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Correspondents in other Principal Cities of the World.

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Cost of Operation

The Cleveland street railway companies have agreed to permit a committee appointed by the United Trades and Labor Council to inspect their books and ascertain exactly what it costs to operate the road and carry a passenger. The railway officials say that this is the first time they have ever been approached by a non-partisan committee looking for facts. It is believed that such an investigation will effectually stop the agitation for 3-cent fares, and it is therefore believed that it will prove a boon to the street railway companies that have been hampered because of the general ignorance on the subject. No doubt a thorough and intelligent investigation would produce results that would prove a revelation to honest inquirers.

Storage Batteries on Street Cars

Public opinion is aickle jade, as has been frequently demonstrated, but nowhere more effectively than in the change of attitude upon the employment of storage batteries upon street cars. Time was when there was great clamor for this form of equipment, and traction managers were denounced as parsimonious because of their refusal to adopt this method of propulsion; yet, to-day, the only storage battery line in New York has been pronounced a public nuisance by the Board of Health, and the people who patronize the road are ready at an hour's notice to hold an indignation meeting and demand the substitution of the underground trolley for the present equipment. Complaint is made that sulphuric acid fumes escape from the storage batteries, and are not only unpleasant, but sometimes cause throat troubles of serious nature. The company has tried several methods to overcome the trouble caused by the fumes, and, it was believed, had succeeded, but the opposition continues just the same; all of which goes to show how difficult it is to satisfy the public.

The Overhead Trolley in Favor in England

It is gratifying to receive assurances that our English cousins—brothers, we might now almost call them—are growing quite enthusiastic over the trolley. Mr. Balfour lately emphasized the fact that it was the trolley system which made possible the present development of electric traction in England, and he might have added that it was the failure of the municipal authorities to recognize earlier the value of this improvement that placed such a handicap upon the British manufacturers and gave Continental, as well as American, rivals such a lead. Mr. Rider, whose opinion should be accepted as authoritative, said, in his address at the Municipal Electrical Association, that if there was anything disagreeable to the eye in the overhead trolley construction it was the fault of the designer and not of the system itself. He admitted that examples of overhead construction were to be found in the United Kingdom that were not pretty; in fact some of them were decidedly ugly, in spite of the fact that it was easy and practicable to design and erect an overhead line that would look well in any locality. Mr. Rider does not favor the combination systems in which both overhead and underground trolleys are employed; in fact, his experience leads him to endorse, unqualifiedly, the overhead trolley for ordinary city service.

Conditions Favorable to Trolley Wheel Wear

Few stop to think of the very severe mechanical requirements of the ordinary electric car trolley wheel in high speed service. In the first place, the diameter of the wheel is very small, considering the speed of the car in miles per hour. A 6-in. wheel, for instance, on a car running at a speed of 30 m. p. h., makes 1740 r. p. m. This in itself is a notable mechanical performance for the wheel on the end of a trolley pole where lubrication and attention is necessarily not of the best. But added to all this there is the requirement that the trolley wheel carry a large volume of current through two moving contacts; first, from the trolley wire to the wheel; and second, from the wheel to the bearing or harp. One assumption, perhaps too commonly made, is that the kind of a bearing put on

a trolley for high speed service is a matter which does not affect the mileage of the wheel metal exclusive of the bearing. Those who are familiar with the subject know very well, however, that the less friction there is introduced in a trolley wheel bearing the greater is the chance for a long life wheel. In the first place a trolley wheel bearing with the minimum amount of friction causes the least dragging effect between the trolley wheel groove and the trolley wire. A trolley wheel which runs hard has a tendency to drag constantly along the trolley wire, and consequently its groove wears faster than if it turned more easily. The improvement of the trolley wheel and its bearing is being worked upon by plenty of good talent, and it is not too much to expect that this investigation will result in marked improvement. It is the common experience that whatever tends to make a larger and more perfect bearing is very conducive to improvement in the mileage secured from the trolley wheel. In this connection the elimination of heavy or stiff contact springs, which tend to make the trolley wheel run hard, should be considered. Another point often overlooked is that the trolley wheel, which must run at such enormously high speeds as are required on the fastest interurbans, should be well balanced. A little different weight at different parts of the circumference of a wheel will cause a vibration which tends to make poor contact and arcing between the trolley wheel and wire, and which soon magnifies the trouble because of the pitting which will soon be found on the wheel as a result of this constant, though minute arcing. The remedy for this unbalancing simply consists in turning off the rough outside of the wheel flange as well as the inside, so that there will be no greater weight of metal on one point on the flange than on another. The trolley wear on high-speed interurban roads is at best very great, and it is only by careful attention to details that it can be kept within reasonable bounds. It is a matter to be thankful for that the third rail is a possible alternative on interurban roads using their own right of way. The admirable working of the third-rail roads already installed will tend to encourage this kind of construction.

A Question for the Traffic Manager

The relation of traffic to frequency of service is a topic which is often discussed, but upon which there are no very useful data from actual experience. In general terms it is very well understood that if the frequency of service upon a given route is increased the total amount of traffic is also increased, but to what extent and under what conditions this proposition is true is only vaguely guessed at. We are a bit suspicious that there is a serious fallacy in the chain of reasoning usually followed, and that while increased service does make traffic it does not continue to do so without limit, and, in fact, depends on many contingent circumstances. For example, a street railway passes from a twenty-minute schedule to a ten-minute schedule, and the next fiscal year shows materially increased gross receipts. The statistician immediately whips out his pencil and note book and shows you with a proud smile the percentage of increase due to doubling the frequency of the service. The early logicians were very familiar with this course of alleged reasoning, and dubbed it the "Post hoc, ergo propter hoc" fallacy, meaning thereby that if one wakes to find his hat eight sizes too small some morning this condition is not necessarily due to the hair cut he had the day before, which may have stimulated the growth of his hirsute adornment. In the concrete case in hand the twenty-minute service may have been hopelessly irregular, while the quickened service had to keep up more sharply to hit the turnouts, or the change may have resulted in great improvement in the cars, or the cars may have been at first outrageously overcrowded, or an amusement park may have been opened, or half a dozen other things may have incidentally happened to increase the receipts upon that particular line. As a rule the schedule is improved only to meet a popular demand which can no longer be put off, and which is the direct cause of traffic improvements.

The really important experiment to try would be to take a well-

established suburban line, well-equipped and operated, say, on a twenty-minute schedule with ample accommodation for the normal traffic and rigid regard for punctuality, and then to pass suddenly to an equally well-kept up ten-minute service. We have no doubt whatever that the traffic receipts would be materially increased, yet nothing like the extent which is often claimed. A crowded and irregular twenty-minute service undoubtedly scares off a considerable amount of short-distance riding, which is the most profitable kind, but this would be regained to no small extent by the use of long and capacious cars and invariable punctuality in the service. A certain other amount of short-distance riding can be saved only by more frequent service, and the increase of traffic usually found on improving the schedule is due to both causes in uncertain degree. Until the service becomes so frequent as practically to abolish waiting for a car, we are inclined to think that comfortable accommodations and punctuality are of more importance than the question of the next car being due at 10:40 or 10:50 o'clock. The ordinary citizen who depends upon trolley service either plans to hit the 10:40 car or goes out at about that time in the certainty that a car will be along in two or three minutes anyhow. Certainly a twenty-minute service which lives up to its reputed schedule is vastly more convenient than a ten-minute service at haphazard.

We have in mind numerous places where the total number of daily cars is very large, and which still would be much better served by half the number run on a sharp schedule. In ordinary service the cause and amount of increased traffic following a shortened schedule is of comparatively small moment, for the service is guided by the demands of the public, and generally has to hustle to keep up with it, but the philosophy of the matter is of real importance in much suburban and interurban work, and the need of data is very great.

Take, for example, the case of a long interurban road with fairly heavy traffic. Will it be advisable to run hourly trains for the through service or single cars every twenty minutes? It has generally been tacitly assumed that the latter procedure would win out in the matter of traffic, and doubtless it sometimes would, but upon what definite facts can we base such a conclusion? If the trains and the single cars ran at the same speed and had the same passenger capacity in the aggregate there might or might not be a difference in traffic. A fast electric line between, say, New York and Philadelphia, would be a case in point. If the running time were the same for hourly trains and for single cars we very much doubt whether the total number of passengers carried would be materially changed by passage from one schedule to the other. A short distance suburban service on the contrary would probably show a considerable difference in favor of single cars if the trains were as infrequent as one an hour, but this would be greatly diminished in comparing a half-hourly train service with single cars every ten minutes.

Broadly, the longer the running time the less difference will a change of schedule make, since it will then make but a small variation in the total time taken up in travel. But on the whole we suspect that change in schedule alone has a very much smaller effect than is popularly supposed. Change from a crowded and irregular service to a prompt one, with ample accommodations for the public, undoubtedly does bring a large increase of traffic, and this is the whole point of the matter. In ordinary urban traffic, where the cars are already comfortable and capacious, passing to a shorter schedule, is the only simple way of giving the added accommodations if the service is already punctual. Hence the result so often observed. In classes of service where trains can be used it seems doubtful whether extra trains, save at the rush hours, will win much traffic over longer trains. During the crowded hours every feasible means of increasing the accommodations have to be taken, and many electric lines both add cars and run more trains. But general data on the effect produced by running more frequent cars where those in use are punctual and not uncomfortably crowded are very meagre, and we should welcome an addition to them.

Pennsylvania Railway Terminal Assured

At the hearing before the Railroad Committee of the New York Board of Aldermen last week, it was evident that an attempt would be made to hold up the Pennsylvania Railroad tunnel franchise, on the ground that adequate compensation had not been secured for the city; that the proposed franchise was perpetual, and therefore antagonistic to the spirit of the new charter, and that the responsibility of the railway company for damages had not been fixed with sufficient clearness. To the first objection the most effective reply that can be made is the fact that the rate of compensation and the total amount provided for are far greater than have ever before been secured by the city for any privilege, and this is all the more noteworthy, because the franchise granted the railroad company does not entail any additional burdens on the city, nor will the improvement obstruct highways or take anything from the municipality or property owners; but, on the contrary, the building of the tunnel will directly benefit the entire community, and particularly property owners in the neighborhood of the route, as is shown by the advance that has already been made in prices of real estate in that section. The objection raised to the provision that the franchise be a perpetual one is met by the terms of the contract, which call for revaluation and adjustment of the rate of compensation at specified periods, and provide other safeguards of the city's interest which will always ensure for the municipality a supervisory control over the property. On the other hand it is pointed out that the perpetual character of the franchise will enable the company to make an improvement that will be permanent in every respect. It could not be expected of any corporation that it would make such an investment if its concession were for a limited period and liable to be canceled at the whim of an irresponsible city board. The railroad company meets the last objection by offering to give whatever reasonable guarantee may be required to meet all claims that may be established for damages of whatever nature growing out of the tunnel construction. Thus all legitimate ground for criticism is removed, yet opposition remains. The aldermen are still jealous of the powers of the Rapid Transit Commission, and will probably resort to every possible device to thwart the present movement. It is gratifying, however, to have definite assurance that the delay will only be of short duration and that the present plan will certainly be approved and the contract executed by the city.

Street Railway Exhibits at St. Louis

A circular lately issued by the department of transportation exhibits of the St. Louis World's Fair shows that street railway apparatus has been assigned space in the building devoted to transportation, under the official classification known as group 74, and comprising classes 462, 463 and 464, as follows:

Class 462.—Other railway systems. Rack, cable, elevated, aerial, sliding railways; movable platforms, permanent way; motive power or motors; rolling stock.

Class 463.—Traction railways, intramural, suburban, industrial, etc. Various types of tracks upon different kinds of roads; switches and crossings; turntables; implements for track-laying, cleaning, etc.

Class 464.—Cars drawn by animals; locomotives and automobile vehicles; rolling stock for street railways operated by mechanical traction; braking appliances; equipment for using stored power (hot water, compressed air, electricity, etc.)

It will be seen at once that this is neither comprehensive nor complete, and, therefore, must of necessity be unsatisfactory to the street railway interests. Electric railroading is deserving of much more prominence in an industrial exhibition than that assigned it by the management of the St. Louis Fair, and a great mistake will be made if the present plans are followed. The most important features of electric railroading to-day are not provided for here; the power plant, the transmission and distribution system, the practical working of modern car equipments are all overlooked in this classification. No doubt apparatus for these purposes will be provided for elsewhere, in the electricity department, may be, or in the service plant; but this will not be satisfactory to street railway men, as it will make a very inconvenient division and distribution among several departments. The place for all apparatus pertaining

to electric railway operation is in the transportation division, and any plan that does not make adequate provision for a complete and comprehensive exhibit will not be satisfactory to the electric railway interests. They will demand, too, as is their right, that proper recognition be given this feature of modern life in which such marvelous advancement has been made, and in which American engineers and manufacturers have distinguished themselves perhaps more than in any other branch of industrial activity.

Some difficulty may be experienced by the management in revising its plans so as to make proper provision for the electric railway, and the tendency to subordinate it to the steam railway will doubtless be hard to overcome; but justice and policy both demand the change. Everything considered, we do not hesitate to say that electricity is deserving of the greater prominence in the exhibition, both because of the popular interest which it excites, and the commanding position it now occupies. The recent advancement in suburban and interurban work alone should lead the Fair managers to adopt a liberal policy toward electricity in this respect. Electrical engineers welcome a comparison between steam and electrical equipment, in mechanical design and construction, as well as accomplishment, and for this reason the logical place to make the exhibit is in the transportation building, but they do object and most earnestly protest against subordinating their interests to those of the steam railway.

Brooklyn Bridge Plans

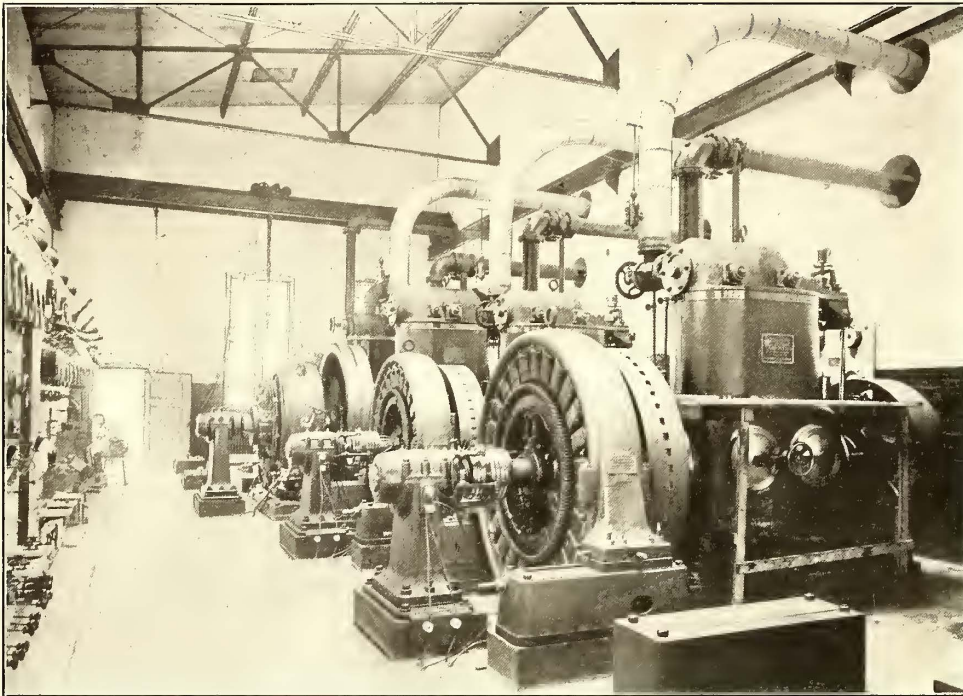
The action of the Rapid Transit Commissioners at their last meeting, in reconsidering their approval of Mr. Parsons's plan for relieving the conditions at Brooklyn Bridge, seem, on closer inspection, to amount practically to the side-tracking of the entire scheme. Mr. Parsons did not expect to put his plan into immediate operation, and that feature of it to which Bridge Commissioner Lindenthal took exception might have been put aside temporarily until immediate demands had been satisfied; but the objection to this part appears to have been taken merely as a pretext for shelving the entire plan. Mr. Lindenthal now comes forward with his moving sidewalk plan as a substitute really, instead of a modification of the Parsons subway, for with no cars on the Bridge there would be no need of a subway; but, it is not entirely clear that the present nuisance would be abated by such a measure. It is more likely that if it were adopted and proved as successful as Mr. Lindenthal predicts in handling the crowds on the bridge, it would merely transfer the seat of trouble from Manhattan to Brooklyn, and instead of the crush and confusion now witnessed daily opposite City Hall, there would be a wild scramble for cars at the Brooklyn plaza.

Mr. Lindenthal's plea on behalf of the moving sidewalk is an attractive one—on paper. He offers to carry 65,000 seated passengers an hour, whereas at present both the train and trolley car service, with fearful crowding, carry only 38,000 an hour. There are drawbacks, however, and one of them is the necessity of change for all passengers at the Brooklyn end of the bridge, and the difficulty of operating the platform in conjunction with any system of through cars. The train passengers who now have to change do so without extra cost, and as they can only thus connect with the elevated lines in Brooklyn, a portion of the traffic is diverted to the trains, though the chief crush is on the trolley cars. Passengers on the platform would be required, not merely to change cars, but to pay an extra cent, and the tendency would be strong to crowd the trolley cars worse than ever if they were left on the bridge.

If the cars were removed from the bridge adequate terminal facilities would have to be provided, and the Brooklyn Rapid Transit Company would not feel inclined to pay the bill for these changes, as the conditions which these improvements are intended to meet would not be of their making. Altogether we fear that Mr. Lindenthal's desire to ride his pet hobby has mixed matters badly, and that instead of a far-reaching and comprehensive scheme, such as Mr. Parsons proposed, we are again condemned to go through the ordeal of listening to a repetition of arguments that have already been threshed out on rejected plans.

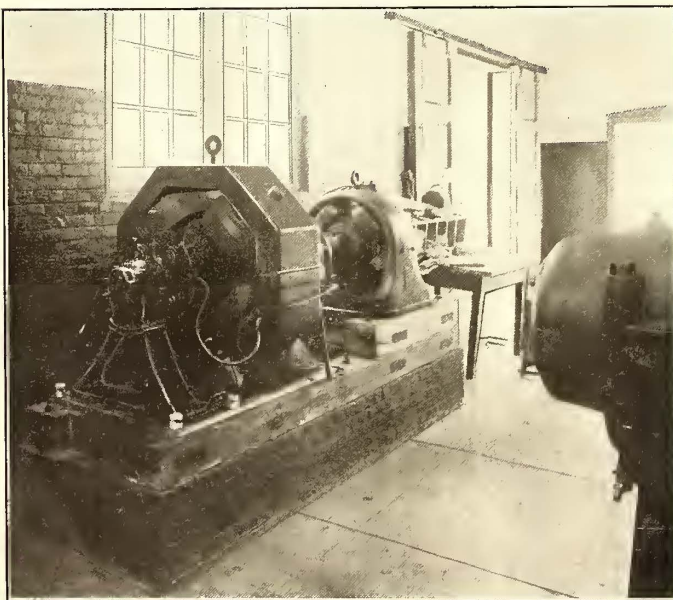
New Power House of the Peekskill Lighting & Railroad Company

While the equipments of large undertakings naturally attract the greatest attention they rank little higher in general interest than the design of more modest installations. Among electrical plants intended to meet the traction and lighting requirements



GENERAL VIEW OF ENGINE ROOM

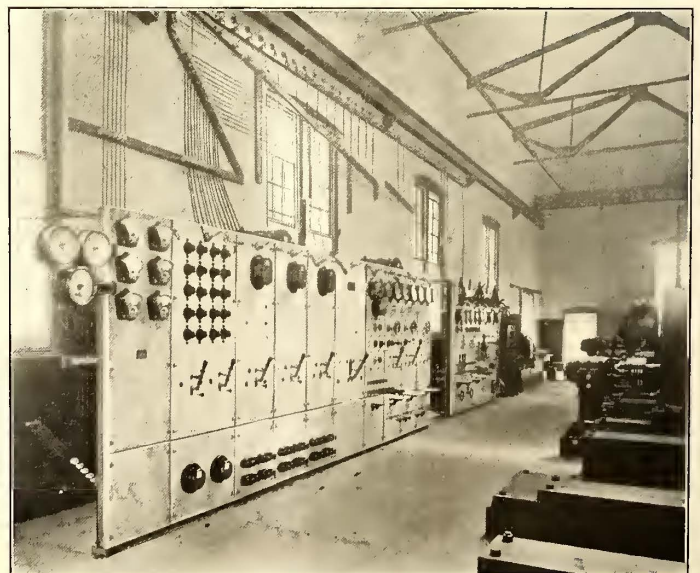
of cities of small size the new power house of the Peekskill Lighting & Railroad Company, of Peekskill, N. Y., is of peculiar interest as illustrating a small, modern equipment in which effective provision has been made for expansion and for marked changes in the loads on either lighting or street railway service, the plant being also especially designed to permit of carrying heavy overloads with safety and with the greatest possible economy. The new



STORAGE BATTERY BOOSTER

carting amounting to 50 cents per ton. This expense is entirely obviated in the new plant, which, being located on the water front, is admirably situated for the cheap reception and handling of coal in bulk, as well as for the disposal of ashes.

The power house, which is 77 ft. wide by 100 ft. long, is of the most approved type, well-lighted and ventilated; its proportions, as well as the general character of the plant throughout, having been determined with reference to the prospective as well as the present load. The building proper is of fire-proof construction, with brick walls, steel columns and steel roof trusses. It stands close to the tracks of the New York Central Railroad, parallel with and facing the Hudson River. The concrete foundations with capping timbers rest on piling driven to bedrock, a method of construction made necessary by the soft, unstable character of the soil. Otherwise the building might have been caused to settle and move outward toward the railroad embankment by the weight of the power house walls, machinery foundations and equipment, and by the constant jarring of passing trains. The piles were spaced 2 ft. and 3 ft. apart, center to center, and were cut off and capped below low water level, to insure practically unlimited life of the piles and timber caps by having them always submerged. The inshore wall of the power house is built upon a concrete footing that rests on the bedrock, to which the foundations for the engines and dynamos are carried, as indicated in the accompanying sketch. In order to guard against any movement of the heads of the piles adjoining the railroad tracks, the caps resting on the piles were of 12-in. x 12-in. timber, laid parallel with the river and secured to the piles by mortises which fitted tenons on the pile-heads, while at right angles to the caps, at intervals governed by the spacing of the piles, there were placed pieces of 12-in. x 12-in. timber long enough to support the concrete pier footings carrying the wall above. To insure still greater stability the piles were further secured by splicing long capping timbers, so as to form practically continuous ties which extend inshore and are anchored to the heavy, buttressed foundations of the inshore wall. These tie timbers



ALTERNATING CURRENT AND RAILWAY SWITCHBOARD

station described and illustrated herewith is owned and operated by the combined gas, electric light, and street railway interests of the town of Peekskill, situated on the Hudson River, about 41 miles from New York city. Temporarily, or until the increased demand for electric current necessitates a change, there will be used in the new plant a part of the equipment of the company's old station, which was located on the hillside, near the center of the town, and to which it was very expensive to haul coal for fuel, the cost of

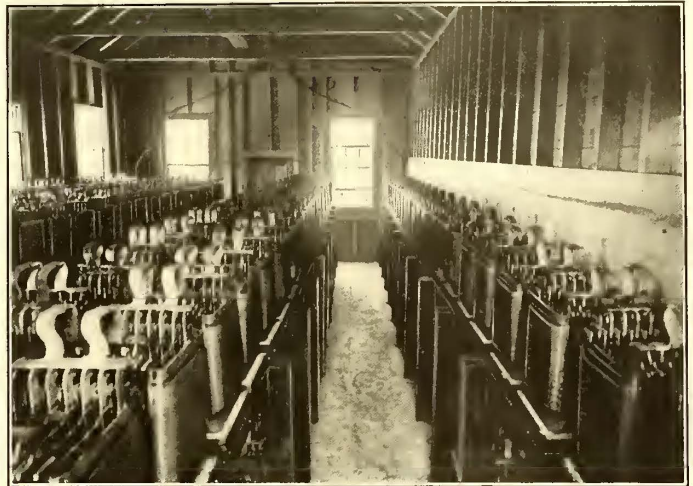
were boxed or notched over the caps and spliced by heavily bolted ship joints.

The equipment of the boiler room, which is 44 ft. x 98½ ft. in size, consists at present of four 6-ft. x 18-ft. Bigelow return tubular boilers, each of 150 hp and built to carry 150 lbs. pressure. Provision has been made for the future addition of two more boilers of the same size. The boilers are fitted with Roney mechanical stokers, to which coal is delivered by gravity from an overhead,

concrete and steel coal storage bunker through weighing hoppers of approximately one-ton capacity each, the two delivery outlets of each hopper being closed by slides to permit of weighing the fuel before it passes to the stoker. The arrangement of the scales, which are located on the wall opposite the stokers, and also of the weighing hopper, is shown in one of the illustrations. Combustion is regulated by means of mechanical induced draft, the boiler uptakes being connected to a flue 5½ ft. in diameter, through which the products of combustion are drawn by either one of the two 120-in. Buffalo fans shown in the accompanying elevation of the power house. Provision has also been made for the future installation of a fuel economizer. The mechanical stokers and mechanical draft apparatus were furnished by Westinghouse, Church, Kerr & Company, New York. Coal is delivered to the storage bunker by means of an overhead steel bridge spanning the New York Central Railroad tracks and connecting the company's dock on the river channel with the power house coal yard by an automatic railway. The dock carries a coal hoisting tower with electrically operated tub hoist, mast, hopper and weighing scales. The machinery used for unloading soft or low grade coal from scows at the dock is also utilized to handle the hard coal for the company's gas works adjacent to the electric power house. This arrangement insures cheap water transportation rates for coal, and also permits cheap delivery of Texas oil for fuel if desired.

The feed water for the boilers is supplied by the town water-works, under an average pressure of 120 lbs. and, after passing through Blake feed pumps, is measured by an extra heavy Worthington water meter. For heating the feed water a Harrisburg pri-

tically at the center of its length, expansion taking place both ways from that point. It is divided into three sections, provided with



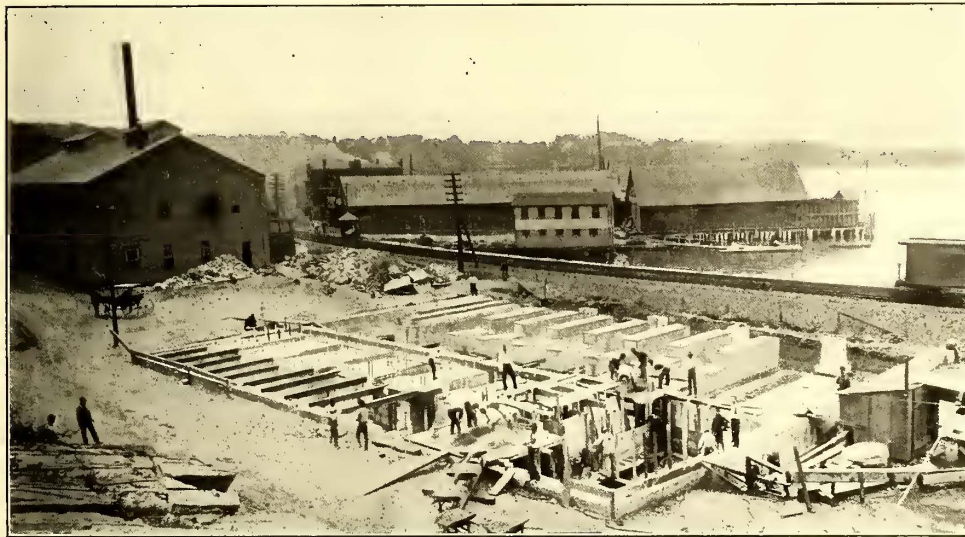
THE STORAGE BATTERY INSTALLATION

gate valves, so that any given section may be shut off from another, in case repairs or changes are necessary. The exhaust header, varying from 18 ins. outside diameter to 14 ins. inside diameter, is supported throughout its length by pipe columns resting on the floor. The live steam and blow-off fittings are extra heavy, all material throughout the plant being of the best obtainable.

The live steam piping is designed to carry a regular working pressure of 150 lbs., and straight-way, self-packing, gate valves are in general use to permit a free flow of steam. Corrugated copper gaskets, well smeared with a thick mixture of red and white lead and linseed oil, are used in live steam piping. The exhaust piping is also provided with gate valves. Flanged valves are used throughout down to three inches to readily permit removal if worn or defective.

The extra heavy blow-off header, 3 ins. in diameter, back of the boilers is also cross-connected, so as to be used as an emergency feed line. Steam header drips run to a 2-in. drip header, which is connected with an Anderson

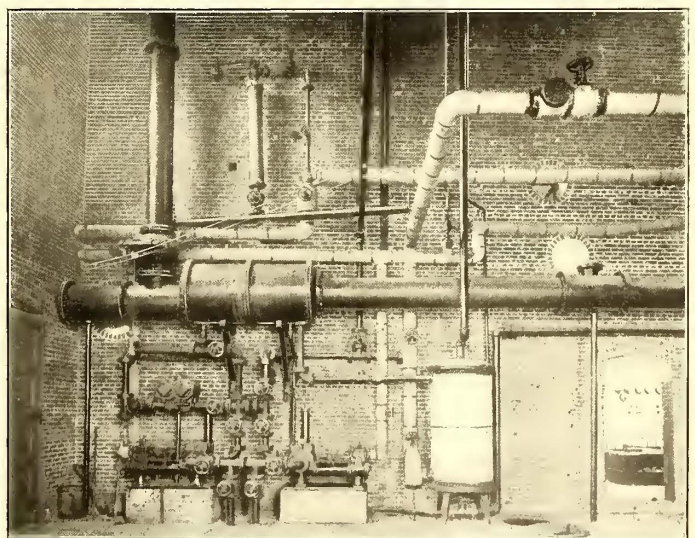
trap, thence venting into the sewer. This drip header has an independent connection with the sewer through a by-pass



BUILDING FOUNDATIONS FOR POWER STATION

mary horizontal feed water heater of 500-hp capacity, arranged eccentrically to drip at the lower end, is provided, and also an auxiliary vertical heater of the same make and capacity. Both heaters are made by the Harrisburg Pipe and Pipe Bending Company, of Harrisburg, Pa. As indicated by the accompanying view of the feed water piping, a system of by-passing permits the use of either heater separately or both in combination, so that possible injury to any part of the feeding system would not affect the continuous operation of the plant; and also in case of a failure of the town water supply connection can immediately be had with the river, which at that point in the Hudson contains on the average about seventy-five grains of salt per gallon. Provision has been made at one end of the boiler room for the installation of a compression refrigerating system for the manufacture of ice and for cold storage business. The outlines of this apparatus are shown by dotted lines in the plan of the building. A Kipp hydraulic elevator is provided at the south end of the boiler room for raising the hand cars by which the coal is transported from the yard to the overhead coal storage bunker, a corner of the north end of the boiler room serving for toilet rooms and shower bath for engineers, firemen and attendants. Steam from the power house boilers is also supplied to the gas house for power and gas making purposes, while electric current is supplied to the coal hoist on the dock and to a stone crusher near the power house which provides macadam ballast for maintaining the roadbed of the trolley system.

The main steam and exhaust headers are carried on the boiler room side of the brick fire wall between the engine and boiler rooms, the supply and exhaust pipes for the engines passing through openings in the wall. The 10-in. live steam header is supported by brackets and I-beams and is anchored to the separating wall prac-



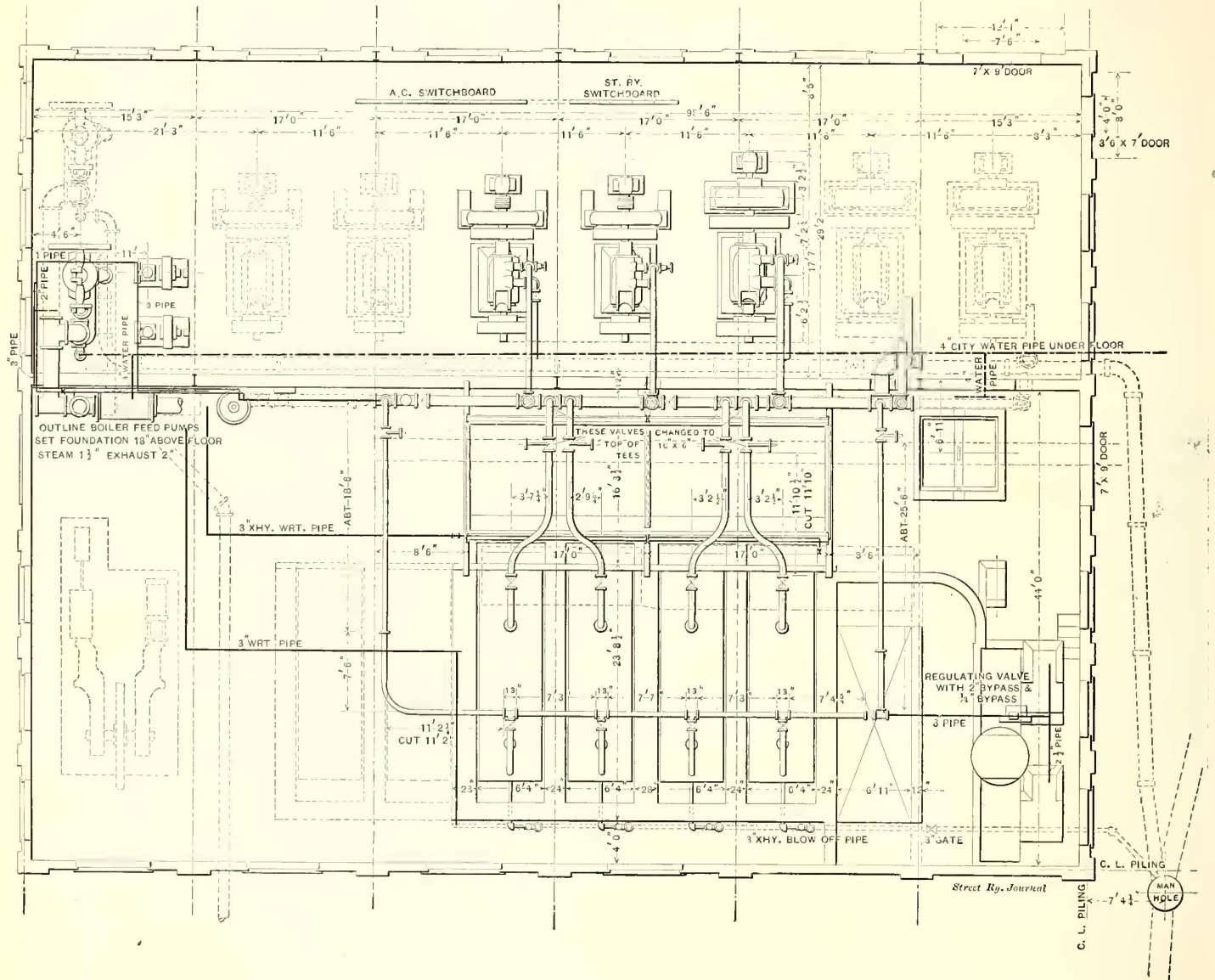
FEED-WATER HEATERS AND PUMPS

around the trap; in fact, all traps are by-passed and each is provided with a three-way cock on the outlet of the

trap, so that leakage through the trap may be detected by opening the three-way cock into the room. The low pressure drips, as well as all drips from throttle valves and high-pressure cylinders, are run through the engine room floor, venting into the space below. Exhaust drips containing cylinder oil from exciter engines, feed pumps, heaters, etc., are piped to an oil separating tank under the boiler room, where the oil is separated from the water.

The live steam piping throughout the plant is covered with a 2-in. thickness of 85 per cent magnesia covering, neatly finished with canvas, and painted with fireproof paint, the exhaust piping being uncovered. Fire protection is secured by direct connection with the town water supply. Standpipes rise through the power house floor to a height of about 5 ft., where hose attachment is

direct-current, 550-volt generator. Of this equipment the two last-named compound engines, and the 120-kw railway generator form a part of the new plant, in addition to which there are installed three new Westinghouse, direct-coupled, compound engines and generators, making a total in the present plant of five compound engines, the largest of which, with cylinders 16 ins. and 27 ins. in diameter, by 16-in. stroke, has a rated capacity of 300 hp at 125 lbs. steam pressure, when running condensing at a speed of 250 revolutions per minute. This engine is direct-connected to a 550-volt direct-current, eight-pole Westinghouse generator of 150-kw capacity. The other two new compound engines have cylinders, 14 ins. and 24 ins. in diameter by 14-in. stroke, and similarly rate at 250 hp each. These engines are direct-connected to Westinghouse, 2200-



PLAN OF STATION. DOTTED LINES SHOW POSITION OF APPARATUS NOT YET INSTALLED

made. Two of these pipes are located in the engine room, one at each end, and one in the boiler room.

The engine room, which is separated from the boiler room by a 12-in. brick wall, is about 29 ft. wide x 98½ ft. long. It contains a small portion of the generating apparatus of the old station. The old station equipment comprised one horizontal Armington & Sims simple engine, belted to a 550-volt direct current Edison bipolar 60-kw generator, supplying current to the trolley system, the engine being also belted, in tandem with the Edison dynamo, to a four-pole Western Electric differential booster, supplying current to storage battery installation of 264 cells, having a capacity of 240 amps. and connected through main trolley line with the generators; one Westinghouse standard engine, 11 ins. x 10 ins., belted to an old style Westinghouse alternator and No. 2 exciter; one Westinghouse standard engine, 11 ins. x 10 ins., used as a reserve, belted to a 750-light old style Westinghouse alternator; one Westinghouse compound engine, 11 ins. and 19 ins. x 11 ins. stroke, belted to a 60-kw Stanley inductor alternator and Westinghouse No. 2 exciter; and one Westinghouse compound engine, 14-in. and 24-in. cylinders, by 14-in. stroke, belted to a 150-kw Stanley inductor alternator, with a 3-kw C. & C. exciter and also to a 120-kw Westinghouse

volt, two-phase, 60-cycle, alternating-current generators, each of 150-kw capacity. The 14-in. Westinghouse compound engine from the old station is belted to the 120-kw direct-current railway generator from the old station, while the 11-in. compound engine from the old station is belted to a 75-kw Westinghouse alternating-current generator similar to those above described. The alternating current is used for general commercial lighting, for series incandescent street lighting, and also for motors on power circuits for commercial purposes, the direct current being used for operating the electric road. Provision has also been made and foundations furnished for the additional later installation of two 16-in. and two 14-in. engines, with generators of the above direct-connected type, so that the ultimate equipment of the station will comprise three 16-in. and four 14-in. Westinghouse compound engines, having an aggregate capacity of nearly 2000 hp under 150 lbs. steam pressure.

When the demand for current warrants it, one of the new 14-in. compound engines to be installed will replace the old 11-in. compound engine, while the other 14-in. engine will occupy the foundation of the dynamo at present belt-driven from the 11-in. engine. At the other end of the power house the two new 16-in. compound

engines will take the place of the old 14-in. engine and its belt-driven railway generator, now temporarily mounted on one of the 16-in. engine foundations. The engines were furnished by Westinghouse, Church, Kerr & Company.

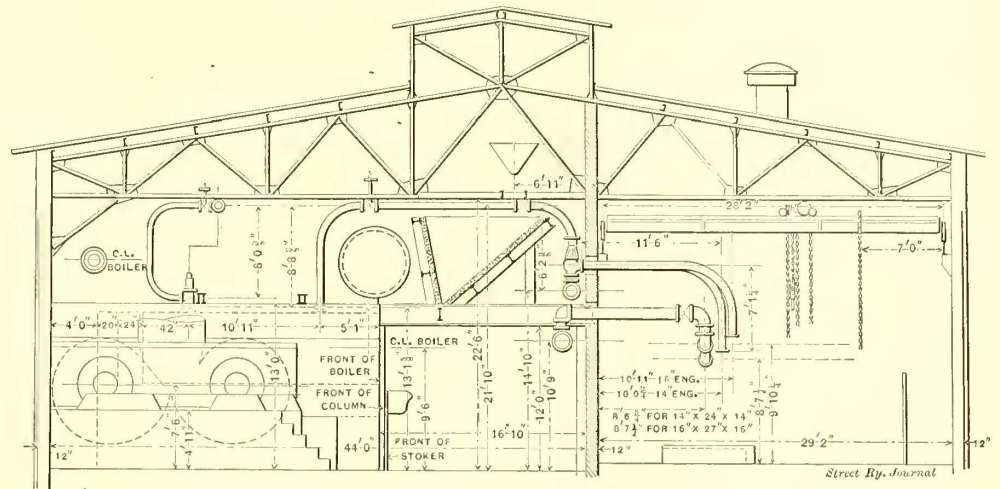
As shown by the accompanying plan, the exciter sets, made by the General Electric Company, consisting of two 15-kw generators, direct-connected to 8-in. x 6-in. engines, are located at one end of the engine room. The extreme corner of the room is occupied by a Conover jet condenser, river water being used for condensing purposes. The exciter engines are operated at less than boiler pressure, steam being taken to a low pressure receiver through an adjustable reducing valve, by which the steam pressure is reduced from 125 lbs. or 150 lbs. to 80 lbs. per square inch. The piping is so arranged that in case of injury to the reducing valve the exciter engines may be operated by taking steam through a 1-in. pipe, by which the steam is throttled sufficiently to reduce its pressure to the required amount. The steam supply to a Westinghouse air pump, which is used to furnish compressed air at about 30 lbs. pressure for blowing out dust and dirt from the electrical machinery, is taken from the exciter engine steam supply line between the reducing valve and the exciter engines.

The lighting and railway switchboards are of Westinghouse make. The usual measuring instruments, switches, pilot lamps, rheostats, circuit breakers, etc., are mounted thereon, the panels being of 2-in. blue Vermont marble, and all metal work copper finished. To facilitate handling and repairing of apparatus, the engine room is spanned by a 5-ton traveling crane made by the Reading (Pa.) Crane & Hoist Works.

The construction of the engine room floor is worthy of note. A smooth false work of 2-in. plank was closely laid, hard up under the top flange of the floor I-beams, this false work being supported by blocks resting on the top of the bottom I-beam flange. The top of the false work was thus brought about an inch below the top of the I-beams. On the false work so constructed, and raised from it about an inch, expanded metal sheets were laid with the long axis of the diamond at right angles to the floor beams, the

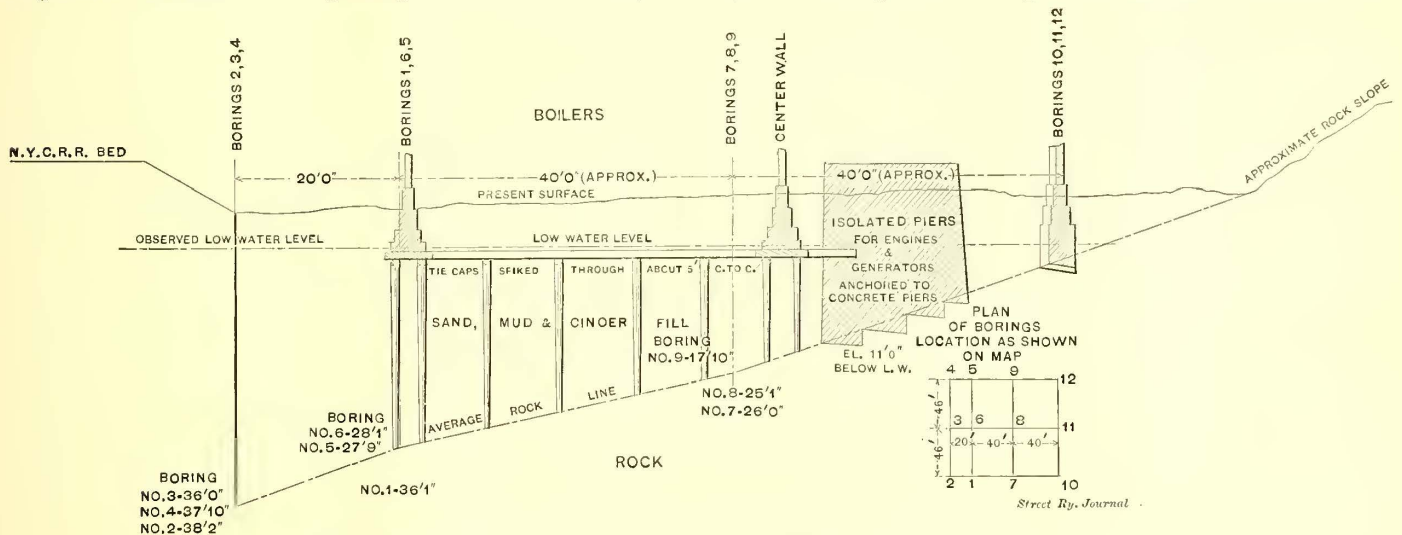
I-beams, and to avoid general surface cracking the floor was kept wet for two weeks after laying.

One feature of the equipment of both the old and new stations that deserves special mention is the use of a storage battery for leveling the load, the character of which would otherwise at times be indicated on the load diagram by extremely high peaks, due to the demand for current when cars are ascending the hills. The character of the road is such, and it is necessary to so arrange the



SECTIONAL ELEVATION OF POWER STATION

schedule, that at certain times during the day the majority of the cars are on the up-grade. The road is an unusually hilly one, so much so that fairly level portions are the exception and are never more than 1600 ft. in length, the heaviest grade being about 9 per cent. The storage battery consists of 264 chloride accumulator cells, made by the Electric Storage Battery Company, Philadelphia. Each cell was originally composed of fifteen plates 10½ ins. square, suspended in glass jars, and mounted upon a wooden tray filled with sand to insure an even foundation for the jar. These trays rest in turn upon glass insulators supported by a wooden rack. On full charge the battery had a maximum rated capacity of about 160 amps. More plates have been added recently, and the capacity is now 240 amps. As a matter of fact, however, it is often called upon to discharge at even a higher rate than this.



SECTION THROUGH FOUNDATION, SHOWING METHOD OF CONSTRUCTION

sheets lapping 6 ins. on the ends and 3 ins. on the sides. The tensile strain coming on the ends only, it was necessary to lap the sheets 6 ins. in order that the concrete might bind the sheets together. The concrete was thoroughly worked under the metal sheets, which were thus protected from rusting by moisture on the under side. Five inches of concrete were laid, and above this a 1-in. finishing cement floor, composed of a mixture of the proportion of 4 lbs. excelsior carbon black, 1 bbl. Atlas Portland cement, 1 bbl. sand, and 1 bbl. extra fine quality 3-16-in. crushed granite. This made a smooth, glossy, slate-colored floor of extreme hardness and fine wearing qualities. It was divided into squares about 3½ ft. on a side. Expanded metal sheets were placed just below the top of the concrete over each of the I-beams, so as to prevent any tendency of the floor to settle in the center and crack over the

The value of the storage battery was well illustrated in the old station in the operation of both lighting and railway generators from the same engine, an arrangement which ordinarily would produce serious flickering in the lights, but with the battery in use it was impossible to detect the slightest change in the brilliancy of the lamps, although the railway load might be fluctuating between its widest limits. While no tests have yet been made to determine the saving of coal through the use of the storage battery, it is believed that such saving is sufficient to pay a good return on the battery investment, over and above the interest and depreciation charges. This belief is largely based on the increased economy of a unit operating at a constant load approximating its rated capacity, as contrasted with one of, say, three times the size, but doing the same work under widely fluctuating load conditions. The

battery prevents all sudden overloads from the generating machinery, and the strain thus removed from the minds of those in charge is a valuable consideration as well. The battery is also valuable in other ways, as in case of a mishap necessitating temporary generator shutdowns. At times it is also desirable to run a car for some special occasion very late at night, when the generators are shut down, and by throwing on the battery the necessary current is then immediately available. The battery is located in

Leaving the town proper the road to Lake Mohegan traverses a beautiful rolling country dotted with the summer residences of wealthy New Yorkers. There is also a line of track, about 6 miles long, running through the residential section of Peekskill, thence through Centerville and Buchanans to Verplanck Point, where there is a popular pleasure resort. This branch of the trolley line serves a population of about 2500 people, who would otherwise have no means of reaching Peekskill except by stage.

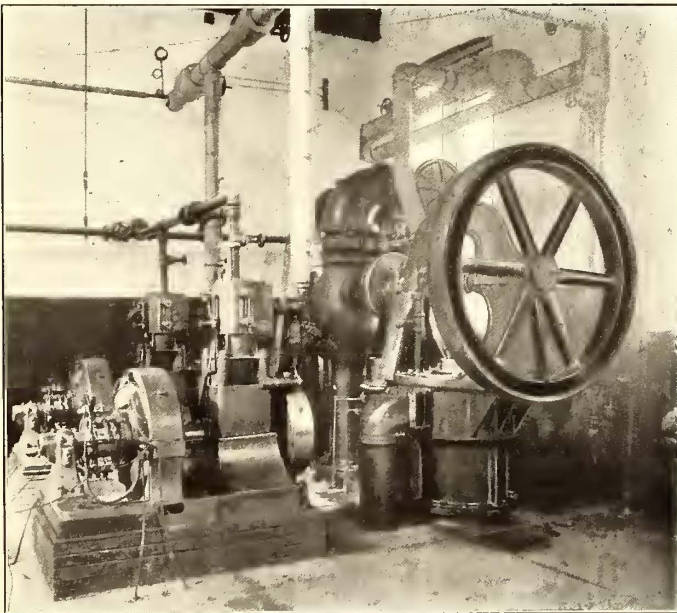
An extension of the trolley system from Lake Mohegan eastward



BOILER ROOM

a detached brick building a short distance from the power house. The storage battery booster mentioned in connection with the equipment of the old station is utilized in the new plant, where it is driven by direct connection to a Westinghouse, 30-hp, 550-volt, direct-current motor.

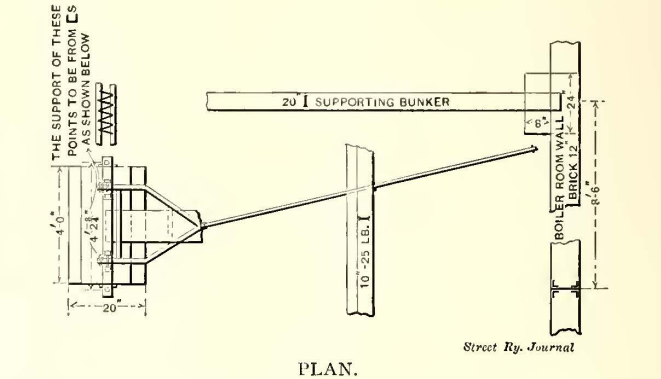
On account of the change from 133 cycles in the old, to 60 cycles in the new station, the transformers and meters on the system were replaced by new apparatus of Westinghouse make. For the use



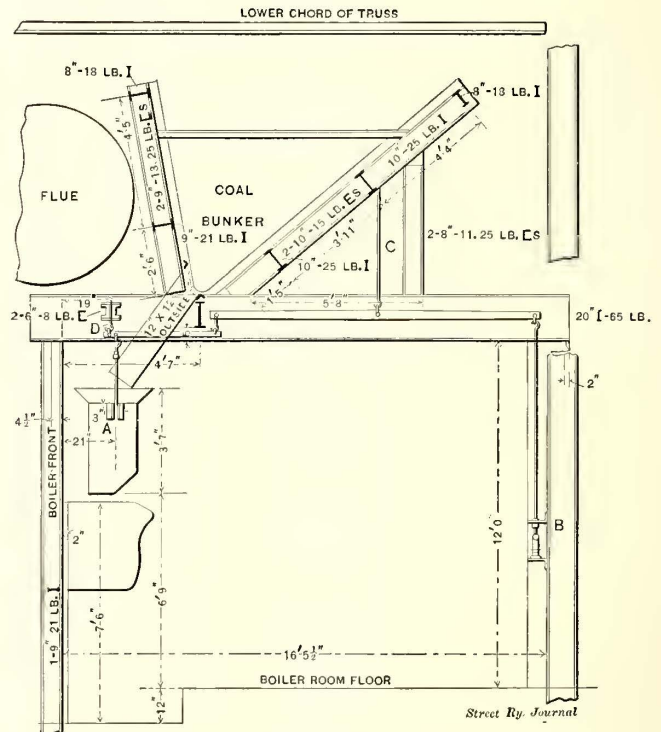
CONDENSERS AND EXCITER SETS

in connection with the series street incandescent lighting system, there are provided in one corner of the engine room six General Electric automatic reactive coils for controlling and regulating the voltage on the several street lighting circuits.

The electric railway was put in operation in July, 1899, the tracks extending from the New York Central & Hudson River Railroad station in a practically straight line through the main streets of the town to Lake Mohegan, a distance of about 5 miles, with a 3/4-mile branch to the State Camp Ferry.



PLAN.



ELEVATION.

DETAILS OF WEIGHING HOPPER

is under consideration, and negotiations are pending with the Danbury & Bethel Street Railway Company, of Danbury, Conn., which has offered to extend its line approximately one-half of the way to Lake Mohegan to meet this proposed extension. There would thus be established a through trolley connection from the Hudson River to Long Island Sound. The territory which would be opened up has at present poor transportation facilities. In addition to the passenger service it is proposed to handle light freight traffic.

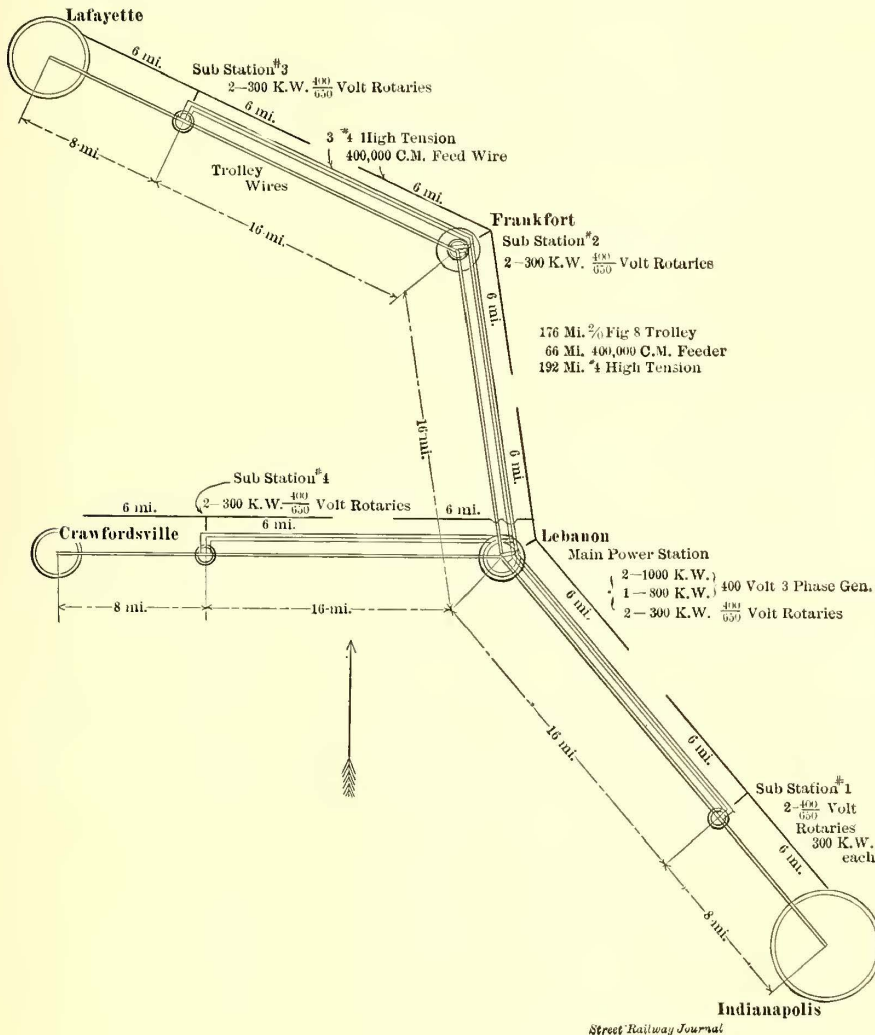
The rolling stock of the company consists of five closed cars of the vestibule type, with electric heaters, ten open cars, and a Wason snow plow. All are of excellent construction and of modern type. The car motor equipments are of Westinghouse make. The car house, to which an addition has just been made, is a substantial fireproof brick building with a capacity for twenty-five cars. Yards are provided for the storage of rails, ties and other materials.

The overhead construction of the system is simple, consisting of 00 trolley wire throughout, with 0000 feeder wire, tapped in at regular intervals and extending to within a half-mile of Lake Mohegan and within 1000 ft. of the power-house end of the road. The State Camp branch has no feeder. The entire line, representing 10 miles of single track, with 5 turn-outs, is constructed of 56-lb. T-rails, which are laid in the usual manner. The plant was designed and installed by Sanderson & Porter, engineers and contractors, New York.

High-Speed Electric Railway for Indiana

The Indianapolis, Lebanon & Frankfort Railway is another important high-speed line now being built out of Indianapolis, and will be second only to the Union Traction Company of Indiana in mileage. One peculiarity of this road will be that it passes through very few small towns, and will depend for most of its business on high-speed through service between Indianapolis, Lebanon, Crawfordsville, Frankfort and LaFayette.

The accompanying diagram of the road, which shows the electrical distribution and distances between towns gives a good idea of the actual route of the road, although only a diagram, because the route between cities, except from Indianapolis to Lebanon, will be practically straight. Running northwest from Indianapolis, the line parallels that of the Big Four Railroad as far as Lebanon, where the road branches, one line going to Crawfordsville, 24 miles west, the other north to Frankfort, 16 miles, and then 24 miles northwest to LaFayette. The road is to be single track with 70-lb.



MAP OF INDIANAPOLIS, LEBANON & FRANKFORT RAILWAY

T-rails on oak ties, well ballasted. There will be no grades to exceed 2 per cent, and very few of those.

In order to secure passenger business between these towns and Indianapolis, in spite of the competition of steam roads, high speed will be a necessity. The maximum speed figured on is something over 60 miles per hour. The cars will be equipped with four 75-hp motors. Cars are to be 50 ft. in length, of standard construction and with very fine finish and furnishings. The power house, as indicated on the map, will be located at Lebanon, and will contain two 1000-kw, and one 800-kw 400-volt three-phase generators, and two 300-kw rotary converters, taking 400 volts on the alternating current end, and delivering 650 volts to the trolley wire on the direct-current end. There are to be four sub-stations fed from the main power house by three-phase high-tension lines. Feed wires extend 6 miles each way from a sub-station as auxiliaries to the trolley wire.

It is the expectation to make the run from Lafayette to Indianapolis, 70 miles, in two hours. The time from Crawfordsville to Indianapolis, 54 miles, is to be one and one-half hours. There

will be but very few stops between the towns. The schedule will be as high, or higher, than anything now being maintained in electric railway operation in the United States. All the principal towns connected by this road are county seats, and when it is completed it will connect five county seats and run through as fine a farming country as can be found in the State of Indiana.

Townsend, Reed & Company, railway builders, who now have headquarters at Indianapolis, are the contractors and financiers of the road. The officers of the Indianapolis, Lebanon & Frankfort Railway are: George Townsend, president; Pierre Gray, vice-president; Robert P. Woods, treasurer, and W. S. Reed, secretary.

Atlantic Avenue Improvement

The Atlantic Avenue, Brooklyn, improvement will be continued in spite of the attempt to stop the work by injunction. The application of the Brooklyn Rapid Transit Company for a restraining order to stop the depression of the tracks of the Long Island Railroad in Atlantic Avenue has been denied by Supreme Court Justice Smith. The work of tunneling and track depression had made considerable headway before the Brooklyn Rapid Transit Company applied for the injunction. The fight, it is said, grew out of the denial of the right of the Brooklyn Rapid Transit Company to run a trolley line through the avenue after the steam cars have been removed.

Justice Smith says that the delay of the Rapid Transit Company in beginning this action and making the claim that the Atlantic Avenue improvement is illegal and violative of its rights as landlord of the Long Island Railroad Company is inexcusable and unexplained, and furnishes a sufficient and conclusive reason why the preliminary injunction ought not to be granted. The court refers to the public agitation for years for the removal of steam cars from the surface of Atlantic Avenue, and the final appointment of a commission by the State Legislature to put the improvement through, all of which was known to the Rapid Transit Company, which made no move in the matter until work had begun under the several contracts.

Electrical Industries of Pittsburgh

At the recent annual meeting of the American Association for the Advancement of Science, which was held at Pittsburgh, Pa., and at which 400 members were present, an interesting address was given by George H. Gibson, of the Westinghouse Companies' Publishing Department, on the "Electrical Industries of Pittsburgh and Their Economic Influence." Mr. Gibson spoke of the rapid growth and present extensive dimensions of the Westinghouse Electric & Manufacturing Company's plant, and pointed out that this immense installation is shortly to be duplicated. Continuing, he said:

"The modern industrial age began with the advent of the steam engine, but, in order to utilize its power, some means of transmission was necessary. The agent par excellence for power distribution is electricity. Electricity has furnished also the most useful means of lighting, and electro-chemistry has opened up a new but rapidly developing branch of industries." Mr. Gibson spoke of electric traction as an important factor in developing cities, redistributing populations, building up suburban districts, and affording convenient transportation to farming communities. He also referred to the use of electricity in the modern factory, and of the possibilities of electricity in mining. He said that electro-chemistry has not only made aluminum a rival of copper as an electric conductor, but nearly all the copper is now electrically refined. He said that mechanical and engineering development is a measure of a country's civilization, and showed that the power plants of the United States generated 69 per cent of all the electricity used in the world, 76 per cent of all that portion available for traction, 76 1/2 per cent of all the electric railway mileage, and 83 1/2 per cent of all the trolley cars.

An Obstacle to Rapid Transit

BY HOWARD S. KNOWLTON

Rapid transit in cities is to-day a complex function of four important variables—right of way, equipment, operators and passengers. The transportation efficiency of any system is vitally dependent upon each one of these factors. This efficiency may be expressed as a percentage by dividing the safe running time of any equipment between two or more points by the actual time made in practice. The best that the equipment can do in accelerating from standstill upon a tangent level track in good condition, reaching maximum speed at normal voltage, maintaining this speed over unrestricted right of way until a quick braking stop ends the run, is the measure of minimum time possible between two points with the car brought to rest at each. Such a speed-time characteristic is ideal from the kinematic standpoint alone, and entirely neglects economy of power, judicious coasting, making up lost time on schedules, and, to some degree, comfort of passengers. Such a percentage is merely suggestive of possibilities, and is important to the maker of schedules in much the same way in which the electrical efficiency of a generator is of interest to the dynamo designer. The figure which most concerns the progressive manager is what might be called the "commercial efficiency of transportation," or the ratio of schedule time to actual time in the same units.

The relative importance of the four factors mentioned depends largely upon the system examined. Neither acceleration nor station stops are of prime interest on an interurban road from fifteen to twenty miles long or upward. Maximum speed of equipment and right of way are here in the front rank, while in a congested city street or on an elevated or underground line, acceleration and stops are of the utmost importance.

In perfecting the machinery of transportation remarkable progress has been made in all of these factors, with the exception of the last. The average passenger's inability to realize that he is to do his own part if he is to obtain and conserve rapid transit is most apparent on elevated railways and in subways through the crowded districts of large cities. Money spent for quick acceleration to high maximum speed is largely thrown away when station stops become prolonged to two-thirds of the running time between stopping points through the inability of the passengers to perceive the consequences of each second of delay. Multiple-unit control and 100 per cent weight on drivers can do little for the transportation efficiency if passengers fail to recognize the helplessness of the entire service against their own dallying. An excellent example of the importance of station stops in their influence upon the schedule is found in the operation of trains northbound through the Boston subway. From Pleasant Street to Haymarket Square, inclusive, a distance of about 1.13 miles, with 15-second stops at Pleasant Street, Boylston Street, Park Street, Scollay Square and Adams Square, the running time is easily made in 6 minutes, with a schedule speed of 11.3 miles per hour and an average speed of 14.5 miles per hour. Increasing the stops 10 seconds at each station brings the time to 6 minutes and 50 seconds, and lowers the schedule speed to 9.9 miles per hour, a reduction of nearly 12½ per cent. With stops averaging 35 seconds, a frequent rush hour condition, the trip is readily made in 7 minutes 40 seconds, schedule speed 8.8 miles per hour. The reduction from normal is over 22 per cent. The average distance between these stations is about 1195 ft., and the effect of stops would be still more pronounced if the alignment and grade were less severe. Adding 20 seconds to each of the stops on the Brookline circuit of the Boston & Albany Railroad, at present operated by steam, would lengthen the running time by about 11 per cent on a line 22.9 miles long with twenty-one stations averaging 1.09 miles apart.

On crowded city streets delays in passengers boarding or leaving cars are likewise pernicious, although to a less degree in the majority of instances. In spite of the fact that stopping points are fast becoming regularly designated in the best street railway practice by marked poles or signs, the average duration of stops does not bear as high a proportionate relation to running time as does that on a strictly rapid transit road, in view of the fewer number of passengers ordinarily encountered.

The remedy for such delays lies of course with the passenger and railway company jointly. It behooves every manager who has to meet the criticism of "slow service" to look well into the stops of his cars and trains. When a passenger is brought to realize that the aggregate delay to sixty of his fellow beings on a car or train is one minute for each second of time which he uses up in getting on or off, a step in the right direction has been taken. In America few men will intentionally delay others on a car in the face of the amount of public sentiment which can be produced by an impatient body of passengers. The company owes it to the public to see

that its individual members realize the importance of each doing his part in making transportation safe and swift, and the passenger needs to be informed by open and fair illustration that, although the equipment may be well designed, the track level and straight, the operating personnel well trained, without his co-operation rapid transit on short, quick runs cannot be obtained.

Hearing on Pennsylvania Tunnel Franchise

The public hearing before the committee on railroads of the New York Board of Aldermen upon the Pennsylvania tunnel contract proved to be an interesting event, as it disclosed the policy of the opponents of the measure and the plan they propose to follow. Alderman Whittaker read a protest, in which he said in part:

"In my judgment the city should never grant perpetual franchises. The action of the Board of Rapid Transit, approved by the Mayor, is in its nature a usurpation of power. It is absolutely impossible to foresee all the conditions which should be provided against in behalf of the city. Hundreds of contingencies exist; thousands of possibilities lie dormant, most of which cannot be solved at this time; and the attempt to solve them by a contract which binds the city perpetually is to attempt the impossible."

Alderman Doull wanted to know why the commission had not required bonds from the company as in the case of the contract for the subway. Comptroller Grout answered that the company intended to spend about \$50,000,000 in building the tunnel, and that the city would have a lien on its property for the proper execution of the work and to protect the city against damage claims. Mr. Grout added that the proposed railroad, while it would prove of great benefit to New York, would not only not cost the city a penny, but would be a profitable source of revenue. "If every railroad company owning franchises in the city paid as much for their trackage as the Pennsylvania will pay," said the Comptroller, "our revenue would be increased by about \$10,000,000 a year."

Alderman Doull wanted to know what was the real purpose of the Pennsylvania Company in seeking the franchise. He was sure there was "something hidden behind the whole thing," and the aldermen ought to know all about it and they would before the franchise was granted, said he.

"It is well known," responded Mr. Boardman, "that the Pennsylvania Company has acquired control of the Long Island Railroad. The Pennsylvania Company is desirous of competing with the New York Central Company, and for that purpose it wants an entrance into New York. The Pennsylvania also wants a large share of the competitive passenger business of Long Island. Therefore, it wants to connect its main system with the Long Island system. Then they are interested in the freight traffic, and I suppose they also have some views with regard to the future."

For the closing up of Thirty-Second Street between Seventh and Ninth Avenues, the Pennsylvania will pay \$788,000. This amount, Mr. Doull said, was a pittance and did not represent the value of the property. The eight corners to be taken over were worth at least \$100,000 each, he said.

Then the real animus of the opposition was revealed, and, as had been expected, proved to be the jealousy of the aldermen because of the great powers vested in the Rapid Transit Commission. The alderman then attacked the Rapid Transit Commission. It was a self-perpetuating body, he said; was not responsible to the people, and therefore should not be empowered to have any control over the granting of public franchises. Then other aldermen protested that the franchise was a perpetual one, that the readjustment clause did not sufficiently protect the city, and that the contract contained no eight-day clause. Mr. Doull called into question the sincerity of the Rapid Transit Commission. He said it seemed to him that the commission had sought only to safeguard the interests of the Pennsylvania Company.

Mr. Orr resented the imputation. So far from giving the company any advantage, he said, Mr. Cassatt and other officers of the company had charged that the commission was trying to keep them out of the city by making the terms prohibitive and had pointed out that in no other city in this country or in Europe had a railroad company been charged for sub-surface privileges.

Contrôller Grout then said he wished to impress on the committee that this was not a case in which municipal ownership could be considered, as the railroad was not for citizens within city limits, but for travelers from distant parts. Referring to the eight-hour labor law, the controller said he sympathized with the Central Federated Union, but at no time did it occur to the members of the commission that it could be inserted in this franchise, as it was dealing with a corporation.

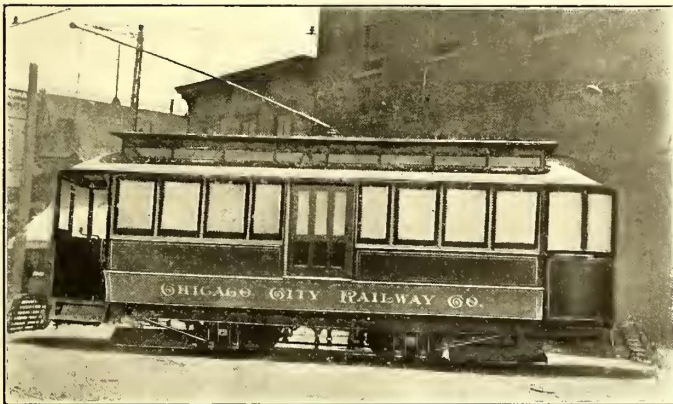
At the conclusion of the hearing it was generally believed that

some delay would be experienced and that the contract between the city and the railroad could not be executed before the fall, but there seems to be no doubt that the franchise will be granted on the present terms. It was announced that the better element of the Board of Aldermen was convinced that the building of the tunnel would be a good thing for the city, and the leaders of the Republican party in the various boroughs have promised that they will exert their influence to have the plan pushed through without delay. The franchise will be approved by the aldermen early in September. A majority vote for the contract has already been assured.

In speaking against the approval of the suggested contract on Friday Alderman Doull said that he lived in the region where the terminal is to be built, and that the property owners of that district were opposed to the Pennsylvania project for the reason mainly that the city had not insisted on the company paying more money than was stipulated in the contract for the closing of that street. When the resolution to approve the franchise comes up before the aldermen a petition will be presented wherein it will be shown that over 90 per cent of the property owners are in favor of the Pennsylvania tunnel scheme, and facts will also be brought forward to demonstrate that since the plan of the company has become known the value of property in the district has increased considerably.

Car for the Distribution of the Chicago Tribune

The Chicago Tribune recently put in operation, on the Chicago City Railway, a special car for the early morning delivery of its papers. This car, which is shown in the accompanying engraving, was rebuilt by the Chicago City Railway Company from one of its single truck box cars, the main change being the removal of the ordinary seats and cutting of doors in the sides, through which large bundles of newspapers can be passed. This car leaves the



TROLLEY CAR FOR NEWSPAPER DISTRIBUTION

corner of Clark and Washington Streets at 3.45 a. m., and runs down Clark Street and Wentworth Avenue as far as Englewood, about seven miles. At points along the line distributing wagons meet the car and relieve it of its load of newspapers. There would seem to be no good reason why a similar practice could not be carried out in many other cities and in other parts of Chicago. This is the first move made by any of the Chicago street railway lines towards carrying anything but passengers and the United States mail.

Baltimore Company to Insure Employees' Lives

The United Railways & Electric Company, of Baltimore, has arranged to insure the lives of the motormen and conductors in its employ. In the case of fatal accident while in the service of the company the sum of \$1000 will be paid to the family of the victim.

This arrangement has been entered into with State Insurance Commissioner Wilkinson, who is designated by a law passed by the last Legislature to act as agent for such a plan. This is known as the "Employers and Employees' Co-operative Insurance and Liability law."

It permits the employer to deduct one-half of the cost of this insurance from the wages of the employee. It has been decided by the management of the United Railways that the company will pay the entire amount and will make no deduction from the wages

of the men. It will cost 60 cents for each employee so protected, and the aggregate to be paid by the United Railways will be about \$1800 a year. The insurance is to be accepted as settlement for any claim against the company, and in this sense is a mutual arrangement between employer and employee.

What is Meant by a Grade Stated in Per Cent?

BY CARL IHERING.

It has become customary in this country, and the custom is a good one, of stating grades in per cent, meaning the vertical rise in feet for every 100 ft. of distance. In France the expression "o/oo" instead of "%", is often used in a similar way for very slight grades, and it then means per thousand instead of per hundred. In England the reciprocal value of the per cent is used, that is, instead of referring to the rise per hundred feet distance, the slope is indicated by the distance in which the rise is 1 ft. What the advantages are in the English system is not apparent, but as neither the French nor the English system is used in this country neither need be discussed here; it suffices merely to know what they mean when we read foreign literature.

In stating grades in per cent, the question arises, "What is meant by the distance of 100 ft.?" "Is it the horizontal distance, as would be measured on a map, or is it the sloping distance as would be measured by the length of rail or track?" Or, in mathematical terms, does the term per cent refer to the tangent of the angle of the slope, or to its sine? Reference books of the "shears and paste" order use the term per cent without defining it, while others do not use the term, but give grades in other terms, which involve no ambiguity, leaving one in the dark, however, as to what is meant by per cent.

Before preparing a table which involved this question, the writer obtained the opinions of a number of experts, and from these it was found that practice was decidedly different among different engineers; some say the tangent is invariably meant, others say the same of the sine; some were more cautious and said that a certain one was "usually" meant. Owing to this discrepancy, the matter was considered to be of sufficient interest to warrant calling attention to the ambiguity and to the lack of any uniform practice. This ambiguity is not without due cause, however, as there are good reasons for sometimes referring to the horizontal distance and sometimes to the inclined distance, and it is therefore improbable that uniformity will ever be established, much as it may be desired. When maps are used the horizontal distance is invariably referred to, as that is the one directly measurable on maps; the tangent is then meant in stating grades in per cent. On the other hand, in using the usual formulas or diagrams for calculating the tractive effort or resistance on grades, the sloping distance or length of track seems to be invariably meant, as the part of the tractive effort due to the grade then bears the same relation to the total weight of a car or train as the rise bears to the sloping distance; or, in other words, on a 3 per cent grade, for instance, this tractive effort will be 3 per cent of the weight; this calculation, therefore, becomes very simple. In the latter case the term percentage refers to the sine and not to the tangent. This difference in the use of the term "per cent," when referring to grades, shows the necessity of stating what one means when one uses this term. In existing literature, in which an author did not explain what he meant, the probabilities are that if he is a civil engineer or steam railroad engineer he meant the tangent, and if he is an electrical or mechanical engineer and referred to the tractive force, he meant the sine.

It can readily be shown that in the usual engineering calculations involving grades, there is really no material difference whether the tangent or the sine is used. In the usual steam railroad practice, involving only very small grades, the difference would hardly be measurable, and either the tangent or sine may be used in calculations, depending upon which is the most convenient. In electric traction, grades on adhesion roads rarely amount to 14 per cent or over, and it will be found that for a grade of 14 per cent (about 8 degs.) the difference between the tangent and sine is almost exactly 1 per cent, from which it follows that in most engineering calculations involving grades not over 14 per cent the question of whether the tangent or sine was meant is of no great importance unless great accuracy is required. It is in tables which are intended to be accurate, and in calculations involving steep-grade cable roads, inclined plane roads or rack and pinion roads, that it becomes important to state clearly whether it is the horizontal distance or the slope distance that is referred to when the grade is stated in per cent or per thousand or by the English method. As these cases are by no means infrequent, however, it is very desirable that one of the two methods be made standard, so that it may be clearly understood whether the tangent or the sine of the angle of slope is involved in denoting the grade in per cent.

Brooklyn Bridge Plans

Mr. Parsons' plan for relieving the crush at the Manhattan terminal of the Brooklyn Bridge, and providing adequate facilities for future developments, seems destined to meet the same fate as its predecessors. As announced last week the Parsons plan was received with favor by the Rapid Transit Commissioners, and a resolution approving it was passed unanimously; but at the next meeting this action was reconsidered after Bridge Commissioner Lindenthal had had his innings, and the approval was withdrawn so far as it related to the Nassau Street plans. Mr. Lindenthal's communication reviewed the plan proposed by Mr. Parsons, and revived the agitation for a moving sidewalk. He said in substance:

MR. LINDENTHAL'S PLAN

The connection of the bridge with the Williamsburg bridge by tunnel road under Centre Street offers decided advantages, for the reasons so convincingly stated by Mr. Parsons, and which must be obvious to any one who had studied the situation. My former recommendation of connecting the Manhattan end of these two bridges by means of an addition to the present elevated railroad along Park Row and the Bowery had for its principal reason the avoidance of disfigurement of Centre Street.

While the elevated railroad which I had proposed for the connection of the bridge termini offered easier grades and would have been less costly to build and to operate, it carried with it the complication of a necessary combination with the Manhattan Elevated Railroad Company, whose structure is now on Park Row and the Bowery.

A tunnel from the Manhattan terminus of the Williamsburg bridge, along Delancey Street to Centre Street, can be built independently of the Manhattan Elevated Railroad, but there is little question that this company will find it to its interest to join the city in the construction of a suitable station at City Hall Park. The bridge terminal would be under the street level, and the Manhattan Elevated Railroad above the street level, and over the same land.

If, however, no arrangement could be made with the Manhattan Elevated Railroad Company for a station in common at this point, the city will still be able to go ahead with its own improvements.

The Williamsburg bridge will be of very little use unless provided with a direct approach to the City Hall region of Manhattan; therefore, the connecting link from the Williamsburg bridge down town should be commenced at the earliest practicable moment. The present indications are that the Williamsburg bridge will be completed Oct. 1, 1903.

The tunnel under Delancey Street and Centre Street can be built, if necessary for financial reasons and to save time, in two installments; the first being from the Williamsburg bridge to the intersection of the proposed extension of Delancey Street and Centre Street. At that point, which is near the Spring Street station of the subway, passengers could be temporarily transferred from the Williamsburg bridge to the subway under Elm Street, until such time as the second installment of the tunnel, under Centre Street to the terminal at the Brooklyn Bridge, shall have been completed.

To this end it would be advisable at once to carry out the plans now before the local Board of Public Works in regard to widening Delancey Street, from Clinton Street to the Bowery.

The continuation of the tunnel tracks on Centre Street to the Manhattan end of the Brooklyn Bridge, and the underground station there, could be done while the Williamsburg bridge is in use, with its tunnel approach temporarily ending at Elm and Spring Streets.

In regard to depressing the trolley tracks from the Brooklyn Bridge to a tunnel in Nassau Street, it is my opinion that the work should not be considered until the proposed tunnel under Maiden Lane shall have been authorized.

In the meanwhile, the traffic over the Brooklyn Bridge is certain to grow, notwithstanding the relief which the Williamsburg bridge will afford, and it is absolutely necessary to increase the transportation facilities over that bridge, without waiting for the completion of the Williamsburg bridge, or the Whitehall Street tunnel, or the Maiden Lane tunnel.

Permanent relief over the Brooklyn Bridge can best and quickest be given by a moving platform. I have pointed out before that the transportation capacity of the moving platform is several times as great as that of a string of trolley cars crowded to the utmost, which is the rule now on the bridge during rush hours. It would at once more than double the capacity of the present structure, which must be relied upon for several years as the principal outlet to the Borough of Brooklyn.

The safety of the bridge and its durability will be enhanced by substituting for the present concentrated trainloads the uniformly

distributed and much lighter load of a moving platform—until such future time when the antiquated stiffening system can be replaced with a modern construction of two decks, carrying at least six tracks. Then it will be an easy matter to change the moving platform from one set of tracks to another, and thus in the end the Brooklyn Bridge may accommodate elevated trains, trolley cars, and the moving platform—all on the same structure.

A moving platform can be placed upon the Brooklyn Bridge in nine months' period, in connection with an orderly and systematic trolley terminal at the Brooklyn end of the bridge—for which there is ample room on the bridge plaza owned by the city—can be readily built. The Brooklyn Rapid Transit Company, with the same number of cars which it owns now, will be able to accommodate the traffic more efficiently at that point and throughout Brooklyn.

I beg, therefore, to recommend: First, that the tunnel line be built from the Williamsburg bridge to Centre Street and down Centre Street to the City Hall terminus, and that accurate plans and estimates of cost be prepared therefor; second, that simultaneously a moving platform be installed on the Brooklyn Bridge, and that the necessary legal steps be authorized therefor; third, that all further improvements be taken up later, and in a systematic manner, so as to fit into a general scheme of rapid transit connection between the East River bridges and rapid transit lines on both sides of the East River.

CONDITION OF BRIDGE

In the discussion which followed the reading of this report Mayor Low stated that he was now satisfied that so much of Mr. Parsons' plan as related to the Centre Street subway met with the approval of the majority of citizens. He therefore asked the commission to authorize him to ask Mr. Parsons to co-operate with the Bridge Commissioner in the preparation of detailed plans. As to that part of the Chief Engineer's plan which referred to Nassau Street, he had reached the conclusion that this was a matter which required careful study, and therefore he would withdraw that portion of the resolution offered by him at the last meeting of the board, which referred to the Nassau Street plans.

The board having agreed without discussion to the proposal that Mr. Parsons should discuss the details of the Centre Street plan with Mr. Lindenthal, an informal discussion arose concerning the merits of the movable platform system as it might be applied to Brooklyn Bridge.

George S. Morison, a civil engineer, explained the advantages of the system, and was seconded in his efforts by the Bridge Commissioner. Mr. Morison and Mr. Lindenthal agreed that the moving platform would travel at the rate of from 2½ to 10 miles an hour. They admitted, however, that if the bridge trains were used in addition to the platforms it would be necessary to build a new suspended superstructure. This, Commissioner Lindenthal remarked, could be done at a cost of about \$2,000,000, and he added: "The Bridge is not adapted to the trolley car traffic it is now mostly used for. The capacity of the bridge has now reached its utmost limit, and although the anchorages, cables and piers are all right yet, it is only by keeping a large staff of men at work inspecting the already overstrained stiffening trusses and in looking out for the starting of rivets that it is possible to insure safety under the present conditions of traffic." This statement was corroborated by William Barclay Parsons and George S. Morison, another engineer of prominence.

Increase in Passengers Carried in St. Louis

According to the statement of the St. Louis Transit Company, filed with the City Register on July 9, the business of the company for the quarter ended in June has surpassed the record of any quarter since the organization of the company. In the three months 33,229,842 passengers were carried in 1,296,544 trips. In the same period last year 30,210,677 passengers were carried in 1,262,436 trips. In April, May and June, this year, 34,108 more trips were made than in the same quarter of last year, and 2,019,165 more passengers were carried. A large increase over the same period of 1901 was also made in the first quarter of this year. The half-year closing June 30, was, judging from returns on file, most prosperous that the St. Louis Transit Company has ever had. In January, February and March of this year 31,575,192 passengers were carried in 1,145,634 trips. In the same months in 1901, 25,713,910 passengers were carried in 1,268,952 trips. In the first quarter of this year 123,318 less trips were made than in 1901, but 5,861,281 more passengers were carried. In this half year the company carried 64,805,033 "revenue passengers" in 2,442,178 trips, as compared to 55,924,587 passengers in 2,531,388 trips in the first six months of 1901. The passenger patronage shows an increase for the six months of 8,880,446 fares, and a decrease of 89,210 in the

was practically a return to the old schedule, some items being a little higher, and some a little lower. It is supposed that the arbitrator arrived at a settlement by taking the actual figures of operation of both roads, and allowing each the same proportion of business it has been handling, the balance of earnings to be pooled and later divided."

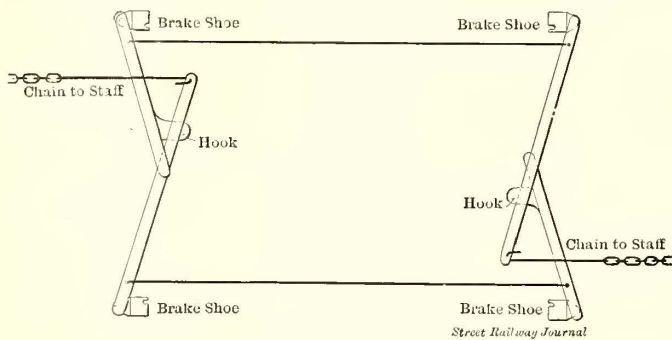
A return to anything like the old schedule of rates gives a very excellent prospect for substantial returns from operation.

Equalizing Brake Rigs and Wheel Wear—Changing Wheels and Car Bodies

For several years the Grand Rapids Railway Company has had a number of single trucks in operation which were designed and constructed by W. W. Annable, the master mechanic of the system. These trucks are exceedingly simple in construction, consisting simply of a rectangular frame made of two thicknesses of bar steel $\frac{7}{8}$ in. x 7 ins. hung from the journal boxes. The car body is supported by elliptic springs on the four corners of the truck frame and spiral springs are placed over each journal box.

The construction is extremely simple and does not entail many repairs, but the criticism which most railway men have to offer against this design is that there is no way of getting the wheels out from below, and that to take the car body off the truck consumes too much time. Mr. Annable admits the first part of this criticism while denying the last. He considers the money spent in shop equipment, and the sacrifices made in truck design to permit wheels to be taken out from below a mistake. He maintains that with his shop force and the simple attachments between truck and car body which he employs with the home-made trucks just spoken of, he can remove wheels as quickly by running the truck out from under the car as by any other plan; moreover, this ease of truck removal makes it possible for him to change car bodies on a truck in an hour.

On these trucks a form of equalizing brake rigging is used which calls attention to some points in brake-shoe wear which are not commonly considered, but which Mr. Annable believes to be important. The equalizing brake rig used on the Annable truck is shown in the accompanying sketch. For the sake of clearness everything has been omitted but the brake rig proper. A pull on



EQUALIZING BRAKE RIGGING

either brake chain shortens the distance between brake-shoes, and since the brake beams are connected by rods as usual, the brakes are set. The brake beams are each in two parts, which form the brake levers. The hooks shown on the levers are for preventing the rear levers from loosening when the power is applied at the brake chain in front. With this rigging, which applies an equal pressure to all the wheels, Mr. Annable says he is able to obtain a very even brake-shoe wear on all four wheels, and consequently an even wheel wear, while with some other riggings this is not true. On a very common form of brake rig it is necessary to put the pivotal point which does the equalizing between the opposite wheels on a brake beam a little to one side of the center of the beam, and there is consequently uneven wheel wear. This, Mr. Annable thinks, is the reason for many cases of mysterious uneven wheel wear, since wear on wheels by brake-shoes in street railway service is an important factor in determining the total wear on a wheel. When once one wheel has worn smaller than the other the tendency is to make that wheel flange crowd the rail and cause a sharp flange. This suggests another cause of sharp flanges that may be worth considering..

Robbing the Toronto Street Railway

The Toronto Street Railway Company, impressed with the belief that it was being systematically robbed by its employees, put the matter in the hands of a detective agency. An employee of this agency, applying for a position, was given a place as an

extra conductor, and, associating with the men, soon ingratiated himself with the other employees. As a result of this he gained their confidence, and finally he had disclosed to him the systematic plan of stealing that was being operated among the men. Fare boxes are used in Toronto, and out of these boxes the employees were extracting tickets by an ingenious but simple device. A strip of metal, about 8 ins. long, just wide enough to go through the slot of a fare box, was used. Some 2 ins. or 3 ins. of one end of this was doubled over a lead pencil, thus forming a spring, and pressed together the ends were pushed into the slot in the box, the shorter end being secured by the springs of the box. With the box held upside down, the contents pass down the longer end, out of the slot, into the rounded portion formed over the pencil and into the conductor's hand. As a result of these discoveries nine conductors were arrested on June 5 while operating their cars. Out of this, it is said, grew the demand of the men for the recognition of the union, and also for a uniform rate of wages of 25 cents an hour for all motormen and conductors, with nine hours to constitute a day's work.

Consolidation of Lines at Trenton

The Trenton, Lawrenceville & Princeton Railroad, the Trenton, Lawrenceville & Princeton Extension Railroad, the Princeton Street Railway, the Yardley, Morrisville & Trenton Street Railway, and the Newtown & Yardley Street Railway have been consolidated with the New Jersey & Pennsylvania Traction Company, although each of the individual charters will be preserved. The meeting at which the consolidation was effected was held in Trenton on July 10, and the officials of all the roads were represented. Robert E. Wright, of Allentown, Pa., president of the Lehigh Valley Traction Company, which is the dominant power in the movement, was present, and it was decided to purchase the stocks and bonds of each of the roads in the name of the New Jersey & Pennsylvania Traction Company. The Trenton, Lawrenceville & Princeton and Trenton, Lawrenceville & Princeton Extension Railroad Companies have steam railroad charters, the Princeton Company has a street railway charter, each of the other companies, which operate across the river in Pennsylvania, also have street railway charters, while the New Jersey & Pennsylvania Company has a traction charter, embodying all the privileges of a steam railroad charter in New Jersey, except the carrying of freight. A steam locomotive and freight cars are run on the Princeton line, so far as the two steam charters cover the route.

The capital of the New Jersey & Pennsylvania Traction Company, was increased from \$1,000,000 to \$1,500,000, and this will be increased later to \$3,000,000 or more. The new company was chartered last fall, and Jilson J. Coleman is its president. John B. Hoefgen, to whom the three-cent fare ordinances in Cleveland, Ohio, were awarded, is president of all the companies in the combination excepting the Princeton Street Railway Company, which is headed by T. C. DuPont, of Wilmington, Del. C. M. Bates, secretary and treasurer of the Philadelphia & Lehigh Valley Traction Company and the Lehigh Valley Traction Company, is secretary and treasurer of the companies at Trenton.

The New Jersey & Pennsylvania Traction Company now owns more than \$1,000,000 worth of property in this vicinity. The line to Princeton is 11.6 miles long, and the one to Yardley, 5.5 miles. The former is to be extended to the center of Trenton, adding another mile to its length, and the Yardley line is to be extended to Newtown, Pa., an additional distance of 5.5 miles, or 11 miles altogether. The first of the roads is built entirely upon private right of way, except in Princeton Borough. The Yardley line runs entirely upon streets or alongside a public road. The company also owns the upper Delaware bridge between this city and Morrisville, and thus possesses the only means of bringing an electric railway into Trenton from the Pennsylvania side.

It is the intention of the New Jersey & Pennsylvania Traction Company to extend the Yardley line to Newhope, 10 miles further up the river, as well as to Newtown, and much business is expected from both of these extensions. An elaborate local system is planned, upon which the fares shall be but 3 cents, with free and unlimited transfers within the city limits, and a minimum wage scale of 20 cents per hour is to be maintained. Franchises for this system will soon be asked for, and work will be commenced soon after the privileges are secured.

Jilson J. Coleman, who was at one time connected with the St. Louis Car Company, and who assisted the late Albert L. Johnson in carrying out many of his schemes, will look after the company's interests in Trenton, while J. A. Barry, the superintendent of the Trenton lines, will have charge of the extensions, as well as the construction work upon these extensions. Mr. Barry was connected with the Johnson interests when they were operating the Nassau Electric Railroad, of Brooklyn.

Robert E. Wright, president of the Lehigh Valley Traction Company, in which position he succeeded the late A. L. Johnson, says that the Philadelphia & Lehigh Valley line, being completed between Philadelphia and Allentown, the company is in a position to push the work to Trenton. It is generally understood that the Princeton line will eventually be extended to Bound Brook, and probably from there into the North Jersey territory.

Work has just been commenced upon the extension from Yardley to Newtown, and the other lines will be pushed later on. An effort will probably be made within the next two or three weeks to secure a more convenient terminal in Trenton for the Princeton line, and abolish the local stage line transfers which the company is operating, and which proves very expensive and more or less unsatisfactory.

New Interurban at Richmond, Indiana

The Richmond Street & Interurban Railway Company, which operates the Richmond, Ind., city lines, will soon open its interurban line between Richmond, Cambridge City and Dublin. This line will be entirely free from curves, and the grades are very light, as $3\frac{1}{2}$ per cent will be the heaviest grade on the road. It is intended to make the distance from Richmond to Dublin, eighteen miles, in fifty minutes.

The rails are 70-lb., laid on ties 2 ft. between centers. The ties are 6 ins. x 8 ins. x 8 ft. long, of white oak. The poles are 35 ft. chestnut. The trolley wire is No. 00 single wire, on brackets, with a second similar hard drawn wire on the pole line as a feeder. All the bridges are steel, and built independently of the highway bridges. They are 12 ft. wide in the clear, and were furnished by the Lafayette Engineering Company.

The power station is at Richmond, and contains two 450-hp Edgemoor water tube boilers, equipped with Roney stokers. There are two 500-hp Buckeye tandem compound engines, each direct-connected to Siemens & Halske generators of 350-kw capacity. These supply both the local and interurban lines of the company. For transmission over the interurban line a 150-kw inverted rotary converter and step-up transformer will be used for transmitting at 13,000 volts, to a sub-station at Cambridge City, where a step-down transformer and rotary converter of similar capacity will be put in operation. The interurban line will make connections at Dublin with the Indianapolis & Eastern Traction Company, so that some day through service can be maintained from Richmond to Indianapolis. A branch line will be run south from Cambridge City to Milton, two miles, and possibly also to Connersville, eight miles.

E. B. Gunn, superintendent, is now actively pushing the business of securing excursion parties to Glen Miller Park, at Richmond. This park is owned by the city of Richmond. Mr. Gunn is advertising it extensively for the sake of the excursion business which it attracts from other towns, and has issued a handsome booklet entitled "Scenes from Glen Miller Park," which is well illustrated with fine half-tone engravings, and most effectively sets forth the attractiveness of this beautiful tract of over 200 acres. The park being large and well appointed, and offering a great diversity in the way of scenery and amusement, is the favorite place for picnic parties and excursions from neighboring cities. Mr. Gunn is sending out these booklets to prominent members of churches, societies, colleges and business enterprises, which are likely to have a picnic or outing some time during the season. Mr. Gunn says that two or three excursions a week come to Richmond from outside towns. Richmond is 40 miles west of Dayton, 68 miles east of Indianapolis, and 70 miles from Cincinnati. Mr. Gunn has always been active in pushing this class of business. He did much in that line at Lafayette before going to Richmond.

Holiday Accidents

The record of holiday accidents is a startling one, and again must call attention to the necessity of more care in the operation of cars, especially cars on suburban and interurban lines, where high speed is made. From Gloversville, N. Y., New Castle, Pa., and Boulder, Col., come tales of terrible accidents in which many lives were lost and scores of people were injured.

At Gloversville a wreck, which occurred on the Mountain Lake Railroad, resulted in the death of thirteen persons, while some thirty-three persons are known to have been injured. In this accident the bodies of many of the victims were crushed and maimed beyond recognition. The accident, it is said, was caused by a combination baggage and passenger car, returning from a summer resort four miles away, getting away from the motorman and rushing down the mountain side at terrific speed. The brakes are said to have refused to work, and at the end of the grade the

heavy car crashed into a loaded open car also descending the mountain. The latter was hurled from the track and turned on its side, more than 50 per cent of the passengers being injured. Those who were pinned directly under the cars were crushed to death. The combination car also left the track and turned on its side.

The accident at New Castle happened on the Pennsylvania & Mahoning Valley Railway, and one man was killed, one fatally injured and more than a score were seriously injured. In this accident two cars, each carrying about 100 persons, crashed together on a curve near Edinburg, four miles west of New Castle.

In an accident at Boulder one woman was killed and twenty persons injured. In this accident two heavily loaded cars, running as a train, rushed down a hill with tremendous velocity, overturning at a bend in the track.

A Cheap and Durable Cattle Guard

Cattle guards are becoming a subject of increasing interest to electric interurban lines which are now generally built on a private right of way. Since the abandonment by steam roads of the old style pit cattle guard, which was expensive to construct and maintain, and introduced an objectionable break in the continuity of the roadbed, many patented forms of guards, intended to lie on top of the ties, have been introduced, one of which combining simplicity and cheapness is the "Climax" guard, which is made of sections of vitrified clay. A photograph of one of these guards is reproduced herewith. The sections from which a guard is made up are 24 ins. long, $8\frac{1}{2}$ ins. wide and $1\frac{1}{4}$ ins. high. Each piece is of inverted



CATTLE GUARD FOR INTERURBAN AND SUBURBAN ROADS

W form, the walls of which are $1\frac{1}{4}$ ins. thick. The sections are made 2 ft. long to exactly bridge the space between two ties, and they rest directly on the ties. For each 8 ft. x 8 ft. guard there are 40 blocks or sections. A wood strip is laid around the guard to hold the sections in place, and their weight is sufficient to hold them down without other fastening. Among the numerous advantages urged for this guard are that it is made of a material that the weather has no effect upon, it is handsome in appearance, never needs painting, cannot burn, is free from accumulations of snow and dirt, allows no weeds to grow through it; it cannot injure employees crossing over it, and stands the chance of least financial damage from low brake beams or wrecks. This is a comparatively new guard, but is finding ready adoption upon both steam and electric roads. The new Aurora, Elgin & Chicago Railway is using these exclusively, having ordered over 700. They have also been adopted by the Western Ohio Traction Company, the Cleveland, Elyria & Western, and the Chicago & Milwaukee Electric Railroad. This guard is made by the Climax Stock Guard Company, of Marquette Building, Chicago.

For computing the heating surface required in feed-water heaters one of the manufacturers of such apparatus says that, knowing the amount of feed-water and assuming that there is sufficient steam for the work, a quick rule is to divide the number of pounds of feed-water used per hour by 100 for copper, 90 for brass, and 60 for iron coils. The quotient will represent the required number of square feet of heating surface. This method of calculation applies particularly to the coil type of heater, and it gives sufficiently accurate results within the limits of ordinary practice. In other types of heaters, where the circulation of the water may be less rapid, a larger amount of heating surface must be employed in order to obtain the same results. This rule is given in some recent literature on the subject issued by the Whitlock Coil Pipe Company, Hartford, Conn.

Topics of the Week

The Cleveland, Elyria & Western Railway is affording the means for carrying on an interesting trade war between the merchants of the thriving towns of Wellington and Oberlin. The towns are 9 miles apart, and before the building of the road there was little rivalry between them. Now, the competition is intense. Oberlin merchants started the fight by buying car tickets and offering them to the Wellington shoppers on Saturday evenings for 10 cents a round trip. Last week Wellington merchants retaliated by furnishing free transportation to all Oberlin residents who would come to Wellington for their Saturday evening trading. Now the Oberlin people have gone one better and have placarded Wellington with posters, announcing free transportation, free ice-cream and free band concert for Saturday evening. The railway company is offering inducements to both parties to continue the fight.

It is a matter of common knowledge that the United States Navy has furnished many brilliant engineers for the street railway field, and now it seems as if the trolley companies were getting many good men from the fore-castle for the front platform. It is explained that the training of the ordinary sailor of to-day makes him familiar with the use of simple electrical apparatus, and his drilling is of utmost importance in the matter of discipline and subordination. He knows how to obey orders—often a difficult thing to teach the ordinary landsman—he does not get “rattled” in emergencies, and he is respectful in his demeanor towards his superiors and the public. The inducements to stay in the navy, it is explained, cannot compete with the opportunities of advancement presented to the street car employee which enable him to marry and settle down and enjoy a home with living wages to keep it going.

A certain street railway company operating in one of the large cities in the West has offered, in order that it may “get out of politics”—that is, in order that it may escape the octopus-like grasp and harassments of ambitious office-holders—to guarantee the city in which it operates \$90,000 for the first year, and \$100,000 each year thereafter during the life of a twenty-year renewal of its franchises. The direct offer is 8 per cent of its gross receipts in return for a renewal of its franchise and an abatement of all State, county and city taxes. However, the company guarantees that the payments shall not be less than the amounts named. The company in question has for a long time desired to make extensions to better its service, and to enlarge its earning capacity as well as its usefulness and convenience to the public. But it has been unable to do this, for on every hand and at every turn it has been confronted by the boddlers who have thus far thwarted advancement. Tired of appealing to the city authorities for the privileges that would alike result in benefit to the city and the company, it has laid its case before the people, with all the evidence. The politicians, we are told, are panic-stricken and distressed.

The recent remarkable mortality among the children of Brooklyn has attracted the attention of the physicians of that city, as the death rate among those under four years of age has been for some time about double that of children of the same age in New York. As might have been expected such a striking disproportion as this, showing, as it does, some local cause, should result in an investigation by a committee of physicians of the city; but of the three separate causes contributing to this excessive mortality, who would have expected to find among them the trolley car? Such is the case, though. Bad water, impure milk and long rides in open trolley cars are the causes mentioned in the committee's report. It would seem that Brooklyn mothers, clad in the diaphanous waists that have become so popular for summer wear, have forgotten that this kind of clothing is not the proper thing for a child sensitive to the cool breezes that are created by the rapidly moving car, and the physicians say that when thus scantily clad and taken for a trolley ride the child's body cools off too rapidly, and with disastrous effects. The practice of trolley-riding is particularly pleasant in summer, and is beneficial to all, but the children should be properly protected, however scantily clad the mothers may desire to go about.

Down in South Africa street railway matters have been in a bad way for some time, but now the prospects are greatly improved, and it is quite probable that considerable construction work will be undertaken as soon as normal conditions are restored. The situation in Pretoria, as outlined by an officer of the local traction company in a letter to the STREET RAILWAY JOURNAL, may be taken as a fair example of the general condition that prevails. “Owing to the war and the restrictions of martial law,” says this corre-

spondent, “we have been unable to resume working operations. The trams were kept running until the British occupation of Pretoria, when the Boers seized all our horses, and since then the company's premises have been occupied by the military and police. We trust, however, now that peace has been declared, that operations will soon be resumed, though as the government has not yet made any intimation as to the result of the Concessions Commission's report, no definite decision has been reached by our board. No additions to the line have been made, and it is still only fitted for animal traction, though at the time of construction the road itself was laid for electric working. Heavy rails, 81 lbs., were used and were electrically bonded. If our concession is confirmed by the government there is no doubt that the system will speedily be converted to an electric one. We are gathering information so as to enable us to make the change with as little delay as possible and to ensure the use of the best and latest improvements, though in all probability we shall again restart with the old horse service, pending the arrival of the necessary plant.”

Trolley Conductor an Aid to Justice

The telegraph, submarine cable and telephone have long been recognized as marvelously efficient aids to justice, but these agencies were rivalled in Boston last week by an electric car, which, combined with the coolness of a conductor, Ernest S. Johnson, of the East Milton line of the Old Colony Street Railway Company, resulted in the capture of an escaping murderer. The man was wanted for shooting his mother and sister, and had fled to the Lawrence Woods in Dorchester after committing the crime with a posse of about 150 men on his trail, thoroughly scouring Franklin Park and adjacent territory. Conductor Johnson is a college student, who runs a car in the summer. On the run from East Milton to Milton Lower Mills the conductor saw a man run out of a swamp on Reedsdale Road and jump on the car while it was going at full speed. Johnson went forward to point out the danger of boarding a car at such high speed, and the passenger held out a \$2 bill, requesting the conductor to keep the change and remain quiet, as he had no more use for the money, because he was going to buy poison and end his life. With the exercise of tact and coolness the conductor kept the man on the car until a drug store at Pierce Square was reached, to which he directed the murderer as a good place to buy the poison. Johnson then stopped the car and ran around the corner for a patrolman, but none was in sight, and as the murderer came out of the drug store, having been refused poison, the plucky conductor walked with him to the Dorchester Avenue car house of the Boston Elevated Railway Company, and there turned him over to a police officer. The conductor's coolness in emergency furnishes one more example of the ability of street railway employees to keep their heads in the face of sudden and trying situations.

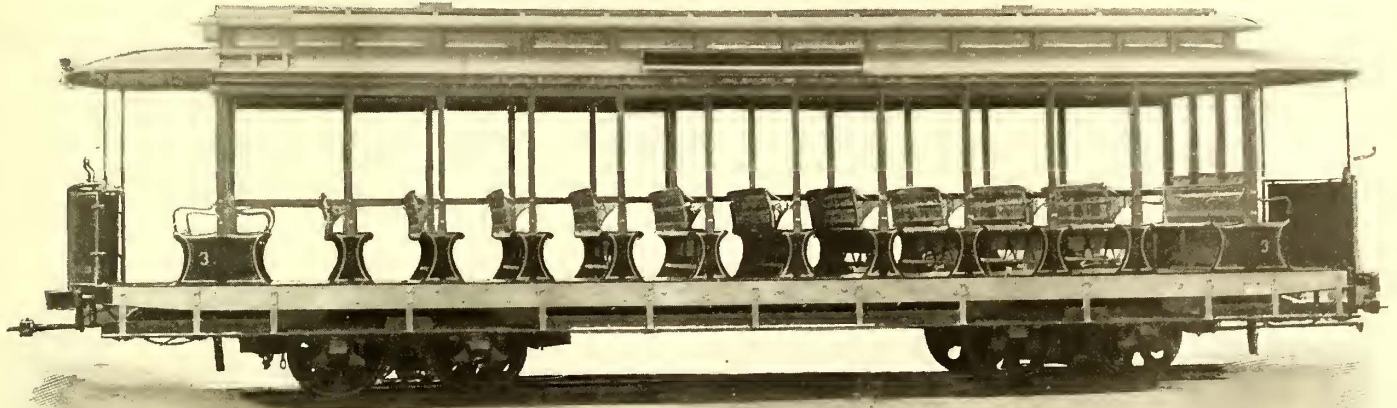
New Publications

Alternating-Current Machines, by Samuel Sheldon, A.M., Ph.D., and Hobart Mason, B.S., E.E., 265 pages. Illustrated. Price \$2.50. Published by D. Van Nostrand Company, New York, 1902.

This volume is a companion to “Direct-Current Machines” and forms the second part of the series on “Dynamo Electric Machinery, Its Construction, Design and Operation,” which the authors have written. While primarily intended as a text book to be used in connection with class room instruction, the logical arrangement and clear explanations make the text readily understood by all who have a grounding in the ordinary mathematics essential to engineering calculations. This feature of the book renders it of particular service to electrical, civil, mechanical or hydraulic engineers, who, while familiar with direct-current work, have not that proficiency in alternating-current calculations that is at present necessary in almost all undertakings, and the first four chapters give many of the simpler ways of explaining alternating-current phenomena and solving problems resulting therefrom. The remainder of the book describes the principles, construction, operation and testing of the various types of alternators, transformers, motors, rotary-converters, etc., as well as giving one chapter to high tension work as found in modern power transmission. While the subject of alternating-currents can, by no means, be thoroughly covered in a book of this size, the condensed, lucid explanations which are given has enabled the authors to compile most of the more useful data required in ordinary practice, and the brevity of the text enables the reader to refer to exactly what he wants without having to search for it among a mass of irrelevant or elementary matter.

Some New Open Cars

The St. Lawrence International Electric Railway & Land Company of Redwood, New York, has recently purchased from the John Stephenson Company, Elizabeth, N. J., a number of fourteen-bench open cars, one of which is shown in the illustration accompanying this article. The cars measure about 41 ft. over the buffers. They are 7 ft. 7 ins. wide at the posts, and the height is 9 ft. There are bulkheads at each end with three drop sash, which are protected on the outside by three-bar window guards of bronze. The floor frame of the car is strong and stiff, the side sills being of yellow pine and plated with $\frac{3}{4}$ -in. steel. The other portions are of oak, as are the crown pieces. The bolsters are of iron, of the steam car type. The monitor or raised deck has eleven ventilator sash



A HANDSOME OPEN CAR.

on each side and two at the ends. The bonnets are of the standard street car form, with iron supports and iron moldings and trolley-rope guides. The brackets are of malleable iron.

The cars have ten reversible back seats and four stationary seats placed against the bulkheads. All the seats are of ash slats, the reversible seats having spindle backs. The car will easily seat seventy persons, the width being somewhat more than usual. With a little crowding it would not be difficult to find space for eighty-four persons on the seats. The seats are finished with the Stephenson patent diagonal corner seat end panels. This panel makes a neat seat end, and a very strong post connection. Furthermore, the diagonal corner gives a wide space at entrance, greatly reducing accidents, while it increases the comfort of the passengers. All the openings are furnished with spring roller curtains, which come all the way to the floor. The form of the panels is such as to prevent any sticking or catching at the ends of the seats, thus preventing wear. As the posts of the car are somewhat straighter than usual, panels in this construction make a particularly stiff connection. A guard rail is provided on both sides of the car sliding within the hickory grab handles.

One unusual feature found in these cars is the placing of the register cord under the water table. The bell cord is placed inside. The cars are mounted on the Stephenson No. 20 trucks, having a 4-ft. 10-in. wheel base and 33-in. wheels. The trucks are spaced 21 ft. from center to center. These trucks were adopted on account of the ease with which they ride, and their strength as well as the small amount of power which they require for propulsion. The folding steps extend the whole length of the cars and are carried on an improved style of hanger. The toe board is so carried as to give $\frac{3}{4}$ in. additional width to the step, while at the same time it is flush with the hangers.

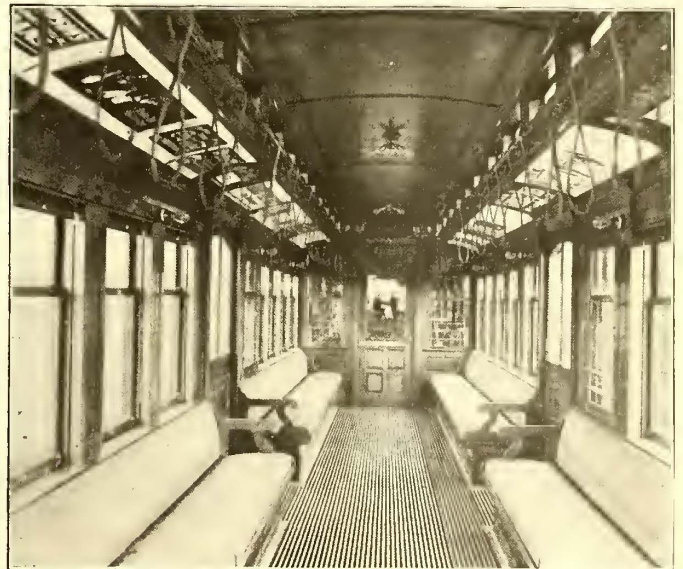
The cars are handsomely painted in yellow and dark green, relieved by gold striping. They have box signs on the sides of the roof and on the hoods. Taken all together they are neat and stylish cars, extremely well adapted to the service in which they are to be placed.

The employees of the Virginia Passenger & Power Company, controlling all the street railway lines of Richmond, went on strike on July 16. The trouble between the men and the company is over the question of wages. The original proposition of the men was for 20 cents an hour and a nine-hour day, but this has been modified to 20 cents an hour for motormen and 19 cents for conductors.

Elevated Railway Car Built by the Brooklyn Rapid Transit Company.

The accompanying illustrations show a car which has recently been constructed at the East New York shops of the Brooklyn Rapid Transit Company. This car is one of the standard elevated trail cars used in the elevated service in Brooklyn, and was built entirely with the facilities at the disposal of employees in the company's shops. The car was built on the remains of one of the cars destroyed in the fire which occurred at the Thirty-Sixth Street yards last February, when everything was destroyed except the trucks and some other metal portions of the construction. As will be seen from the illustrations, both the interior and exterior of the

car are fully up in the standard of finish to any cars in use on the road. The car is 47 ft. 9 ins. over all, the body being 39 ft. 5 ins. long. The height from the head of the rail to the roof of the car is 12 ft. 5½ ins., and the height of the platform is 3 ft. 7½ ins. The width of the car over all is 8 ft. 10 ins.



INTERIOR BROOKLYN ELEVATED CAR.

The car is fitted with Hale & Kilburn longitudinal cane seats. All the interior woodwork is of cherry, which gives a fine finish to the car, and the brass trimmings are all new. The racks for advertising signs, as seen, are placed more out of the way than is customary, although the advertisements are as clearly read as when extending further down on the sides of the car. The appearance of the car is greatly improved by the arrangement shown, as it gives a much richer appearance above the windows.

The shops in which this car was constructed, and which are in

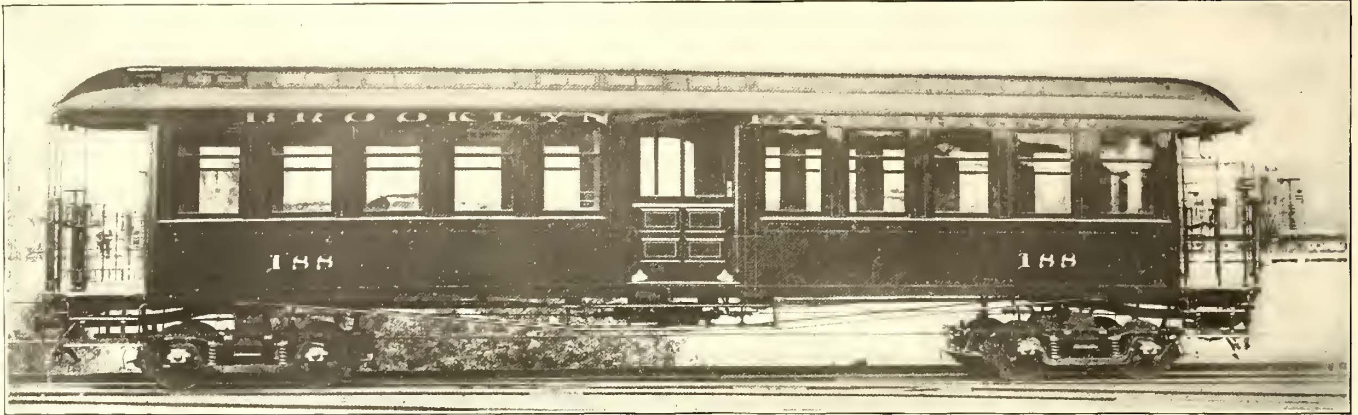
charge of Master Mechanic A. J. Wilson, are situated near the East New York Loop. A number of new tools have recently been added to their equipment, and while the facilities are not yet as great as the requirements of the service might indicate, the work done in the shops is of the very highest order. Under the former policy of the company, this was one of the auxiliary shops, which were under the control of the superintendent of equipment, whose office was located in the main surface shops at Fifty-Second Street and Second Avenue, but since recent changes have been made in the organization the elevated shops are now distinct. It is possible, therefore, that many additions may be made to them in the near future. A striking feature of the department is the traveling crane shown in the accompanying illustration. This crane was con-

moved, have a capacity of 8,000 lbs. each. Since the construction of this crane, ten 5000-lb. motors have been unloaded in one hour with ease, whereas previously it was not only a very lengthy, but a very difficult operation to receive heavy apparatus of this kind at the shop.

London Letter

(From Our Regular Correspondent.)

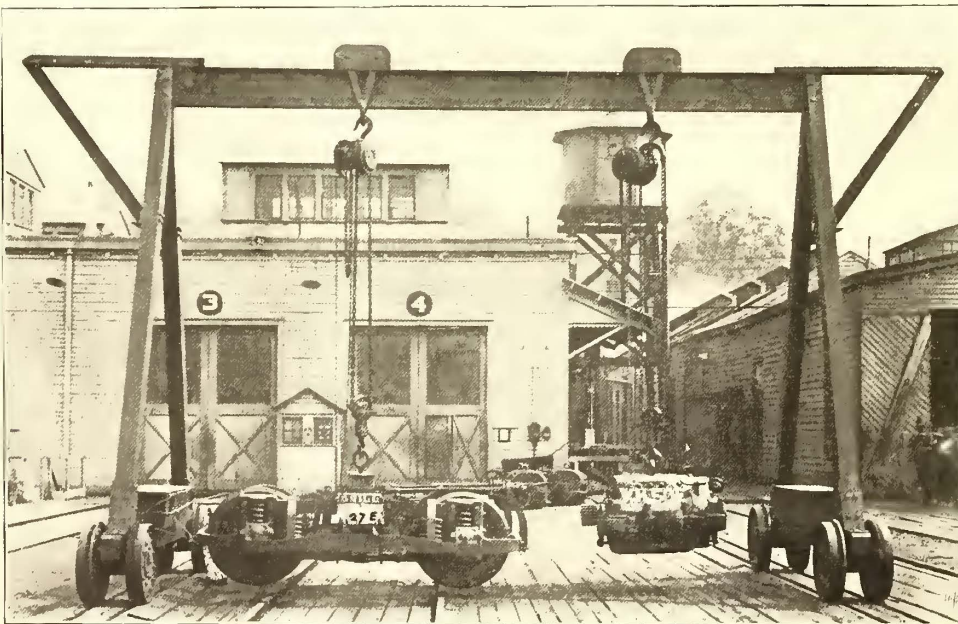
The scheme of the London County Council for tramways on the embankment was vigorously attacked this month in the House of



ELEVATED CAR BUILT IN REPAIR SHOPS

structed at the shops from designs made by Master Mechanic Wilson, and it has proved of great value in handling the heavy materials which are shipped to the yard. The illustration shows it supporting a Brill 27-E truck, and a 150-hp Westinghouse motor, and indicates the ease with which these heavy parts of the rolling stock can be unloaded from the cars used in transporting them to the shops. The crane is about 18 ft. high, and it is 22 ft. wide.

Commons, but managed to emerge from the ordeal successfully. It is proposed to connect with the shallow underground tramway from Theobald's Road under the new Holborn and Strand thoroughfare, passing under the Strand and emerging on the embankment at Waterloo Bridge. It is generally believed, also, that this scheme will connect the southern tramways by means of the bridges, although no powers to that effect have yet been sought by the London County Council.



TRAVELING OVERHEAD CRANE IN YARD

The wheels upon which it is mounted are old elevated car wheels which have been pressed upon short axles and trued up in the lathe. The journals are carried on the under side of the lower beam of the crane. The uprights are of wood, mortised into the lower beam and strengthened by half-inch plates bent at an angle to fit the joint, and bolted to both pieces. The top of the uprights which support the horizontal I-beam are mortised so that they support the beam on both the top and bottom flanges. The entire construction, therefore, is very rigid, although it is light enough to be easily pushed along on the track by the workmen. The differential pulley blocks which are used for hoisting the apparatus to be

The London United Tramways Company has at present a bill in Parliament by which power is sought to construct tramways in Richmond, Barnes, Mortlake, Hammersmith, Malden, Wimbledon and other places by which their already extensive system in the west of London will be very much increased. As this company has thrown in its lot with the Morgan group of underground tubes, it will be seen that the ramifications of the whole system, from the extreme northeast of London to the extreme southwest, will be most thorough and complete.

A company is being promoted for the purpose of building an electric railway from the city to Reigate and Redhill, and it is understood that it intends to have its terminus at the monument. The route which will be followed will pass Brixton, Streatham, Norbury, Croydon, Worlingham and Caterham.

The new Stewart Street station of the Manchester Corporation has now been formally opened, though much of the machinery has yet to be installed. The present installation in this building consists of about 15,000 hp, for which Dr. Kennedy was the consulting engineer, and a further 12,000 hp will soon be installed under the scheme promoted by G. F. Metger, the corporation electrical engineer. The service of electric cars to Stockport and Belle Vue has now been opened. This marks another stage toward the completion of the vast scheme which the committee has formulated and intends to carry out. Both Belle Vue and Stockport will be reached in about half the time taken by the horse cars, and by business men especially the change will be welcomed.

The Halifax Town Council has sanctioned the construction of

an extension of their lines to the outlying town of Sowerby Bridge. The work has already been commenced. The Town Council endeavored to proceed with this branch of their system more than two years ago, but were vigorously opposed by the shopkeepers of Sowerby Bridge. Now the inhabitants of Sowerby Bridge have petitioned the corporation to carry out the extension as soon as possible, and the necessary powers were included in the Halifax Parliamentary bill which recently passed the House of Commons committee. This will undoubtedly be a valuable branch line both for Halifax and Sowerby Bridge, and shows conclusively the usefulness of foolish opposition to such an extension by a few interested people.

After a delay of about two years the Board of Trade has at last confirmed the Swansea Light Railway order, and we presume there will now be no further obstacle raised to the carrying out of the needed tramway extensions in the town and district. The object of the order is to effect extensions (1) to Brynmill, (2) up Walter Road to Sketty, (3) to Ynisforan from Morrision, (4) to Fforestfach from Cwmbwrla, (5) from Quay Parade to St. Thomas, while there are various connections also authorized.

The financial year of the Aberdeen Corporation tramway, just closed, shows very satisfactory results. The total receipts for the twelve months amounted to about £37,000, an increase of nearly £2225 over the returns for the preceding year. The actual expenditure is not yet known, but it is believed that there will be a substantial credit balance. The whole of the routes have now been electrically equipped, the last of the horse cars having been recently withdrawn.

James Ross, of Montreal, chairman of the City of Birmingham Tramways Company, has sold his interest in that concern to the British Electric Traction Company. Mr. Ross held, in conjunction with his son, 32,727 ordinary shares out of a total of 60,000, so that the Electric Traction Company acquire a controlling interest. The company already own a network of lines in the back country, and the purchase of the Birmingham tramways will complete their system. The corporation was pledged to municipalization on the expiring of the lease, but it is stated that an effort will be made to get them to depart from that policy on the basis of the Electric Traction Company paying an annual sum toward the rates.

The scheme for connecting Burton and Ashby de la Zouch and the intermediate and populous villages with a light railway is being revived. The Midland Railway Company has stepped in again as promoters of an almost identical scheme. The gage of the proposed railway is to be 3 ft. 6 ins. and the motive power optional, but it is believed electricity will be used.

The St. Helens Electricity Works, which supply current for lighting and power and also for the electric tramways, last year produced electricity at the lowest cost in the kingdom, but have even done better this year, due in some measure to the fact that a considerable portion of power is obtained from the refuse destructor. The works cost for the production of electricity is this year .65d. per unit, against .82d., a reduction of 20 per cent, and the total cost 1.04d. per unit, against 1.18d., a reduction of 10 per cent.

A special meeting of the Heywood Town Council was held recently for the purpose of sealing the agreement with regard to the purchase of the Bury, Rochdale & Heywood tramway undertaking. The agreement related to a joint contract being entered into between Heywood, Bury, Rochdale, Littleborough, Royton and Unsworth for the acquisition of the tramways on a common date, and appointing James Moore, Jr., of Edinburgh, valuer. It was urged that joint acquisition would be more advantageous than separate action. The agreement was sealed.

At a special meeting of the Maidstone Urban District Council a formal resolution authorizing application being made to the Light Railway Commissioners under the light railways act of 1896 for a provisional order for the construction of a system of tramways from High Street to Barming, in accordance with the scheme of Mr. Sellon, approved some few weeks ago, was unanimously passed.

At Hastings, the Town Council has conditionally approved a scheme to construct an electric tramway system connecting the island suburbs with the center of the borough and providing for the laying of lines on the sea front.

The financial year of the Glasgow Corporation tramway department ended the last day of May, and with the advent of June the new table of cheaper fares was inaugurated. Four half-penny stations is now the penny limit—an arrangement the advantage of which will be seen when it is stated that from Argyle Street to the center of populous Govan, from Queen Street right into Patrick, from Charing Cross to Queen's Park or Pollokshields and from Argyle Street to Alexandra Park or to Ibrox one can travel for one penny, while to go directly across the city from Scotstoun in the far west to Rutherglen in the east cost only three-pence.

During the year ended May 31 163,600,000 passengers were carried, as compared with 132,557,724 last year. The increase is therefore 31,042,276. The revenue for the same period totals £612,794, as against £484,872 last year, an increase of £127,922.

The Yorkshire Electric Power Company will soon start work on its big power and distributing system. This company has an area of 1800 square miles to serve and is the largest of the power companies in Great Britain which has been formed to supply electricity in bulk to local authorities, factories, coal mines, etc., and for which H. F. Parshall is acting as consulting engineer. The area broadly includes a larger population to the square mile than any similar area. The idea underlying the formation of the company is that electric energy can be generated very cheaply, owing to the magnitude of the undertaking, and owing also to the convenient location of the generating station in regard to the supply of coal and water. Four sites have been scheduled for power houses, each of which is advantageously situated for coal and water facilities. Work will very shortly be commenced upon the generating stations and transmitting system and sub-stations. Arrangements have already been made for supplying a large number of consumers, and it is expected that in a very short time the total power required will amount to 250,000 kw. The company's prospectus says that it is estimated that the net profits will amount to 8 per cent on the total outlay after paying all expenses, including maintenance, and providing for a depreciation fund; and it is further estimated that this profit will be attained as soon as the capacity of the plant reaches 50,000 kw.

There is not much news to report regarding the several tube schemes for London, as comparatively little progress has been made in Parliament since the decision which we published last month. Meantime the District Railway Company is making rapid progress with its enormous power house which is to be situated on the banks of the Thames at Chelsea, though naturally somewhat delayed by the novelty of design. Each of the four smoke stacks which, by the way, will be even larger than those used for the Manhattan Railway in New York, will have an internal diameter of 19 ft. It has now been definitely decided also to increase the size of the steam turbo-generators to 5500 kw instead of 5000 kw as originally intended, and while it is difficult to ascertain what guarantee of coal consumption has been given it is understood that it will be well under two pounds per electrical hp. The space occupied by each of the eight turbo-generator units will be about 12 ft. by 50 ft. The condensers for this power house will all be of the vertical type and have involved a very interesting and difficult problem in engineering, owing to there being a 24-ft. rise and fall of tide, particulars of which we hope to give in a later issue. Regarding the rolling stock it has now been definitely decided that each carriage of the trains will have three doors, one at each end and one in the middle to assist in the quick change of passengers at stations so as to reduce the necessary stop to a minimum. The Brompton and Picadilly tube which is part of the Yerkes group has now been definitely commenced. It will be remembered that the short section from Picadilly Circus to Charing Cross was refused by the Lords Committee as also the short connecting link from the southern end of the Great Northern and Strand Railway from the Strand to the Temple. These little pieces, however, will not militate against the success of the whole system, as the tube from Picadilly Circus to High Holborn has been granted.

A very important concession has also been granted to the Yerkes group of tubes in the extension of the Charing Cross, Euston and Hampstead Railway from Hampstead to Golders Green which will enable this tube to come to the surface at Golders Green, thereby allowing them to have extensive car sheds and shunting facilities. Had the tube been arranged to stop at Hampstead it would have been most inconvenient, as at that point it would have been at a great depth under the level of the streets. With the two smaller exceptions mentioned, all of the Yerkes schemes will go through. The whole of the Morgan group has received the sanction of the Lords Committee with the exception of the loop line from Shepherd's Bush to Hammersmith. They have also received the approval of the Lords Committee for the tube which is to run by exactly the same route as the Brompton and Picadilly Circus tube from Hyde Park Corner at least as far as Picadilly Circus or to Charing Cross. As the Brompton and Picadilly tube before mentioned was sanctioned years ago and is now in progress of construction, it will be an extremely interesting problem if this second tube passes the House of Commons to find out whether it will be possible to construct it under the one which is now being made. The vibration question would also be an extremely interesting one, as it will be difficult for any committee to judge as to which of the tube railways was causing any possible vibration troubles on the surface, and adjudicate damages.

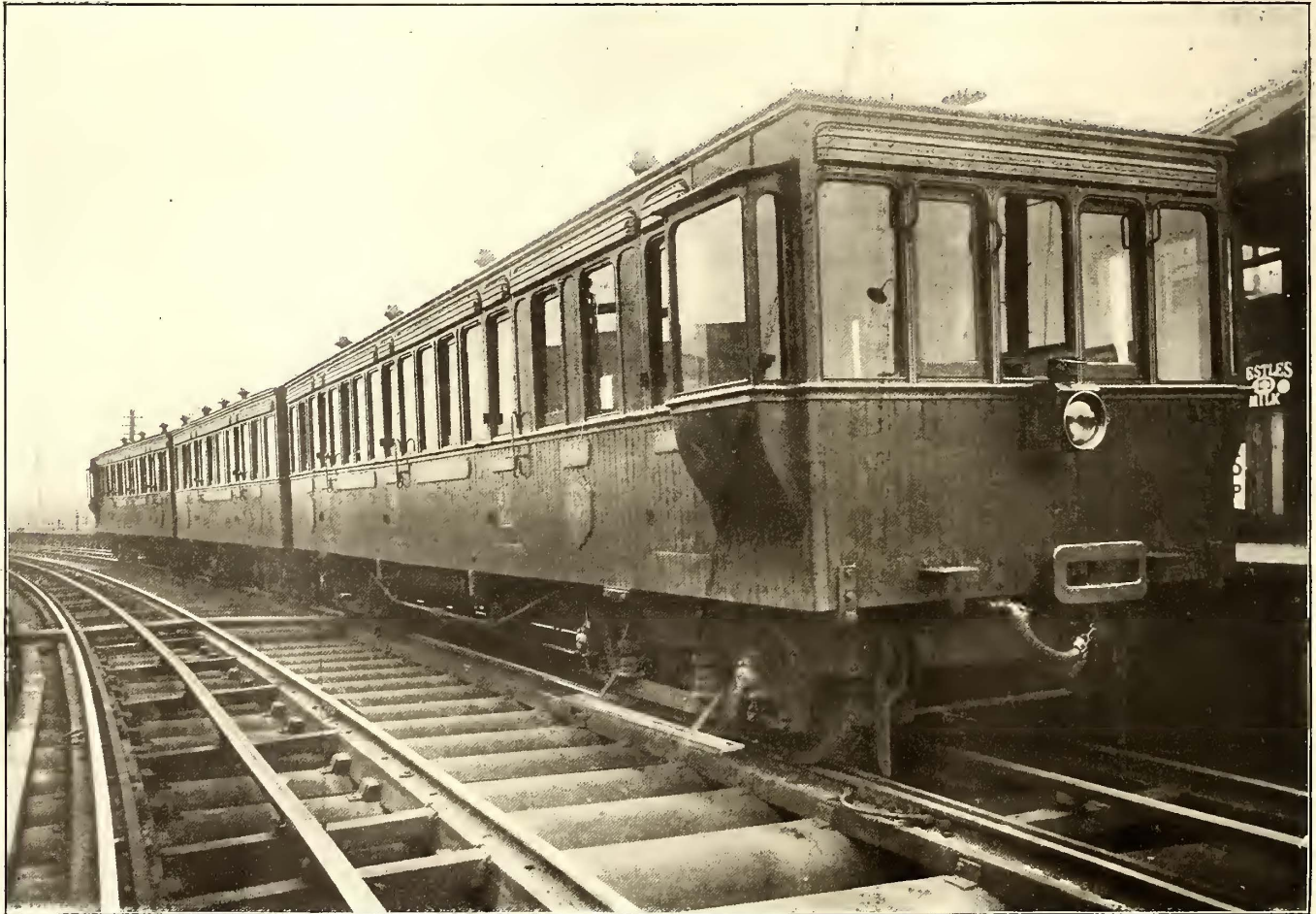
A. C. S.

New Equipment and Improved Schedule of the Liverpool Overhead Railway

The importance of increased acceleration on electric railways, is well shown by what is being done on the Liverpool Overhead Railway by means of a new type of equipment supplied by Dick, Kerr & Co., Ltd., of London. It will be remembered that the Liverpool Overhead Railway was one of the first elevated lines in the world operated by electricity, and was equipped some ten years ago. The total length of the line is a little over $6\frac{1}{2}$ miles, with double track and a third-rail feed, and a special rail return operated by 500 volts direct current. The trains are made up of two or three cars, the larger trains weighing about fifty-five tons. With the old equipment the entire distance was run in 32 min-

perfect action of the brakes during the retardation of the train. The negative acceleration reached 4.8 ft. per second per second recorded, which is probably near the practical limit in actual service. The diagrams of current in pressure at the motors are recorded and are of interest in determining the power consumption at different parts of the run.

The frequent stopping of trains running at high schedule speed will consume from 120 watts to 150 watts per ton mile. If, however, the stops are far apart, the watts required are from 90 to 100 per ton mile. In the experiments recorded the watts consumed were 137 per ton mile, or about 6.35 kw per train mile run. The results of the new accelerated service are shown in the following table. In consequence of the successful issue of these tests, the Liverpool Overhead Railway have instructed Dick, Kerr & Company to re-equip the whole of the rolling stock.



ELECTRIC TRAIN ON LIVERPOOL OVERHEAD RAILWAY

utes including 16 stops, or practically at a scheduled speed of $12\frac{1}{2}$ miles per hour. This requires a minimum of 14 trains running at five-minute intervals to handle the traffic.

About twelve months ago, however, it was decided to experiment with a new equipment in order to ascertain what acceleration could be obtained, and Dick, Kerr & Company, Ltd., entered into a guarantee to run the whole distance—including 16 stops of 12 seconds—in 20.9 minutes; in other words, to improve the scheduled speed from $12\frac{1}{2}$ miles to nearly 19 miles per hour. The weight of the train, including 154 passengers, was 55 tons. A most careful series of elaborate tests and trial runs were made by Mr. Cotterell, the engineer-in-chief of the Liverpool Railway, assisted by Mr. Mallock, and it was clearly demonstrated that the new train would make the journey easily under $20\frac{1}{2}$ minutes. Acceleration curves obtained from these trials are given on the following page. From these it will be seen that the acceleration reached 42 ft. per second per second, or nearly three miles per hour per second, the average acceleration being well over one mile per hour per second, thus enabling the train to cover the 2,110 ft. between the stations in little over one minute, including starting and stopping. This rapid acceleration is possible owing to the excellent commutation of the motors, which will not spark when carrying 300 amps. or 400 amps.; that is, three or four times their normal current. During the acceleration of the train in the series position of the controller, each motor is carrying 300 amps. of current, as shown by the curve. The curves also show the

Each of the new trains is to be fitted with four 100-hp railway motors, which are designed by S. H. Short and built at the works of the English Electric Manufacturing Company, Preston.

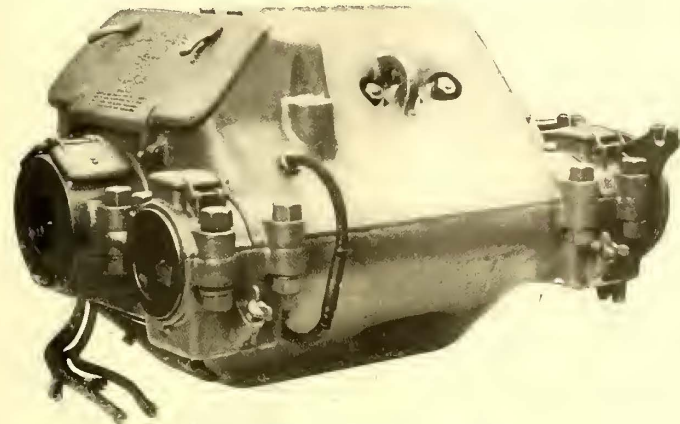
RESULTS OF TESTS ON THE LIVERPOOL OVERHEAD RAILWAY

	Old System	Accelerated Service
Mean speed.....	$12\frac{1}{2}$ miles (20 k. m.)	$19\frac{1}{2}$ miles (31 k. m.)
No. of stops.....	16	16
Mean time at stations..	11 seconds	11 seconds
Mean distance between stations.....	729 yards (666 m.)	729 yards
Watts per ton mile....	110	137
Acceleration.....	1.6 ft. (0.44 m.) per second per second.	3 ft. (0.91 m.) per second per second
Retardation.....	3 ft. (0.91 m.) per second per second.	4.8 ft. (1.26 m.) per second per second

The performance of these motors is shown in the efficiency curves herewith, these having been made from actual measurements taken from one of the motors during the experimental run. The efficiency is unusually high, being practically 93 per cent at the full load of 75 kw. Their weight is 4,200 lbs., or only 42 lbs. per hp, which is a point of considerable importance in keeping down the dead weight of the train.

The new motors, in use on the Liverpool Overhead Railway, are completely enclosed in a cast-steel shell, forming a fire and waterproof casing; this shell also serves to form the magnetic

circuit of the fields and to support the armature and axle bearings. The only opening in the motor casing is over the commutator and brushes; this is, however, securely closed by a hinged lid fitted with fastenings. The motor frame is divided on the horizontal plane, the upper half being removable, leaving the lower half supported on the car axles and the nose suspension. In this way the armature and fields can be easily uncovered for inspection and repair, without entirely dismantling the motor. This method of opening the motor is just the reverse of the tram-car motor, where the lower half of the frame is let down



LIVERPOOL RAILWAY MOTOR

into a pit for inspection of the interior, which would not be practical with motors of such great size.

The interior of the motor frame is provided with four laminated steel pole pieces, each with its own field spool, held in place by large bolts passing through the outer shell. The field spools are made of copper ribbon, about two inches wide, wound with asbestos and mica strip, between layers, and insulated outside with mica and asbestos combination boxes, held in position by means of heavy braided tape. The complete coils are treated with a water-proofing insulating compound and thoroughly baked. The same number of turns of copper ribbon is put on each pole, so that a perfectly symmetrical field is produced, in which the armature revolves. The armature is iron-clad, the copper bars with which it is wound being let into deep slots. Each coil in the armature is made with only one turn, and without joints, except at the commutator. The insulation of these coils is also composed largely of mica and asbestos, treated with a special insulat-

of copper, connecting it directly with the brush holder supports and main cables from the controllers.

The efficiency of the motor is well over 90 per cent, as shown by the characteristic curves of the machine. The temperature rise, after one hour's run at full load, is far below the standard of 75 degs. C., being as follows:

Commutator	55 degs. C.
Armature	39 degs. C.
Fields	57 degs. C.
Pinion bearing	14 degs. C.
Commutator bearing	9 degs. C.

The bearings are all made of the best bronze and provided with both oil and grease lubrication. Special provision is made to



ARMATURE OF MOTOR

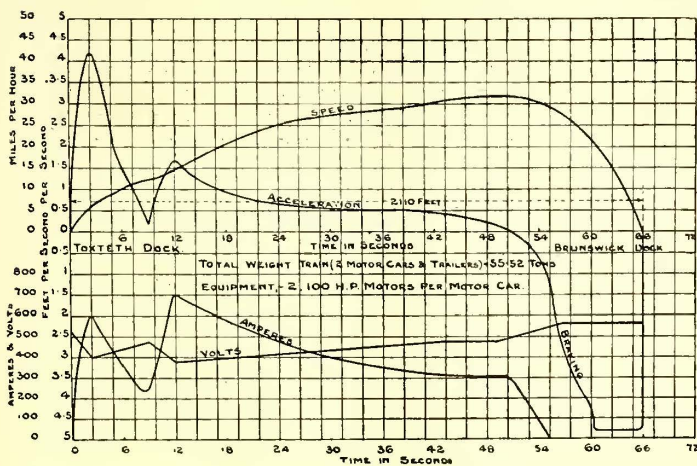
catch all the oil from the ends of the bearings and to return it to the wells, so that it will not be dropping on the permanent way. The gears are of cast steel, with the teeth cut out of the solid casting. The pinion is of hammered machine steel. The gear housing is of malleable iron, made oil tight.

The complete motor weighs as follows:

Motor	3,945 lbs.
Gear	260 "
Housing	140 "
Links	40 "
Key	2 "
<hr/>	
Total	4,387 lbs.

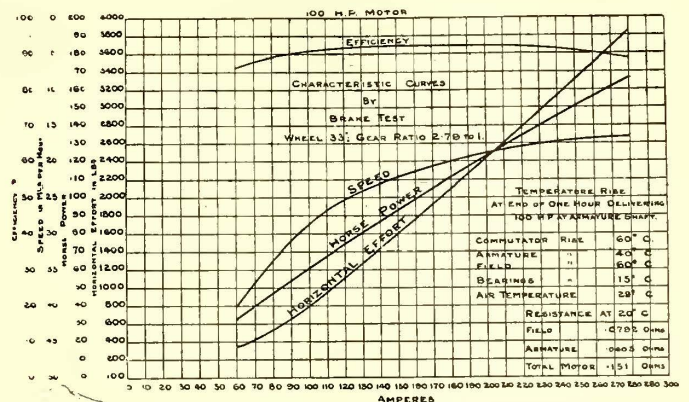
Thus including gears, gear housing, etc., complete, the motor weighs only 43.8 lbs. per hp.

The motors are journaled at one end to the driving axle and spring supported on the truck frame at the other side. The method of suspension relieves the permanent way of severe



ACCELERATION CURVES

ing varnish, taped and baked. The coils are all alike and interchangeable, so that injured ones may be replaced with ease. Ample ventilation is provided for the interior of the armature core, and air ducts leading to the surface aid in keeping up a good circulation. The high-grade steel from which these cores are made insures low hysteresis losses, and the thorough insulating of the laminæ from each other prevents the formation of eddy currents. The commutator is very large and has many bars, rendering the commutation perfect, even with an extra heavy load on the motor. The brushes are in two sets at the top of the commutator, with two brushes in each set. No sliding contacts are permitted to carry current, each brush being fitted with a brass clamp which moves with it, and a flexible braided ribbon



EFFICIENCY CURVES

shocks at the rear joints and cross-overs. The motors are carried on each of the two end cars of the train. The controlling mechanism is in many respects similar to the series-parallel method of control adopted by Dick, Kerr & Company, and is fitted with a new blow-out device which renders it perfectly proof against fire.

The effect of this improved equipment will be very important upon the service of the Liverpool Overhead Railway. The twelve trains of the new type will replace fourteen of the old, and it is a matter of interest that these new trains will accommodate exactly the same number of passengers as the old ones.

As a comparison, the following table, furnished by Dick, Kerr & Company, is of interest as showing the scheduled speeds with

the new Liverpool equipments, and those obtaining on other lines:

Railway System.	Miles per Hour, Including Stops.
Liverpool Overhead Railway	19
Manhattan Elevated Railway	13½
Metropolitan Elevated Railway	14.1
South Side Elevated Railway (Chicago).....	14.6
Lake Street Elevated Railway (Chicago).....	12½
City and South London.....	12½
Central London	14

With the previous equipment the trains ran 144 train miles per hour, while in the new method they will run 216 train miles per hour. There was a five-minute headway between the old trains, but under the new regime this will be reduced to 3½ minutes. In other words, the journey from one end of the line to the other will be made in two-thirds of the time taken on the old method, and what is of supreme importance, the load on the power station will be more uniform, and, as a consequence, the machinery will be running under more efficient conditions.

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English Municipal Railways.*

BY J. H. RIDER

It is no small thing to be president of a body which is now representative of nearly 150 municipalities in the United Kingdom. Taking, as I did, some little part in the formation of the Association, it has been a matter of great personal gratification to me to watch its gradual growth from 1895, when some twenty-five engineers modestly formed themselves into the Municipal Electrical Association, up to the present, when we number not only about 210 municipal electrical engineers, but also 120 municipalities themselves, among our members.

One of the subjects with which the municipal electrical engineer of to-day has to deal, and which has developed in this country almost within the life of this Association, is that of electric street tramways. In 1895 there were but five at work, and, with the solitary exception of Blackpool, they were all owned and operated by companies. At our 1896 convention I read a paper in which the possibilities of a combined tramway and lighting load were pointed out and in which attention was drawn to the economies which were likely to result from such an arrangement. To-day there are thirty-six electric street tramways in operation, which are owned by municipalities, and sixteen others in progress of construction. Of the former twenty-eight are, and of the latter eleven will be, supplied with current from a municipal combined lighting and tramway station. There are also four instances in which the municipal station is supplying current to tramways owned by companies.

With about three exceptions, the whole electric tramways in this country are worked by the trolley system, and it is worthy of note that no company, whose first aim, after all, is to pay a dividend, has adopted any other. The Wolverhampton Corporation is experimenting with a surface contact system, the Bournemouth Corporation is putting down a short length of underground side-slot conduit, as part of a general scheme of overhead traction, and the London County Council has adopted the centre-slot conduit for practically the whole of its lines. The costs of the road construction for these three distinctive types of electric traction vary largely according to the local conditions, but are generally somewhat as follows:

Overhead construction.....	£5,000	}	per mile of single track, including rails and paving in each case.
Surface contact construction.....	10,500		
Conduit construction.....	13,500		

In the face of the very great saving in capital expenditure, which can be made by adopting the overhead system, what are the conditions which would warrant the use of the conduit system? In the first place, in my opinion it is not warranted, unless a car service can be maintained with not greater than a two-minutes' headway. The capital charges on the road construction are so heavy, that the only way to bring down the cost per car-mile is to increase the number of car-miles as much as possible, by working the lines for all they are worth. Several corporations have recently been considering the use of the conduit in a similar manner to Bournemouth, namely, for a small portion in the center of the town, with the overhead system outside. I do not think the conduit is warranted under such circumstances. Certainly the additional cost, for such a short length, may be very small, when compared with the cost of the whole scheme. But is it worth

while burdening the undertaking with a combined system, merely for æsthetic considerations?

It may be argued that such combined systems are working satisfactorily in Washington, Paris, Berlin and other places, and that the change from the conduit to the overhead wire, and vice versa, can be made in a very few seconds. That is quite true, but they mean (1) the constant additional labor of at least one man at each changing place, (2) the carrying of the idle trolley over the conduit section and (3) either separate machines and feeders for the conduit conductor bars, or the permanent earthing of the negative bar, because of the rail return of the overhead section.

The abandonment of the overhead for any other system, merely for æsthetic reasons, is, in my opinion, not justifiable. The examples of overhead construction, to be seen in several towns in the United Kingdom, are anything but pretty. Some of them are even ugly. But that is the fault of the designer, and not of the system. It is perfectly easy and practicable to design and erect an overhead line which shall look well in almost any locality. Neat, and even artistic, work costs very little more than rough and unsightly work. When, then, are we justified in adopting the conduit system? When the traffic over the lines is so great that the heavy capital charges do not make any serious addition to the costs per car-mile. This is a condition of things only met with in metropolitan cities, and, after all, is no reason why the overhead system should not be used. Again, when powers for the tramway can only be obtained on the condition that the conduit is used, or when the system of lines is so complicated that the overhead construction becomes cumbersome and dangerous.

One of the principal difficulties in designing neat overhead construction is that of guard wires. Many an otherwise neat line is entirely spoiled by them. Acting apparently with a view to the safety of the public, but really to protect the telegraph and telephone interests, the Board of Trade has 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 a week or two ago, 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 of Trade refused to allow the principles of guard-wire protection to be discussed, and would only permit remarks on the various regulations which were proposed.

As is well known to those with the largest experience in overhead traction work, guard wires may be a protection in some few cases, but in the large majority they are the means of causing the very accidents which they are intended to avoid. Being of necessity only small wires, they are a constant trouble to maintain. They are very liable to break when heavy telegraph or telephone wires fall upon them. A number of automatic devices have recently been placed upon the market, with the object of cutting off the current should any other wire fall across the trolley wire. But neither guard wires nor any of these devices strike at the root of the matter, which is to prohibit entirely uninsulated wires of any kind crossing 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 as possible, in order that a broken wire may not reach the street. They should be insulated at such crossings, and, if guards are insisted upon, in addition to the above, they should be provided by a netting or similar arrangement under the telephone wires, and not over the trolley wires. The recent accidents, which have happened in Liverpool and other towns, have been caused just as much by the telephone wires as by the trolley wires, but, in the mind of the public, they are called trolley-wire accidents, and nothing else. If local authorities would insist on all telephone wires being placed underground, there would be no necessity for guard wires, or such like unsatisfactory half measures.

Before bringing these somewhat rambling remarks to a conclusion, perhaps I may be permitted to say a few other words, more particularly to our younger engineer members. A visit to a number of electricity works in this country leads one to the conclusion that, in too many cases, plant of too small a size has been put in. By this I do not mean not enough plant, but generating sets for too small an output. Those responsible for the design of the works did not seem to have been very sanguine as to the future of the undertaking, and so they put in sets for as small as 50-kw output, and in some cases even smaller. In the course of a few years, when the station has grown, these sets have become too small, and are either never used or are sold at a loss. Surely, if we expect the business of electricity supply ever to approach the extent of gas supply, we should lay out our power stations on generous lines, and put in plant with an idea to its future economical use, rather than to its suitability for just the number of customers we may have for the first year or two.

* Abstract of presidential address before the Incorporated Municipal Electrical Association's seventh annual convention at London.

Street Railway Patents

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

UNITED STATES PATENTS ISSUED JULY 8, 1902

704,044. Side Bearing for Railway Cars; C. F. Huntoon, Chicago, Ill. App. filed April 23, 1902. The special feature of this invention is the provision of rollers in the upper face of the bearing for supporting the load combined with other rollers arranged to take the lateral thrust.

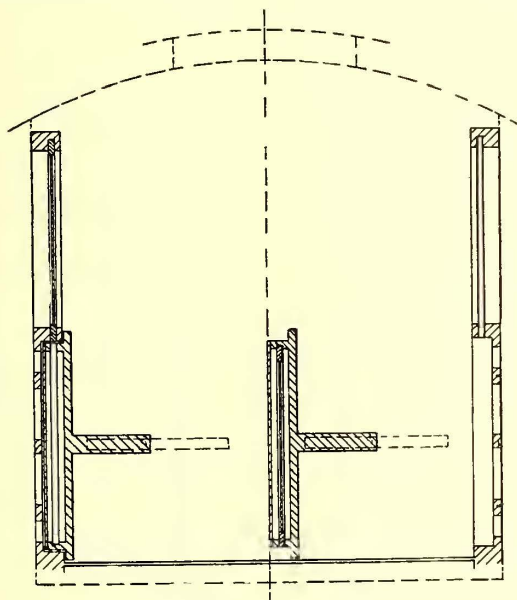
704,067. Tramway Car; A. Maurer, Ehrenfeld, Cologne, Germany. App. filed March 3, 1902. A convertible car in which the seats run lengthwise and are pivoted at the ends of the car; the back of the seat is vertical and extends to the floor, the back and seat being secured together. To convert into an open car, one seat is thrown over until the back rests along the center of the car, both seats then facing in the same direction. The side windows are then removed.

704,088. Side Bearing for Railway Cars; S. Northrop and A. G. Steinbrenner, St. Louis, Mo. App. filed Nov. 21, 1901. Details.

704,092. Contact System for Electric Railways; T. B. Patch, North Cambridge, Mass. App. filed Nov. 29, 1901. Standards arranged alongside the track carry insulated contacts with which the collector makes under contact.

704,093. Contact System for Electric Railways; T. B. Patch, North Cambridge, Mass. App. filed April 4, 1902. A modification of the preceding system in which the contact shoe extends from one truck to another.

704,141. Street Car Fender; C. T. Stoelting, St. Louis, Mo. App. filed Dec. 9, 1901. The fender is adjusted to the car to have a bodily motion in both a vertical and lateral direction, springs being arranged to cushion the movement in each direction.



PATENT NO. 704,067

704,143. Hand Strap for Street Railway Cars; M. Straus, Denver, Col. App. filed Oct. 28, 1901. The regular loop is provided with a series of cross-straps to accommodate a number of persons at the same time.

704,166. Street Car Fender; C. Zimmerman, Chicago, Ill. App. filed Feb. 19, 1902. A pair of normally open jaws which close upon and hold a person struck.

704,188. Car Truck; B. Haskell, Saginaw, Mich. App. filed May 13, 1902. Details.

704,210. Sander for Railways; J. Quin, Toronto, Canada. App. filed Aug. 24, 1901. Through gearing manipulated from the platform, a rotary shovel is operated to force the sand out of the hopper.

704,227. Ratchet Brake for Cars; H. Witte, St. Louis, Mo. App. filed July 3, 1901. Details.

704,432. Guard Rail for Street Cars; W. S. Bradley, Philadelphia, Pa. App. filed May 8, 1902. A rail which is swung across the end of the passage leading to the cross-seats of an open car to prevent entrance and exit.

704,452. Vehicle Brake; C. B. Fairchild, New York, N. Y. App. filed Sept. 16, 1901. A heavy brake brush is adapted to be forced into contact with the roadbed to obtain great braking power.

704,461. Car Fender; J. T. Hodgins, St. Louis, Mo. App. filed Nov. 4, 1901. A drum or disk arranged in front of the wheel is adapted to be forced into contact with the wheels when it is struck by an obstacle, and is thereafter rotated in a direction to roll the obstacle along the roadway.

704,491. Brake Shoe; G. A. Woodman, Chicago, Ill. App. filed April 5, 1902. The shoe has a back plate of ductile metal which holds the front plate together until it is worn out.

PERSONAL MENTION

MR. J. R. HARRIGAN, of Columbus, has been appointed superintendent of the Newark & Greenville Street Railway, which was recently purchased by the Appleyard interests.

MR. C. F. GLADFELTER, who was formerly associated with General Manager Gilbert, of the Chicago Traction Company, of Chicago, Ill., has been appointed auditor of the Miami & Erie Canal Transportation Company.

MR. W. B. GRAHAM, assistant superintendent of the St. Paul City Railway Company, has resigned from that company to accept a position under General Superintendent Dow Smith, of the Brooklyn Rapid Transit Company.

MR. E. P. VINING, formerly general manager of the Market Street Railway, of San Francisco, Cal., has become prominently identified with the Midland Pacific Railroad, which is to build a road from Bakersfield, Cal., to the Pacific coast.

MR. W. A. BAILEY has resigned as treasurer of the Worcester & Webster Street Railway Company, of Worcester, Mass., and will probably be succeeded by Mr. M. J. N. Potter, manager of the Worcester & Webster Street Railway. Mr. Bailey will in the future devote his entire attention to the Worcester & Southbridge Street Railway Company.

MR. CHARLES THRASHER, for a long time auditor of the Southern Ohio Traction Company, and later of the Cincinnati, Dayton & Toledo Traction Company, has been appointed auditor of the Western Ohio Railway. Mr. Thrasher will be succeeded by Mr. John Huntington, of Lorain, O., at present auditor of the Lorain Street Railway Company.

MR. C. W. MANSFIELD, who has been connected with the president's office of the Brooklyn Rapid Transit Company for about a year, has been given the management of the company's office building on Montague Street. Mr. Mansfield has a genius for details, and has not only thoroughly familiarized himself with the routine office work but has an extensive knowledge of the road and its operation.

MR. C. W. GEARHART, who recently resigned his position as superintendent of the Bridge Division of the Brooklyn Rapid Transit Company, has accepted a position with the Crocker-Wheeler Company in its sales department. The announcement that Mr. Gearhart had gone to Boston, which appeared in these columns a few weeks ago, was an error, as Mr. Gearhart resigned his position with the railroad in order to accept his present one with the manufacturing company. He will make his headquarters at the main office of the company, Ampere, N. J.

MR. W. S. DIMMOCK, who for the last year has been general manager of the lines of the Richmond Passenger & Power Company, of Richmond, Va., has resigned from the company to accept a position with Stone & Webster, of Boston, taking charge of their lines in Tacoma, Wash. Mr. Dimmock has left Richmond for Boston, the headquarters of Stone & Webster, and after a rest of about ten days he will start for Tacoma. Before becoming general manager of the Richmond Passenger & Power Company Mr. Dimmock was general manager of the Omaha & Council Bluffs Railway & Bridge Company and the Omaha, Council Bluffs & Suburban Railway Company. When he entered the electric railway field Mr. Dimmock had been prominently identified with a number of steam roads. Beginning at the bottom he worked up through the transportation and freight departments, holding positions of trust with the Burlington, Wabash, Union Pacific and other lines. Much of the experience gained while in the service of the steam companies proved advantageous to Mr. Dimmock, for in his street railway connections he has had to solve in the operation of suburban electric lines problems similar to those met in steam railroad work. Mr. Dimmock was a charter member of the Street Railway Accountants' Association, and has also taken an active part in the affairs of the American Street Railway Association.

FINANCIAL INTELLIGENCE

THE MARKETS

The Money Market

WALL STREET, July 16, 1902.

The expectations of immediate gold exports commonly held a week ago, were after all unfulfilled. A firmer tendency in the local time money market, and a simultaneous easing of rates abroad, caused renewed drawings of bankers' bills, which served to depress exchange quotations sufficiently to allow no further chance for profit in shipping gold. Meantime the Paris demands in connection with the French Government debt conversion appear to have been supplied. Sterling exchange at Paris has consequently recovered a fraction, and so has helped to render the situation unfavorable to a movement of gold. These developments have relieved the local money position substantially, at the moment when it was beginning to feel the strain of the heavy withdrawals of currency by the West. Along with this the Treasury has been disbursing unusually large sums on account of war department expenses, and special appropriations, the government deficit for the month thus far already reaching upward of \$10,000,000. A lasting suspension of the "Sub-Treasury drain" is not, of course, to be expected, even with the diminished internal revenue. But the temporary excess of government outlay is certainly a timely factor in assisting the money market over an uncertain period. Whether the Western currency demands are largely an incident of the Chicago corn corner, or whether they are the early beginnings of the regular crop-moving requirements, the main fact is that the local banks in remitting now will lighten the pressure of the movement when the season is farther advanced. The curious feature of last week's operations, which completely upset Wall Street's preliminary calculations, was the substitution of bank notes for legal tenders in the forwardings to the interior. As a result of this, the loss in lawful money holdings reported in Saturday's bank statement, turned out less than half what had been anticipated. Surplus reserve instead of decreasing heavily, as apprehended, actually increased over \$2,000,000. This unlooked-for showing served to check the hardening tendency which had begun to appear in call money rates, but it did not affect the disposition of lenders to hold out for better terms in their time contracts. Rates on this class of loans have been marked up quite generally to 5 per cent.

The Stock Market

The upward movement, which for some time has been gathering energy in the stock market, has broken out into a more vigorous demonstration during the last week. Outside developments of a favorable character are partially responsible for the more aggressive nature of the advance. The government experts issued on Thursday last their first computation of the season's corn crop, and it made a most excellent impression upon all classes of the financial community. Without going into a lengthy analysis, suffice it to say that the present outlook promises the largest yield in the history of the country, and that the conditions are brightest in the sections where good results are most needed—namely, in the States of the Missouri Valley, which suffered most from last summer's disaster. Along with the extraordinary corn estimates, the official returns indicate a record oat crop, and the third largest crop of wheat ever gathered. These indications have gained strength, moreover, from the final termination of the long spell of rainy weather in the West, and the development of the normal July conditions of sunshine and heat which are needed for the ripening of all grains. The promising crop position, it need hardly be pointed out, has been the influence of first importance in the week's movement on the Stock Exchange. Next to it comes the relief already described in the money market, and following this are the further evidences of a gradual disintegration of the miners' forces in the coal strike. With the satisfactory adjustment of these several uncertainties in the outside situation, the powerful speculative and financial interests which for some time past have been laying their plans for another "bull" campaign, have felt emboldened to begin active operations again. How far they will carry their undertaking at this particular time, is something regarding which one person's judgment is as good as another's. At this writing there are no signs that the advance is about to halt.

The local traction group, although displaying more activity than the previous week, have not cut a prominent figure in the trading. Sentiment is very bullish on the three active stocks, however, and confidence is expressed that they will shortly join the procession toward higher prices. We note some further accumulation of Brooklyn Rapid Transit by houses representing the leading speculative interests in the property. Manhattan Elevated also continues

to be absorbed very confidently on all recessions. The dealings in Metropolitan have been too light to possess any significance, but it is noteworthy that someone is losing no opportunity to bid up the quotation on the new issue of the Metropolitan Securities Company. Business has also begun on the curb in the new 4 per cent Metropolitan bonds "when issued." They are quoted a fraction above 99.

Philadelphia

The new Philadelphia Rapid Transit stock has been the feature in its local market during the past week. It rose on heavy buying from 9 to 9 $\frac{3}{8}$, and the indications rather point to a continuance of speculative operations encouraging an upward direction. There is nothing new in connection with the property itself, apart from a good deal of conjecture as to the character of the Union Traction report for the fiscal year which is due now before long. The general expectation is that a moderate increase will be shown over the earnings of the previous year. Union Traction holds steady around 45, but with dealings light and very much scattered. Doubtless the arrangement for a gradual dividend increase from 1 $\frac{1}{2}$ per cent the first year, to 3 per cent after 1908, has invited some outside investment purchases. Philadelphia Traction has also been well bought at an advance to 99 $\frac{1}{4}$, which is the highest it has sold since the payment of the last quarterly dividend. Other sales of traction stocks have been few and unimportant, including only American Railways at 45 $\frac{3}{4}$, Railways General at 43 $\frac{3}{4}$ and Consolidated of New Jersey at 68 $\frac{1}{4}$. Bonds have been moderately active, with sales reported in Electric People's Traction 4s at 99 $\frac{1}{2}$, Syracuse Rapid Transit 5s at 103 $\frac{1}{2}$, United Railways 4s at 87 $\frac{3}{4}$, Consolidated of New Jersey 5s at 109 $\frac{3}{4}$, and Indianapolis Railway 4s at 86 $\frac{3}{4}$.

Chicago

All danger of a strike on the Chicago surface lines seems at the moment to have been removed. The City Railway has flatly refused to grant the demands of its employees for an increased wage scale. On the removal of the strike apprehension Union Traction common recovered sharply from 13 to 15. Reports were circulated from speculative sources later that the company was about to undergo reorganization, but these stories were so quickly denied by officials that they had little effect. Metropolitan Elevated preferred rose sharply from 90 to 91 $\frac{1}{2}$, reflecting the view that the company could easily pay a 2 per cent dividend in August, and 3 per cent in February, completing the authorized 5 per cent on the preferred stock. Liquidation in Lake Street Elevated is seemingly over for the present at least. The stock does not rally, however; it is hanging reluctantly around 10. The only other sales for the week were scattered lots of Metropolitan common around 38, and Northwestern common at 35 $\frac{1}{2}$.

Other Traction Securities

Business in the Boston tractions continues exceptionally light. Dealings in Massachusetts Electric, by comparison with recent records, have amounted to practically nothing during the last week. The common is off a point to 41 $\frac{1}{2}$, and the preferred is unchanged at 97 $\frac{3}{4}$. Scattering sales are reported in Boston Elevated at 166 down to 164, and in West End common at 95 $\frac{3}{4}$. The feature of the Baltimore dealings has been the sensational fluctuations in Nashville Railway securities. The basis of the advance during the last fortnight was the expectation of a decision from the Tennessee court dismissing the motion attacking the company's charter, and so giving the reorganization committee a clear course to carry out its plans. Anticipating this, the 5 per cent trust certificates which sold as low as 63 two weeks ago, rose to 78, and the stock advanced from 3 to 7 $\frac{1}{8}$. On Monday the news was received that the court had handed down a decision unfavorable to the company and practically declaring the charter forfeited. The bond certificates broke violently on this announcement to 70, and the stock to 60. United Railways of Baltimore securities remain quiet but firm around 70 for the income bonds, and 16 for the stock, the general 4s selling around 97. Other Baltimore transactions for the week comprise City and Suburban (Washington) 5s at 104 to 105, Anacostia & Potomac 5s at 102 $\frac{1}{2}$ to 103, Atlanta Railway 5s at 105, Charleston Consolidated 5s at 95, Charleston Railways 5s at 105, City Railway Light & Power of Newport News 5s at 100, and Lexington Street Railway 5s at 103 $\frac{3}{4}$. Columbus Street Railway shares have become more active, the preferred selling up above 108 and the common rising to 52 $\frac{1}{4}$. All offerings of Louisville common around 125 have been absorbed, and the probabilities are that the stock would find buyers if offered as high as 130. New Orleans Railways common has been strong at an

advance of a half point to 11. Rochester Railway preferred is selling freely at 101½, and the bonds at 112½. On the New York curb sales of \$5000 San Francisco Street Railway bonds were made at a decline to 90½. St. Louis 4s are stronger at 87½. San Francisco preferred has sold at 63½, Toledo at 31 up to 31½, Washington Electric 4s at 82¼, and American Light & Traction preferred at 94.

Toledo Railways & Light was again the leading feature on the Cleveland exchange last week, 783 shares selling at 30¼ to 30½. Southern Ohio Traction advanced from 67 to 70¼ during the week, on sales of 542 shares; it was strong at the close at 70½ asked. Bidding was strong on Detroit United, but only about 200 shares changed hands, at 78. Northern Ohio Traction common dropped a point and a quarter on 226 shares, which sold from 40 to 41¼. The preferred was strong at 89 and 89¼, 102 shares selling. Western Ohio dropped to 25½ and 25¾, 220 shares selling. Lake Shore Electric sold on the exchange for the first time since the stock was listed, 200 shares brought 10, subsequent quotations advancing to 11¼ bid and 17 asked. A sale of Syracuse Rapid Transit common was made at 27. Total sales in traction was 2417 shares compared with 2038 the week before. Monday 200 Detroit United sold at 79 and 79½, and 87 shares of Northern Ohio Traction common went at 40.

Security Quotations

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

	Closing Bid	
	July 8	July 15
American Railways Company.....	45½	45½
Boston Elevated	164	164
Brooklyn R. T.	67½	68½
Chicago City.....	205	205
Chicago Union Tr. (common).....	15	14¾
Chicago Union Tr. (preferred).....	50½	47½
Cleveland Electric	a87	..
Cleveland City	105	..
Columbus (common)	50½	52
Columbus (preferred)	107	108¼
Consolidated Traction of N. J.....	68½	68¼
Consolidated Traction of N. J. 5s.....	*110	109¾
Detroit United	76¼	78½
Electric People's Traction (Philadelphia) 4s.....	99¼	99½
Elgin, Aurora & Southern.....	41	a45
Indianapolis Street Railway 4s.....	86¾	87¾
Lake Street Elevated	9¾	10¼
Manhattan Railway	132	132½
Massachusetts Elec. Cos. (common).....	42¾	41½
Massachusetts Elec. Cos. (preferred).....	97½	97½
Metropolitan Elevated, Chicago (common).....	38	37½
Metropolitan Elevated, Chicago.....	89	90
Metropolitan Street	148¾	148¼
New Orleans (common).....	34	34
New Orleans (preferred).....	112½	112¼
North American	121½	126¼
Northern Ohio Traction (common).....	41	39¾
Northern Ohio Traction (preferred).....	89¼	89
North Jersey	30¾	30½
Northwestern Elevated, Chicago (common).....	35½	36
Northwestern Elevated, Chicago (preferred).....	80	80
Philadelphia Rapid Transit.....	9	9¾
Philadelphia Traction	98½	99¼
St. Louis Transit Co. (common).....	30¼	30½
South Side Elevated (Chicago).....	108	109
Southern Ohio Traction.....	64	70½
Syracuse Rapid Transit.....	26	..
Syracuse Rapid Transit (preferred).....	a70	..
Third Avenue	131	131
Toledo Railway & Light.....	30¼	30¾
Twin City, Minneapolis (common).....	119¼	119
United Railways, St. Louis (preferred).....	82	82½
United Railways, St. Louis, 4s.....	87	87¼
Union Traction (Philadelphia).....	44¾	45
Western Ohio Railway.....	25	22½

* Ex-dividend. † Last sale. (a) Asked. (b) Ex-rights.

Iron and Steel

The general reports of the iron market continue the same substantially as they were a week ago. The coal strike continues to hamper the foundry iron makers to such an extent that some of them are unable to supply their customers. In the West, the product is being sold freely for delivery in 1903. On the other hand, in the steel trade, supply seems to be fast overtaking demand, owing to the fact that sheet and wire mills which find business dull are reselling their stock of billets and bars. No let up, however, is reported in the tense condition of the structural material, and steel rail branches of the industry, and in the latter the chances favor an early considerable increase in imports of for-

eign goods. Quotations are unchanged on the basis of \$21.50 for Bessemer pig, \$33 for steel billets, and \$28 for steel rails.

Metals.

Quotations for the leading metals are as follows: Copper, 12 cents; tin 28¼ cents; lead, 4½ cents, and spelter, 5¼ cents.

WORCESTER, MASS.—The trustees of the Worcester Railway & Investment Company have declared a regular semi-annual dividend of \$2.25 per share, payable on August 1, to shareholders of record at the close of business on July 21.

BOSTON, MASS.—The Railroad Commissioners will not give hearings on the petition of the Boston & Northern, Old Colony and the Lawrence & Reading Street Railway Companies for increased capital until next August, at the earliest. The Boston & Northern asks for \$2,250,000 new capital, the Old Colony, \$1,250,000, and the Lawrence & Reading, \$100,000.

PITTSFIELD, MASS.—The Pittsfield Street Railway Company, which recently absorbed the Hoosac Valley Street Railway, is to petition the Railroad Commissioners for authority to increase its capital stock from \$100,000 to \$400,000, for the purpose of taking up the floating indebtedness and the bonded debts of the company and to make important improvements to the line. The stockholders of the company held a meeting a few days ago and these directors were elected: Colonel F. S. Richardson, of North Adams; Hon. W. B. Plunkett, of Adams; A. H. Rice, P. H. Dolan and W. L. Adam, of Pittsfield. The directors elected the following officers. Colonel F. S. Richardson, president; A. H. Rice, vice-president; Ezra D. Whitaker, of Adams, treasurer; S. Proctor Thayer, of North Adams, clerk. P. H. Dolan and P. C. Dolan, of Pittsfield, will continue as general managers of the road, and W. T. Nary is to remain as superintendent. C. Q. Richmond, of North Adams, resigned as president of the company, and A. C. Houghton and W. W. Richmond resigned as directors.

WORCESTER, MASS.—The directors of the Worcester Consolidated Street Railway Company have voted to petition the Railroad Commissioners for the right to increase the capital stock of the company by an amount not to exceed \$500,000. The present capitalization is \$3,995,000. The additional money is wanted for the purchase of new cars and to pay for the addition to the Market Street car house.

BOSTON, MASS.—The Boston News Bureau says it is understood that the \$1,000,000 Old Colony Railroad 3½ per cent thirty-year bonds were sold to Blake Brothers & Company, Estabrook & Company and R. L. Day & Company jointly, on a 3½ per cent income basis, or in the vicinity of 102.35.

DETROIT, MICH.—The Evening News, of July 15, says that President J. C. Hutchins and other Detroit United Railway directors are in Cleveland in consultation with the bankers' committee having the Everett-Moore interests in charge. The proposition is said to be to organize a new company to include the railways in Detroit, the Detroit & Toledo Shore line, the Monroe & Toledo Railway, known as the Black-Mulkey line, and the Everett-Moore railways between Toledo and Cleveland.

BROOKLYN, N. Y.—There has been filed in the office of the County Clerk of Kings County the \$150,000,000 mortgage authorized by the stockholders of the Brooklyn Rapid Transit Company in March last, covering the property, stock, securities, etc., of the company. The mortgage is dated July 1, and the Central Trust Company of Manhattan is the mortgagee. The purpose of the mortgage, as previously stated, is to allow the company to issue stock for the amount, the money raised to be used for the various improvements in the road and for taking up underlying mortgages as they become due.

NEW YORK, N. Y.—A majority in value of the mortgage bonds of the Staten Island Electric Railroad Company and of the receipts calling for the delivery of stock of the Richmond Borough Company, and of the bonds and stock of the New Jersey & Staten Island Ferry Company and the Richmond County Power Company, having been deposited under the terms of the agreement lodged with the Guaranty Trust Company, of New York, dated April 1, 1902, the committee, consisting of William Lanman Bull, R. Somers Hayes, John Greenough and Walter G. Oakman, has declared the plan of re-organization operative. The time for deposit of securities under the plan mentioned has been extended to July 31 next, after which no deposits will be accepted except on such terms as may be fixed by the committee.

STEUBENVILLE, OHIO.—The Steubenville Traction & Light Company has increased its capital stock from \$700,000 to \$1,000,000.

YOUNGSTOWN, OHIO.—The Youngstown & Southeastern Electric Railway Company was incorporated July 11, with \$50,000 capital stock, by H. E. Hamilton, Thomas E. Connell, E. H. Moore, Gordon Cook and James J. McNally. The plan of the company is to construct an electric railway between Youngstown and Poland.

HARRISBURG, PA.—At the regular monthly meeting of the Board of Directors of the Harrisburg Traction Company a semi-annual dividend of 2½ per cent was declared.

NASHVILLE, TENN.—The Court of Chancery Appeals has delivered an opinion invalidating and declaring void the consolidation attempted to be effected in 1900 by the constituent lines of the Nashville Street Railway. The consolidated properties are bonded at \$6,500,000, and stocked for a like amount. If the Supreme Court upholds the decision the railway company will be compelled to make terms with the city before a consolidation can be effected or the constituent lines will have to be operated independently and the consolidated stocks and bonds will be invalidated, it is said.

NORFOLK, VA.—The Norfolk, Portsmouth & Newport News Company has given a mortgage for \$4,000,000 to the North American Trust Company to secure an issue of 40-year 5 per cent first mortgage gold bonds, and has also given a mortgage for \$2,000,000 to the Richmond Trust & Safe Deposit Company to secure an issue of 5 per cent 40-year bonds.

TABLE OF OPERATING STATISTICS

Notice.—These statistics will be carefully revised from month to month, upon information received from the companies direct, or from official sources. The table should be used in connection with our Financial Supplement "American Street Railway Investments," which contains the annual operating reports to the ends of the various financial years. Similar statistics in regard to roads not reporting are solicited by the editors. * Including taxes. † Deficit.

Table with columns: COMPANY, Period, Total Gross Earnings, Operating Expenses, Net Earnings, Deductions From Income, Net Income, Amount Avail-able for Dividends. Rows include companies like AKRON, O., ALBANY, N. Y., BINGHAMTON, N. Y., BOSTON, MASS., BROOKLYN, N. Y., BUFFALO, N. Y., CHARLESTON, S. C., CHICAGO, ILL., CLEVELAND, O., CLEVELAND & EASTERN, CLEVELAND EL. RY. CO., CLEVELAND, ELYRIA & WESTERN, CLEVELAND, PAINESVILLE & EASTERN, DENVER, COL., DETROIT, MICH., DULUTH, MINN., ELGIN, ILL., HAMILTON, O., LONDON, ONT., MILWAUKEE, WIS., MINNEAPOLIS, MINN., MONTREAL, CAN., NEW YORK CITY, OLEAN, N. Y., PHILADELPHIA, PA., RICHMOND, VA., ROCHESTER, N. Y., SCHENECTADY, N. Y., SYRACUSE, N. Y., TOLEDO, O., and W. NEW BRIGHTON, S. I.