installed by the electric railway management. The fact that poorer grades of bearing metal are used is almost never the fault of the engineering department, but is due to the fact that there are innumerable cheap grades of bearing metal on the market which are attractive to those who are anxious to make a good showing on the maintenance account. The best metal that can be had is none too good, for the conditions are such that the bearing must be discarded before it is really worn out from a mechanical point of view. The chief cause of the wear is due to dust and grit of the roadbed. Every possible precaution should be taken to protect bearings from this most unwelcome intruder. The commutator bearing of the motor on many of the older types is very rarely capped, and, its end being exposed in this way, it suffers quite severely from grinding by dust particles. The conditions under a railway car are such that a dust cap over the end of the motor bearing often trenches upon space which is needed for brake-rods and braces, or even side frames. A device to be recommended in such motors as this is to sacrifice an eighth of an inch of the end of the shaft, trimming down the bearing correspondingly so that it will not cut a groove, and secure a perfectly flat metal cap over the orifice by three or more screws. This cap should preferably be felt gasketed and can be fastened to the bearing shell. Felt guards around the motor shaft on either side of the bearing will materially assist in preventing the wear. In fact, railway motor makers and maintainers will do well to study methods employed to exclude dust from modern bicycle bearings, as the difficulty has there been appreciated and ingeniously met in many ways.

The cost of renewing the bearing metal is, of course, the smallest item in replacing a bearing. The most expensive part is the necessity of dismounting the equipment and placing it out of commission for a longer or shorter time in order to renew the worn bearing shell. Adequately protected railway motor bearings should run very much longer than the more exposed types, and by employing these means the wear limit can then be set at a point much closer than before and the bearings much more nearly worn out, thereby minimizing the periods of dismantling the motor for renewal.

We are fortunately able to present this month an abstract of the results obtained in the Berlin-Zossen tests, with curves showing the actual power consumption on some of the high-speed runs. These data, although somewhat meager, are of great value, as definitely checking the train resistances, about which there seems to have been recently considerable doubt. A glance at the curves reveals the fact that the power taken to maintain speed against air and track resistances was very moderate indeed. We have all along contended that the weight of evidence indicated that the power consumption at high speeds would prove to be much less serious than was feared, and that the track resistances at high speed were very moderate. Now, when a 90-ton car is drawn at a sustained speed of 87 miles per hour, with a power expenditure of less than 500 hp at the generating station, and less than 300 hp at the car, there is simply no room for either large track resistance or large net air resistance, and no amount of theorizing from coasting data will make any room, and that is the end of the matter.

Another very important consideration is the success of the current-collecting devices employed. There has been some, perhaps justifiable, doubt as to the feasibility of collecting current at enormous speeds from a very high-voltage trolley wire, doubts strongly voiced by Huber in his recent paper. The results at Zossen appear to indicate that the difficulty of current collecting has been over estimated, and that high-voltage trolley wires do the work with a very encouraging degree of success. On the other hand the braking seems to be far from easy, and the power brakes did not prove entirely satisfactory. Evidently this part of the high speed problem is none too easy and requires much study and experiment for its solution. The signals, too, involve a serious source of anxiety, which may be somewhat relieved when the braking is improved. Most of all the track requires close attention, and it is clear enough that common track is not good enough to serve the purpose. Broadly, the difficulties encountered are mechanical rather than electrical, as we have steadily contended would prove to be the case. Given a first-class track and adequate braking facilities, and the mere matter of high speed is comparatively simple. There is no doubt whatever that a speed of a hundred miles an hour involves no particular difficulties from the electrical standpoint. The feasibility of such speeds commercially turns upon the demand for them, and upon sound track construction and attention to mechanical details. When there is a definite call for such a fast express service the work can be carried out successfully by means even now at hand. But, as we have more than once pointed out, there is little object in trying for such speeds over anything but considerable distances. Time is money, but it is not yet so valuable as to make a schedule speed approaching 100 miles per hour important except on rather long runs between important centers. It is possible that one-hour trains between New York and Philadelphia might be worth the while, but such speed would be more valuable between New York and Washington or Boston, and still more valuable between New York and Chicago. Railway speed has a slow natural growth, and even now that we have experimental data to serve as a basis for commercial work, it may be a long time before the pressure of public demand is sufficient to produce definite results. Electric traction on a large scale is sure to come in time, but the growth is quite likely to be gradual. It is better, in fact, that it should be so, and that the way should be cleared experimentally before any great enterprise is initiated. But the Zossen tests have laid a solid foundation for further improvements.

It must be apparent to every close observer of public affairs that the drift of opinion in England and on the Continent for years has been favorable to municipal ownership and governmental control of public service works, including street railway properties, and it is the general belief that the tendency is still in that direction, especially in Great Britain. But Mr. Porter, in his article on "The Failure of Municipal Ownership in England," the first part of which is presented elsewhere in this issue, holds out promise of a change of sentiment in that country based apparently upon the recent Parliamentary investigation and the agitation of abuses under the present system.

The idea of municipal ownership of the transportation facilities of a city, or even the ownership without operation, has never been of much more than academic interest in this country. There has been, of course, a certain amount of agitation on the subject, and the demand for municipal ownership has been made the slogan of one side or the other in a great many political battles. It has also been used very effectively on occasions as a means of attacking or fighting local street railway companies to secure some coveted end. But there are many reasons why the municipal ownership propaganda as an actuality has amounted to nothing in the United States. In the first place most students of our political methods appreciate the fact that our system of government is not such as to encourage the hope that public service corporations would be efficiently and economically administered. Again, few, if any, cities of this country have been, or are prepared, to engage in extensive municipal enterprises requiring capital, as they have no money available to buy or to build, nor can they borrow money under the constitutional limitations upon city indebtedness. Consequently they have had to look to private capital to undertake these great public works. The benefits in this co-operation are to-day enjoyed alike by the community at large and the corporation, and we believe that there is general satisfaction with the result.

In England a diametrically opposite course has been pursued, and as a result a number of the largest tramway systems in that country are not only owned, but operated directly, by the municipalities. The roads have been well built, as a rule are well managed, and there seems to be a stability and absence of politics from their operation which could hardly be expected in this country. The great development of municipal tramways in Great Britain has been due partly to a greatly restricted suffrage by which better

and more businesslike local government is assured, partly to the absence of constitutional limitations on indebtedness by which no financial obstacle was put in the way of acquiring and equipping the roads, and partly also to the fact that during the last ten years many of the franchises of the larger tramway systems in the United Kingdom have expired, so that an easy opportunity has been presented by which the municipalities could acquire the tramway systems. For this reason, Mr. Porter's article on the subject of the results secured by this policy in Great Britain is of the greatest interest, and, although Mr. Porter has long been known as an advocate of private ownership for quasi public enterprises of this character, his knowledge of the condition of affairs abroad and at home and his high reputation as an authority on statistics and all public matters, make his testimony of the greatest value.

Judging from Mr. Porter's paper, the municipalities which own their own tramway systems have, perhaps naturally, devoted their energies more toward providing a low minimum fare than toward providing facilities for a cheap maximum ride, and thus encouraging people to live in the suburbs outside of the municipal boundaries and beyond the tax limits. It is right in connection with this question of suburban extensions that we have one of the strongest objections to municipal ownership, namely, the difficulty so far experienced in Great Britain of extending the operation of each city's system much beyond its corporate limits. That this obstacle is irremovable we do not believe. The legal questions can be settled by action of Parliament, but this will not and cannot remove what Mr. Porter considers the most serious difficulty, viz., the unwillingness of several adjoining municipalities to unite upon the standards of equipment necessary for a through line, and waive the control and management of the lines within their own jurisdictions in favor of one central management. This fact will continue to act as a stumbling block in preventing the extension of the municipal systems to neighboring small towns, and the construction of such a network as would be possible by private enterprise. As an example of what may be accomplished under private control, Mr. Porter calls attention to the electric railway systems centering in Boston, which radiate by connections and arrangements through four States and probably sixty or seventy subdivisions, carrying through that great industrial district the boon of cheap and quick transportation.

The subject is such a broad one, and one which affects so vitally electric railway development that all the light which can be thrown on the subject is of the greatest value. The electric road is so important, not only to the cities, but to the development of the country at large, that its growth should be planned upon such comprehensive lines that it shall meet no serious interference. We do not intend to withhold any portion of praise to the managers of the municipal systems which have been built up in Great Britain, and which is due them. But will the Common Council of a city, to whom, of course, the tramway manager is subordinate, have the breadth of view to undertake the solution of this question, in all its phases, in the broadest manner? We already have in the article, the first half of which is published this month, the important testimony of Mr. Porter in favor of private ownership. Can some advocate of the oposite policy give more weighty reasons in favor of municipal control?

Interurban Car Despatching

Train despatching by telegraph on steam railroads has reached a high state of perfection, as is but natural, considering the years of experience that have figured in the solution of the present system. When the electric interurban line began to assume a length and importance that demanded some system of despatching whereby all cars might take orders from one man, the telegraphic system of steam railroads was the only practical example available from which to devise a system for electric interurban work, but it proved too cumbersome to meet the average conditions of electric interurban railway operation, and something new had to be worked out, just as in many other departments of this new railroad art. The first thing that suggested itself was naturally the telephone as a substitute for the telegraph for giving orders. The use of the telephone for this purpose on steam roads has made very little headway. Without discussion as to whether the telephone is or is not the proper means of communicating train orders on steam roads, it can be said truthfully that it meets remarkably well the requirements of electric roads. It is essential that the means of communication be such that motormen can talk with the despatcher at any siding. The maintenance of telegraph operators at all stations where cars may meet was one of the cumbersome and expensive features of steam road operation which had to be eliminated in the operation of electric roads. It has been urged against the use of the telephone in train despatching that there is more chance for error in receipt of messages than by telegraph. It is hard to see that this objection has much weight. If desired messages can be written down and repeated back for approval to guard against error, as in telegraph messages. However, these points are hardly worth arguing, because the telephone has now become generally used and recognized as the proper instrument for despatching on electric interurban roads. This article, therefore, resolves itself into a review of the methods of using the telephone in train despatching.

The first thing to consider is, of course, the construction of the telephone system and whether communication between trainmen and despatcher is to be by means of telephones placed in booths or boxes along the road at the sidings or whether each car is to carry its own telephone instrument and connect with the despatcher's telephone circuit at sidings or other points along the line. Both plans have many advocates. The main point in favor of booths is that instruments located permanently at stations are not so likely to be disabled by hard usage and jolting as are instruments on a car. It is also found that there is some chance for poor contact at the plug or hook which is used to connect with the telephone circuit, where car or portable telephones are employed. Neither of these objections, however, have proved insurmountable. The plan of having a telephone for every car in operation is much more flexible than the other, and the investment is likely to be less to secure the same results if the telephone instruments are placed on the cars rather than in booths, because of the large number of telephone instruments and booths or boxes that must be installed if communication is made convenient from any point along the road.

Whichever system is used, or if the two systems are used in connection, it must be remembered that for despatching purposes it is important that a construction be adopted

which will be free from obscure line and instrument troubles. If telephones are placed in booths or boxes along the line things should be so arranged that both terminals of the telephone instrument will be absolutely disconnected from the line when the instrument is not in use. This can be done by a common double-pole knife switch closed before using the telephone and opened when through, but as this is likely to be forgotten or neglected some precaution is desirable which will automatically enforce the rule. A spring can be put on the switch which will hold it open except when the person talking holds it shut, or the closing of the door of the box or booth can be made to open the telephone circuit, or the weight of a person standing on a platform in front of the telephone can be made to close the circuit. This precaution of keeping the telephones out of circuit when not in use is important for two reasons. In the first place, talking is clearer if only one instrument besides the despatcher's is bridged across the telephone line. If a number of telephones are bridged across at once each takes a certain portion of the talking current, and if the battery of the transmitting instrument is weak very poor results may be obtained. In the second place, the telephones should be normally disconnected from the line because of possible damage to them by lightning. Since nothing is to be gained by having the instruments bridged across the line when no one is at a booth, there is everything to gain and nothing to loose by disconnecting them. Further than this, there is the chance that short circuits in one instrument would disable the whole despatching line were the instruments all normally bridged across the line. In such a case the quick location of the fault might be difficult. If the telephones are carried on the car the points to look out for especially are the selection and location of instruments so that they will not be injured easily, and the manner of connecting into the line so as to avoid trouble either from poor contacts or from short circuits in the contact device. Experience has demonstrated that plain, simple connecting devices with parts so open as to make short circuits both unlikely of occurrence and easy to see if they do occur, are more desirable than more compact jacks and plugs, which, although neat in appearance, may pull apart, leak or become short-circuited a dozen times where some plain, home-made contact device would never give trouble. With a form of connection switch in which the contacts are so wide apart as never to cause short circuits or leakage, the possible telephone despatching line troubles will be practically reduced to breakages of the line wires or other wires falling across them, and when an instrument is defective it is readily known.

Next comes the question as to how the despatching circuit is to be operated and whether it is to be used for business other than despatching. Probably the most advanced practice is that of certain large interurban systems which have two telephone circuits the entire length of their lines. One of these is used exclusively for despatching and the other for general business. On one of the roads referred to the despatcher has a head telephone like a central-office telephone operator, and this is kept constantly at his ear. When motormen call the despatcher for orders they simply connect in on the line and speak without ringing. In this case the ringing is not only unnecessary, but would be a nuisance, because of the liability that some motorman would ring for the despatcher just as some other man was talking. As it is he is obliged to listen before talking, and no confusion can occur. The line being used exclusively for despatching, the despatcher's head telephone is the only one permanently bridged across the line, and consequently the line is very clear talking and free from sources of possible trouble. When a road has not the advantage of a telephone circuit used exclusively for despatching business, and must, in addition, transact the general business of the road over the same wires that are used for despatching, it is necessary to have some ringing for signaling and numerous instruments bridged across the line, all of which interferes with the efficiency of the despatching system, but must be put up with in some cases.

For an interurban road with fast schedules the time that must be consumed in order to get orders from the despatcher must be considered. For this reason the latest and best practice in telephoning from the car makes it possible to receive despatcher's orders and be in motion in ten seconds from the time of coming to a stop. This is done by having the connection box so that it can be reached from the motorman's cab window. The car is run up beside the connection box, and the conductor makes the connection while the motorman receives the order. While the car is being slowed down the conductor is getting the flexible connection ready and the window open so that the instant the motorman has stopped the car he can step to the telephone and talk to the despatcher. As soon as orders are received the conductor disconnects while the motorman starts the car.

This explanation will illustrate a very important advantage which this system possesses, a feature of the greatest value in the handling of high-speed trains, and one which need not sacrifice the accuracy of transmitting orders or the safety of operation, which, being the most important factor, must, of course, be considered before all others.

As regards the manner of giving and receiving orders there is a great diversity of practice. To be secure against mistakes in understanding orders some roads have the motorman or conductor write the order down on blanks for the purpose where the order is anything more than a regular "O. K." giving permission to proceed on regular time to the next regular reporting point. In such case when a written order is taken it is read back to the despatcher for his "O. K." Other roads require orders to be simply repeated to the motorman by the conductor when standing at the telephone in the hearing of the despatcher.

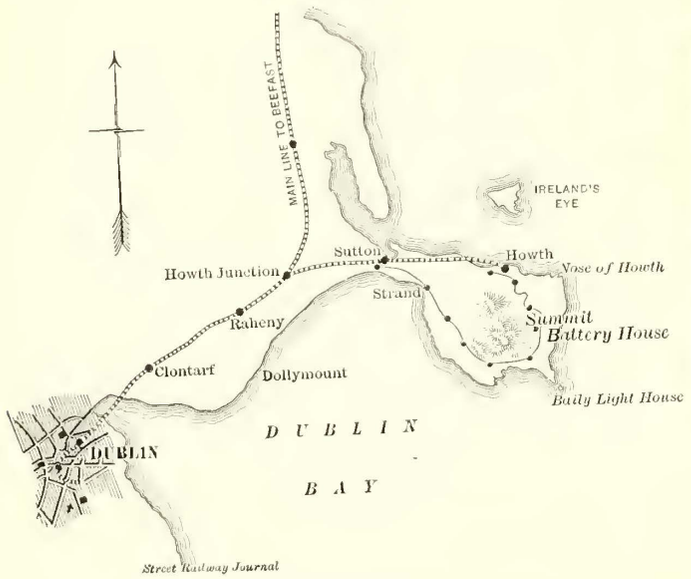
It has been remarked that men with steam-road training are much more likely to be watchful and obedient to rules in connection with train despatching than those with street railway experience, where no such rules are needed. Surprising as it may seem, cases have occurred on very high-speed electric roads where both motorman and conductor have left a regular passing point without orders and without meeting the opposing car, simply through carelessness and forgetfulness on the part of both trainmen simultaneously. These men were recruits from city railway service.

Of course, if conditions are such that station agents along the line can take and deliver train orders, steam-road methods can be followed, but on the majority of electric interurban roads such is not the case, and it is to this majority that the ideas expressed in the foregoing paragraphs apply.

The Sutton and Howth Tramway

The Great Northern Railway Company of Ireland recently opened an electric railway in the vicinity of Dublin, which is intended for use as a feeder to the trains on the Sutton and Howth branch line.

The railway line from the city skirts Dublin Bay, passing through Clontarf and Raheny, and, after leaving the main line to Belfast at Howth Junction, runs through Sutton



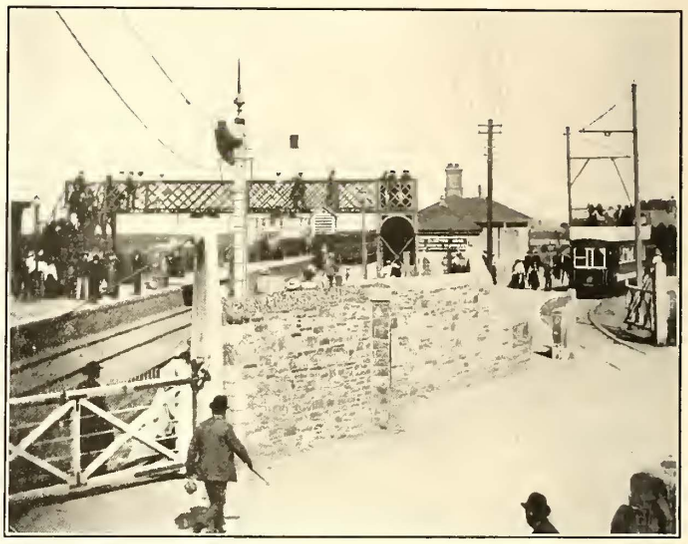
MAP OF THE SUTTON AND HOWTH RAILWAY

and finally terminates at the little village of Howth, close to the harbor.

The Hill of Howth, which rises to 578 ft. above the sea level, affords a commanding view of Dublin Bay and its picturesque surroundings, from Kingstown and Dalkey in the south, to the Mourne Mountains in the north. It has for a long time been a place of resort for Dublin holiday makers, and the opening of the electric line furnishes a cheap and easy method of enjoying one of the most beautiful sea views to be obtained in Ireland without the fatigue formerly attending the hill climbing.

The tramway starts from the railway station at Sutton, and, while gradually ascending, skirts the Hill until the summit is reached at $3\frac{1}{2}$ miles, then, with a descent of $1\frac{3}{4}$ miles into Howth, makes connection with the main line railway into Dublin.

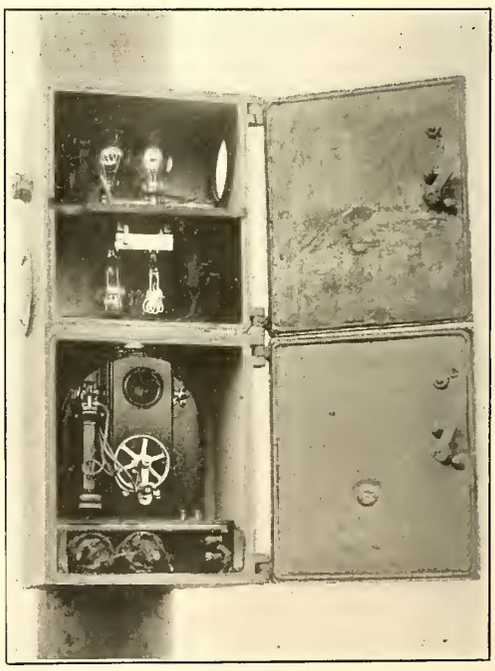
The chief difficulties that had to be encountered were in connection with the steep gradients on the Howth side of the Hill, where long S-shaped curves have been constructed in order to reduce the rise to one in twenty, which is continuous for the whole of the $1\frac{3}{4}$ miles from the railway station to the summit.



SUTTON RAILWAY STATION AFTER ARRIVAL OF TRAIN FROM DUBLIN

The work was designed and completed under the supervision of W. H. Mills, the railway company's engineer-in-chief. Dr. Kennedy was consulted and entrusted with the electrical equipment.

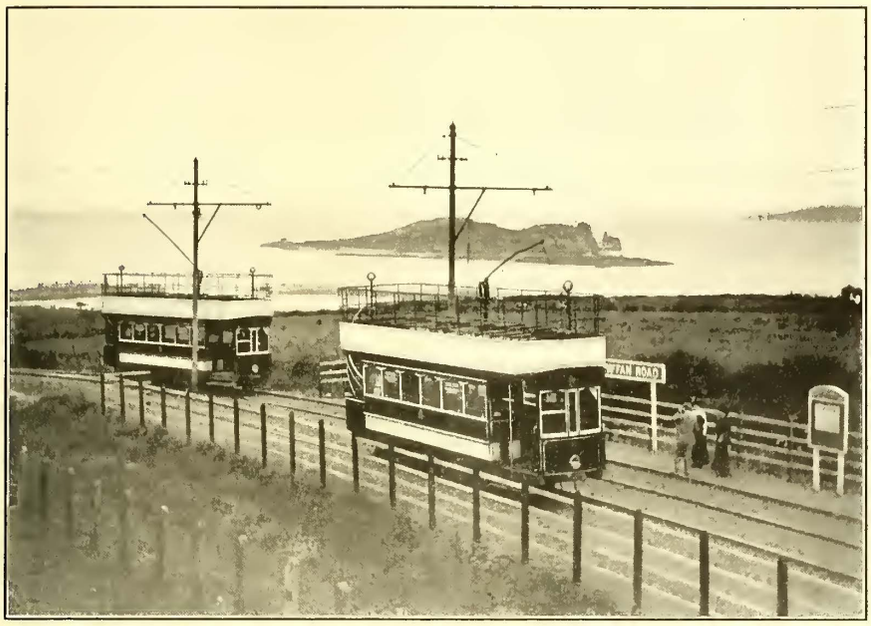
STEEL BRIDGE CARRYING TRAMWAY INTO RAILWAY STATION AT HOWTH



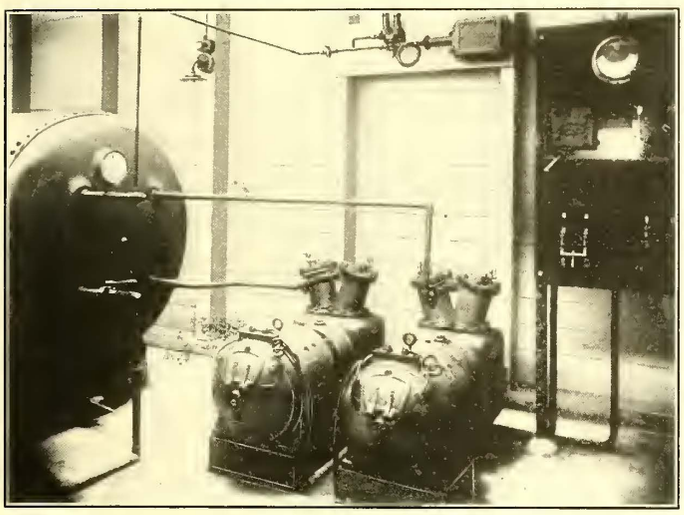
COMBINED SIGNAL AND TELEPHONE BOX

The power house is situated at Sutton, and is a handsome red brick building faced with white stone, and contains the generating plant, installed by Ernest Scott & Mountain, of Newcastle. This equipment consists of three vertical compound non-condensing steam engines, running at 350 r. p. m., coupled to direct-current, compound-wound generators. These units have a capacity of 125 kw

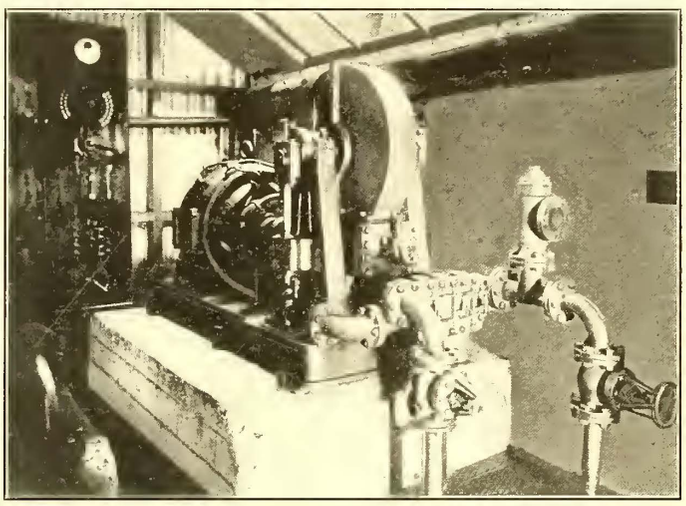
at full load, and supply current to the line at a pressure of 550 volts. Over each machine is fixed a sliding contact switch for varying the compounding by altering the number of coils in series.



TRAMWAY STATION ON ROAD TO SUMMIT, WITH VIEW OF IRELAND'S EYE.



WESTINGHOUSE AIR COMPRESSORS FOR CHARGING CAR BRAKE RESERVOIR



ONE OF THE SCOTT & MOUNTAIN ELECTRICALLY-DRIVEN BOILER FEED PUMPS

A boosting set, composed of two negative boosters, driven by a motor is installed. The field coils of the boosters are separately excited, and the necessary variation in voltage is obtained by regulating resistances.

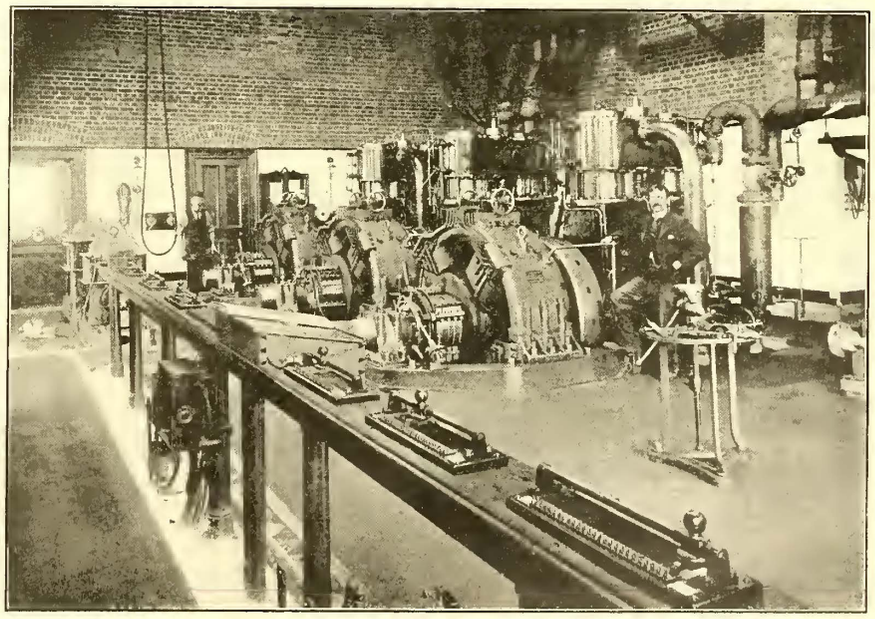
Two return feeders are connected to the rails at points approximately two miles distant, through which the boosters draw a part of the return current. The boosters are bipolar, and have a capacity of 160 amps., at 100 volts.

The switchboard, made by the General Electric Company, consists of three feeder, three machine, and two battery panels; the instruments are of the Kelvin and British Thomson-Houston pattern.

Three Lancashire boilers, 30 ft. long by 8 ft. 6 ins. in diameter, supply steam at a pressure of 160 lbs. per sq. in., and are fitted with drums in order to ensure the supply of dry steam. The main flue is built above ground, the sections increasing toward the shaft, so as to permit of further extensions. The shaft is 120 ft. high, with an internal diameter of 8 ft. 6 ins., and contains a firebrick lining built clear of the outside walls.

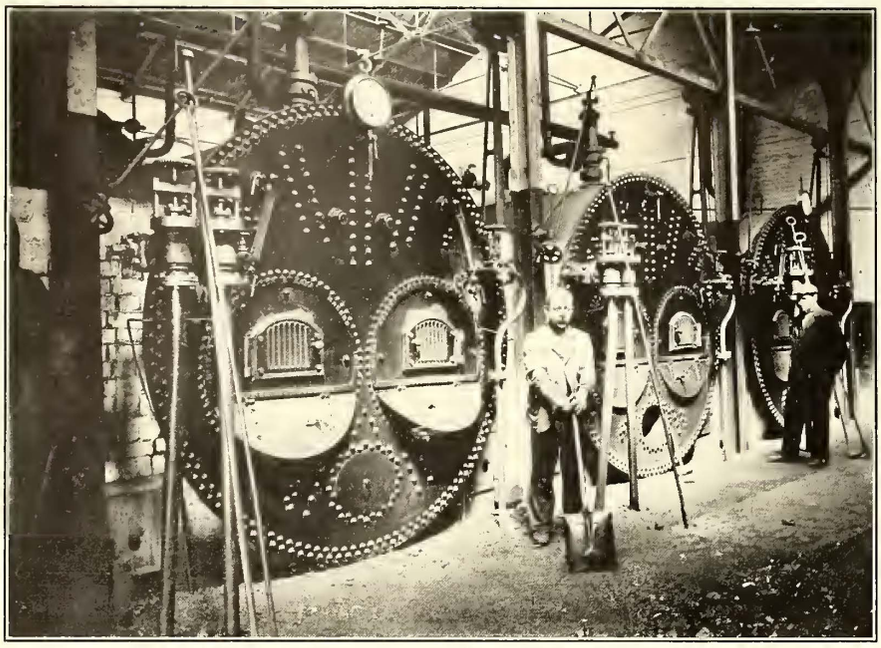
An injector and two 3-throw electrically-driven pumps have been provided for supplying water to the boilers, drawing from a 4000-gallon tank placed outside the boiler house, 17 ft. from the ground. A reserve supply of water has been provided by the erection of a tank with a capacity of 20,000 gallons, 20 ft. from the ground. The pipe connections are designed so that water may be drawn from these tanks in case of fire. The boiler feed pumps supply the necessary pressure, and as these are electrically driven, they can be put in use at any time in the day or night, current being always available from the main generators or the battery station.

The tanks are supplied with water from



ENGINE ROOM, SHOWING SCOTT & MOUNTAIN GENERATING SETS

a well by means of Pulsometer and Worthington steam pumps. This water is exceedingly hard, and water softening apparatus of the Archbutt-Deley type is in course of erection, capable of dealing with 1600 gals. per hour. A feed heater of the vertical type is connected to the exhaust pipe from the engines.



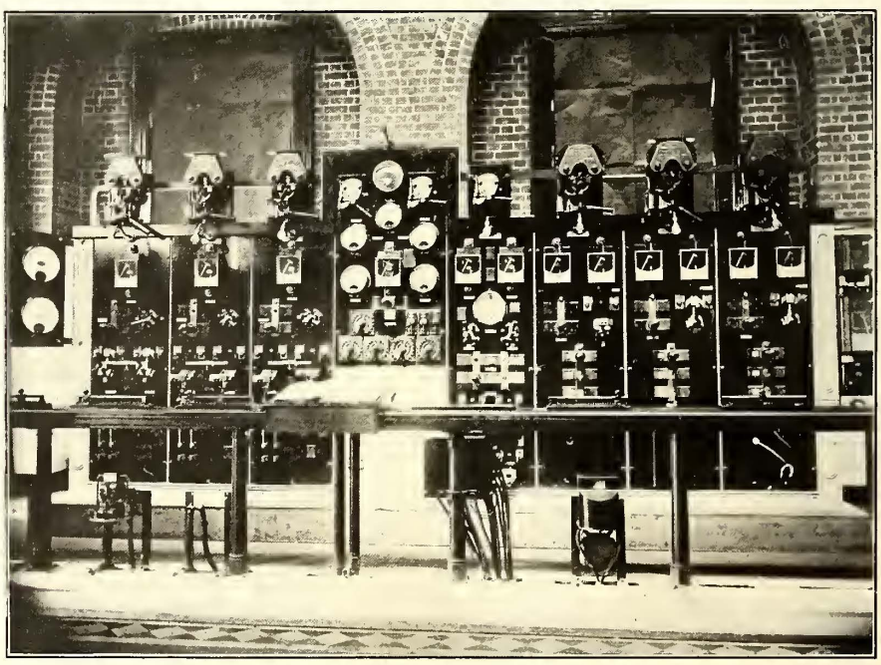
LANCASHIRE BOILERS IN POWER HOUSE

The car house at Sutton is a substantial frame building, in which three tracks are laid, and accommodation provided for 15 cars. Here are situated the workships, fitted with electrically-driven machine tools, so that repairs may be made without delay.

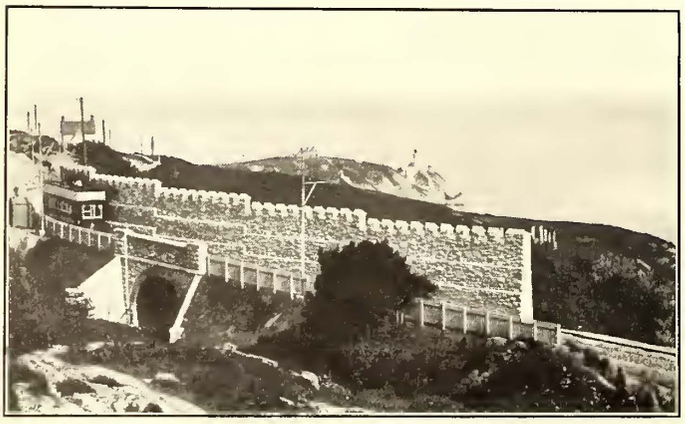
The rolling stock consists of double-deck cars, with seating accommodation for 67 passengers. The cars are carried on double-bogie Brill trucks, fitted with two 37½-hp Westinghouse motors. Three brakes are provided, namely, the ordinary hand brake, an electric brake, fitted to the B 18 British Thomson-Houston controller, and a Westinghouse air brake. The Westinghouse brake is operated by air at 75 lbs. pressure per square inch, which is obtained from storage reservoirs, consisting of long cylindrical drums placed under the car seats. The cars are charged from a storage reservoir in the car house, which is fed by motor-driven compressors, supplied by the Westinghouse Company. The car reservoirs, when fully charged, contain sufficient air to make forty stops, with a reduction in pressure of 25 lbs.

The overhead construction consists of a single 0000 trolley wire, with double construction at passing places every half mile along the route. The current is fed to the line at every quarter of a mile, and section insulation is provided at every half mile.

A signalling system has been established throughout the line, by means of which any section, between two loops, can be blocked on or off by means of electric lamps controlled by suitable switches. The lamps are contained in combined signal and telephone boxes, which are erected along the route at each loop. These boxes consist of two compartments, one containing the telephone and the other the signalling lamps, with the necessary operative switches. Perforated holes allow the heat from the lamps to circulate through the telephone compartments, and so keep the instruments in good condition and free from moisture.



SWITCHBOARD IN POWER STATION



STELLA MARIS VIADUCT ON SUTTON SIDE OF HILL, 400 FEET ABOVE SEA LEVEL, BAILEY LIGHT IN THE DISTANCE

There are two feeder cables, supplied by the British Insulated Wire Company, consisting of paper insulated, lead covered and armored conductors, feeding round the Hill in opposite directions—No. 1 from Sutton, along the tramway to the battery station, and No. 2 along the railway line, passing up the hill to the battery house, via Howth station.

Leaving Sutton railway station the tram line runs on the company's own land to the Sutton cross roads, where the Dublin United Company's system is crossed. The gage of the track is 5 ft. 3 ins., and consists of 72-lb. bullhead rails, carried on cast iron chairs, on sleepers placed 2 ft. 8 ins. apart. The work is substantial in character and similar to the company's standard practice on its main line. Passing

the gates of the Golfers Hotel, lately erected by the Irish Tourist Development Company, the line runs on the right-hand side of the road, on a track raised 6 ins. above the road level, and close to the sea, which is left behind half a mile farther on, where the ascent of the hill commences. As the ascent is made there are varying gradients up to 1 in 16.7, and as the height increases a magnificent panoramic view opens out, with the city of Dublin in the distance and the narrow isthmus joining the Howth peninsula to the main land in the foreground, while far away to the north the Mourne Mountains, in County Down, may be seen beyond a stretch of 50 miles of sea, and to the south and west the waters of Dublin Bay, with the Wicklow Mountains in the background. The sea view is uninterrupted, and higher up opens out to the west when the Baily Post Office is reached, 2¾ miles up the line. The route now enters the company's ground, and after running along a steep embankment overlooking the Baily lighthouse, and crossing the Stella Maris Viaduct, a handsome structure in masonry, again joins the main road, which is skirted for a distance of 200 yards at a height of 400 ft. above the sea level, when private ground is again entered, and with a continuous rise of one in twenty the summit is reached, after a trip of 3¾ miles.

At this point is situated the sub-station, equipped with a battery of 255 Tudor cells of 200-amp hours capacity, with the necessary booster for charging and attendant switch gear.

The railway company has bought land at the summit, which is being ornamentally laid out as a park. A pretty tea house has been erected for the accommodation of visitors, upon a point which allows the finest views being enjoyed from its verandas.

On leaving the summit the line runs entirely through the company's grounds, and with a continuously-descending gradient of one in twenty, during which many sharp curves are encountered, Howth is reached after crossing a fine steel bridge leading into the railway station.

The railway company has spared no expense to ensure the comfort of visitors, and to make the line attractive to them. The railway stations at Howth and Sutton have been furnished throughout with electric light, which has also been installed at the cross roads and passing places along the route.

It is announced that the traffic arrangements are in the hands of Henry Plews, the general manager of the company.

Tunnel Franchises

One tunnel under the East River, connecting the Borough of Manhattan with Brooklyn, is now assured, and another is in contemplation. On advice of counsel that it might be illegal and would be unjust to accept a bid for the Brooklyn tunnel which included the construction of an underground road from Forty-Second Street to Union Square, because such an offer had not been invited, the Rapid Transit Commission last week accepted the Belmont-McDonald syndicate's proposal to build the Brooklyn extension for $2,000,000. Undoubtedly the alternative bid would otherwise have been accepted and was put aside with regret, as the commission regards that proposition favorably and will be pleased to have it renewed in proper form at an early day, when a line north from Union Square, connecting with the proposed crosstown tunnel to the Pennsylvania Railroad will be added to the original system.

According to the plans of the Rapid Transit Commission the tunnel will be burrowed from Broadway and Ann Street, New York, to Flatbush and Atlantic Avenues, in Brooklyn. Ann Street is where the Manhattan-Bronx line has its downtown end. After leaving that street the new tunnel will run down Broadway to Bowling Green, with stations at Fulton and Wall Streets. At Bowling Green the Brooklyn line proper will diverge, while an additional loop will go under Battery Park and furnish an outlet to the ferries at the foot of Whitehall Street. When the course of the Brooklyn line leaves Bowling Green it will strike the East River east of Whitehall Street. Under the river the construction will be similar to that being used in going beneath the Harlem at Lenox Avenue and 148th Street. There will be two steel tubes, each with a track in it, lined and covered with concrete. The tubes will be connected, and they will enter the Borough of Brooklyn at the foot of Joralemon Street, after which the line will extend to Fulton Street, to Flatbush Avenue, and out to the junction of Flatbush and Atlantic Avenues, where the station of the Long Island Railroad is situated.

Upon the completion of the discussion of the original tunnel plan and its award to the Belmont-McDonald syndicate by the Rapid Transit Commission, a resolution was introduced providing "that the chief engineer be directed to prepare and submit to the board routes and a general plan for a rapid transit railroad which shall, as directly as practicable, connect the general region of the City Hall Park, in the Borough of Manhattan, with the general region of Borough Hall Park, or some other equally convenient passenger transportation center in the Borough of Brooklyn." President Orr offered the following explanation: "It is the intention and desire of the board that the amount of money for municipal rapid transit construction which has been saved to the city by the bid of the Rapid Transit Subway Construction Company for $2,000,000, instead of for the estimated actual cost of such construction, being the sum of $8,000,000, shall, if practicable, upon reasonable terms be applied to some rapid transit connection between the Boroughs of Brooklyn and Manhattan, which shall secure to the maority of the citizens of Brooklyn who do business in Manhattan, and are not adequately served by the other rapid transit facilities, rapid transit service between their homes in Brooklyn and the business section of Manhattan for the single fare per entire trip not exceeding 5 cents." The resolution was accordingly adopted.

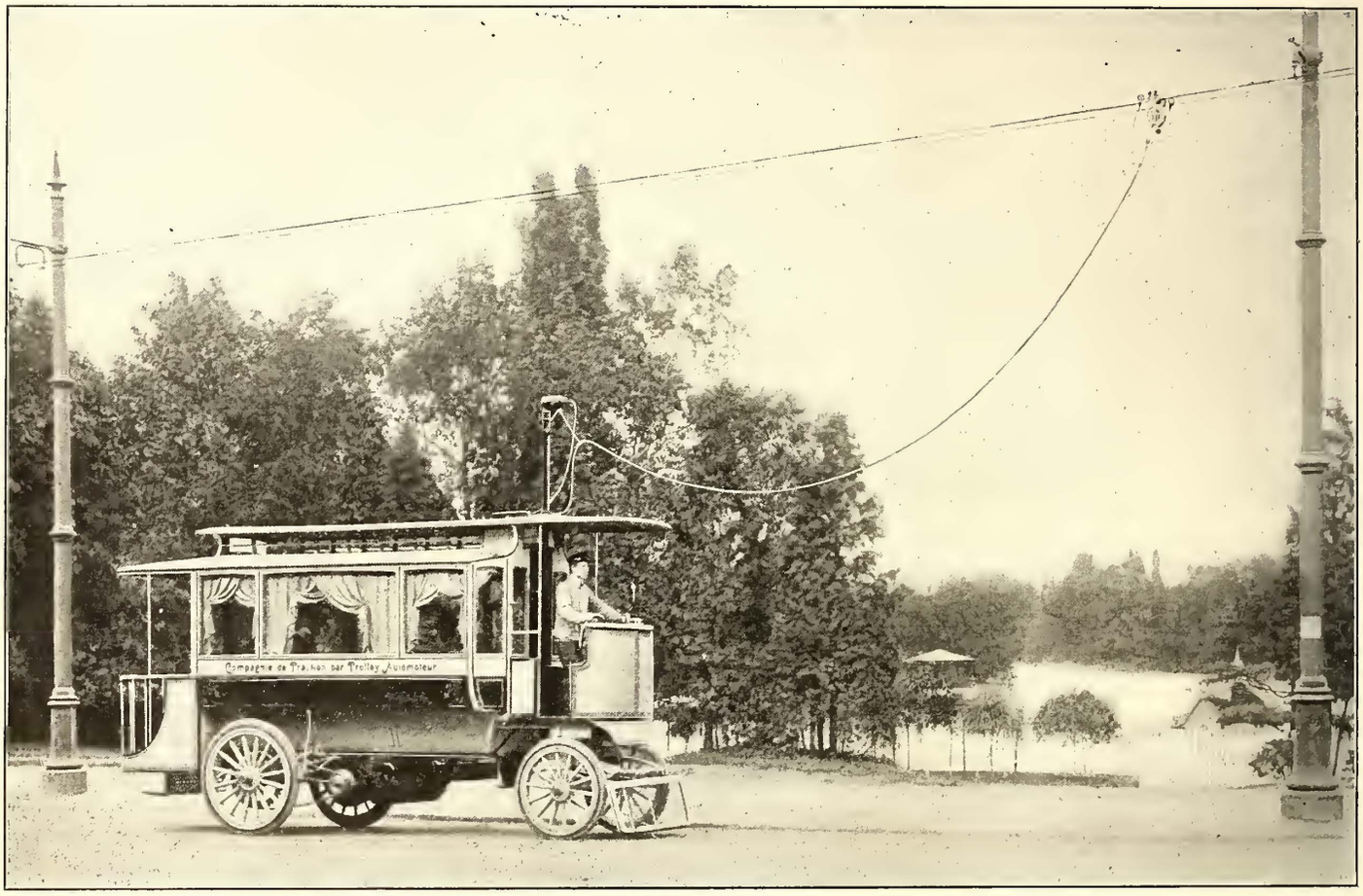
The East Side branch of the rapid transit subway system is now practically assured, as it is the intention of the Rapid Transit Commission to take up the subject, together with the proposed extension through Broadway from Forty-Second Street to Union Square, in the autumn. Borough President Haffen, of the Bronx, says that he has "received positive assurances from all the city authorities that the East Side subway will not only be constructed, but that its authorization is of the very immediate future."

A public hearing by the aldermanic committee on bridges and tunnels in reference to the approval of a route for the New York and New Jersey company to build and operate a tunnel from New Jersey to New York, with a terminal about Christopher and Tenth Streets, was held last week. No one appeared against the proposition. Former Assistant Secretary of the Navy William McAdoo, as counsel for the corporation, spoke in favor of the route. The committee will give another hearing.

Trolley Omnibus Line Between Nice and Upper Monte Carlo

The auto-trolley system of omnibuses finds favor in many parts of Europe, where the authorities will not permit the laying of rails and the employment of the usual methods of operation. One advantage is that these cars may move freely from the extreme of one side of the street to the other, whether the roadway be wide or narrow, and without reference to the relative location of the overhead wires or the pole line. This is a very important factor for localities in which public authorities hesitate to make over any special portion of the road to transportation companies, and it overcomes, at once, the objection to the ordinary street railway and the double-trolley omnibus system, for while the latter provides for a possible side deviation of ten feet, it is pointed out that it might be very difficult in practice to handle these cars in case of emergency and in crowded streets. For instance, whenever a sudden turnout is to be made at a sharp angle from the overhead line, there is great risk of the ordinary trolleys leaving the wire. This would, of necessity, disable the car altogether, as a failure to apply the brakes promptly would result in the vehicle going too far away from the overhead wires, thus cutting off its current supply until it could be hauled back into position to reach the line. On the other hand, it is claimed for the auto-trolley that the flexible cable provides against such contingency, and meets all the requirements of the public authorities in France and other European countries where similar conditions obtain, as it is free to turn to either side in as short a space as an ordinary automobile, and is entirely independent of its relative position, so far as its overhead connections to the trolley wire are concerned.

In the accompanying views, these features are very clearly illustrated. Reproductions from photographs are presented, showing 'buses of this kind in operation under widely varying conditions. One of these shows a car in normal position passing along a boulevard or driveway where there is a straight road; another shows the 'bus in a crowded, narrow court obstructed by carts and trucks, among which it must slowly thread its devious way, while a third shows the operator in the act of making a quick, sharp turn. A view is also presented showing one of these cars in what would be called, in this country, an alley-way, passing a two-wheeled cart in a road where there is barely room to turn out. Here the pole line is carried along the fence or garden wall, and the overhead wires are suspended from brackets attached to the poles.



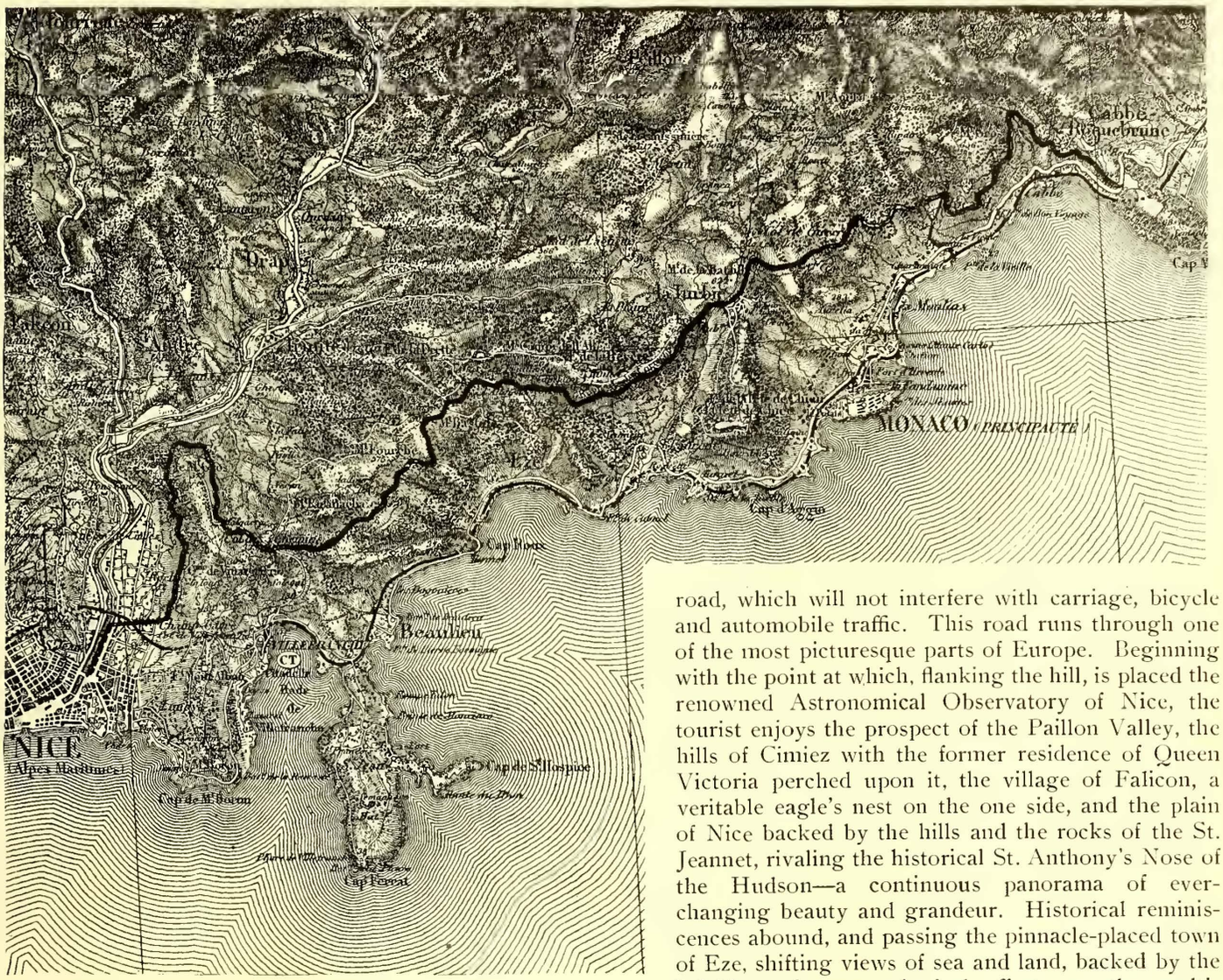
AUTO-TROLLEY OMNIBUS IN NORMAL POSITION ON STRAIGHT ROAD

These views show very clearly the great flexibility of the system for which such strong claims are urged by those familiar with its operation, and they also afford an excellent opportunity of forming an opinion as to the appearance of the overhead construction.

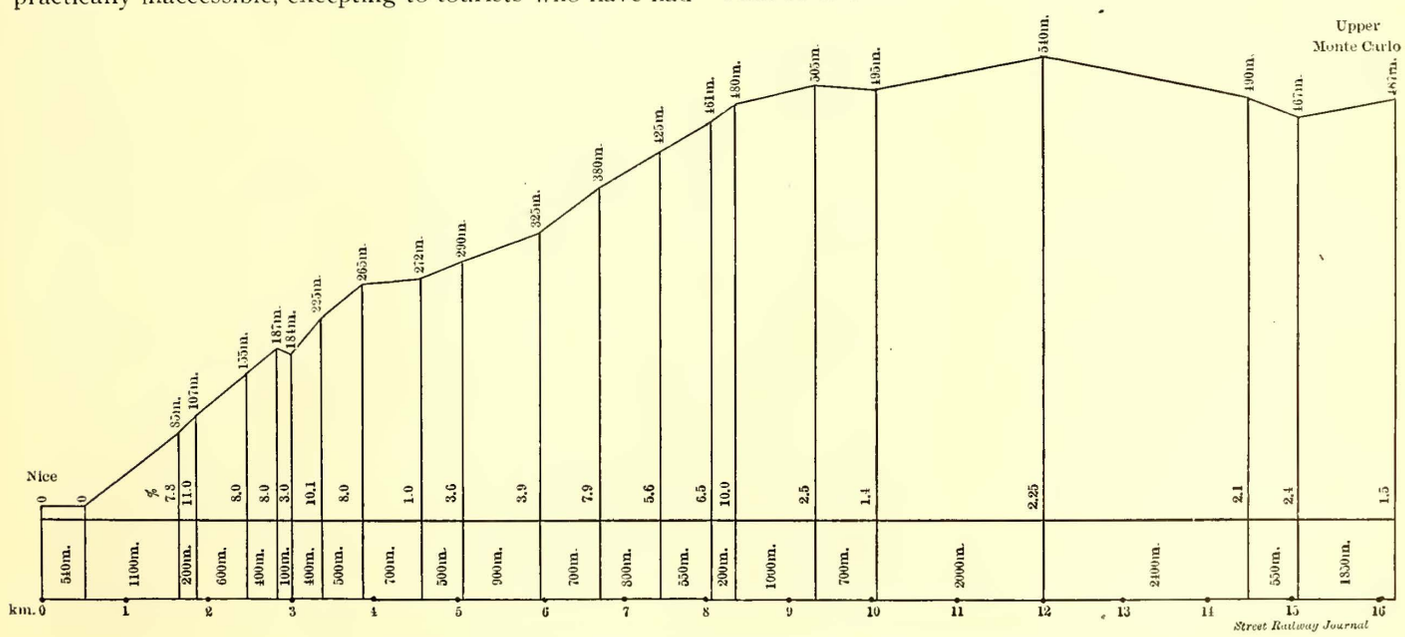
Trackless trolley lines can only be utilized to the best advantage along well paved streets, but it is not difficult to find thoroughfares that will answer the purpose in most European countries, even in out-of-the-way places and along the mountain roads. This is especially true in localities much frequented by tourists, where a trolley line, similar to those common in America, would be generally opposed, on the ground that it would be liable to detract from the natural beauty of the scene. In such places, the auto-trolley omnibus may find a distinctive field. It has already been installed in France at Fontainebleau, and at Eberswalde near Berlin in Germany, and now it is proposed to install an important line along the Corniche Road from Nice to Upper Monte Carlo. This, undoubtedly, will be the most important undertaking of this character that has yet been attempted, and will be of interest not only to

street railway men, but to American tourists and European travelers.

The Corniche Road was built by Napoleon I. and has been made famous by renowned writers, but it has been practically inaccessible, excepting to tourists who have had almost unlimited facilities, both in time and money. Consequently, it offers an exceptional opportunity for a well-built, properly-managed and luxuriously-equipped electric road, which will not interfere with carriage, bicycle and automobile traffic. This road runs through one of the most picturesque parts of Europe. Beginning with the point at which, flanking the hill, is placed the renowned Astronomical Observatory of Nice, the tourist enjoys the prospect of the Paillon Valley, the hills of Cimiez with the former residence of Queen Victoria perched upon it, the village of Falicon, a veritable eagle's nest on the one side, and the plain of Nice backed by the hills and the rocks of the St. Jeannet, rivaling the historical St. Anthony's Nose of the Hudson—a continuous panorama of ever-changing beauty and grandeur. Historical reminiscences abound, and passing the pinnacle-placed town of Eze, shifting views of sea and land, backed by the kaleidoscopic atmospherical effects on the multi-colored rocks of the Riveria and the cerulean Mediterranean form a trip of variety and of æsthetic attraction, unequalled elsewhere, in the opinion of travelers who have been so fortunate as to have made it.

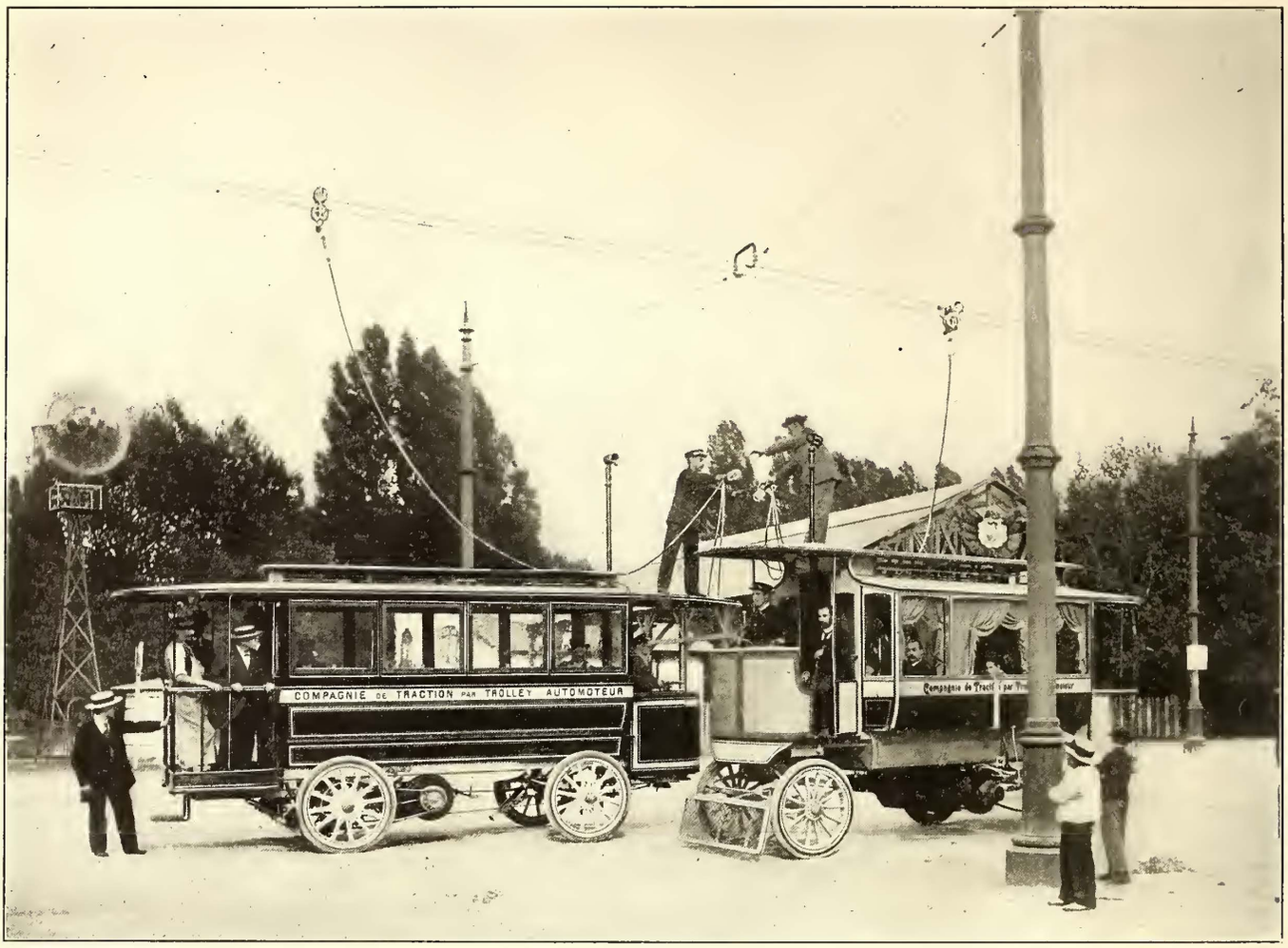


AUTO-TROLLEY OMNIBUS LINE BETWEEN NICE AND UPPER MONTE CARLO BY THE FAMOUS CORNICHE ROAD



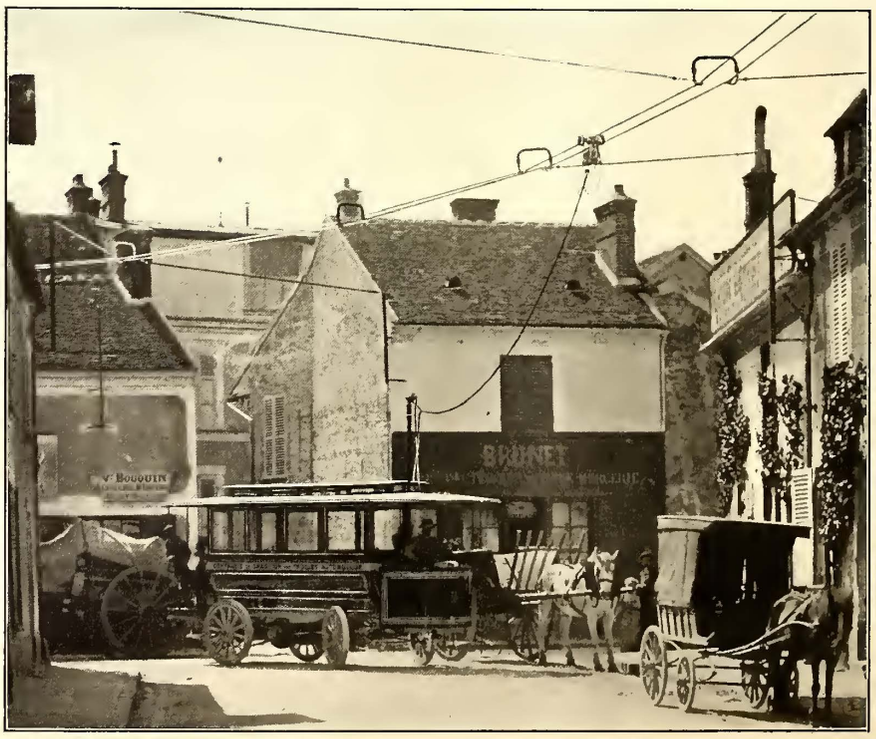
PROFILE OF ROAD BETWEEN NICE AND UPPER MONTE CARLO

Because of the historical associations and the surpassing beauty of the scene, the French people and the French Government have persistently refused permission for the building of a trolley line or other railroad that would necessitate cutting up the roadway, but consent was readily obtained for the establishment of an auto-trolley omnibus system of the Lombard-Gerin type, and a concession, or fifty-year franchise, was granted by the government to G. Sacco Albanese, an engineer of Nice, who has undertaken the completion of the road before the end of the present year. It is proposed to procure current for the operation of the line from the Mediterranean Power Company, which has an electric power station at Nice, and others at convenient points where water power is available for driving generators. This will greatly simplify the problem, as it will be necessary only to provide for the transmission and distribution of power, and no delay will be experienced on account of the building of a power house. Current will be furnished by the Mediterranean Power Company at 10,000 volts, and it will be transformed at sub-stations located at each end of the line and one midway, and then delivered at 500 or 550 volts to the motors. The overhead construction will be designed with a view to detracting as little as possible from the natural beauty of the scene. Special ornamental iron poles will be used within the city limits and wooden poles along the road out of town. The details of line construction are clearly shown in the accompanying cuts.



CHANGING CONNECTIONS WHILE PASSING

When the line is opened, the first of the year, twelve omnibuses or cars will be operated, and each car will be arranged to carry sixteen passengers, twelve seated and

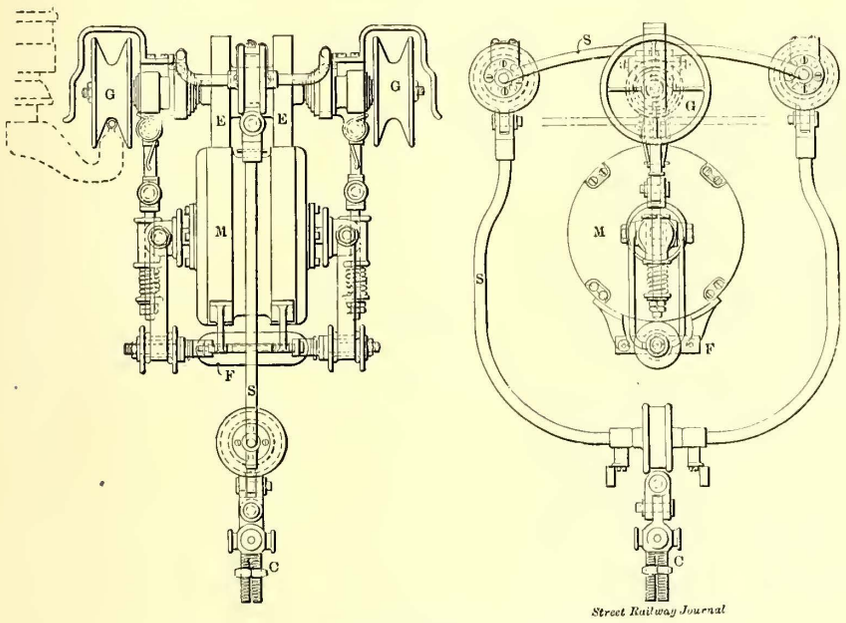


IN A NARROW AND CROWDED COURT

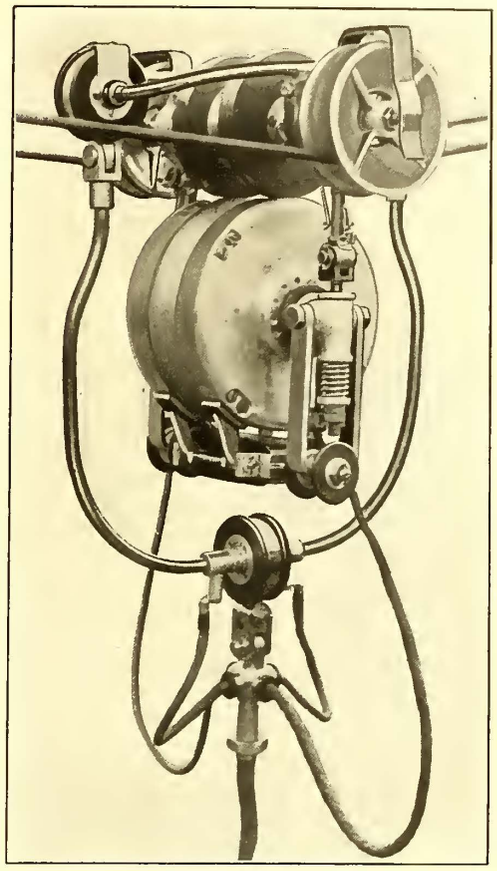
four standing. On other lines, larger cars have been used, the capacity of which was twenty-two, sixteen seated and six standing, but, in this connection, it was decided to keep the weight of the cars as low as possible, owing to the heavy grades all along the road. Mr. Albanese, who has furnished the information about this installation, estimates that the cost of construction for 20 km of line, including three sub-stations and equipment, car shops, twelve cars and all accessories for the operation of the system, will not exceed $200,000.

The system to be installed is a development of the Lombard-Gerin auto-trolley system of Paris, the principal feature of which is the auto-trolley attachment, or current collector, which comprises a small three-phase motor suspended between the two conducting trolley wires, set twelve inches apart and supported by ears fixed on a ⌒-shaped double suspension, which, as in ordinary underrunning trolley construction, is either hung between span wires or supported by a bracket. The motor is hung on a frame which supports, at the same time, two trolley wheels. It is of the fixed armature type, and its pole pieces impart a rotary movement through fibre friction wheels to the two trolleys which are on the same axle and run over the trolley wires. An even friction adjustment is obtained by the regulation of special suspension springs.

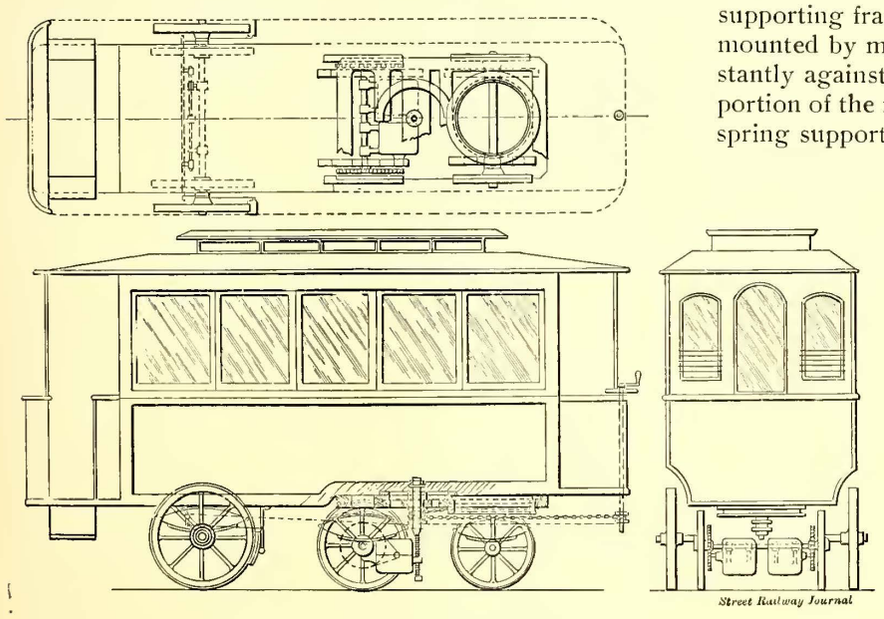
The design, construction and application of the collector are clearly shown in the half-tones and diagrams herewith presented. It will be noticed, by reference to the diagrams, that on the shaft which carries the trolley wheels, *G*, and between these and the hard rubber discs, *E*, is the supporting frame of the motor, *M*, on which the motor is mounted by means of springs which press the motor constantly against the hard rubber driving discs. The outer portion of the motor, and not the inner one, revolves. Two spring supports carry the armature shaft with which they are rigidly connected. The motor is very light, weighing with its accessories only 40 lbs., and is supported by two aluminum plates. The shaft revolves in ball bearings. Beneath the motor are four movable shoes, *F*, carried by an iron core supporting an induction coil, which is connected to the brake contact point of the controller. When



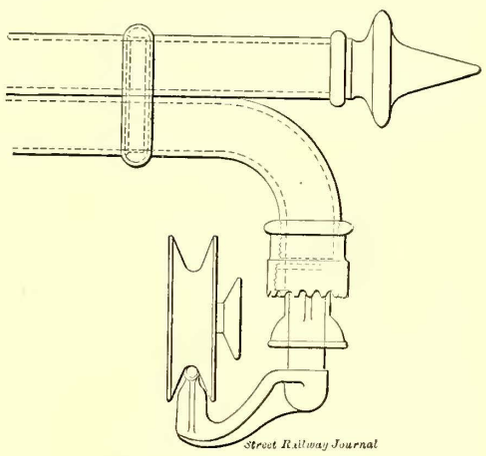
DETAILS OF LOMBARD-GERIN COLLECTOR



CURRENT COLLECTOR ON THE LINE



DETAILS OF CAR CONSTRUCTION

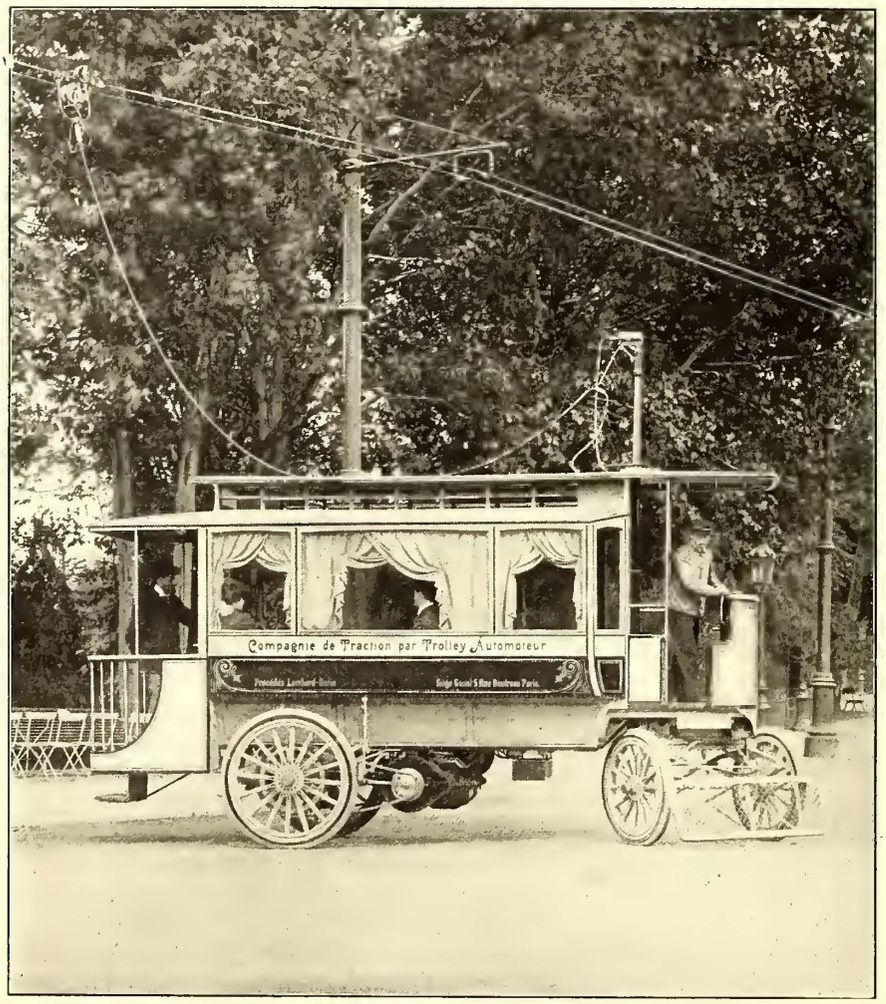


OVERHEAD CONSTRUCTION

current is sent into this coil the shoes are magnetized, and are attracted toward the revolving motor-frame, thus preventing it from turning. This, in turn, will clamp the collector spools and will prevent the contact carriage from rolling back, should the current be suddenly cut off while ascending a grade or when it is desired to stop on steep grades.

A flexible cable leads the current from the main line to the car and the three-phase current from the car to the little trolley motor, which is fed from the motors which run the vehicle. This is done by means of taps taken at the back of the armature and connected to three collector rings fixed on the shaft, as is usually done in ordinary rotaries.

As the speed of a three-phase motor is synchronous with the current feeding it, it is evident that the trolley motor runs automatically at a speed proportional to that of the motor on the vehicle. In this special case, the proportion of gearing has been so calculated as to allow the trolley motor a little lead over the car itself, in order to have the flexible cable at the proper tension, and this characteristic has earned for it the name of "blindman's dog," which describes, graphically, the respective positions of the trolley motor and the vehicle itself.



MAKING A SHARP TURN

Some very interesting data upon the design and construction of the Lombard-Gerin type of auto-trolley omnibuses has been contributed in a paper by Thomas Marcher, as a result of his practical experience with this apparatus. He points out that the cars for such systems partake of the characteristics of the omnibus and the ordinary street car, differing from the latter, principally, in being built much lighter and, of course, in a modified form so as to permit steering like the ordinary road wagon or automobile. The body should be constructed of wood and the frame partly of tubing and partly of wood. In distributing the load it has been found that the forward platform should be reserved for the exclusive use of the operator, and it is usually shut off entirely from the interior of the car, while the rear platform is only big enough to hold four to six persons, when the seating capacity is twelve and sixteen, respectively. This precaution is deemed necessary, so as not to cause an uneven pressure on the springs, which rest on the axle bearings. In order to get a uniform distribution of the weight in a varying load, compound springs, that is, spiral and leaf springs, are used. On account of these springs and because of the fact that the axles and the car body do not always occupy the same relative position toward each other, the power is not transmitted by means of gears, but by a chain. It has been found advisable to use seperate motors for each axle, and in this way the speed of each wheel is entirely independent of the others, while a wide range in speed regulation may also be obtained. Generally, series motors are used. They are built of light cast-steel, and, in the main, resemble ordinary street car motors. Both electrical and mechanical brakes are provided. The controller occupies the usual place on the front platform that it does on a street car, and it is operated in the same way by the motorman.

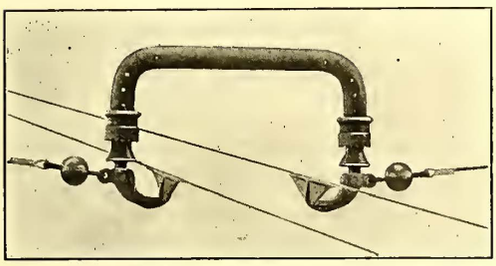
The wheels have wooden spokes and rims from 16 to 20 mm in thickness, and are supplied with rubber tires. It is common, however, to cover the wheels with ropes composed of aloe fibres, which insure good adhesion, especially on smooth roadways. The rear wheels are generally larger than those on the front axle, which are used for steering, and consequently have to pass under the car body. Two methods of steering are employed, namely, the common method of turning the axle about a king-pin, and the individual wheel method. A modification is shown in the equipment of a car, the details of which are illustrated herewith. In this arrangement it will be seen that a small pinion meshes into the large wheel, which has teeth cut around a part of its circumference, and is held in the car frame. A track is built around the king-pin under the car body. The vehicle is steered by means of the front axle, which is operated by the attachment mentioned.

The trolley wire can be suspended freely in the center of the street or on poles and brackets, the latter being, of course, the cheaper method. There may be either two or four trolley wires, including the return. On single-line roads, overhead switches are provided, or the cable may be exchanged when two cars pass each other, as is being done on two of the cars shown in one of the accompanying cuts. For this purpose there is a pin contact at the lower end of the flexible cable. It is proposed, on the Turbie line between Nice and Upper Monte Carlo, to have the trolley poles constructed so that they may be lowered, and thus the conductor will not be obliged to climb on the roof. When the traffic is heavy, a double line is installed. The lowest point of the trolley wire is 5 m above the ground and the pole is generally 8 m high. The normal

distance between poles is between 35 m and 40 m. The span and anchor wires are made of 5 mm steel, having a tensile strength of about 70 kg per square meter, while the copper trolley wire has a strength of 40 km. The insulators are designed especially for this service to stand heavy pull and pressure, and not absorb moisture. Soldering of the trolley wires is avoided, as special sleeves are used for connectors. The details of the overhead construction are very clearly shown in the accompanying cuts.

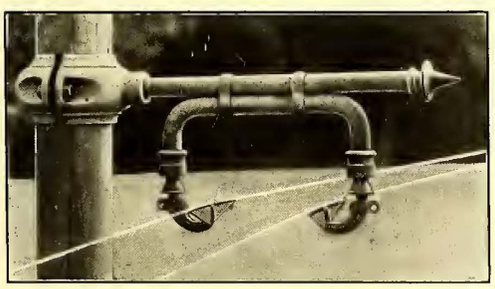
The cars are equipped with signal bells and the collectors are lighted by colored lamps, so that the direction in which the car is moving can be readily distinguished.

Mr. Marcher has made a series of tests of the amount of power required for operating cars upon trackless trolley lines, with the view of comparing the actual cost with that of systems employing rails, and he is convinced that auto-trolley cars must be built as lightly as possible in order to make a satisfactory showing by comparison. If the weight



OVERHEAD CONSTRUCTION, SUPPORTED BY SPAN WIRES

of a bus is as great as that of an ordinary trolley car, say 9 tons, three times as much power would be required to operate it, and for a wagon weighing as much as a car for



BRACKET SUPPORT

mixed service, namely, twelve tons, four times as much power would be consumed. The report of these tests indicates that accumulator cars are not adapted for trackless roads, and this assumption has been borne out by the records of performances in actual practice elsewhere.

Mr. Albanese has furnished some data upon the cost of operation of the experimental line at Fontainebleau near Paris, where a car was in service 110 days over 2.5 miles of road, making a total of 5,428 car miles, for which the following operating expenses were charged against it:

Cost of power at 3 cents per kw-hour.	$162.84 or .0300 per car mile
Repairs and care of cars and sheds, etc.	155.19 or .0286 per car mile
Employees (one man per car)	91.20 or .0168 per car mile
General expenses	61.51 or .0113 per car mile
Total	$470.74 or .0867 per car mile

The total receipts were $995.14 or 18.3 cents per car mile, and as the expenses were 8.6 cents per car mile, this left a surplus amounting to 9.7 cents per car mile to take care of interest and depreciation and pay dividends. The rate of fare charged, the possible earning capacity of the equipment under these conditions, and other items that would have a bearing on the problem are not given, but it is to be presumed that this is a fair showing, at least, for the plant.

Another installation, described by Mr. Marcher in his paper, offers some data of interest. This road is 5 km in length, and there are twelve cars operated under ten-minute headway on week days and five-minute headway on Sundays. The cost of construction and equipment is given as follows:

Five km of overhead construction	$15,000
Twelve cars	22,500
One car house and small office equipment	6,500
Transport, packing, interest, superintendence and incidentals	2,500
Totals	46,500

AUTO-TROLLEY LINE ON ROAD TOO NARROW FOR STREET RAILWAY

The following statement of the expenses and receipts for a year are given:

1.—Salaries:—	Expenses.	
	One superintendent and inspector	$750.00
	Twelve motormen at $300	3,600.00
	Two car cleaners at $225	450.00
	One machinist	300.00
2.—Office expenses, material and lighting of cars		500.00
3.—Repairs on cars and line		625.00
4.—Sinking fund and 10 per cent interest		4,650.00
5.—Taxes, uniforms, sick fund, etc		375.00
6.—Current:—		
(*a*) Sundays and holidays: 6-hp x 14 hours x 12 cars x 70 days x 2½ cents		1,764.00
(*b*) Week days: 5-hp x 14 hours x 6 cars x 295 days x 2½ cents		3,097.50
Total		$16,111.50
	Receipts.	
(*a*) Sundays and holidays		$11,025.00
(*b*) Week days		12,390.00
Total		$23,415.00

Meeting of the Association of Municipal Tramway Managers of Great Britain

The organization of the above association, which has already been announced in these pages, was completed last month, when the new association held its first annual meeting, July 3, in the Royal Agricultural Hall, in London. There was a large and very representative attendance. Mr. Young, of Glasgow, who had been elected president of the association, outlined in his presidential address the extent of the municipal tramway business in Great Britain and the plans and scope of the new association. Among other things he said:

"Municipalities in Britain now own and operate about 1200 miles (single track) of tramways, and have invested over £15,000,000 in these undertakings. This year, again, there are bills and orders before Parliament for further extensions of municipal tramway systems.

"What should be the objects of this association? First, I would say, the association is not formed in opposition to any other tramways association. On the contrary, I feel sure our desire, as individuals and as an association, is to work cordially alongside of other managers and associations so far as we have interests in common. I don't think there is, and there never should be, any jealousy or exclusiveness among managers, municipal or otherwise, in connection with the construction and working of tramways. So far as my experience goes, I should say the courtesy and readiness to impart information shown by tramway men is above all praise. And I mean the compliment to be international."

Following the presidential address C. R. Bellamy, of Liverpool, read a paper on "Some Traffic Problems." An abstract of this and the other papers presented at the meeting follow:

SOME TRAFFIC PROBLEMS

BY C. R. BELLAMY,

General Manager of the Liverpool Corporation Tramways

"In Liverpool under horse traction in 1897 (the last year of company management), with but few exceptions, a twopenny fare was the minimum, with an average stage of 2½ miles; to-day penny stages are in operation, covering, practically, the same distances. Under the general Act of 1870 Parliament imposed an obligation on promoters to carry workmen at a minimum fare of 1 penny per mile. Under recent powers conferred upon local authorities for the electrification of their tramways the rate is reduced to 1 halfpenny per mile, with a minimum fare of 1 penny. In Liverpool and other towns it has been found possible to apply this rate, or something better, to all classes of passengers, but still the public are asking for more.

"The question of how far a workman resides from his work is of no moment; the important considerations are: How many minutes need be occupied in covering the distance, and the cost of doing it. If we accept the principle that a wider distribution of the inhabitants in large towns is desirable, it is important that long-distance passengers should be specially considered, and that they should be carried to the outskirts, where land is plentiful, as cheaply and as speedily as possible. The cost is governed by the unit fare, and the speed, unfortunately, by the Board of Trade regulation, which I will deal with later.

"Dealing with the unit fare, it is reasonable that the short-distance rider in the heart of the city should pay relatively more for his ride, seeing that valuable time is saved to him as a result of the concentration of the cars from all routes in the central area, where there is always one at his disposal to travel from point to point in the business zone.

"It is frequently urged that if a passenger can be carried at the rate of 2 miles for 1 penny he can be carried for 1 mile at a cost of 1 halfpenny, and there would be weight in the contention if it were not for the considerations I have referred to.

"I have gone carefully into the question of the effect of the introduction of a halfpenny 1-mile stage on the traffic receipts in Liverpool for the purpose of arriving at a definite conclusion in the matter. I caused a census to be taken of the distance traveled by each passenger on a typical route over a short but fairly representative period.

"I found that of the total passengers traveling 91 per cent paid penny fares; of this number 30 per cent rode less than 1 mile, and 30 per cent less than 1½ miles. Of the latter it is fair to assume that under half-mile stages at least half the passengers in that group would take advantage of them by walking to the halfpenny limit, and I may, therefore, reasonably calculate that under such stages 45 per cent of the present penny passengers would pay halfpenny fares. On my present revenue this would mean a diminution of over £84,400 per annum.

"The principal argument in favor of halfpenny fares is that a great number of short-distance passengers are secured who would not pay a penny fare. I do not know whether an accurate measure has been obtained to substantiate this view, but as the result of my investigation, the figures prove that under such reduction an increase of 40 per cent, or 40,000,000 passengers, would be required to maintain the present traffic receipts; but having regard to the fact that a large increase in the rolling stock, staff and maintenance charges would be involved, it is not unreasonable to assume that an increase in the number of passengers carried of at least 50 per cent would be necessary to counteract the falling off in receipts.

"Having regard to the fact that we are carrying considerably over 1,000,000 passengers per track mile per annum in a city, the business center of which is on the river, with 200,000 people on the other side who are carried by boat, it is exceedingly unlikely that any such increase could take place, and the inevitable result would be that the long-distance passenger could not be given the advantages which he is allowed under the present system.

"I do not advance any strong objection to half-mile halfpenny stages, but I am convinced that, if they were introduced, the force of public opinion would make it impossible to resist the argument that halfpenny stages should approximate *pro rata* in length to the penny stages, and the disastrous results which I have proved would follow, and would certainly render it necessary to increase the fares very considerably on the longer stages. I submit the proposition that the unit fare and stage should be fixed, so as to secure that the passenger traveling to the outskirts of a large town, a distance of four or five miles, can be carried for a fare not exceeding twopence, and that this cannot be done with a halfpenny-mile unit.

"I have earlier pointed out that one of the main considerations in the minds alike of business men and workmen in selecting a residence is the time occupied in going to and from his place of business or work center.

"Under the present restrictions imposed by the Board of Trade one of the great benefits of electric traction—viz.: rapid transit—is very much reduced. I have frequently pointed out to official inspectors (whose individual courtesy and consideration I gratefully acknowledge) the unreasonable limitation of speed of electric tramcars, which are confined to a definite track, with brake appliances capable of bringing them to rest under almost any conditions in about twice their own length, to 6 miles, or 8 miles, or 10 miles per hour, whilst horse-drawn vehicles, which are entitled to use any part of the road, commonly travel at 10 miles or 12 miles an hour, and motor cars are allowed a limit of 14 miles an hour; and everyone is familiar with the cyclist, who is practically free from all speed restrictions

"What has been very aptly described by Mr. Trotter as 'journalistic sensationism' has induced the popular belief that electric tramcars are a source of untold danger to pedestrian traffic, and has filled the Patent Office with appliances, generally wrongly designed, to prevent accidents, which statistics have shown to be so rare as to be almost negligible.

"In Liverpool, with about 5000 cars running in and out of the city daily, and carrying well over 101,000,000 of passengers per annum, there were only during last year nine fatalities directly attributable to the running of tramcars, the ratio to passengers carried being one in 11,250,000, whilst under horse traction, in 1898, the ratio was one in 6,000,000; and I have no hesitation in affirming that the comparative risk to pedestrians has actually been reduced by the introduction of electric traction, and it certainly is noteworthy that as compared with nine persons killed by tramcars in Liverpool in 1901—each incident having a long and very often sensationally exaggerated press notice—thirty were killed during the same period by other vehicles, of which the public knew little or nothing, as they were scarcely referred to.

"As you are all aware, the Board of Trade has been approached on the subject of speed limitations, and I hope the members of this association will, after discussion, agree with me, as a result of their experience, that a maximum limit of from 15 miles to 20 miles per hour and a minimum of eight, excepting on crossings, curves and junctions, is safe and expedient.

"The third problem, which I think may be usefully discussed, is the question of—how best to secure greater comfort for outside passengers in inclement weather. When electric traction was introduced in Liverpool it was thought desirable to follow the Continental and American practice of adopting single-deck cars. The two main arguments in their favor were (first) that the speed would render outside traveling dangerous, and (second) that too much time would be occupied in ascending or descending the staircase. The first objection can only apply to one-half of the year, and the second was entirely met in Liverpool by adopting a staircase which enables conductors to refuse to stop the car excepting to the order of a person actually on the lower deck, as

the staircase can be safely used whilst the car is traveling at any speed.

"The fourth problem which I shall submit for your consideration, and which I shall make the last, having regard to the limits of human patience, is how to secure a full and speedy collection of fares. I think there is a general consensus of opinion that the box system has failed for the obvious reasons, among others, that no voucher is given for the fare, and no system of inspection can disclose whether a passenger has or has not paid.

"The bell punch and tickets, with a proper system of inspection, affords very great protection, but careful observation will disclose that a great many fares are missed, due either to the carelessness or cupidity of conductors or passengers.

"I have been very much impressed with the general honesty and care displayed by the majority of conductors, but in every large body of men there is sure to be a proportion that will take advantage, where possible, of any system, and I have found, unfortunately, that a small section of the public must be placed in the same category. Such persons soon familiarize themselves with the methods of open checking commonly in vogue, and manage to evade them, and after very careful consideration I came to the conclusion that this class of offense could be best dealt with by the detective staff of the police, and arrangements were made for a number of that body to be placed upon tramway duty. For the first few months they applied themselves wholly to the tramway staff, with the result that a considerable number of arrests were made, and convictions secured, and it was found that the fear of the unseen hand was the strongest possible deterrent, and pilfering by conductors, as far as any evidence could be obtained, was wholly stamped out, and the attention of the detective staff was devoted to a small but active section of the public, which was known to be evading its liabilities by very many ingenious methods, with the result that during last year over 400 persons were summoned or arrested, over half that number being for avoiding payment of fares.

"The effect has been exceedingly good, and has appreciably increased the revenue; the system is not only highly effective, but is very economical, as only four men are employed on the work, who are changed frequently to avoid any disclosure of identity, the total annual charge amounting to £400, which in Liverpool amounts to about £1 per car per annum.

"Passenger checking is an important part of tramway management. It is earnestly hoped that a free and general discussion will follow upon the problems raised."

POWER WORKING STATION

BY A. L. C. FELL,

General Manager of the Sheffield Corporation Tramways

"In the majority of tramway undertakings the tendency is to start by putting down a power station too small to cope with the expansion of the scheme which invariably takes place immediately after the routes are opened for traffic. As corporation rate-payers and company shareholders are very loth to put down their money for what they invariably call an experiment, it is necessary for the engineer to formulate in his own mind a complete scheme, and then see what is the least he can do with for a start. In all cases the original power station buildings should be so designed that they will form the nucleus for the extended buildings, the ends being built up in a temporary manner, so that they can be moved forward at a very small cost as extra plant is installed.

"In the writer's opinion it is a mistake to instal very large generating sets for a start. The size of the units should be gradually increased as the installation is extended, and they should be so arranged that two-thirds of the plant installed will do the maximum load. By this means much greater efficiency can be obtained, as large units have not got to be run when the load is very light, and the supply can at all times be regulated to meet the demand under more efficient conditions.

"It is important to see in what way manual labor in the power station can be replaced or reduced. In a small station this is not a very important matter, but in a large station great saving can be effected. Automatic coal and ash-conveying plants, stokers, and oiling arrangements are the most important items under this heading.

"The next point to consider is that of uniformity. This is very important, as it is on this that the question of spare parts depends. Wherever possible the wearing parts liable to require frequent renewal should be made interchangeable, and as far as possible uniformity of arrangement should be observed. All pipes, valves and connections to each set should be arranged as far as possible on the same plan. Also all switchboards and connections should be arranged in this manner, so that the attendants in the power station may be trained to work like machines, it will then be found that in a case of emergency requiring prompt attenton the attendants have not got to think, they simply act.

"Staff.—It is necessary to have a fully qualified electrical engineer in charge of the whole power station, and under him shift engineers, to actually run the plant. Until fairly recently the question of obtaining properly trained electrical engineers for the latter positions with a sufficient knowledge of mechanical engineering to take charge of the shifts was a difficult one. A low rate of salary being offered, only very inexperienced men applied, and these, although they might have had a very fair technical training, had no actual combined electrical and mechanical experience, so that in the majority of power stations it has been necessary to have an additional foreman to look after the more purely mechanical part of the plant. Happily, however, a new type of station engineer has arisen, viz.: the marine engineer who has given up seafaring, and has devoted a sufficient amount of time to electrical engineering to be able to deal with any ordinary problem that may arise.

"The wages question is getting a vexed one in power stations, but up-to-date machinery will gradually relieve the situation. At the present time trades union representatives do not appear to realize the fact that automatic machinery is doing away, to a great extent, with the necessity for skilled labor. For instance, taking the question of automatic stokers, if these are in operation, it should only be necessary, in a large power station, to have one leading fireman on each shift, and a few ordinary laborers to do any odd work that may be necessary. Before adopting automatic stokers it is necessary to consider whether the interest on the capital outlay and the cost of up-keep and operating the stokers will be balanced by the reduced cost of labor and the decrease in the cost of coal. The first item is not, but the second may be a large item, as automatic stokers require careful attention and fair treatment to make them efficient. In stations where boilers have been originally hand-fired there is naturally a very strong prejudice against automatic stokers, and they are not, sometimes, used to their best advantage. To get the full advantage of automatic stokers it is, of course, necessary to have automatic coal-handling plant, as the labor of placing the coal in the stoker hoppers costs nearly 60 per cent of the item for hand-firing, in addition to the time for looking after the stokers and driving gear. Cheaper and smaller coal can be used in automatic stokers, but it is found that where either forced or induced draught is in operation that a large proportion of the smaller coal is carried into the flues only partially consumed. Again, small coal invariably contains a greater percentage of non-combustible material, so that what is saved in first cost is spent in carriage and handling, this matter both before and after it has passed through the fires. It is a question as to whether it is advisable to use washed coal, as unless the coal has an exceptionally high calorific value, the effective heating capacity is greatly reduced by having to evaporate so much water out of the coal. The writer would strongly recommend the use of washed coal if coal merchants would only charge for the quantity of coal weighed out to the boilers after it has been stored in the coal bunkers in the boiler house for at least forty-eight hours.

"Oil Separators.—Extracting the oil from the exhaust steam from the engines, so that the water from the condensers may be again fed into the boilers, is of vital importance, as a small proportion of oil will often cause very serious trouble in the boilers. The oil forms a deposit, and it is quite possible that this may cause a collapse in the crown of the boiler, as a non-conducting film is formed on the plates, and they may become red-hot. There are numerous chemical-methods of dealing with this matter, but they are all somewhat complicated, and require very careful attention. Filters for taking the oil out of the feed water are practically useless, as a large proportion of the oil forms an emulsion with the water, and passes through the filtering medium, and it does not separate until it comes into contact with the heating surface of the boiler. One of the simplest and best methods of dealing with this question is by using a separator, consisting of a large tank placed in series with the main exhaust pipe. This tank should be of sufficient capacity to sufficiently reduce the velocity of the steam, so that all solid particles of oil and water will separate out and drop into the bottom of the tank. To assist the separation, baffle plates, formed of angle iron, should be placed in the tank. The oil and water in the bottom of the tank is drawn off by means of a pump, and only the dry steam is allowed to pass away to the condenser. The only difficulty in connection with this matter is that if the steam is exhausted at a very high temperature it is necessary to use a fine cold water spray in the tank to reduce the temperature, otherwise a fairly large proportion of oil would pass away into the condenser in a state of vapor.

The following table gives a few figures showing the growth of

the Sheffield Power Station, giving the number of units generated, and the cost per unit for each half-year during which the electric tramway system has been in operation. It will be noted that the cost of power per passenger carried has been fairly uniform. The increase during the period from Dec. 25, 1899, to March 25, 1900, was due to the difficulties experienced with snow on the tracks. It will be seen throughout that the cost of power per passenger is slightly more in the winter than in the summer:

Date	No. of Units Generated	Cost per Unit	No. of Passengers Carried	Cost of Power per Passenger Carried
1899. September 4th to December 25th	313,260	871d.	4,646,427	.05d.
1900. December 25th to March 25th	321,534	777d.	3,281,129	.07d.
March 25th to September 29th 1901.	1,002,664	758d.	16,550,287	.04d.
September 29th to March 25th	1,498,546	672d.	17,635,418	.05d.
March 25th to September 29th	2,281,359	493d	25,627,839	.04d.
Sept. 29th, 1901, to March 25th, 1902	2,803,085	433d.	23,177,816	.05d.

BRAKES FOR TRAMCARS.

BY C. J. SPENCER,

General Manager of the Bradford Corporation Tramways

"The brake question is, perhaps, one of the most important problems with which tramway managers and engineers have to deal, and I respectfully use this plea for venturing to trespass on the valuable time and good nature of this assembly with a subject that may be considered somewhat hackneyed.

"A standard brake equipment for all conditions and circumstances cannot, I venture to say, be at the present time admitted as possible or desirable, though I certainly think that something could be done in the way of settling the vexed question of what type or design of brake is applicable and advisable for given conditions.

"Local conditions may be broadly divided into two classes. Towns with heavy grades, and towns without grades greater than one in twenty. Brakes may also be roughly divided similarly:

(1) "Brakes which retard by applying friction between the car in motion and the stationary roadway, using the car wheels, and possibly the axles and gearing as intermediate links.

(2) "Brakes which are direct acting, in the sense that they are designed to create friction between the moving car and the permanent way or roadway, without intermediate connection or links of any description. The great disadvantage of all brakes of the former class, which, in future, I will call 'wheel brakes,' is that their maximum retarding effort is attained when the skidding point has been reached. Leaving sand out of the question for the moment, the skidding point of car wheels under certain conditions is comparatively low, with the result that a wheel brake on very greasy and slippery metals (by no means an uncommon occurrence on most lines) becomes next door to useless in retarding the speed of a car.

"Sanding the track from the car (thus increasing the tractive effort) is looked upon as a remedy, and so far as it goes is certainly effectual. Given a perfect driver (a very rare commodity) it may be considered satisfactory. Unfortunately the average tramcar driver is very much like his fellow man, by no means a perfect individual, and the less he is counted upon the better. An empty sand-box or a choked sand-pipe accounts for many street car accidents.

"The failure of a brake to act when applied does not always have the same result. It may be over-running a stopping place on a level track, or disaster on a steep grade. If, therefore, it is possible to operate brakes without danger of skidding the wheels, then I submit that it is desirable, that is, of course, providing that a corresponding disadvantage of equal magnitude is not introduced. The slipper or track brake is essentially designed to overcome this trouble of skidding wheels by applying the brake-shoe direct to the track instead of to the periphery of the car wheel. At first sight it would appear that no possible advantage could be gained by so doing.

"A skidding wheel and a sliding shoe are certainly one and the same thing, and no matter what sort of levers are designed to push down the shoe onto the track, the effective pressure on the shoe is limited to the weight of the car.

"The question therefore arises, is it new weight that is brought to bear on the slipper shoe, or is it simply transferred from the weight already in the car wheels? The answer is simple, for whatever downward pressure there is on the shoe it must have been taken off the wheels.

"However, whilst it is not practicable to change the material from which car wheels are made, and to employ some substance with a higher coefficient of friction, it is possible to construct the slipper brake-shoe from some such material, thus obtaining a greater retarding effort for the same weight.

"For the purpose of finding out exactly what does actually take place, I have made certain tests and trials with the brake equipments on an ordinary single truck, fifty-two passenger car, at Bradford.

"The hand brake was the standard Peckham form, the electric rheostatic brake of the ordinary type, and slipper brake of mechanical construction applied by a hand wheel on the car platform, driving through bevel gear a horizontal thread into a nut fixed to the pull rod of the slipper brake gear on the truck. The tests were conducted on a level track with a wet rail. The car was drawn by two ordinary cars through a dynamometer draw bar. A second dynamometer was connected to the pull rod of the slipper brake, from which readings the downward thrust of the

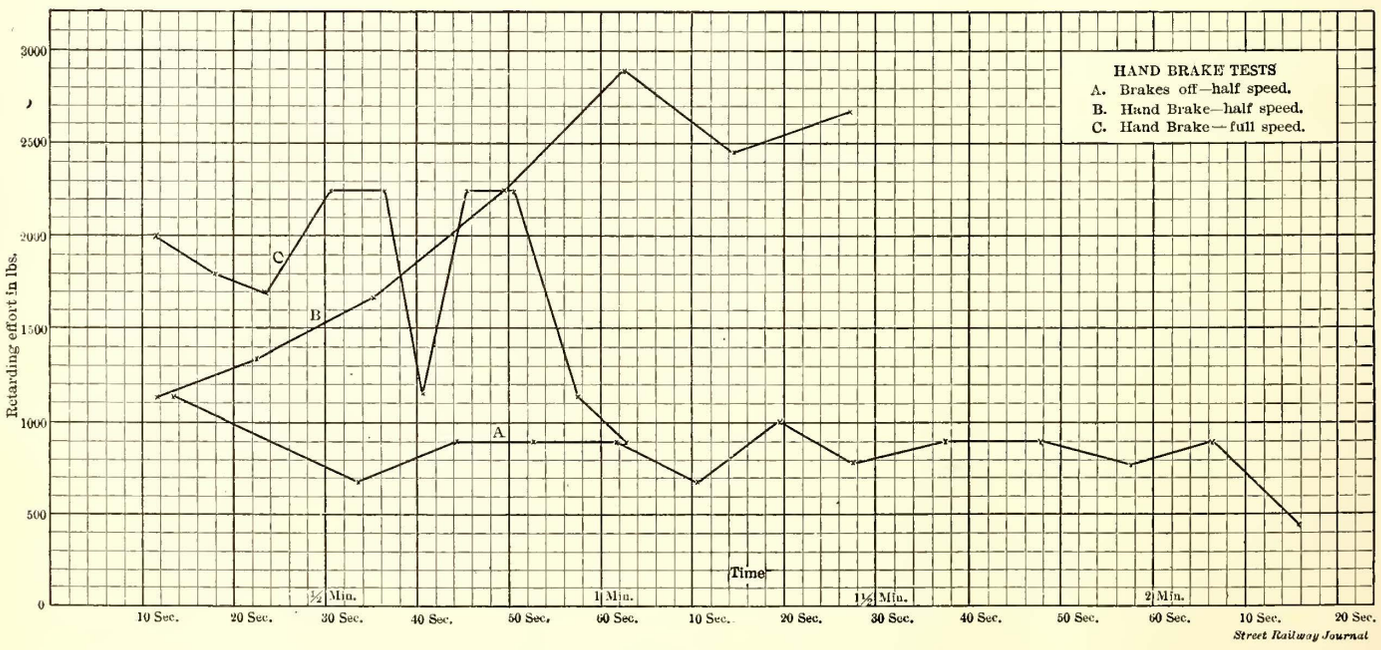


CHART NO. 1—DIAGRAM OF HAND BRAKE TESTS

wooden slipper block against the tramway rail was calculated. The downward thrust, and, consequently, the retarding effort of the slipper, will probably be considered low, compared with the hand brake. After considerable experience, however, I find in Bradford that the retarding effort is quite sufficient to control and stop cars on gradients, used in conjunction with the hand brake, varying from one in twenty to one in ten, under all conditions, without the use of sand. I further find that in practice the wet rail is the worst rail for the wood-block slipper brake, whereas, as is well known, car wheels bite almost as well on a wet rail as on a perfectly dry rail. The curves are almost self-explanatory, and will, I hope, provide useful data, and throw new light on the brake question in this special phase.

"Examining Chart No. 1, it will be noted that 'A'—namely, the frictional pull, plus gravity—averages about 850 lbs. at half-speed (I found it impossible to get reliable readings at full speed A maximum retarding effort was obtained with a slipper and a hand brake combination, when, with a downward pressure on the rails of 3150 lbs., and with the hand brake applied to obtain a maximum braking effort, a total friction of 3300 lbs., less 850 lbs., equal to 2450 lbs. actual, was obtained, thus showing an advantage of 400 lbs. over the hand brake alone.

"Were it not for the fact that the slipper brake takes a certain amount of weight off the car wheels, the combined effect of the brakes would actually have been 2050, plus 650, equal to 2700 lbs.

"From the above figures the true value of the slipper as a factor in the retarding effect of the brake equipment may be deduced under the worst conditions (for the slipper), namely, a wet rail.

"Unfortunately, time did not permit me to make further tests with a dry and with a greasy rail, respectively.

"I find, however, from experience, that a greasy rail cannot exist on steep grades where the slipper is in constant use, as the

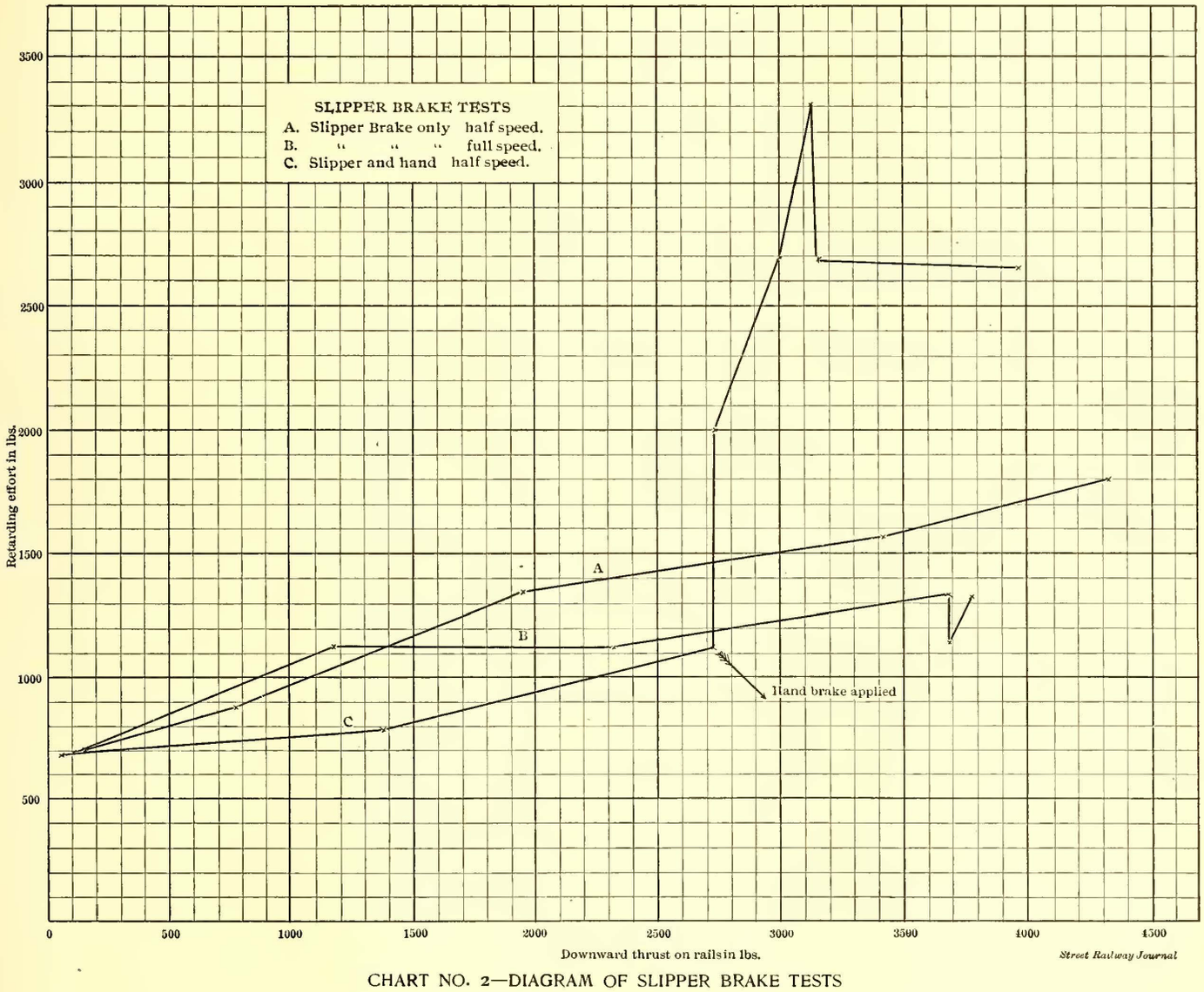


CHART NO. 2—DIAGRAM OF SLIPPER BRAKE TESTS

on the draw-bar dynamometer due to jolting), so that 850 lbs. must be taken from the retarding effort reading in the brake tests to obtain the true friction value of each brake and combination of brakes.

"Half and full speed are, I am afraid, vague terms, and may mean anything or nothing; but as they are to be used only in their relative sense, they will serve their purpose. The uneven nature of 'A' is due to the jolting between the two cars.

"In curves 'B' and 'C' the readings are steadier, due to higher tension on the draw bar couplings. At half-speed the hand brake was applied gradually, until a maximum was reached of 2900 lbs., less 850 lbs., equal to an actual maximum effort of 2050 lbs. on a wet rail. A little more tension was applied to the periphery of the wheels, locking them and causing them to skid, thus dropping the friction from 2050 lbs. to 2450 lbs., minus 850 lbs., equal to 1600 lbs. actual.

" 'C' shows the reduced friction at higher speeds, and the effect of locking the wheels.

"Chart No. 2 shows an interesting relationship between downward thrust of slipper shoes and retarding effort on a wet rail. rail is kept free from slime and dirt by the constant cleaning action of the wooden slipper blocks.

"The mechanical lever slipper brake is, in my opinion, useful only as an auxiliary brake in descending grades, and not as a separate working or emergency brake.

"My actual experience with slipper brakes is limited to mechanical designs, and I cannot, therefore, speak with certainty about power slipper brakes.

"I believe that compressed-air slippers are in successful operation in some towns, and I should be very glad to compare notes with tramway engineers operating power slippers.

"With large, heavy cars power brakes, both wheel and slipper, are necessary, but it appears to me very desirable that they should each be fitted with hand gear, in case of failure of the power at critical times. For example, a driver may have descended a certain heavy grade 999 times safely with a power slipper brake, and on the 1000th time something may happen to prevent the efficient working of the compressing plant.

"If it were possible to hold the brakes on by mechanical means, all danger would be averted.

"It seems to me, therefore, that it would be a good thing to work ordinary mechanical geared brakes with power, leaving the hand gear on the car platform, as at present, for use in cases of power failure.

"The electromagnetic slipper brake seems to overcome many disadvantages inherent in the ordinary slipper brake.

"The downward thrust on the slipper blocks can be carried to a dangerous point—namely, until sufficient weight is not left on the car wheels to keep their flanges in the grooves of the rail.

"With the electromagnetic brake, this is not altered, as the brake is applied. In towns where the grades are sufficiently easy to allow the wheel brake to control the car under any conditions, I should consider the electromagnetic brake admirable as a non-wheel skidding quick-service stop brake.

"Where, however, the grades are heavy and dangerous, and a failure of the slipper brake would mean a runaway car, I think I would prefer to pin my faith to a simple mechanical slipper, worked ordinarily by power, if desired, and not to a brake liable to derangement by a shorted armature or a faulty cable.

"I am afraid that my matter is somewhat crude and decidedly unorthodox, but I hope that the data may be of use to some members of the tramway industry."

NOTES REGARDING PRACTICE ON SOME AMERICAN TRAMWAY SYSTEMS

BY J. B. HAMILTON,

General Manager, Leeds Corporation Tramways

"Our worthy and most energetic secretary has insisted on my giving these disjointed remarks a title. Well, there is no use in our having a secretary if we do not obey him, and, consequently, I have dignified my observations of a private holiday trip across the Atlantic with a title, taking care, however, that it was sufficiently comprehensive as to enable me to range over all the subjects which call for so much of our time and attention on this side of the ledger. In drawing our attention to this group of headings, of which most are sufficiently important to have required your sole consideration, I do so more with the intention of giving point to general interchange of opinions than in the hope of being able to offer you any new views. Indeed, the inception of the paper was primarily intended more for the purpose of giving you a brief epitome of some of the salient features which a hurried tour over the principal tramway undertakings in the Eastern half of the United States enabled me to make during the month of April last. At that time I found myself in the, to me, unusual position of being able to snatch four or five weeks' holiday, and having during the preceding two and a half years had some experience of the costs and difficulties which are met by everyone in the operation of electric traction, I felt that pleasure and information could be combined in a visit to those cities which had so many years' longer experience of this form of traction than the majority of us have had on this side. Through the kind offices of friends in New York I was enabled to present introductions to the managers of all the principal systems in the cities which I visited, and was received with a frank kindness and courtesy which seems characteristic of our brethren on the other side. Everywhere the utmost attention and opportunity for gaining information was afforded, and I desire to record my heartfelt appreciation of the hospitality and desire to show everything and answer any query which was shown to me by everyone. The time at my disposal, about twenty days, enabled me to visit and learn something of the systems in the following towns: New York, Brooklyn, Boston, Buffalo, Toronto, Detroit, Cleveland, Pittsburgh, Washington, Baltimore, Philadelphia and New Jersey. Whilst the principal object of my visit was generally looking over the organization and methods of management to obtain information on (1) track maintenance (2), care of equipment (3), interchange of traffic and (4) power station labor, I did not confine myself to these subjects, but was prepared, when time permitted, to examine transportation arrangements and the various items under general expenses, from the salary of vice-president, or general manager, downwards. In fact, if I may put it colloquially, I had a general look round.

TRACK MAINTENANCE

"The difference in the surface appearance of track in this country and the United States will be familiar to you all. Whilst in many cities the track seems to be kept in admirable order, there are still a large number in which the track in many parts is in a very bad state of repair, loose joints and worn rails being quite common. This is, I think, largely owing to the fact that only recently consolidations have taken place, by which a number of companies have been grouped into one. Probably foreseeing this has been likely to take place, the former owners have not maintained the track in first-class condition. In this connection I may state that the paving, where that is done, is frequently in a state which no public authority in this country would tolerate. The most economical and efficient methods of repairing track is a question which is necessarily being seriously considered at the present time by every street railway manager upon whom I called. Owing to my visit having taken place early in April, which is immediately after the winter is over, I had not an opportunity of seeing any joint repairing in process. Briefly, there are four methods of performing this work, which were referred to.

CAST-WELDED JOINTS

"In one city I had the opportunity of seeing some track which had been done on this system, and, after two years' wear, it seems on the surface to be fairly good. There is no doubt that some weldings which had been performed when the method was first experimented with had not proved quite satisfactory, but improved methods are now being adopted, which, it is hoped, will result in more perfect joints being formed. These facts, no doubt, account for the varying opinions expressed to me by responsible managers.

ELECTRIC WELDING

"This form of welding joints has been adopted in several cities, and in Buffalo I had an opportunity of seeing a very considerable quantity, as they have over 30,000 joints distributed over 109 miles of track. In a recent communication from Mr. T. E. Mitten, the general manager, he says this method of welding has been very satisfactory indeed. The number of broken joints since the contractors removed their welding plant has been about 1 per cent. The welding heat is so concentrated in the web of the rail that the steel in the head is not affected. The electrical engineer states that the electrical return has been very much increased. There can be no question but that, barring broken joints, the efficiency of the joint as to conductivity is all that can be required. The disadvantages of the joints are, the increased time that tracks in process of reconstruction or welding are out of service; an electric welding plant occupies the track, or a considerable portion of it, night and day, until the welding is completed. If the tramway company has not an electric-welding plant of its own, the cutting in of broken joints is an expensive matter. Broken joints can be rewelded at a small cost, but if cut out, and a short piece of rail inserted, it becomes expensive. The feeling has been with this company, after three years experience, that any new girder rail constructed should have the joints electrically welded. Arrangements had just been completed for laying a considerable portion of new track during the present summer, and this was all to be electrically welded. Certain precautions are required in preparing the rails for welding, and when these are observed they are quite satisfied that this low percentage of breakages will be reduced. It is estimated that the cost per joint will be about £1. Speaking generally, those who have had experience of electric welding were very favorable to this method, and it was considered that when the improvements in the methods of preparing the rails are observed in operation, that electrically-welded joints on tracks of not less than one in sixteen grade would become largely used. One experienced manager was of opinion that when the grade was less than this the weight would tend to lessen the advantages of the welding.

CONTINUOUS RAIL JOINTS

"In Detroit this method of repairing joints is being largely used, and I saw a considerable portion of track in fair order which had been well worn before being repaired in this fashion. This form of continuous joint is supplied by the Continuous Rail Joint Company, of Newark, N. J., and I must refer you to them for particulars. In cases where joints have become worn down and afterward repaired by continuous joint, it was necessary to grind down the rail so as to taper off the worn portion. This was done by an electric grinder, and when the joint is stiffened up, lessens the jolt, and tends to prevent it coming loose again. In Philadelphia I had an opportunity, by the courtesy of Mr. Twining, the chief engineer, of seeing a form of joint repairing which he is presently experimenting with. As a full account of it is given in the Street Railway Journal of this year, I need not describe it beyond saying that those responsible for it are highly satisfied with the result of their experiments so far, and are, indeed, quite satisfied that they will be able by this means to repair a large portion of the track as well as probably adopt it when laying new track. Whilst speaking on this subject, I may state that in Leeds an experiment has been made of welding two joints in a new piece of track, which is just about to be run over, by means of a chemical preparation which fuses the metal. I had not an opportunity of being present when the process was being gone through, but have since inspected the joint, and on the surface it appears to be perfectly solid. Should it prove satisfactory it seems to me to be a very handy method of repairing old or welding new joints. Of the importance of this class of work I do not need to speak to the practical gentlemen I see present. In my opinion it will within

the next few years form a matter for serious consideration in many cities in which, up to the present, owing to the track being newly laid, it has not been necessary to go into the question.

CARE OF CAR EQUIPMENT

"This was a subject to which in every place I gave a considerable amount of attention, as it is one which I felt it likely that much valuable information as the result of long experience might be obtained. In many points the practice of the different rolling stock superintendents was very much opposed. In some cities they were of the opinion that equipments should be examined every three or four days, and overhauled certainly not more than every two months, whilst in other cities they were quite prepared to merely inspect them once a week, and overhaul them only when the armature bearings required renewal. Speaking generally, about one man to every seven cars is the custom. Nearly everywhere the cars are brought from the different depots to a central point for everything but the most elementary repairs. There is no doubt that the very most is got out of the plant they possess, and in some of the very largest systems practically no spare cars are allowed, so that in the rush hours every car may be on the route, except those undergoing a large repair. Very close and accurate account is kept of repair works done by each man, and thus bad work is easily traced to the repairer. Everywhere in the car repair shops the utmost attention is given to the use of labor-saving appliances, alike in wood and iron-working machinery. The comfort and convenience of those employed are exceedingly well cared for by the provision of light, airy messrooms and lockers for keeping clothes. The varieties of equipments in use vary from the very earliest to the most modern, and the ingenuity and patience of the car works' managers are taxed to the uttermost to keep the plant (much of which is now practically obsolete) in working order. The result is that a very considerable staff for electrical repairs has to be maintained. In the majority of cities this work is done by the piece, and very satisfactorily. In Brooklyn all the overhauling work on trucks is likewise carried out on stated terms. The jobs are divided into seven: 1, Overhead truck frame; 2, Overhauling and taking out and replacing wheels, so much for each pair, single truck; 3, Taking out and replacing pony wheels of double truck; 4, Overhauling motor and replacing armature and fields; 5, Replacing brake beam; 6, Replacing shoe-brake; 7, Replacing journal box. The prices paid are. For overhauling truck, about $2; for overhauling motors, $1; replacing wheels, 50 cents; replacing pony wheels, 30 cents; replacing brake beams, 40 cents; replacing brake-shoes, 60 cents. Of course closer inspection as to the quality of the work is required than if the work was done on time, but, on the whole, I am satisfied that it is the most economical method. In many of the larger cities the trolley wheels and all overhead material, except trolley wire and spans, is made by the operating company from their old material, and everywhere the very closest attention is paid to the avoidance of leakage on scrap, and to getting the contracted amount of wear from wheels and other purchased parts. I must confess I was much disappointed with the outside finish of the average street car. The inside is quite up to practice here, but the outside is neither so highly painted and varnished, nor are they kept so clean as we keep them. In fact, it is only customary in most places to wash them, and that with water, once a week. The insides, however, are kept very clean, being swept out every night and disinfected. In this connection I may say that everywhere there is the most scrupulous observance by passengers of the spitting prohibition. How much this restraint may be due to the boldy-printed notice of a fine of $500, which is put up in every car, I cannot, of course, say. Generally speaking, the arrangement for repair and maintenance of overhead lines are the same as here; but in Detroit I had an opportunity of seeing their organization, which seemed very perfect. By arrangement, whenever a fire alarm in any part of the city is rung, it signals, in addition to the fire station, the emergency depot of the tramways, the offices of the various newspapers and the police department. Whenever the call is within a half-mile circle of the center of the city, the wagon goes out at once. When the call is beyond that they await the summons of the division superintendent. Each wagon, in addition to ordinary jacks, etc., carries two cross-overs, which can be laid in three minutes each.

POWER STATIONS

"As much of the station apparatus for producing direct current has been in operation for a period of from eight to ten years, during which practice has varied considerably, it was extremely difficult to get anything like standard practice with regard to the number of attendants who were required for the work. Generally speaking, however, the intention seems to be to adopt the three-phase system at a more or less early date, and in doing so it will be necessary for the various companies to very considerably modify their present power station practice, and to scrap large quantities of their generating plant. In most of these cities the early practice of carrying the feeders upon poles is still maintained, but in Baltimore they are presently transferring these to conduits, and in Philadelphia this has already been completed. At the present time I may, therefore, say that the power station practice is in a state of transition, and that a visitor, two years hence, will probably find alternating current being generated in most of the large cities. In New York, as I have said, this system of generation and distribution has already been adopted, with the happiest results. Eleven engines are at present in operation, and a more compact, economically-operated station it is impossible to find.

TRANSPORTATION

"I think there is only one other point to which I wish to refer, and that comes under the heading of 'Transportation.' It is the method which obtains in many cities of arranging the duties of the motorman and conductor. In almost every case the route is arranged to touch at some point, preferably the terminus, the car depot or an office where the cash for the run is paid in. Sufficient running time to perform the journey is allowed, but no lying time; they simply turn the car round and proceed with the journey. When, however, they reach the point at which the money is paid in, if the journey is sufficiently long (say two hours), they step off the car, and a motorman and conductor, who are in waiting, immediately proceed with it for another journey. If the round journey is shorter than indicated, they may do two round trips. Those men leaving the car are allowed about five minutes, or as the service may be arranged, and take up the car which is then due. This goes on until the time for which the meal hour is arranged, when they stop off for, say, an hour, and then take up the car due at that time. By this means the maximum amount of service is obtained from the running plant, and employees are allowed sufficient time to get off, and it is possible to arrange for the meal hours at the best times. The men are usually paid by the hour, and in conjunction with this system it is easily possible to divert traffic in any direction, and to supply a sudden demand, without upsetting a rigid system of relief, whilst keeping, by means of trip sheets or way bills, a perfect record of the work done. It is exceedingly difficult in the time at my disposal to fully explain this matter, but I shall be glad to go more completely into the question, should anyone present wish me to do so. With regard to speeds, I am of opinion that the maximum speeds between the stops in cities is not greater in most American cities than it is here, but a higher average speed is obtained by the acceleration from a stop being quicker performed. Indeed, this is a marked feature in street work—no sooner is the first notch applied, and due speed attained, than the other notches are piled up quickly, so that, where the distance between the stops is 200 yards, the controller will be on top notch of speed (with a clear good track) before the car has covered the first 25 yards. The average speed granted in central parts—and they do not speak of anything else but average speeds—in cities is 8 miles per hour, and I am of opinion they make more stops in the very busy cities, such as New York, Boston, Pittsburgh and Philadelphia, than we do in the average city here. They fully maintain the average speed of 8 miles. Outside the cities, of course, much higher speeds are permitted and maintained. In the foregoing remarks I feel I have not been able to place before you anything of a very substantial or controversial character; but as the subjects themselves are very important, bearing, as they do, so closely on our everyday work, I trust that in the course of the discussion many interesting points may be raised. In that, I feel, will largely lie my justification for detaining you with my remarks."

The members on the evening of July 3 enjoyed a dinner at Agricultural Hall, by invitation of the promoters of the exhibition, and on the evening of July 4, after a visit to the Shepherd's Bush station of the Central London Underground Railway and to the Chiswick power station of the London United Tramways Company, dined together at the Star and Garter, Richmond.

Convention of the Incorporated Municipal Electrical Association

The seventh annual convention of the Incorporated Municipal Electrical Association was held in London, July 2-5, some of the meetings being held at the Institution of Mechancial Engineers and others at Berner's Hall.

At the first session, on July 2, Sir John McDougall, chairman of the London County Council, welcomed the members to London. He pointed out that the convention was of great importance in finding out the very best means of locomotion for London and the other large towns, of which there was great need.

John H. Rider, electrical engineer of the London County Council Tramways, in his presidential address stated that the association was now representative of nearly 150 municipalities. In 1895, when it was founded, there were but five electrical street tramways in Great Britain, all, except Blackpool, owned by private companies. At present there were thirty-six owned by municipalities, and sixteen in course of construction. With three exceptions the whole of those were worked by the trolley system. Overhead construction cost about £5000 per mile of single track, including rails and paving, while surface contact construction cost £10,500, and conduit construction £13,500. Owing to æsthetic considerations, Washington, Paris, Berlin and other places adopted the conduit system in the center of the town, with the overhead system outside, and several corporations, including Bournemouth, had done the same thing; but it was really not worth while. It was true that the examples of overhead construction to be seen in several towns in the United Kingdom were anything but pretty, but that was the fault of the designer, and not of the system. It was perfectly easy and practicable to erect an overhead line which would look well in any locality. Neat, and even artistic, work cost very little more than rough and unsightly work. With reference to guard wires, the Board of Trade had recently issued a new set of regulations based practically upon those adopted by the post office In order to hear the views of the various tramway authorities upon these regulations a conference was held on June 20 last at the offices of the Board of Trade. On the advice of the officials of the post office and of the National Telephone Company, the Board refused to allow the principles of guard wire protection to be discussed. Guard wires might be a protection in a few cases, but in the large majority they were the means of causing the very accidents they were intended to avoid. They were a constant trouble to maintain, and were very liable to break when heavy telegraph or telephone wires fell upon them. The root of the matter was to prohibit entirely uninsulated wires of any kind to cross the trolley wires. If telegraph and telephone wires must be erected overhead, they should only be allowed to cross the streets at right angles, the spans should be kept exceedingly short, and the wires carried as high up as possible, in order that a broken wire might not reach the street. They should be insulated at such crossings, and if guards were insisted upon in addition they should be provided by a netting under the telephone wires, and not over the trolley wires. The recent accidents which had happened in Liverpool and other towns had been caused just as much by the telephone wires as by the trolley wires, but in the mind of the public they were called trolley wire accidents, and nothing else. If local authorities would insist that all telephone wires should be placed underground there would be no necessity for guard wires or such unsatisfactory half-measures.

Papers were then read on "Double-Current Generators and Their Application," by Mr. E. T. Ruthven-Murray, electrical engineer to the Willesden District Council, and on "High-Tension Continuous-Current Systems," by Mr. A. S. Barnard, of Hull.

Mr. E. T. Ruthven-Murray referred to four power stations in England in which double-current generators are being installed; the largest being that of the Mersey Railway, which will contain three double-current generators of 1200 kw each. These machines will have thirty-two poles, will run at 94 r. p. m., and will have on the a. c. side a frequency of 25 per second, and on the d. c. side a voltage of 650. He then described two 300-kw double-current generators being installed by himself. They can be separately or shunt excited, will have twelve poles and will run at 250 r. p. m. He considered that there was an excellent future for double-current machines.

In the afternoon visits were paid to the generating station of the Central London Railway at Shepherd's Bush, to the generating station of the Metropolitan Electric Supply Company, Willesden, and to the works of the Incandescent Electric Lamp Company at Wood Green. The start was made in brakes from the Westminster Palace Hotel, the headquarters of the association while in London.

On July 3 a visit of inspection was made to the tramways exhibit at Agricultural Hall, after which the association was entertained at lunch by the exhibition committee.

After lunch an adjournment was made to Berner's Hall, in Agricultural Hall, when the following papers were read and discussed: "Steam Turbines," by S. E. Fedden, city electrical engineer of Sheffield, and "The Correct Type of Engine for Large Generating Stations," by A. A. Day, borough electrical engineer of Bolton.

Mr. Fedden, who is now installing at the Sheffield power station some 1500-kw turbo-alternators, said that he considers the following main factors to be considered in laying down a steam turbine plant:

First.—Good vacuum in the condenser. This, he says, is even more necessary than with an ordinary engine, as the makers claim that the turbo expands the steam right down to the vacuum of the condenser. The following table of actual tests, taken on a 500-kw set, is quoted to show how important it is to obtain a high vacuum:

CONSUMPTION OF 500-KW TURBO ALTERNATORS, RUNNING AT 2500 REVOLUTIONS, WITH 140 LBS. STEAM PRESSURE AT THE STOP VALVE AND NO SUPERHEAT.

Vacuum Constant from Full Load to No Load	Consumption per kw-hour			
Inches of Mercury	Full Load	Half Load	Quarter Load	No Load
29	----	----	----	1,500
28	22.2	25.6	32.4	1,700
27	23.1	26.9	34.5	1,900
26	24.0	28.2	36.6	2,100
25	25.1	29.7	39.0	2,300
24	26.2	31.2	41.2	2,500
23	27.5	32.9	44.8	2,700
22	28.9	34.7	46.3	2,900

Second.—Arrangements for high superheat, as tests show that with 50 degs. F. of superheat, there is 8 per cent, and with 100 degs. F, 12 per cent economy in steam consumption. From the tests taken on the 1250-kw steam turbine sets, which are now working satisfactorily at Elberfeld, in parallel with Sultzer engines, where the speed ratio is something like 16 to 1, it was shown that there was a gain of 12 per cent with 55 degs. C. superheat, and that every inch of vacuum improves the steam consumption by 4 per cent. It was also shown that the steam consumption in the turbines, other things being equal, decreased constantly with increasing loads, whereas the Sultzer engines showed a less economy over three-quarter load.

The steam consumption in a turbine closely follows the right line law, or is proportional to the load added to a constant quantity which represents the consumption of steam at no-load.

In discussing the correct type of engine for large generating stations A. A. Day stated that the type which he considered most desirable was the horizontal slow-speed, compound or triple-expansion engine. Such engines, in mill work in Bolton, are giving an ihp-hour for less than 0.1*d.*, with coal at 7*s.* per ton, and this on a load having a variation of 10 per cent. Two other papers were also read on subjects connected with electric lighting.

On Friday, July 4, a general meeting was held at 10 a. m. at the Institution of Mechanical Engineers, Storey's Gate. The following papers were read: "Some Notes re Earthing," by H. Faraday Proctor, city electrical engineer, Bristol; "Two vs. Three-Wire Distribution," by J. F. C. Snell, borough electrical engineer, Sunderland, and "High-Tension Continuous Current Systems," by A. S. Barnard, city electrical engineer of Hull.

Mr. Barnard made a plea for the use of high-tension direct current for power transmission systems, especially for railway work, where alternating current would have to be converted to direct. The direct-current step-down transformers have both high and low tension windings on the same armature, and are started as motors on the high-tension side from one central switchboard, and are switched into circuit on the low-tension network by means of electrically controlled switches, also operated from the central switchboard. Transmission systems of this kind or modifications of it are in operation in Oxford, Wolverhampton, Moore Camp, Barrow-in-Furness, Manchester, Hull and elsewhere. At Hull the main generators are of the four-pole type, and have an output of 510 kw each at 2250 volts. Recent tenders for a 480-kw enclosed engine and three-phase generator, running at 375 r. p. m., were on a basis of £9 1*s* 6*d* per kw, while for the high-tension direct-current generator and engine of 510 kw and 270 r. p. m. were on the basis of £8 6*s* per kw. He also quoted recent prices on a high-tension direct-current transformer, and a three-phase to direct-current motor generator, indicating a saving of nearly 25 per cent for a 90-100-kw unit.

During the afternoon visits were made (alternatively) to the generating station of the City of London Electric Lighting Company, Ltd., at Bankside, or the conduit tramway construction on the Tooting lines of the London County Council, by invitation of the contractors, Messrs. J. G. White & Co., Ltd. The former station supplies both alternating and continuous currents for public and private lighting in the city of London, and is one of the largest of the kind in Great Britain.

In the evening a very popular and successful smoking concert was held at St. James' Hall Restaurant, Regent Street. The artists included Thos. H. Harrison, Dr. Byrd Page, T. E. Gatehouse and others, and was largely attended. The business meeting of the association, which was held on July 5, concluded the sessions for the year.

Visit of the Transportation Committee of the Chicago Board of Aldermen to New York City

As readers of this paper are aware, the broad subject of a complete reorganization and improvement of the local transportation facilities of Chicago has been under consideration for some time by the authorities of that city. The history of this movement, which it is expected will be of incalculable benefit to Chicago, is so recent that it is hardly necessary to review it here. It might be said, however, that an extended report of the committee on local transportation, of the Chicago aldermen, which went very thoroughly into the relations of the city with the railway companies and which outlined the steps to be taken in the opinion of the committee, was presented to the mayor last December. Briefly, the report recommended a unification of the downtown terminals, so that an interchange of traffic between the principal surface lines could be affected, and the introduction of a subway by which the congestion on some of the downtown streets could be reduced by the removal of the railway lines to below the surface. This plan was approved by Mayor Harrison last January in his message to the City Council, in which he also made further recommendations which, if carried out, will demand a complete reorganization of the transportation systems of the city. Realizing, however, that before taking any radical action in the direction of one plan or another, it was advisable to investigate the transportation situation in other cities, the city authorities decided to send a delegation, consisting of its committee on local transportation, to make a study of what was being done in the East. The cities selected included New York, Boston and Washington, and the purpose of the committee was to interview the gentlemen who have been prominent in the development of the transportation lines in those cities, and to decide upon a policy which would be suitable to the needs of a city the size of that of Chicago, and which would combine the best experience in subway and other construction which had been secured in the cities to be visited.

The committee on local transportation includes some of the leading and most successful business men in Chicago, and consists of Frank I. Bennett, chairman; and Messrs. M. I. Foreman, Charles Werne, E. F. Herrmann, H. W. Butler and H. F. Eidmann, lawyers; Wm. Mavor and Thomas Carey, prominent contractors; W. J. Raymer, John Minwegen and W. T. Maypole, manufacturers, and W. S. Jackson, of the Chicago Board of Trade.

These gentlemen reached New York on Thursday, July 24, directly from Chicago. On Friday, July 25, they examined the Manhattan Railway system. In the afternoon, at the invitation of President Greatsinger, of the Brooklyn Rapid Transit Company, they took a trip in a special car over the lines of that company, visiting the power station and other points of interest. On Saturday a visit and tour of inspection was made of the construction work of the Metropolitan Street Railway Company. On Monday, July 28, the committee called on William Barclay Parsons, chief engineer of the Rapid Transit Subway, and later made an inspection of the City Hall terminal of that road, now under construction, and visited other parts of the work. On Monday evening they were entertained by James H. McGraw, president of the STREET RAILWAY JOURNAL, at a dinner at Sherry's, at which President H. H. Vreeland and Assistant General Manager Root, of the Metropolitan Street Railway Company; Contractor John B. McDonald and Chief Engineer Deyo, of the Rapid Transit Subway, as well as others, were present. On Tuesday morning the committee left New York for Boston.

The committee is being accompanied, in its trip, by Bion J. Arnold, who, as recently stated in these columns, has been appointed the consulting electrical engineer and transportation expert of that city. Mr. Arnold's reputation as an electrical engineer is well known, and he was recently engaged by the New York Central Railroad Company to draw up a system of recommendations for the electrical equipment of the Park Avenue line of that company by electricity. Mr. Arnold has associated with him in the work on which he is now engaged for the city of Chicago a number of the leading experts on transportation matters in the country, including Oren Root, Jr., assistant general manager of the Metroplitan Street Railway Company of this city; Charles V. Weston and George C. Sykes, of Chicago, and others.

Apart from some discourteous articles which appeared in several of the New York papers in regard to the purpose and standing of the committee, the visit to New York was very successful, and the delegates expressed themselves as deeply gratified with the treatment accorded them by the local transportation managers and engineers, and as satisfied with the information secured by them during their visit.

Annual Meeting of the Union Traction Company of Chicago

The annual meeting of the stockholders of the Chicago Union Traction Company was held on Wednesday, July 23. Four changes were made in the board of directors, and the old officers were re-elected. The meeting was slimly attended in numbers, but 188,186 shares of stock being voted. William Dickinson, C. K. G. Billings, P. A. B. Widener and Charles L. Hutchinson retired from the board of directors, and William F. Harrity, of Philadelphia, and John Lambert, Henry G. Foreman, and Joseph Downey, of Chicago, were elected in their places. The board of directors, as now constituted, consists of Jesse Spalding, chairman; Walter H. Wilson, James H. Eckels, John V. Clarke, John M. Roach, John Lambert, Henry G. Foreman, Joseph Downey, R. A. C. Smith, H. B. Hollins, and W. F. Harrity. At the directors' meeting, following the stockholders' meeting, the retiring officers were re-elected as follows: John M. Roach, president and general manager; R. A. C. Smith and Walter H. Wilson, vice-presidents; James H. Eckels, treasurer; Markham B. Orde, secretary and assistant treasurer; W. W. Gurley, general counsel; John A. Rose, general attorney; F. E. Smith, auditor.

The financial statement showed a deficit for the year of $247,528. The gross revenue from operation and the income from other resources showed an increase of $549,750 over last year, but there was an increase of operating expenses, amounting to $628,525. The general expenses increased $347,131. The report shows an immense increase of taxes, amounting to $294,120. The complete statement of operations for the fiscal year ending June 30, compared with the previous year, follows:

	1902	1901
Gross earnings	$7,825,119	$7,289,139
Operating expenses	4,570,719	3,942,194
Net earnings	$3,254,400	$3,346,945
Other income	117,349	869,670
Total income	$3,371,749	$4,216,615
Fixed charges	3,619,277	4,058,040
Deficit	$247,528	†$158,575
Preferred dividend	.....	150,000
Deficit	$247,528	‡$8,575

† Balance. ‡ Surplus.

President Roach, in presenting the report, said:

"The business done by the company during the fiscal year closed June 30, 1902, so far as increased earnings are concerned, was all that the management could reasonably expect under the adverse conditions with which we had to contend. Briefly, however, the financial statement will show that prospective profits have been taxed into a deficit.

"That this is not an overstatement will sufficiently appear by reference to the enormous amounts paid out for taxes during the past year, viz.:

Personal property taxes	$112,492
Real estate taxes	60,429
Capital stock tax	311,567
Car licenses and amounts paid to city as per requirements of different ordinances	64,893
Amount paid account taxes reassessed for 1900, as directed by United States court	134,350
Total	$683,731

"This is equal to about 8½ per cent of the total gross receipts of the company for the year, and to about 21 per cent of the net receipts for the same period, counting as net receipts the gross receipts less only operating expenses, and not including in operating expenses either the interest on bonded indebtedness or rentals paid underlying companies. The company has some reason to hope that for the current year it may have its property, including capital stock, assessed upon the basis of its earning capacity, the only just method. If this hope shall be realized, the capital-stock tax ought to be, and doubtless will be, greatly reduced. The item of $134,350 additional tax for 1900, of course, will not occur this year, and upon the basis of earning capacity the item of $311,567 capital-stock tax for 1901 would be reduced by at least $100,000, and should be reduced by $125,000.

"Large sums were expended in permanent improvements in right of way, rolling stock, and power plants. Several miles of new track have been laid, thousands of rail joints have been cast-welded, and upon streets where city improvements have been made we have

resurfaced our tracks, substituting granite, asphalt, or brick pavement in place of cedar block or cobblestone. The improvements, when completed, will lessen the cost of operation and improve the service to the public, but at present they eat heavily into the receipts, with no immediate financial return. Our rolling stock has been maintained at a high standard and increased by a large number of new cars. Power houses are now more efficient than heretofore, and contemplated improvements will place the operating department in a position to better care for the traveling public.

"In view of our heavy expenses for improvements, the early settlement of the river bridge problem and the general prosperity of the community, the management confidently expect (barring unforeseen contingencies) that the ensuing fiscal year will show results more satisfactory to the stockholders of this company."

The additions made to property during the year were as follows:

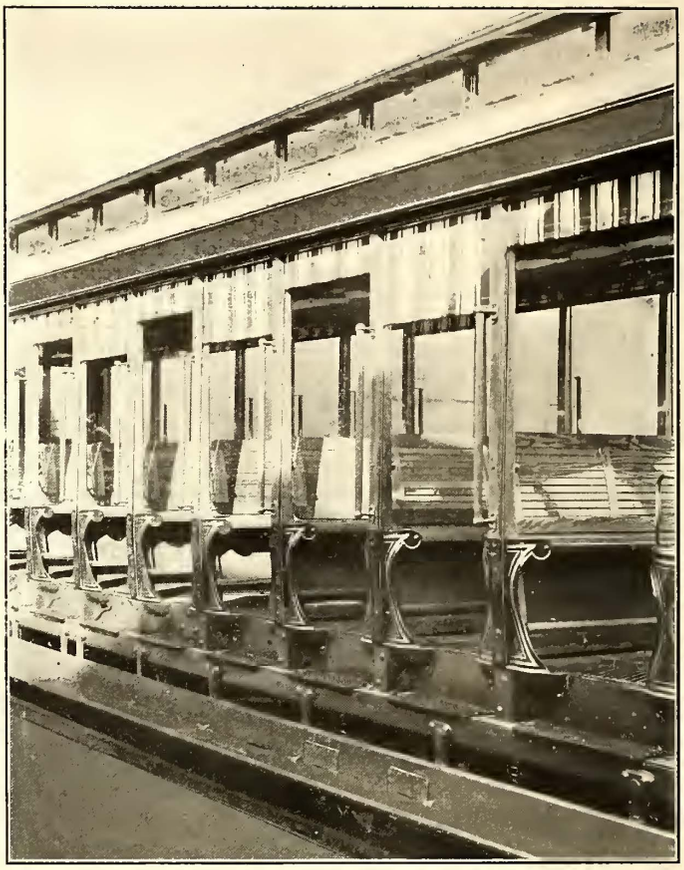
Construction		
Track and roadway	$5,815	
Electric line	2,474	
		$8,389
Real Estate		
Buildings		4,507
Equipment		
Power plant equipment	4,098	
Shop tools and machinery	2,077	
New cars	65,108	
Electric equipment of cars	31,443	
Mail cars	294	
Total	103,020	
Less credit from sale of wagons and coal motor	2,653	
		100,368
Other Property		
Furniture for law department		395
Reconstruction		159,987
Total		$273,646

Throughout the year every effort was made to reduce the liabilities of the company through the sale of unused real estate, and the proceeds of the sales made, amounting to $74,000, have been used so that an annual saving in fixed charges of $8,641 has been effected.

New Cars for the Old Orchard Beach Road

The Portland (Maine) Railroad Company has recently received ten 14-bench open cars from the J. G. Brill Company, of Philadelphia, for use on the Old Orchard Beach Division. The cars are of the Brill patented "Narragansett" type described in the Street Railway Journal of last October. The first lot of this type were built for the Narragansett Pier Road—from which they took their name—and were so successful that it is not surprising to learn that a number of large roads are equipped with them this summer.

It will be remembered that the car was invented by John A. Brill, vice-president of the J. G. Brill Company, with the view of providing a double-step open car of no greater width than the standard single-step car and still have space for the radiation of high-speed trucks. His invention accomplishes this, and in addition is a form of construction unequalled for giving strength and rigidity to a long car body, namely, a main sill of deep angle iron having another angle iron bolted thereto, forming together a Z-bar. The extra strong manner in which the posts are secured is plainly shown in the illustrations. The "round-corner seat-end" panels—another of Mr. Brill's inventions—have an important part in the general comfort and convenience to the passenger. Attention should

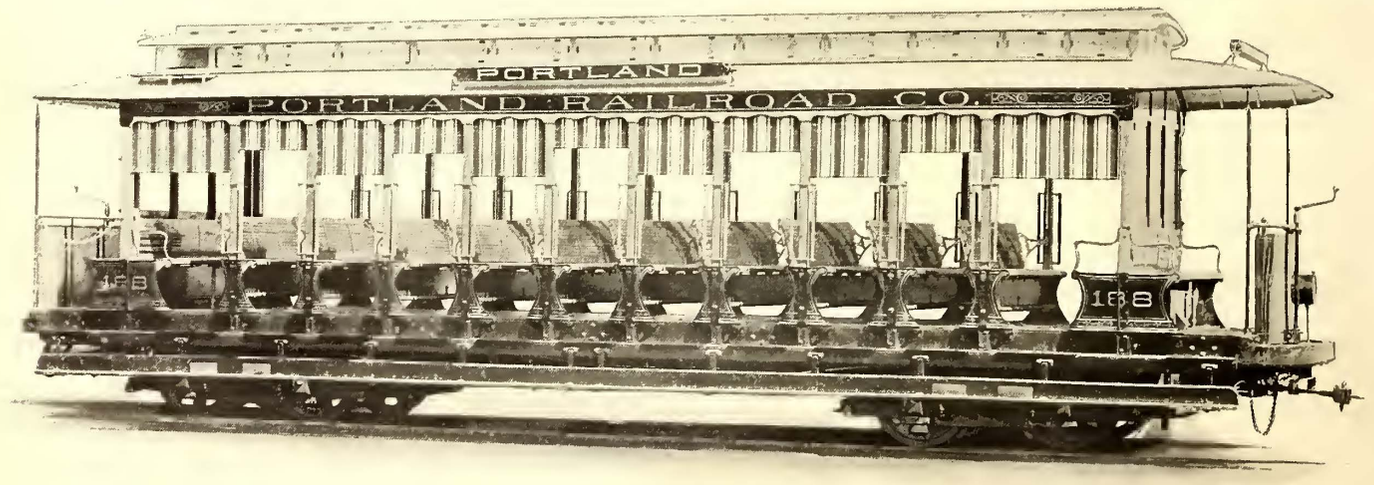


SEATS AND STEP CONSTRUCTION FEATURES OF OLD ORCHARD BEACH CARS

be called to the fact that the length of the seats is not curtailed.

The Portland cars are 37 ft. 10⅜ ins. long over the crown pieces; 7 ft. 10½ ins. wide over the sills, and 8 ft. over the posts. The width over all, with steps lowered, is 9 ft. 2 ins., and with steps raised, 8 ft. 3 ins. The distance from the rail-head to the top of the lower step is 16 ins. The bulkheads are fitted with drop-sash, and the roller curtains can be drawn to the floor, making a tight car in stormy weather. The inside finish is of natural ash and cherry, with decorated oak veneer ceilings.

Brill patented angle-iron bumpers, radial draw-bars, ratchet brake-handles and "Dedenda" gongs are included in the equipment. The trucks are Brill No. 27-G.



OPEN CARS FOR OLD ORCHARD BEACH

Jack for Electric Railway Service

Street railway repair gangs, as well as the construction department and contractors, find frequent use for a jack that can be readily handled. The Railway & Electric Supply Company, of New York, as manufacturer's agent, is introducing a device of this character, which is made by the Bray Manufacturing Company of Newark, N. J. This jack, like the others made by this company, is of the best iron and steel, has ball-bearings and interchangeable parts. These devices are strong, light and quickly adjusted. The cut shows a jack with two steps attached, and is designed especially for electric and street railway service. It may be used in track construction, also as a car jack in cases of emergency, such as derailments or accidents where cars have to be lifted quickly and lowered gradually. The rack with steps can be easily detached, thus presenting a complete lifting jack, adjusting from 14¼ ins. to 23 ins., with a capacity of 12,000 lbs. to 14,000 lbs. The combined weight is 35 lbs.

RAILWAY LIFTING JACK

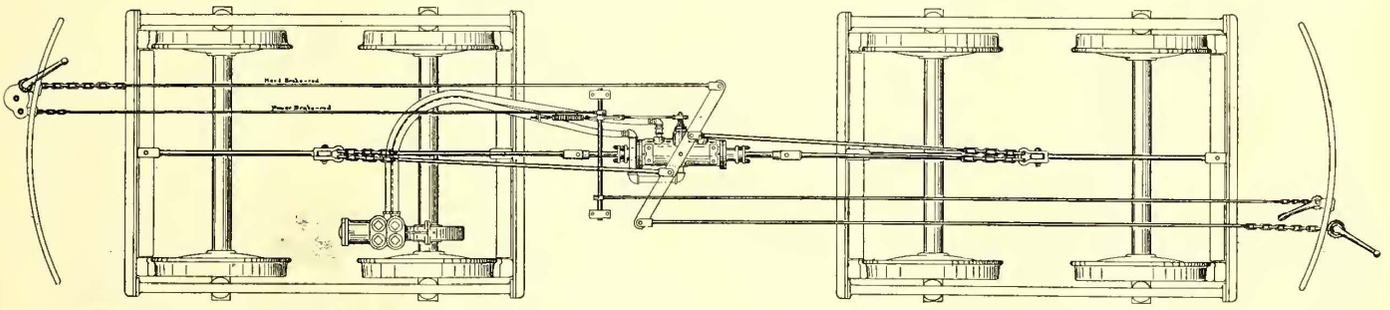
The Neal Duplex Brake

The United States Steel Company, of Everett, Mass., has closed a contract for supplying 170 brake equipments to the North Jersey Street Railway Company, and the Jersey City, Hoboken & Paterson Street Railway Company. The brakes are of the improved Neal duplex type, made by the United States Steel Company. The closing of the 170-equipment order was the result of a several months' test, made under the severest conditions on the Jersey roads.

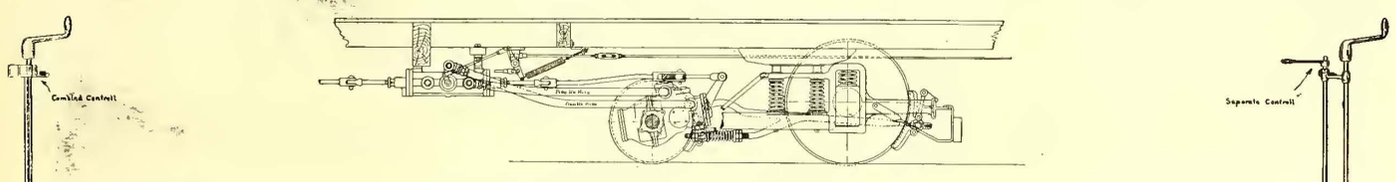
This brake is designed for city and suburban electric cars, and is applicable to any form of truck, and was invented by J. H. Neal, whose long connection with the Boston Elevated Railway Co. familiarized him with the requirements of the service. The Neal duplex brake, the mechanism of which is very simple, is composed of two essential parts, namely, an axle driven pump of ordinary construction, operated by an eccentric, with absolutely no air friction, consequently no heat; and a cylinder holding about three gallons of a non-freezable oil, which is fastened to the sills of the car. This cylinder contains two pistons which are connected directly with the regular brake levers. The oil, when the brake is not in use, is forced by the pump through one piece of a flexible hose, and returns to the pump, through another. The valve by which the oil leaves the cylinder can be closed by the motorman with one-quarter of a revolution of the ordinary hand brake, after which the brake remains on, and hand brake may be wound up as far as desired. Release of the brake is instantaneous.

When the valve is closed, the oil is forced through ports in each end of the brake cylinder, thereby operating the brake. The pressure is identical at each end of the cylinder, and, therefore, should one truck or pull rod become crippled, it is still possible to brake one end of the car or one truck; but should one end of the brake adjustment be up close and the other slack, it would be impossible to brake the close end until the pressure on both ends was equalized. The present hand brake rig is not disturbed. The brake cylinder valve is provided with graduated ports, thereby enabling the motorman to make either an emergency or a service stop, as occasion may require.

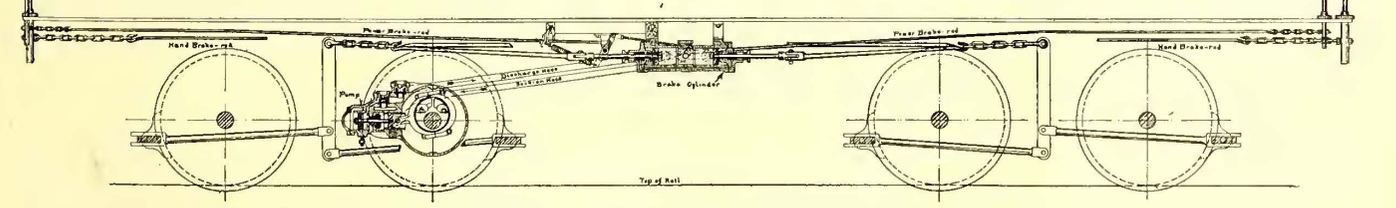
The first cost of the brake is moderate; the weight is less than 500 lbs., and the cost of maintenance is slight. The power for this brake is provided from the axle of the car. The use of the hydraulic principle, instead of the air compression or friction clutch, secures smoothness, uniformity, and directness of action. It is unaffected by weather or dust conditions. When the car is in motion the brake is ready for application and the pressure is always at hand. It is also free from electrical troubles, and it is absolutely noiseless. It contains no complicated air valves, and as it runs in oil is self-lubricating. The skidding of wheels is automatically checked, inasmuch as the pressure on the brake cylinder piston heads instantly decreases with the stopping of the pump on axle. It is also a combination power and hand brake operated at the same time and upon the same staff, so that the motorman at all times has at hand the full efficiency of the ordinary chain brake by simply continuing to revolve the one brake handle. Another point claimed in favor of this brake is that it can also be operated independent of the hand brake, and that it will stop a car quicker and more smoothly than any other brake. It can also be operated by vertical or horizontal wheels, levers, or brake handles and be adjusted to any truck that allows six or more inches of axle space. One-half revolution of a 33-inch wheel makes an emergency application of the brake. One important point to be taken into consideration is the fact that it is impossible for a motorman to allow the brake shoe to ride the wheel, thereby creeping close to the car in front and increasing liability of an accident.



PLAN VIEW OF DOUBLE TRUCK EQUIPMENT, NEAL DUPLEX BRAKE



BRAKE FOR MAXIMUM TRACTION TRUCKS

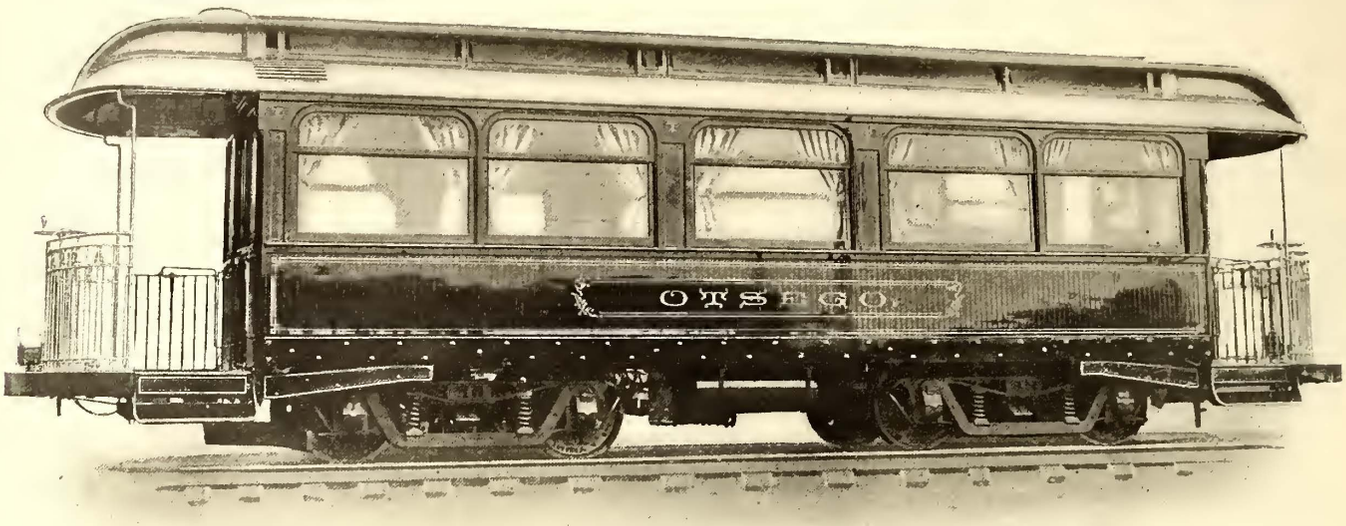


SIDE ELEVATION, SHOWING DIFFERENT METHODS OF CONTROL

A Handsome Parlor Car

The Oneonta, Cooperstown & Richfield Springs Railway Company has recently secured from the St. Louis Car Company the parlor car shown herewith. It has a 28-ft. car body, 38 ft. over bumpers and is mounted on St. Louis Car Company's No. 23 truck. The interior finish of the car is African figured mahogany with marquetry work decorations.

The car has a toilet room provided with wash-stand, etc.; a cabinet for books, ice box and locker for china and tableware, water cooler, etc., so that the occupants can pass the time comfortably, even on a much longer journey than the service for which the car is intended.



A NEW PARLOR CAR

The smoking compartment is particularly attractive. The car is also equipped with chairs upholstered with blue plush to match the carpets and draperies. The name of this car is "Otsego."

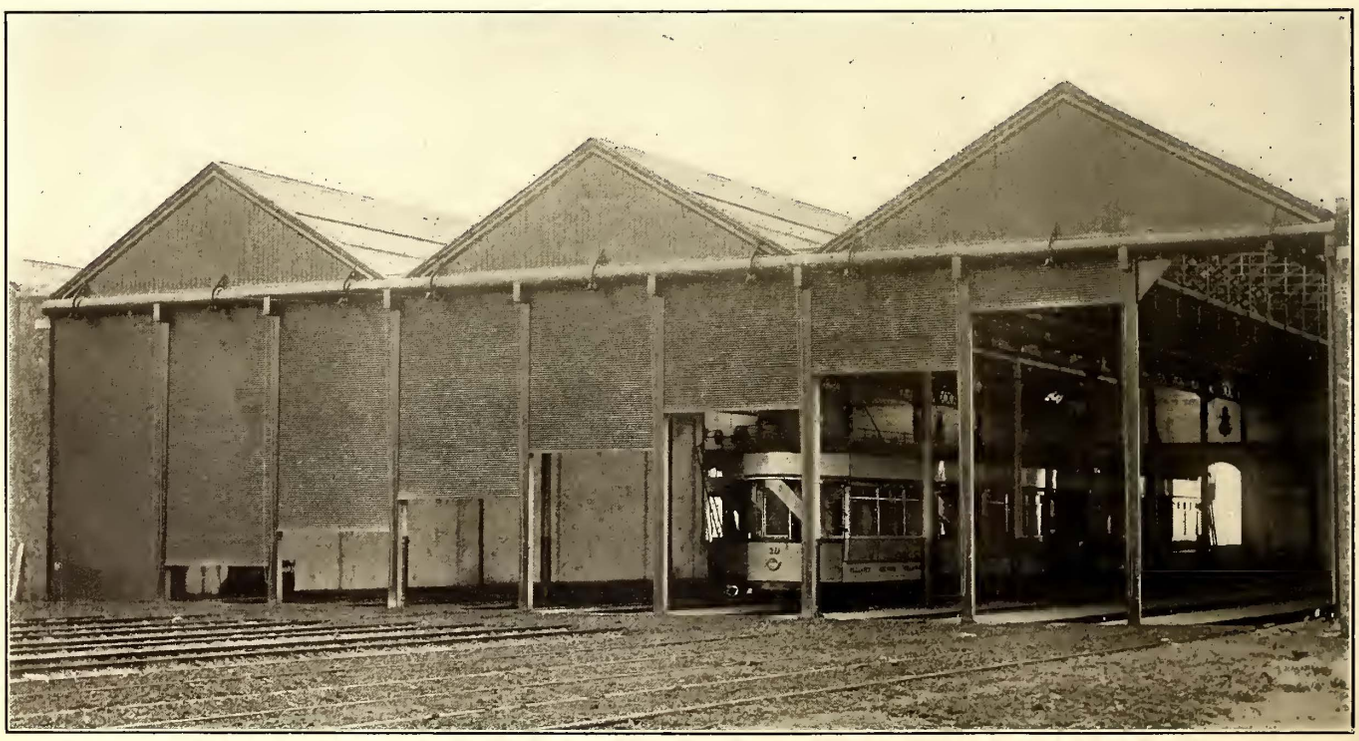
The car is also equipped with Christensen air brakes, St. Louis arc head lights, interior arc lights, G. E.-57 motors, and has proved very popular with the public in Oneonta.

Car Sheds at Wallasey, England

The accompanying cut illustrates the front of a tram car shed of the Wallasey Urban District Council Tramway, Wallasey, England, the front of the shed being equipped with "Kinnear" steel rolling car house doors, manufactured by the Kinnear Manufacturing Company, Columbus, Ohio, U. S. A.

In addition to their extensive use in America, the "Kinnear" car house doors are being largely used by many of the European tramways. The merits of these doors may be said to consist largely in their compact construction, durability, ease and speed of operation and fireproof qualities. A further important claim is made for the minimum cost for maintenance, and repairs in case of damage.

In connection with the car house doors, the Kinnear Company constructs a special trolley wire connection, which permits of an uninterrupted current with the doors at any position, and when open automatically provides for an unobstructed trolley surface. These doors are built in large sizes, and they are constantly gaining favor with managers of the larger roads.



CAR HOUSE AT WALLASEY WITH STEEL ROLLING DOORS

Shaw's Non-Arcing Lightning Arrester

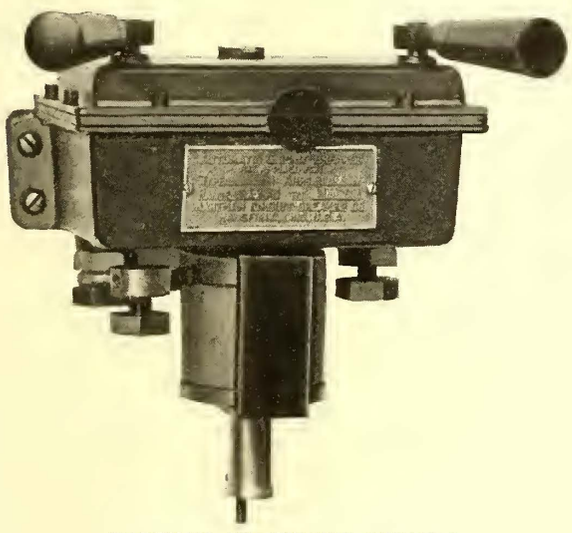
The accompanying cut illustrates the Shaw non-arcing lightning arrester for railway plants, manufactured by the Universal Electric Company of New York. It meets the requirements of the National Board of Fire Underwriters, and, in practice, has proved a very efficient means of protection. It is composed of alternate layers of non-arcing composition and mica assembled upon a fibre rod which is supported upon brasses containing serrated teeth projecting toward the composite body, and fastened to a porcelain base by studs, washers, and burrs which serve also as a means for making line connection. It is placed in an iron box thoroughly insulated. The lid may be easily removed by a few turns of a thumb screw. In this form of construction, the serrated teeth break up the discharge as delivered to the first layer of non-arcing composition, and it is again broken into minute discharges as it passes over the mica disc to the next layer of composition and successively until passed to the earth. The minute discharges are completely disseminated, and are not strong enough to carry the dynamic current along with them. It is claimed that 25,000 volts have been unable to break through this device, while infinite static discharges are broken and disseminated without any perceptible interference or leakage of the generated current.

LIGHTNING ARRESTER FOR RAILWAYS

An Automatic Oil Circuit Breaker

The Hartman automatic oil circuit breaker type "D. R.," has been especially designed for street car service, and is intended to afford the same degree of protection to the car equipment from the effects of overload or short circuit as is now given to the station apparatus by the modern switchboard instruments.

The special feature of this instrument, which is illustrated herewith, is the operation of the switch mechanism in oil. The break in the circuit takes place in a non-conducting fluid, which prevents the formation of an injurious arc under the most severe conditions of overload or short circuit. The danger of fire, which is always imminent in the vicinity of woodwork, is entirely eliminated, it is claimed, by enclosing the switch mechanism, together with all of the operating parts of the instrument, in a tight metal case. This feature also gives absolute immunity to the circuit breaker from the effects of exposure to the weather and the severe conditions and general rough usage to which an instrument intended for street car use is liable to be subjected. The circuit breaker cannot be



HARTMAN OIL CIRCUIT BREAKER

closed during the continuance of an overload or short circuit. Each side of the switch operates independently of the other. Closing the first switch does not close the circuit. As soon as it is attempted to close the second switch, if a short circuit exists, the first switch, being free to act, will immediately fly open. The motorman is thus notified that the current continues at an abnormal strength.

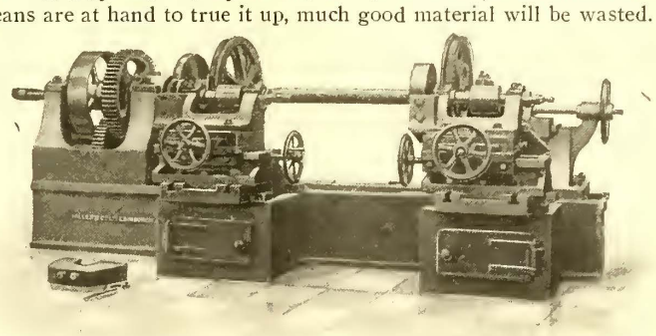
No auxiliary switch need be used in connection with this instrument. A tripping device is provided which is operated by pushing a rubber knob projecting from the upper part of the case. By a pressure no greater than that required to operate the ordinary push-button the motorman can at all times break the circuit without danger of arcing.

Owing to the fact that the operating mechanism is entirely enclosed the instrument is not affected by exposure to damp and unfavorable locations, and it will operate as reliably under such conditions as though it were on the switchboard.

An Improved Car Wheel Grinder

A wheel grinder is a tool almost as necessary in these days of electric traction as a wheel press, as it is just as important an item of economy to keep the wheels in good order as the cars themselves. Everyone having experience of modern railway practice is aware that in spite of all possible precautions "flats" are, at times, formed through wheels sliding.

A flat may occur early in the life of a wheel, and unless the means are at hand to true it up, much good material will be wasted.



AN IMPROVED WHEEL GRINDER

With an efficient grinder the average mileage of chilled wheels can be increased by 30 per cent, and it is, therefore, clear that the initial cost of the machine is soon counterbalanced by the saving effected in maintenance of rolling stock.

A particular feature of grinder illustrated herewith, which is manufactured by Miller & Co., of Edinburgh, is that the car axles revolve on their journals, and the wheels mounted thereon can, therefore, be ground exactly true to the axle. When the wheels are hung in centres only, the pressure of grinding wheel at work and the weight of wheels and axle tend to disturb the true position. Four of the principal tramway corporations in Great Britain have already been supplied with this machine, and the results are very satisfactory.

The machine has been carefully designed, and it is sold at a moderate price, as Miller & Co.'s main object is to furnish a tool within the reach of all, so that the average life of their chilled wheels may be increased.

Reference Book for Exporters

A book devoted to export trade has just been issued by Lewis, Scribner & Co., of 125 East Twenty-third Street, New York, entitled "Foreign Trade Requirements," and it is designed especially to meet the needs of American firms interested in extending their business in foreign markets. It has seemed advisable to include within the limits of this volume only the description of conditions that are likely to remain fairly stable throughout the year, leaving to a series of special reports the task of supplying information as to prices, discounts and competition, custom duties, names of dealers and other specific information regarding the particular line of goods handled by any individual manufacturer or dealer. The information presented has been carefully classified, condensed and arranged in the following sections: Trade Conditions of the World; Traveling Salesmen; Agencies and Advertising; Credit Customs of the World; Commercial Laws of the World; Trade-Mark and Patent Laws of the World; Transportation Facilities of the World; Encyclopedia of all Principal Commercial Cities (giving location, population, industries, banks, etc.); Coins and Currencies of the World; Postal Regulations; Cable Rates; and Weights and Measures of the World (with United States equivalents). No other work ever prepared in any language has attempted to cover the same range of subjects or to occupy the same field.

NEWS OF THE WEEK

Everett-Moore Affairs

Several important transactions affecting properties of the Everett-Moore Syndicate have recently been made. At a meeting of officials of the Detroit United Railway, held in Cleveland, the last instalment of the purchase price of the Rapid Railway System, or Detroit & Port Huron Shore Line, was effected. At the time the deal was made for the control of this road, it was agreed to pay $800,000 for the property, the Detroit United assuming the debt. The embarrassment of the Everett-Moore Syndicate prevented the closing of the transaction and the securities continued in the hands of the Cleveland Trust Company as trustee. The road will continue to be operated under its present corporate organization, since only 75 per cent of the stock was included in the sale. The Detroit United Railway Company has also taken a 60-day option on the property of the Detroit & Toledo Shore Line; the option being subject to an option by W. B. Strang, who has gone to Europe to interest capitalists who own the Grand Trunk and Canadian Pacific roads. If his efforts are unsuccessful, the property will be taken over by the Detroit Company. The Detroit United is also making overtures to purchase the Toledo & Monroe Railway, and in event of its purchase it would be connected with the Detroit & Toledo Shore line. It is announced that the syndicate has completed arrangements for financing the Lake Shore Electric Railway. Bonds on the property to the amount of $6,000,000 will be issued. Two-thirds of this will cover the floating indebtedness, underlying bonds and receivers' certificates; $1,000,000 will be used in placing the road in first-class condition for fast traffic, and $1,000,000 will be retained in the treasury for future extensions. The capital stock is $6,000,000, divided into $1,500,000 preferred, and $4,500,000 common stock. Mr. Moore, who has had charge of the negotiations, declines to name the parties who will take the bonds, but it is generally understood that a Cleveland syndicate, headed by Horace E. Andrews, will do the underwriting of a large portion of the securities. The Everett-Moore bankers' committee held a meeting a few days ago, and it was decided to pay the interest due all security holders of the syndicate up to July 1. It is announced that as soon as the Lake Shore Electric deal is consummated, the bankers' committee will relinquish the partial control which it has exercised over the affairs and actions of the syndicate. On July 22 it was announced that the syndicate had sold all its interest in the Scioto Valley Electric Traction Company to a party of Cincinnati and Columbus financiers, headed by Cyrus Huling, of Columbus. The syndicate owned about 60 per cent of the stock in the line, which is only partially completed. The road will run from Columbus to Circleville and Chillicothe. The syndicate has given an option on one-half of its holdings in the London (Ontario) Street Railway to Claude Ashbrook, of Cincinnati, at a price of $61 per share. The opportunity is given to all stockholders to sell their holdings at this figure. The Everett-Moore Syndicate will be left in control of the property, and agrees not to sell any of the remaining stock until Jan. 15, 1903, at less than $70 per share. The total stock issue is $400,000, of which the Cleveland people control the larger portion.

Massachusetts Companies Win

The full bench of the Massachusetts Supreme Court has handed down, in the cases of the city of Springfield vs. the Springfield Street Railway Company, and the city of Worcester vs. the Worcester Consolidated Street Railway Company, a decision which says that the general street railway statute of 1898, imposing a tax upon all street railways and relieving them from the obligation to keep streets in repair, except where the obligation is a condition of an original grant of location, is constitutional. In both cases the plaintiffs sought to have the companies make certain repairs in certain streets, but the court held that the effect of the legislation of 1898 was to free the street railway companies from all obligations thereafter to keep any portion of the surface material of the streets, roads and bridges in repair unless the obligation so to do had been imposed in a grant of an original location, which the act defines to mean the first location granted to the company in the city or town as to whose streets, roads or bridges there might be a question. It was contended by the cities that the statute was unconstitutional, because it impaired the conditions imposed upon the companies to keep portions of streets in repair. This contention was based on the theory that the condition constituted a contract, but the court held that it did not constitute a contract, as the location granted by a city or town is in the nature of a license. In the cases decided the court held that none of the locations were original, and the companies were relieved by the statute of all the obligations which the cities sought to enforce.

Indiana Traction Companies Combine

The final step in the absorption of the Indianapolis Northern Traction Company's lines, rights of way and franchises, as well as all tangible property, by the Union Traction Company, of Anderson, has been effected. The former corporation has filed records in all the counties of the State in which it has any property rights of a lease of its assets to the Union Traction Company. The lease conveys its property for a term of fifty years. The leasehold was written to go into effect July 1 last, and was made subject to a mortgage executed by the Indianapolis Northern Traction Company to the Colonial Trust Company, of New York, to secure bonds issued, the proceeds of the sale of which are to be devoted to the completion of the Northern Traction Company's lines already prospected, and the purchase of new rights of way, and the securing of franchises. The Union Traction Company is to build all the lines of the Indianapolis Northern Traction Company not yet completed, operate the same and pay all taxes and other liabilities and to guarantee the payment of all interest on bonds.

Unique Position of an Electric Railway

The close relations that have been established between the Providence & Danielson Railway, running into Providence, R. I., and the People's Tramway Company, of Putnam, Conn., have produced a situation in regard to the former road which is rather unique. The Providence & Danielson Railway has made arrangements at the Connecticut end of the line with the People's Tramway Company, which is controlled by the New York, New Haven & Hartford Railroad Company, and with the Union Railroad Company at Providence, controlled by the Rhode Island Company, and the Providence & Danielson Railway, running through the western part of Rhode Island and eastern part of Connecticut, is the connecting link between the two great rivals of the railroad field of Rhode Island. The Providence & Danielson Railway has a ninety-nine-year agreement with the Union Railroad Company, and a fifty-year agreement with the People's Tramway Company, otherwise the Consolidated road, and while not participating in the rivalries of the two companies, it enjoys the privileges of sending its passengers over the roadbeds of both. The plans of the New York, New Haven & Hartford Railroad in Connecticut to parallel its lines by establishing electric railways, thus cutting off competition from rival companies, are made manifest through its acquiring the People's Tramway Company, and the plans it has for the extension of that line down to Moosup and beyond, while it has already combined with five other electric railways and established a parallel system between Danielson and Worcester. The Providence & Danielson Railway has constructed its road as far as the Connecticut State line. By the agreement that was concluded with the People's Tramway Company on June 23, of this year, the Providence & Danielson Railway is to lease the right of the People's Tramway Company to construct a road from the State line to Chestnut Hill. This strip is two miles in length and is to be constructed by the Providence & Danielson Railway, while the remaining 3½ miles toward Danielson not yet built, is to be built and controlled by the People's Company. But the Providence & Danielson Company will enter into an arrangement at the other end with that company similar to the arrangement that it has with the Union Railroad Company at the Providence end for the running of its cars from the city line to the terminus at Market Square. Each of the rival companies is thus being kept apart for the time by the Providence & Danielson Railway holding them at arm's length, but as the arrangements provide for a carrying of the cars of either the People's Tramway Company or the Union Railroad Company over the lines of the Providence & Danielson Railway there is no knowing when an interesting situation may arise from the overlapping process.

Another Southern Road Sold

Another street railway is to be added to the long list of Southern properties that have recently changed hands. The Dominion Railway is the property that has been sold, but just who the purchaser is has not been made public. It is reported by some that the property has been acquired by the Gould interests, while others report that the Williams interests, of Richmond, are the purchasers. The Dominion Railway is a consolidation of the Portsmouth Street Railway, the River Front Railway, the Norfolk County Railway, and the Virginia Equipment Company, and its system covers Portsmouth thoroughly, and reaches to Port Norfolk, Parkview, Prentis' Place and Gilmerton. While only a small property, the system is typical of those in the South, and serves in excellent manner the territory traversed by its lines.

A College Town Invaded by the Trolley

The Princeton Street Railway, known as the Witherspoon Street branch of the Trenton, Lawrenceville & Princeton Railroad, was opened to the public on July 17. The road was built for the purpose of securing an entrance to Princeton for the Trenton, Lawrenceville & Princeton Railroad, and the opening of the line marks an epoch in the history of Princeton, as it shows a marked change from the situation there as seen for eight years past. The college and town authorities have always fought the entrance of an electric railway into the town, and in the present case it was only with the greatest reluctance that the Trenton Street Railway was finally given permission some time ago to cross Alexander Street, in the lower part of the borough, in order that it might reach a terminal near the center of the town. Had this road not been already in operation to the lower end of Alexander Street, from which point it came on private right of way nearly to the crossing, the Borough Council would never have granted it permission to cross a street. When the Trenton, Lawrenceville & Princeton Railroad was started toward Princeton there was a general outcry that one electric railway was quite enough to combat with, from the moral standpoint, and that another would probably finish the ruin which it was confidently predicted the first would engender. In the fall of 1901 the Trenton, Lawrenceville & Princeton Railroad reached the northern line of the borough of Princeton and permission was sought to go up Witherspoon Street. While this was being argued cars were put on the line, a passenger waiting-room and freight depot were erected at the temporary terminus, and business went ahead with a rush. After bitter opposition from some of the University faculty a franchise was granted, in which it was specified that the new company should pave the street with Belgian block or paving of equal worth, from curb to curb, and furnish lights for the street. This was locally considered as good as a victory for the anti-trolleyites, but when the ordinance was brought before the Council, the Lehigh Valley Traction Company, at Allentown, Pa. (which controls the Princeton line through the New Jersey & Pennsylvania Traction Company), declined the franchise. Work was only begun upon the extension a few weeks ago, and the company directly supervised all the work done. The ties, which are of chestnut wood, are 7 ins. x 8 ins. and 8½ ft. long, and are laid upon a 10-in. concrete base, or ballast. Between the ties more concrete is used and this is brought up high enough to form a foundation for the vitrified bricks, which are used for paving between the rails, and which will be used upon the street itself. Trilby rails are used, and the gage of the track is 4 ft. 8½ ins. Double span wire and fancy iron poles have been used, and the trolley wire is 0000 phono-electric. A locomotive car hauls freight to the foot of the Witherspoon Street extension, and in an emergency the locomotive also hauls a trolley car, but will not be able to take them further than the old terminus. Cut rates in freight have been the result, and the opposition between the Trenton, Lawrenceville & Princeton and Pennsylvania Railroads, at Princeton, has been quite marked. With the exception of the Witherspoon Stret extension, the road is built entirely upon private right of way, 50 ft. wide, and the 70-lb. rails are laid upon gravel ballast.

After the Rowdies

The local papers in one of the largest cities in Western New York tell of the crusade being made by the railway company in that city against the rowdies who make themselves so objectionable to the passengers on the company's cars to the pleasure resorts in and about the city. Every car will be policed until it reaches the city line, and the local police officials will be asked to station patrolmen at convenient call as soon as the cars enter the city. Men in civilian dress will be placed on cars not manned by constables, and every possible effort will be made to put an end to the disgraceful scenes which have recently marked the operation of cars on Saturday and Sunday. Now, in this question of keeping the rowdy in his place, every street railway company is interested. From all parts of the country there come every summer reports of the outrageous doings of these disturbers of the peace. Traveling in such numbers as to intimidate even him who, in behalf of his fellow passengers, would be tempted to object to their outrageous doings, they carry their rowdyism to a point where the average passenger is deterred from riding on a car. The passenger should be protected, and the company and the police, working together, by making an example of several offenders, ought to be able to check the objectionable actions of these offenders. In a number of instances where the conductor and the motorman of a car have attempted to protect the passengers, the operators of the cars themselves have received rough treatment at the hands of these uncouth offenders.

Atlanta's Good Showing

As an instance of the results that may be expected to accrue through such consolidation as have recently been effected between lighting and power interests in a number of Southern cities, the Georgia Railway & Electric Company, controlling the entire lighting and railway interests of Atlanta, is an excellent example. The company was organized Jan. 1, 1902, as a consolidation of the Atlanta Railway & Electric Company, the Atlanta Rapid Transit Company, the Atlanta Steam Company, and the Georgia Electric Light Company, and while the properties were in excellent physical condition before the consolidation, the economies that have resulted through joint operation has greatly exceeded even the most enthusiastic. The statement of the earnings of the company for the month of May, which is at hand, shows an increase of about 7 per cent over the preceding month, and for the five months ending May 30, 1902, an increase of 20 per cent over the same period for 1901 is shown. The May earnings are: Gross, $107,387.19, as compared with $90,283 for May, 1901, an increase of $17,103.65; net, $56,333, showing an increase of $14,355.80 over 1901. The proportion for interest and taxes is, $38,598, leaving $17,730. Of this $7,500 is necessary for preferred stock, leaving a surplus of $10.230 for common stock.

PERSONAL MENTION

MR. W. H. BACON, of Messrs. Ford, Bacon & Davis, of New York, has been appointed consulting engineer for the Metropolitan Street Railway Company, of Kansas City, Mo. Mr. Bacon's first special duty will be the supervision of the erection of the new power house of the Metropolitan Company.

MR. HARRY JOHNSON has resigned as superintendent of the Norfolk & Bristol Street Railway, of Norfolk, Mass., and is succeeded by Mr. Thomas Gammon, of East Braintree, Mass. Mr. Johnson was presented a handsome gold watch and chain by the employees of the company, as a token of their esteem.

MR. S. N. JAMES, formerly superintendent of the Eighteenth Street Division of the Metropolitan Street Railway Company, of Kansas City, Mo., has been made second assistant general superintendent of the company. Mr. James Griffin, formerly assistant to Mr. James, has been advanced to the position vacated by Mr. James.

MR. ALEXANDER MACKENZIE, a member of the legal firm of Blake, Lash & Cassells, of Toronto, Ont., has been appointed the chief representative of the Sao Paulo Electric Company, of Sao Paulo, Brazil, and severs his connection with Blake, Lash & Cassells to assume his new duties. Mr. Mackenzie returned from Sao Paulo recently, where he had been for three years in the interest of the company.

MR. E. C. HATHAWAY has resigned as general manager of the Lexington Railway Company, of Lexington, Ky., and Mr. R. E. Hunt, assistant general manager of the company, has been elected as his successor. The position of assistant general manager has been abolished. Mr. Hathaway, it will be recalled, is president of the Consolidated Street Railway, Electric Light & Gas Companies, of Norfolk, Portsmouth and Newport News.

MR. CHARLES M. MILLS, assistant engineer of the bureau of surveys, of Philadelphia, in charge of bridges, has resigned to accept the position of assistant engineer in charge of subway and

elevated road work for the Philadelphia Rapid Transit Company. Mr. Mills has been eight years in the service of the city, and among important work done by him was the superintending of the construction of Gray's Ferry bridge. Prior to going into the city service, Mr. Mills was in the employ of the Phœnix Bridge Company. Mr. Mills is a member of the American Society of Civil Engineers.

MR. JOSEPH H. JACKSON, chairman of the Massachusetts Railroad Commission, returned to Boston, July 25, after an extended trip to Europe in the interest of railroad problems, which he has studied in England, France and Germany, giving special attention to the problem of cheap suburban morning and evening traffic, including the interurban means of transportation in European cities. Mr. Jackson made a close study of the London subways, as well as the electrical equipment of some of the Continental railroads, and will embody his observations in a report to the Massachusetts Legislature.

MR. E. C. FOLSOM, general manager of the street railway system of Logansport, Ind., has for the last three months been making extensive improvements on his road, and his efforts are being greatly appreciated by the local public. Under Mr. Folsom's management the road is giving better and faster service and the receipts have increased 25 per cent. Besides thoroughly overhauling the old equipment he has put in much new overhead work, repaired the tracks, added new cars, motors and trucks and generally reorganized the system. The road is soon to be connected with an interurban line to Peru and Wabash.

MR. AMOS CARYLE RIDGWAY, general manager of the Colorado Springs & Cripple Creek District Railway, of Cripple Creek, Colo., has been appointed general manager of the Denver, Northwestern & Pacific Railway Company, and will assume his new duties Sept. 1. Mr. Ridgway was born April 16, 1860, at Water Gap, Pa., and entered railway service in 1877. Since that time he has been, consecutively, the occupant of the following positions: 1877 to 1878, roadmaster's clerk and section hand, Kansas Pacific; 1878 to 1879, freight brakeman and switchman, Union Pacific Railway; 1879 to 1880, freight brakeman and work conductor, same road; 1880 to 1881, chief clerk to the engineer of the Missouri, Kansas & Texas Railway; 1881 to 1882, general roadmaster's clerk and work conductor, Denver & Rio Grande; 1882 to Sept. 1, 1889, chief clerk, second and third divisions of the Denver & Rio Grande; Sept. 1, 1896, assistant superintendent second and third divisions same road; May 1, 1896, to July 1, 1899, superintendent of the same road. Dec. 1, 1899, Mr. Ridgway was appointed general manager of the Colorado Springs & Cripple Creek District Railway.

MR. DOW S. SMITH, the new general superintendent of the Brooklyn Rapid Transit Company, has already made his personality felt on the rank and file of the operating departments of the system. He comes from one of the best-managed street railways in the country, the Twin City Rapid Transit Company, where for eight years he was superintendent of the St. Paul Division, and was largely instrumental in bringing up to the high standard which it has attained, the operation of that road. Mr. Smith is well equipped with expert knowledge of the requirements of his position, added to his undisputed familiarity with every detail of electric railway management. He has an untiring energy and rapid manner of carrying into effect the improvements which he contemplates making. Mr. Smith is a graduate of the University of Minnesota, in the class of 1888, and immediately upon graduation he was made superintendent of construction of the West Superior Iron and Steel Company, West Superior, Wis. He remained in this position for five years, when he resigned to become superintendent in Minneapolis for the Twin City Rapid Transit Company. Remaining here for one year he was transferred to the St. Paul Division, where for eight years he has ably managed that property. The position of general superintendent in the Brooklyn Rapid Transit Company combines entire control of the traffic and repair departments of both the elevated and surface lines, an office which was created during the recent reorganization of the relations between the various departments. Mr. Smith has taken hold of the elevated problem with the same energy which has marked his former connection with the running of surface roads, and promises to make as successful progress in this, to him, new line of work as he has proved himself capable of in his more familiar duties in the West. The combination of the elevated and surface roads is a new departure of the company's, although it has been advocated by many of the officials for some time, and its practicability depends largely upon the efficiency of the man at its head. Mr. Smith's management as general superintendent will, therefore, be watched with considerable interest.

D. S. SMITH

MR. ROBERT I. TODD, second vice-president of the Cincinnati Traction Company, Cincinnati, Ohio, has tendered his resignation to accept a position with the United Gas Improvement Company in Philadelphia. The work which he will have in charge will be in connection with the company's traction interests. Mr. Todd is a native of New Jersey, having been born near Lakewood, Nov. 29, 1869. He graduated from the Johns Hopkins University in the class of 1893. His first connection with street railway work was as assistant superintendent of the Eckington & Soldiers' Home & Belt Railway Companies, Washington, D. C. Later, when these lines and others were merged into the City & Suburban Railway Company, Mr. Todd was made general superintendent and electrical engineer, resigning from this position in the spring of 1889, to take charge of the experimental work of the Compressed Air Company in New York city. Mr. Todd resigned this position in July, 1900, to accept the position of mechanical engineer of the Consolidated Traction Company, of Pittsburgh, which position he held until February, 1901. He resigned at this date to become general manager of the Cincinnati Traction Company, when that property was acquired by the Elkins-Widener-Dolan-Morgan Syndicate. In January, 1902, he was promoted to the position of second vice-president of the company. Mr. Todd s work in these many cities has given him experience with all the various methods of street car propulsion, horse, storage battery, air, underground electric and single and double trolley, and his wide experience in the traction field has peculiarly well fitted him for the work which he now assumes.

CONSTRUCTION NOTES

SANTA CRUZ, CAL.—F. W. Swanton, of Santa Cruz, is reported to have said that a deal has been completed that insures the building of an electric railway to connect the towns and settlements of Pacific Grove, New Monterey, Monterey and Oak Grove with Del Monte. Mr. Swanton is also reported to have said that a deal will be concluded shortly whereby the present horse car line, from Santa Cruz to Seabright, will be converted into an electric road and extended to Capitola.

SUISUN, CAL.—The Board of Supervisors has granted a franchise to J. E. Woolley for the construction and operation in Solano County of an electric railway to connect Suisan, Vacaville, Winters, Elmira and Cement City. There were three bids—J. E. Woolley, who secured the grant; J. W. Hartzell, representing the Vallejo, Benica & Napa Valley, and Lewis A. Hilborn, of Suisun, representing an Eastern syndicate. The line will be about 40 miles long, including branches. The road is to handle both freight and passenger traffic, and it is said that it will be operated by electricity from the Bay Counties Electric Power Company's lines, which touch both Suisun and Vacaville.

HARTFORD, CONN.—It is stated that the electric railway which the Connecticut Railway & Lighting Company is building between Cheshire and Mount Carmel, where connections will be made with the Fair Haven & Westville system, thus forming a continuous line between New Haven and Cheshire, will be ready for operation about Aug. 1. For the present, power for the new line will be supplied by the Fair Haven & Westville line. After the completion of the road to Cheshire the Railway & Lighting Company will proceed to extend the line to Milldale to connect with the lines of the New Britain district. Completion of this stretch will make a continuous line of trolley between Stamford and Boston by way of Hartford and Springfield. , , ,

FERNANDINA, FLA.—The Amelia Beach Company has been organized to build a street railway from Fernandina to Amelia Beach. John G. McGiffin is president of the company; L. G. Hirth, vice-president; E. W. Bailey, secretary, and John W. Simmons, treasurer.

BLOOMINGTON, ILL.—Charles P. Griffin, G. G. Metzger and W. T. King, and others, have organized a company to build the Bloomington, Peoria & Pekin Railway. Right of way has been secured between Bloomington and Pekin, Ill., and work will start as soon as the balance has been secured, which will be in the near future.

NEW ALBANY, IND.—A new electric railway from New Albany to White Sulphur Springs by way of Leavenworth, Ind., is being planned. Capt. W. W. Hite, of Louisville, Ky., president of the Louisville and Evansville Packet Company, is reported to be interested in the project.

DONALDSONVILLE, LA.—The Town Council has granted M. D. Bringier the privilege to operate a railway through the streets, the grantee to pave the streets through which the road runs. The grantee is given nine months to begin work.

ROCKLAND, MAINE.—The extension of the Rockland, Thomaston & Camden Street Railway to Warren has been placed in operation.