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DO YOUR WORK YOURSELF The Public Service Commission for the First District of New York may, as Chairman Oscar Straus says, "look with favor" upon 80-cent gas legislation for certain wards in Brooklyn and Queens, but we believe that such legislation would constitute a distinct retrogression in rate-making policy. The commission has had before it for a long time several cases affecting rates in the wards in questions, with the testimony all collected, and this should form the basis from which it should, if possible, fix the proper rates. If there are any legal technicalities that make action by the commission on the merits of the case impossible, it should render a formal opinion clearly stating the facts. To turn back the cases voluntarily into the turmoil of politics is nothing but a nullification of the potential usefulness of the commission. The gas cases in question may need expeditious treatment, but this should not be secured by the commission through shifting its duties if it is at all capable to act in the matter.

MORE LIGHT ON STEAM RAILROAD ELECTRIFICATION In the electrification of steam railroads, history is being made and written at the same time. The successive chapters in this history are the accounts of the conspicuous and significant electrifications which have been installed, such as the Chicago, Milwaukee & St. Paul, the Norfolk & Western, the Great Northern Cascade tunnel, etc. Each of these is contributing its share to our store of technical and economic information. In this issue of the **ELECTRIC RAILWAY JOURNAL** is an article in which are described some of the early operating problems on one of the most recent electrifications. The spirit of this article is typical of that of the railroad men and manufacturers who have contributed to the rapid advance of heavy electric railroading. The experience of one has been placed at the disposal of all, whether this experience had developed virtues or defects in the equipment and in its installation and operation. An A. I. E. E. paper entitled "The Log of the New Haven Electrification," written a few years ago and now a classic, contains the story of the early failures and successes of that pioneer single-phase installation. A symposium comprising an important part of the program of the 1915 Deer Park convention of the A. I. E. E. consisted of similarly helpful records from several roads. There is everything to be gained from such frank interchange of facts in a field so new as this one, and those which Mr. Grimshaw has given us in his article this week indicate the attractiveness which such pioneer work must possess to the engineer who is fond of solving original problems.

CONCENTRATION IN CONVENTION PROGRAMS Approximately one-sixth of this issue is devoted to a detailed report of the annual meeting of the Illinois Electric Railways Association. It is worth the space because the meeting was of an out-of-the-ordinary type. Its plan was unusually definite. Railroad men and manufacturers put their heads together in an effort to make and receive suggestions as to how to produce transportation more cheaply. They summoned theory as well as experience to their aid. Such concentration of effort and unity of purpose are bound to produce results. By focusing interest on one topic not only is valuable information brought to light, but the importance of the subject discussed (where it is important, as in this case) is impressed upon the association membership and beyond. There is undoubtedly a waste of energy and labor in the operation of electric cars, and any possible reduction of this waste should receive the most careful consideration. Savings are already being made, and the work is hardly begun. Such meetings as the one in question will further the movement. We predict that transportation in Illinois will cost less next year as the result of this discussion unless unit costs of material and labor advance abnormally.

WHY DOES THE CIRCUIT BREAKER OPEN? A correspondent recently called attention to the phenomenon of the opening of car circuit breakers when the cars are descending grades at high speed with power on. As F. E. Wynne of the Westinghouse Electric & Manufacturing Company has had occasion to make a special study of this phenomenon, the editors asked him to state his theory in explanation and he has done so clearly in a letter printed in last week's issue. Naturally the first question that arises in one's mind in this connection is, "What is a motorman doing with power on under such circumstances anyway?" The answer is probably, "Making up time." The next question is, "How can a constant potential motor draw much power under any circumstances when running at high speed?" Examination of the characteristic current-speed curve of the series motor shows that the faster it goes the smaller is the current drawn from the line. While, under conditions of steady load and uniform line voltage the current could never reach a zero value, it approaches zero value as the theoretical limit. If under these conditions the power supply is interrupted for even an instant, say by poor contact at the trolley wheel, it is conceivable that the magnetic flux in the motors would be jarred out very quickly due to vibration. When power is restored the current will rise to abnormal values because, for the instant, there

is no counter emf. in the circuit and there is only the resistance of the motors to limit its value. That the magnetic field does die away rapidly was indicated in results of tests of magnetic brakes made in 1904 by the Electric Railway Test Commission. These tests showed that if the brakes were not applied promptly there was an appreciable time lag before the field built up again. There is another probability in connection with the tripping of the circuit breakers in the present instance, namely, that the motors flash over. The sudden rise in current, combined with the high speed and accompanying vibration, provide conditions favorable for flash-over. This is the motor's protection against abuse. All of which goes to prove that there are advantages in addition to energy saving in coasting on down grades.

ANOTHER CONVERT TO PUBLICITY

With the beginning of hearings in Congress on the bill passed by the Senate to provide for a government armor-plate plant comes the announcement that the Bethlehem Steel Company will conduct a publicity campaign for the purpose of laying the merits, or demerits, of this proposition before the country. The formal announcement to this effect says that "In order that all concerned may have the clearest, most concrete and definite information this company can give on this question, so important both to the nation and to itself, the Bethlehem Steel Company will issue a series of statements to Congress. Copies will be supplied to the press, to public officials and to anyone interested."

The first of these statements is headed "Why should government money be spent for an armor factory?" and deals with two possible reasons for such an expenditure; namely, the insufficiency of existing plants and the possibility that the government could produce armor at a lower price than must be paid to private corporations. Other bulletins show that even if the government should immediately begin an armor plant it would not be turning out armor for three or four years, and when the campaign is completed the public will have before it, plainly and tersely stated, all the information and arguments that an intelligent man should have to enable him to make up his mind whether or not he would vote for a government armor plant.

It is evident from these bulletins that the company is following a carefully thought-out policy, the execution of which is in expert hands. This was also evident from the distribution of and press comment on, the remarks regarding armor plate in the company's recently-issued annual report, and the statements of the company's officials.

It is not difficult to apply the wisdom of the policy adopted by the Bethlehem company to the affairs of electric railways. What the Senate armor-plate bill proposes is that the government shall spend \$11,000,000 for the purpose of duplicating facilities already in existence for the manufacture of armor. There is hardly a possibility that the government can make armor as cheaply as it is now being bought, but the Bethlehem company has offered to let the government make its own esti-

mates of the cost of producing armor and agrees to furnish it at a price which will be as low as the lowest price at which the government could possibly make it.

The resemblance between the government armor-plant proposition and one to parallel an existing railway or lighting plant, or to duplicate their facilities, is too clear to require demonstration. It resembles, though perhaps not so closely, other situations with which public utilities have to deal. The Bethlehem company has shown what is the wise thing to do under such circumstances—adopt means to get the facts of the matter before the public. The only criticism that can be made in this connection is that the company did not begin its campaign of education before the Senate acted on the bill. But as it is, the House and the public are going to be informed as to the merits of the armor problem before the bill to establish a government plant becomes a law.

Like the case of the Du Pont company, recently referred to in these pages, the course pursued by the Bethlehem company will, we hope, impress public service corporations with the wisdom of a thorough-going policy of publicity, not only in emergencies, but all of the time and especially in anticipation of injurious legislation and regulation.

RETURNS IN UNREGULATED INDUSTRIES

Electric railways that are endeavoring to pay reasonable returns on their existing investments and at the same time attract the additional capital needed for betterments and extensions are fully aware of the fact that the question of a fair rate of return is not a purely academic one. While public service commissions generally admit the necessity of further development of regulated industries and are willing to allow a "reasonable" rate of return, they are led by their public interests to determine the permissible rate on the basis of their judgment of what the public should concede rather than on the basis of a comprehensive analysis as to what the controlled industries would be required to pay in the face of competition on all sides for money. They deal too much with arbitrary limits, such as legal interest rates, whereas they would in many cases do greater justice to utilities if they took into more full account the attractive rates of return that are so generally obtainable in the industries not under their control. Many attempts, it is true, have been made to find out such rates, but too often they have not been conclusive because the published reports of the unregulated companies have included in the assets good will, patents and other intangible values in such a way that the rate of return on the real investment could not be ascertained.

A noteworthy effort to overcome this fault and to show the true rate of return for unregulated industries, however, was recently made by J. E. Sterrett, a well-known public accountant, in an article in the *March American Economic Review*. Mr. Sterrett studied the various audit reports prepared by his firm and eliminated a considerable number which did not disclose the intangible amounts included in the assets, or which

showed inflated profits because reasonable provision or allowance had not been made for management expenses. He finally had left 158 diversified and scattered companies reporting for the fiscal and calendar years in 1912 and 1913, when, in view of the general business conditions prevailing, the profits may safely be assumed to have been not more than a fair average. For these companies the annual profits, after providing for expenses of operation and management, including depreciation of plant and equipment, represented a return of 13.67 per cent on the real investment. Only 23 companies of the 158 earned less than the usual legal rate of interest, while for other companies the record was as follows: 117 cases, 8 per cent or more; 97 cases, 10 per cent or more; 86 cases, 12 per cent or more; 70 cases, 15 per cent or more; 44 cases, 20 per cent or more; 28 cases, 25 per cent or more; 17 cases, 30 per cent or more, and 10 cases, 40 per cent or more. On the other hand, as Mr. Sterrett points out, the maximum rate of return thus far allowed by the various State commissions for controlled enterprises has been 8 per cent, and in some cases it has been put as low as 7 per cent or even 6 per cent.

The objection may be made that the foregoing figures for the uncontrolled industries are for prosperous companies and do not reflect general conditions, but Mr. Sterrett explains that the public accountant examines both unsuccessful and successful enterprises. In fact, of the 23 companies before mentioned that earned less than the usual rate of interest, 19 earned less than 6 per cent, 14 earned less than 5 per cent, and 4 companies showed no return at all available for interest charges. Furthermore, it should be remembered that we are dealing with the high rates of return that have been secured by a group of unregulated companies selected at random, as contrasted with the maximum rates beyond which commissions are not disposed to allow any utility to go, however successful.

While competition in the unregulated fields is supposed to keep down profits just as regulation does in the case of the monopolistic utilities, Mr. Sterrett's data seem to show that regulation is the more severe taskmaster and thus far has permitted much less free play in the acquisition of profits. Commissions have been loath, as he says, to grant the utilities a return at all comparable to that being earned by unregulated enterprises, even when the latter are exposed to intense and active competition. What the commissions need is a deeper appreciation of the fact that it was only the speculative element of fair profits that made possible the early development of utilities. Fair profits commensurate with the risks involved and attractive in the competitive money market are just as necessary for the development of the future, and the public can accomplish the most good for itself by being liberal with the investors in obtaining the money required. Commissions may save the public a few cents in decreased rates, but they are more than likely thereby to cost the public dollars through the restriction of utility development, and such a penny-wise pound-foolish policy is far from being required by public self-interest.

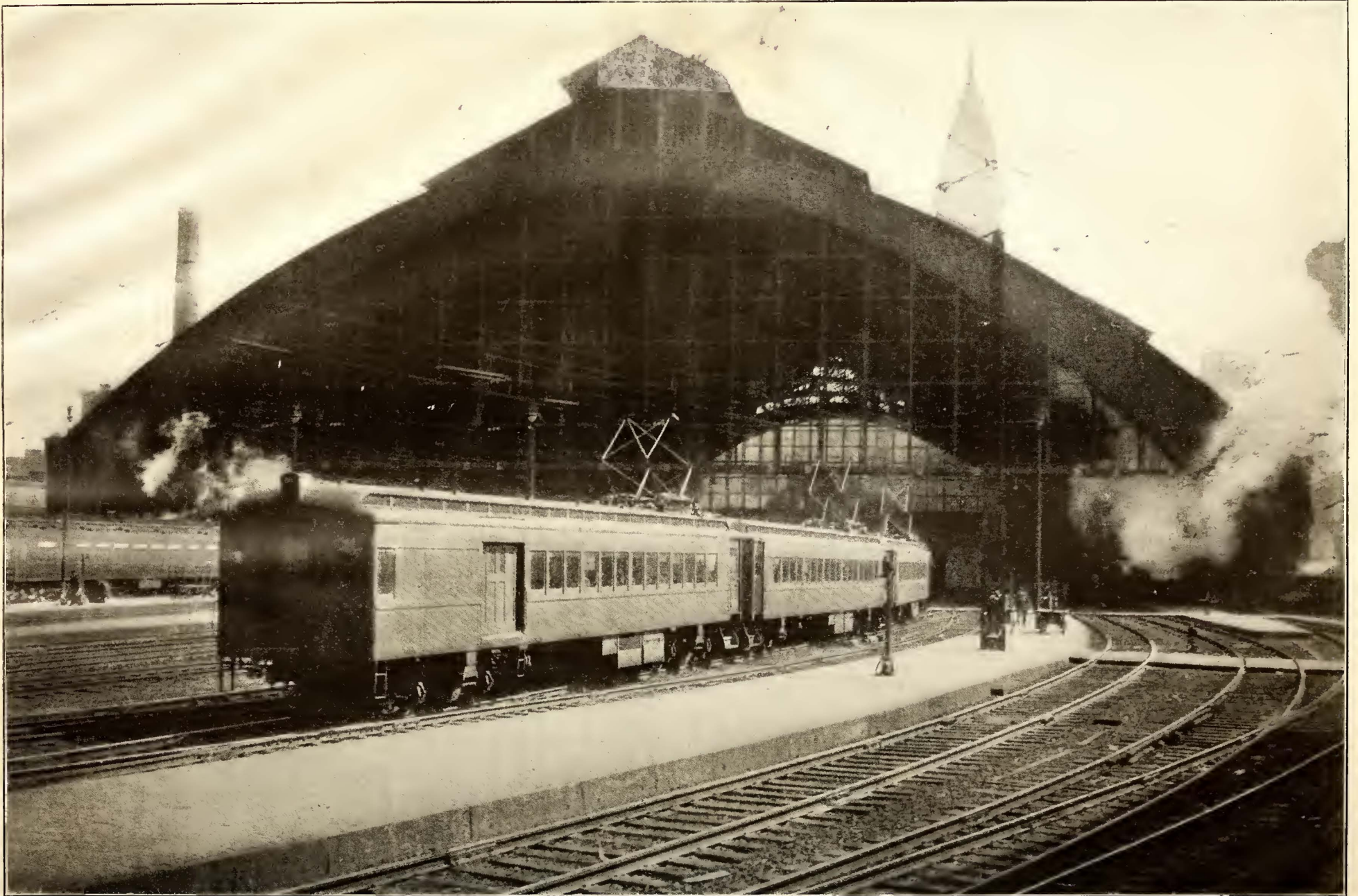
RELIABILITY IN OVERHEAD CONTACT SYSTEMS

We may assume for purpose of argument that the problems involved in designing an overhead contact system so that it will "stay put" have been largely solved. This leaves for consideration electrical strength and mechanical flexibility, both of which have been far from easy to obtain. Lack of these to the necessary degree caused the slight early operating difficulties on the Philadelphia-Paoli electrification. Doubtless every overhead contact heavy traction undertaking could furnish interesting stories along the same line.

The weak link in high-tension power work has always been the insulator. Insulation conditions are bad enough on transmission lines, but in supporting a contact system over a steam railroad they are much worse. Unfortunately the materials which are strong electrically, that is, having ability to resist puncture under electric stress, are weak mechanically. Furthermore, the insulator must be surrounded by air, which is not perfect as an insulating medium, necessitating the use of considerable bulk in the insulator merely to increase the jumping distance through the air. The insulating material must also be of special form to increase the surface creepage distance. All of this applies to overhead lines in general. In heavy railway work provision must be made for hammer blows and in many cases for smoke deposits in addition. When the Hoosac tunnel was to be electrified at 11,000 volts the engineers faced the insulation problem with even fewer data at command than they would have now. The conclusion reached was that all the insulation that there was room for should be put in, regardless of traditional factors of safety. This was done, and the result has justified the procedure.

Flexibility of contact wire is only less important than permanence of insulation. Bitter experience has demonstrated the futility of trying to provide a level contact wire of uniform resistance to upward pressure. The original New Haven overhead had double catenary messengers with stiff triangular hangers. It was unsuccessful until the auxiliary contact wire was added. The latest construction on this system is very flexible. Interurban railways learned the same lesson. For example, one road found that the best results followed when catenary hangers were spaced at long intervals. The general opinion seems to be that the contact wire should, in effect, lie upon the collector, the hangers being merely to hold it in a minimum height position when not in active contact service. Loop hangers permitting relative motion of messenger and contact wire have, therefore, become popular.

On the Philadelphia-Paoli electrification a few hard spots developed in the overhead, as was to be expected. There was slight trouble also with the section breaks. Smoke deposits on the insulators required the reinforcing of some of them. On the whole, however, the inauguration of the service was carried out with remarkable smoothness, and the experiments on the main line have solved the problems of the Chestnut Hill branch work now progressing well and the other extensions of the electric service which must come in due time.



P. R. R. Main Line Electrification—Electric Train Leaving Broad Street Station, Philadelphia

Operation of the P. R. R. Philadelphia-Paoli Electrification

Notes on the Plans Used for Eliminating the Difficulties Which Were Experienced During the Early Period of Operation and on the Organization of the Operating Staff in the Electrified Zone

By F. G. GRIMSHAW

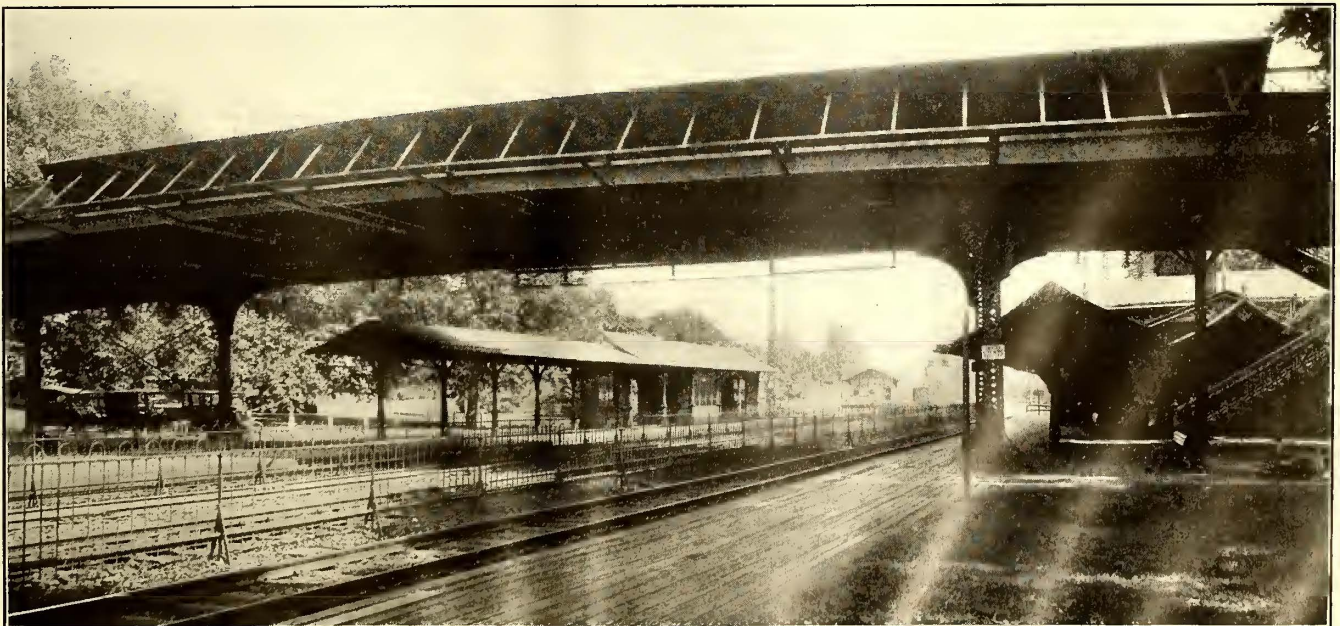
Assistant Engineer of Electrical Equipment, Pennsylvania Railroad, Philadelphia, Pa.

THE electrification of the main-line suburban service between Philadelphia and Paoli, a distance of 20 miles, was undertaken for the purpose of relieving the congestion of train movements at Broad street station which accompanied all-steam operation. A detailed study of the conditions at this point had demonstrated that by handling this service with multiple-unit electric trains instead of steam locomotives, a very considerable reduction in the number of shifting movements could be made and the traffic density at the throat of the station so reduced as to provide, in effect, a reasonable margin of reserve capacity.

The 11,000-volt single-phase system was selected for this installation as best adapted to possible future extension beyond the zone of local traffic, and construction work was begun in March, 1914. Arrangements were made with the Philadelphia Electric Company to supply power for this service from its main plant at Christian street and the Schuylkill River, and four submarine cables were installed between that point and a substation constructed by the railroad company on the opposite bank of the river. Between this point and a second substation located in the West Philadelphia yards, four single-phase transmission lines were installed, two of these lines being carried through to the west end of the electrified zone at Paoli and supplying power to substations located at that point and at Bryn Mawr, the other two lines being provided to take care of the proposed extension of the electric service to the Chestnut Hill branch of the New York division.

The catenary system over the main tracks was divided into three electrical sections, one, including the station and approach tracks at Broad street and the main tracks east of West Philadelphia station, to receive power from West Philadelphia substation; a second, including the main tracks between West Philadelphia and Bryn Mawr, to be supplied from the substations at those points, and a third, comprising the main tracks between Bryn Mawr and Paoli, to take power from substations at each end of that section. In addition to the electrified main tracks, a portion of West Philadelphia car yard and the entire yard at Paoli were equipped for electrical operation.

In the course of the construction work it was found desirable to complete and energize the lines and substations in successive steps with a view to testing out the equipment and incidentally to instruct the engineers and trainmen, all of whom were previously employed in steam service. The lines first energized included one transmission line to Bryn Mawr substation and all contact wires between Rosemont and Overbrook, a four-track section, approximately 6 miles in length. Interlockings located at Overbrook and Bryn Mawr made it readily possible to operate test trains between these points with a minimum of interference to regular traffic, and such trains were run in this section for a number of weeks with Bryn Mawr substation as the power distributing point. Following successively this initial step, the energized lines were extended first to Devon, 6 miles west of Rosemont, then to Paoli, the



P. R. R. MAIN LINE ELECTRIFICATION—HIGHWAY BRIDGE WITH ORIGINAL TYPE OF CATENARY SUPPORT AND SCREEN FOR PROTECTION OF PUBLIC AGAINST CONTACT WITH CHARGED WIRES

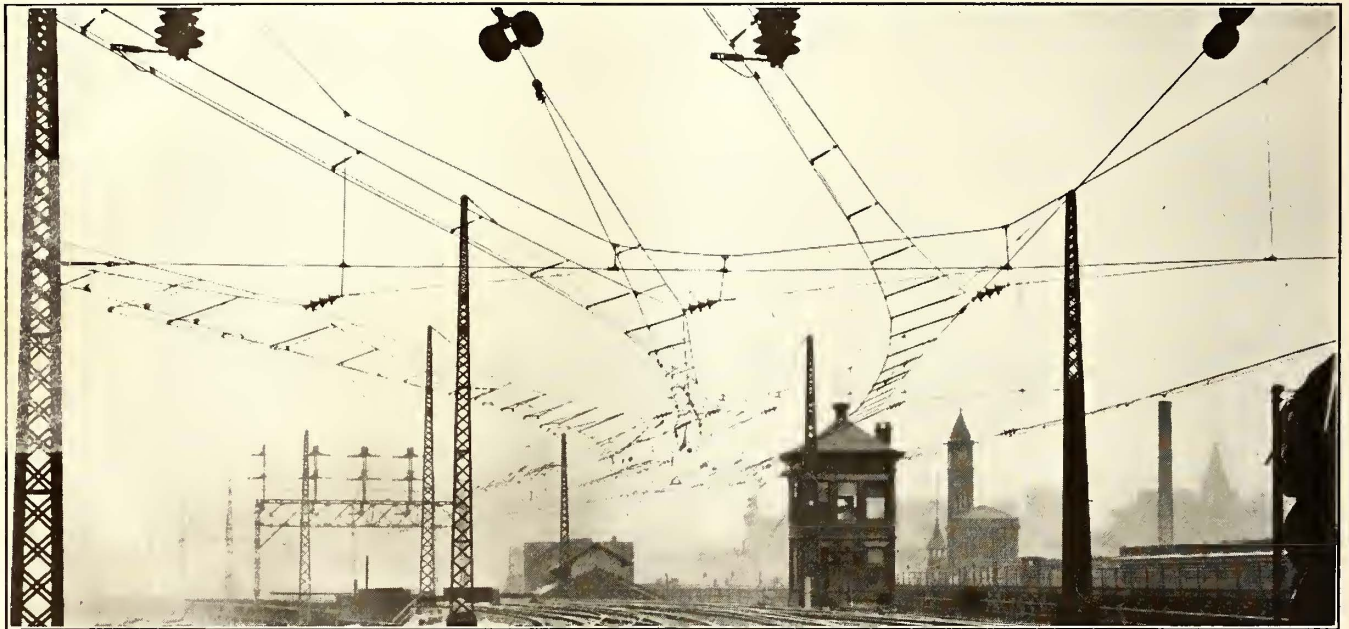
west end of the line, then to West Philadelphia station, and finally to and including the tracks at Broad street station. The test or instruction train operation during this preliminary period proved to be of great value in bringing out the defects in certain features of the original construction, thereby giving opportunity for a redesign of such details as the work progressed. It also made possible the instruction of all men in the handling of the equipment prior to the opening of regular service.

With the completion of the construction work regular electric train service was inaugurated with eight of the seventy-eight trains comprising the schedule, four in each direction, it having been thought advisable to build up the service gradually rather than attempt to make the change from steam to electric service in one step. From this small beginning the number of electric trains was gradually increased until the entire Paoli service was being handled electrically. One result of making the change to electric operation in this manner was the running of electric trains during the change-over period on steam train time. This made necessary an excessive amount of coasting to avoid waiting for time at stations and clearly showed the possibilities of

steam conditions under the highway bridges, particularly on the west-bound side, being very severe. As a result of these conditions, the insulators and wood sticks quickly became covered with a soot deposit and evidence of leakage from the live circuits to the base of the insulators soon made its appearance.

At certain bridges where the conditions of clearance and volume of steam traffic handled were least favorable, a number of insulator flashovers occurred, many of these cases being coincident with the passing of heavy steam trains under the bridges. Cleaning of these insulators met with indifferent success and it was finally decided to replace them with others having greater creepage distance.

The insulator selected is of a special type with two large petticoats, one of 13 in. diameter and the other of 12½ in. diameter. As applied to the particular purpose under discussion two of these insulators are mounted in series. A few installations were made where two combination units were mounted on the bridge structure, one at either side of the track center line supporting a piece of pipe to which the catenary structure was fastened. The arrangement commonly employed,



P. R. R. MAIN LINE ELECTRIFICATION—PRESENT STANDARD CATENARY SUPPORT AT HIGHWAY BRIDGES AND OVERHEAD RAILROAD CROSSINGS, LOCATED OVER CENTER OF TRACK

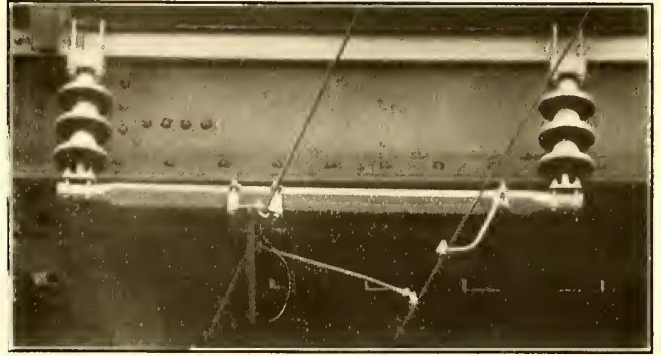
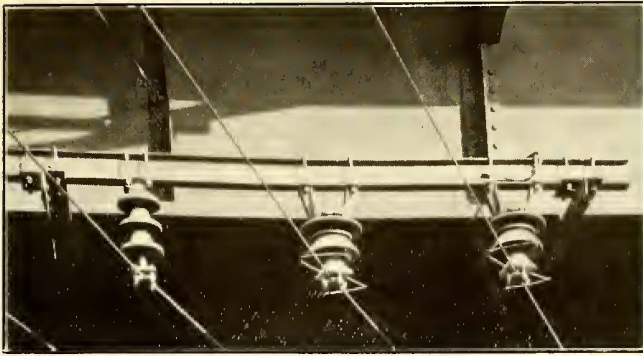
the electric service in the direction of quickening schedules. A reduced running time is now in effect and experience to date indicates that the schedules can be still further cut down.

OPERATING DIFFICULTIES EXPERIENCED

Between West Philadelphia and Paoli there is a large number of overhead highway bridges, of which several clear the top of track lines by not more than 17 feet. The transmission lines, as well as the catenary system, pass under these bridges and, as originally installed, were carried on post-type insulators made up of three 8-in. porcelain disks cemented into malleable-iron caps in series. In the typical highway-bridge overhead construction, these post-type insulators were mounted on I-beams attached to the bridge structure. The insulators carried at the lower end impregnated wood sticks to which were fastened the messenger and contact wires. These insulators on dry flashover test withstood 175,000 volts, and on rain test 90,000 volts. The territory included within the Paoli electrification, however, handles a very heavy steam traffic, the smoke and

however, involves the use of one combination unit per support per track, located directly above the center line of the track and carrying the messengers and contact wires. Both of these last-mentioned installations have proved very successful and no failures have occurred to date.

A limited application of a larger post-type insulator in combination with a pipe support for the catenary structure has also been on trial for a limited period with good success. The 8-in. post-type insulator above mentioned also proved a failure as a support for the transmission lines under highway bridges. The high capacity of this insulator under test conditions led to its selection for this particular service, although the potential to ground on the transmission lines is 22,000 volts as compared with 11,000 volts on the contact wires. As the transmission lines are located to one side of the tracks, the same conditions that caused the failure of this insulator on the contact wire circuit, however, also rendered it unsatisfactory for the transmission lines. After numerous failures it was replaced in this service with an adaptation of the pin-type



P. R. R. MAIN LINE ELECTRIFICATION—OLD AND NEW TRANSMISSION LINE INSULATORS UNDER HIGHWAY BRIDGE. THREE-SHELL, 8-IN. POST TYPE AT LEFT, 12-IN PIN TYPE AT RIGHT

P. R. R. MAIN LINE ELECTRIFICATION—ORIGINAL, 8-IN. POST-TYPE INSULATOR AND CATENARY SUPPORT AS USED AT HIGHWAY BRIDGES AND OVERHEAD RAILROAD CROSSINGS

insulator originally used on the transmission lines at points other than highway bridges. This insulator is of the four-petticoat type, with a maximum diameter of 12 in., and its use under bridges as well as on poles and other structures has been most successful, one failure only having occurred to date.

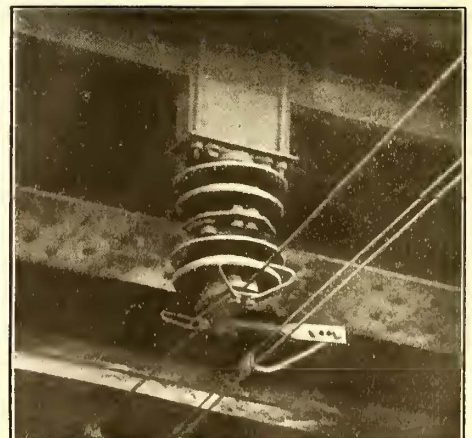
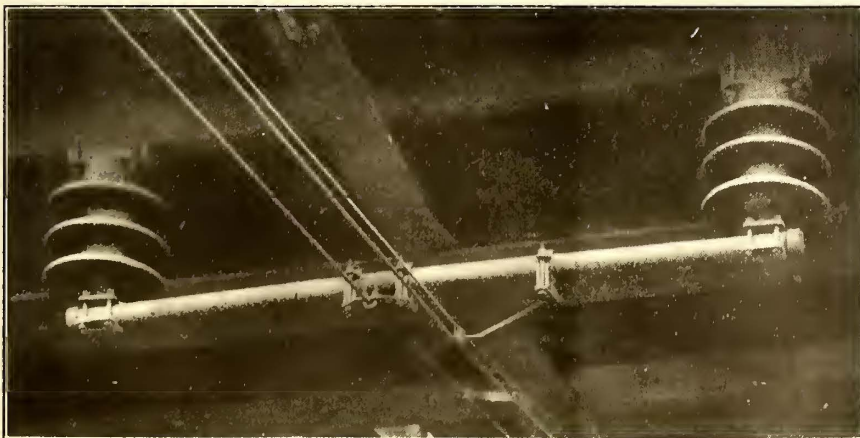
To insure flexibility in the catenary system and avoid hard spots at hangers, the combination of main messenger supporting an auxiliary messenger which in turn carries the contact wire is used. To facilitate erection, a round auxiliary was adopted in conjunction with a grooved trolley wire, the clips holding the latter being a loose fit on the round wire. Some trouble has developed with this construction on tangents as the result of a tendency of the contact wire to turn around the auxiliary, allowing the pantographs to strike the clips. This trouble has been confined almost entirely to cold weather, when the stresses in the wires are maximum. It has been corrected locally by the use of a combined hanger and clip holding the wires in the same vertical plane, or by shimming the clips at the auxiliary fit with thin sheet copper, the clips being then clamped securely to the auxiliary wire. This means of overcoming the trouble promises well, but the complete success of the scheme is not yet assured.

The section breaks first installed were of the wood-stick type, with short, round wire gliders for yard or low-speed service and long T-iron runners for main tracks. This form of break, while satisfactory for low-speed movements, flashes objectionably under high-speed traffic. Extended trials were made with the main track breaks of this type in an attempt to eliminate this trouble, but without success. They were finally replaced on the main passenger tracks with air brakes in which the contact wires of adjoining sections overlap and

dead-end on wood strain insulators located above the plane of the pantograph. This form of break, when properly adjusted, gives excellent service and will undoubtedly replace those of the original wood-stick type still in use on main tracks.

As first erected, the trolley wires were held in alignment on curves by pull-offs attached to steady strands supported at the catenary poles by porcelain strain insulators with wood strain insulators between the contact wires of adjacent tracks. The design involved the use of a stiff vertical member attached to the auxiliary and contact wires in conjunction with a pull-off rod, the assembled unit forming an inverted right-angled triangle. These pull-offs were found to cause hard spots in the line, at which flashing developed, and after considerable experimenting they were all removed. With change in temperature from summer to winter conditions, the alignment and height of the contact wire, which after the removal of the pull-off was free to move, changed on curves, making adjustments at certain points necessary. A few of the original pull-offs were replaced prior to a recent cold snap as a precautionary measure at points where the pantographs were riding too much off center. It is felt, however, that such adjustments in the contact-wire suspension can be generally made as will allow a safe margin of clearance between end horn and contact wire for both summer and winter conditions, as well as keep the variation in height of wire above running rail within permissible limits.

Considerable trouble was experienced during the first sleet storm on account of the formation of sleet on the pantographs, the weight of the accumulated ice counteracting the pantograph spring tension and preventing proper contact between shoe and trolley wire. Experi-



P. R. R. MAIN LINE ELECTRIFICATION—CATENARY INSULATOR, 14-IN. POST TYPE WITH PIPE SUPPORT. AT RIGHT, EXPERIMENTAL CATENARY INSULATOR WITH 13-IN. AND 12 1/2-IN. PETTICOATS, ALSO SHOWN IN SILHOUETTE IN VIEW ON THE OPPOSITE PAGE

ments were made with different grease mixtures as a coating for the pantograph tubing for the purpose of preventing or reducing the formation of ice on those parts, but with indifferent success. It was found necessary to remove the ice from the pantographs at terminals. Experiment showed that the sleet could be quickly and thoroughly removed by the use of steam directed against the pantograph framework from suitable nozzles handled by men stationed on the car roofs after the pantographs had been locked down and grounded, and the matter is now handled in this way. As a further precautionary measure during times of severe sleet storms extra electric trains are operated over the line, covering the hours when no regular electric trains are running to keep the contact wire reasonably clear of ice.

OPERATING ORGANIZATION

The organization adopted for handling the operation and maintenance of the electrical equipment included in the Paoli electrification is similar to that in effect on other electrified divisions of this company. The electrified zone includes portions of both the Philadelphia and Philadelphia Terminal divisions, and the master mechanic of the latter division reporting to each of the division superintendents concerned is at the head of the local organization having charge of the line, substations and car equipment. Reporting to the master mechanic is an assistant engineer of electric equipment, who has direct charge of the electric operation. He is assisted by a foreman of substations and transmission, and a foreman of electric car shop. One assistant foreman gives his entire attention to substation maintenance, and a second is assigned to the car shop located at Paoli.

One wire train is used, working for the present both day and night turn, each crew being in charge of a gang leader. No attempt is made to work on live circuits, the power being removed and the line grounded in all cases before work is started and after the necessary clearance has been obtained. The operation of the high-voltage circuits is in charge of three power directors located at the West Philadelphia substation and covering the twenty-four-hour period. No work is permitted on any part of the line or substation equipment until it has been authorized by the power director on duty, the necessary switches controlling the circuit or apparatus affected opened and a permit issued to the employee on the form provided for the purpose. Telephones that have been installed at very frequent intervals within the electrified zone provide means for promptly reaching the power director in case of trouble, or for handling clearances in connection with line maintenance.

PREVENTION OF ELECTRICAL ACCIDENTS TO EMPLOYEES

The adoption of the high-voltage overhead contact system for the Philadelphia electrification made it essential that careful study be given to the problem of preventing accidents due to employees or others coming in contact with these high-voltage lines. A detailed investigation of the personal injuries that have occurred from electrical causes on other electrified divisions of this railroad, as well as on others using the high-voltage overhead system, was made and these accidents were classified. Rules for the protection of employees and others were then formulated in the light of this knowledge and incorporated in instruction books that were prepared for the information and guidance of men employed within electrified territory.

Certain of the rules so prepared required for their observance a modification of long existing transportation methods, particularly in the movement of freight trains.

A case in point was the rule prohibiting all but qualified traction department men from getting on top of high, rolling equipment while on electrified tracks. The grade from Paoli to the freight receiving yards at Philadelphia is a descending one, with a break between Wayne and Bryn Mawr. It was formerly the practice in handling the heavy east-bound slow freight trains in this territory to set up the pressure-retaining valves on the head end of the train leaving Paoli, to put them down between Wayne and Bryn Mawr, and again to set them up before passing the latter point, to facilitate control of the train. The manipulation of these valves necessitates trainmen riding on tops of cars, and in this territory where a number of comparatively low bridges cross the right-of-way such a proceeding would be attended with considerable danger. Experiment proved that it was feasible to set up retainers before entering the electrified zone at Paoli and to leave them in the raised position until the train reached the yard. Should the retainers be brought into action by brake applications before passing Bryn Mawr it then became necessary to stop the train and bleed the brake cylinders or to haul the train with brakes set on the head end over the short opposing grade at this point. In practice it has been found possible to follow the second alternative, and little or no delay has occurred from the working of this rule which undoubtedly reduces to a minimum the possibility of electrical injury to trainmen.

When steam derricks must be used within electrified territory they must be accompanied by a qualified lineman who arranges to have power removed from such circuits as necessary and the circuits grounded before work is started. Unqualified workmen such as painters, tanners, carpenters, etc., are not permitted to work on structures close to high-voltage wires unless accompanied by a lineman, who is responsible for their safety. Where work of this kind must be done, power is first removed from adjacent circuits with which there is a possibility of the workmen coming in contact, and the circuits are grounded. By rigid adherence to these and similar rules, it is hoped that electrical injuries will be kept down to a minimum.

Vienna Tramways' Semi-Centenary

The Vienna Tramways, according to the *Tramway and Railway World*, celebrated their semi-centenary in the midst of the war. The first tramcar was run in the Austrian capital in 1865 over a line 2.5 miles in length. From this small beginning during the last fifty years there has been built up an undertaking which now forms the greatest municipal enterprise of the city of Vienna, and provides transport for its 2,000,000 inhabitants. The original undertaking, which was a private enterprise, was taken over in 1903 by the municipality. Since that date the tramways have been greatly extended, routes having been constructed into new suburbs, and the speed of the cars raised from 6.2 m.p.h. to about 7.5 m.p.h.

Remarkable attention has been paid to the question of housing tramway employees. A well-built block of apartments of attractive architectural design has been constructed for the accommodation of the employees and their families. No less than 6600 separate apartments have been provided under healthy conditions and in attractive surroundings. Public baths and playgrounds have been erected in connection with the dwellings, and every effort has been made to add to the welfare of the employees. Previous to the outbreak of the war, 12,000 men were employed in the tramway department.

Illinois Association Discusses Power Economies

The Relation Between Car Operation and Power Consumption Aroused Intense Interest at the Chicago Meeting of the Illinois Electric Railways Association—Abstracts of Papers Presented Are Published

ECONOMY of power in car operation, as reported by a sub-committee of the engineering committee of the Illinois Electric Railways Association, and the constructive suggestions to obtain this end offered in several papers delivered at the Chicago meeting, brought out a lively and profitable discussion of this important subject. Practically the entire program was given over to this subject, and essentially every phase of car operation which would contribute to reduced energy consumption was discussed at length.

J. R. Blackhall, general manager Chicago & Joliet Electric Railway, presided, and after calling attention to the committee appointments listed in the pamphlet sent out by Secretary W. V. Griffin, he introduced H. H. Adams, superintendent of shops and equipment Chicago Surface Lines, who spoke as chairman of the committee on standards of the American Electric Railway Engineering Association. Mr. Adams said that a campaign had been inaugurated by the standards committee to further the use of association standards. He called attention to the work that had been done since 1906 to establish thirty-five different standards and twenty-seven recommendations. Mr. Adams said that the member companies were not using these standards as much as they should, perhaps because the value of the standards was not appreciated. He also said that these standards included twenty-five sets of specifications which are specially valuable to the smaller companies. If a more general use of these could be brought about, it would tend to reduce prices and would certainly improve the quality of materials purchased under them. Mr. Adams admitted that there might be some question whether these standards and specifications were all that they should be, because some compromises had been necessary to take into account the best interests of the entire industry. He also brought out the fact that these standards and recommendations were only adopted after they had passed the gauntlet of criticism, and therefore they represented the best thought of the industry. Mr. Adams closed with the statement that the standards committee felt that either through a lack of familiarity or interest the specifications were not being generally used, and it wanted to find out why this condition existed. If the specifications are unsatisfactory, the committee would like to have definite criticisms of them.

G. W. Welsh, superintendent of power East St. Louis & Suburban Railway Company, East St. Louis, Ill., then delivered an illustrated address concerning the power-dispatching system of his company. This system was completely described by Harold W. Clapp, vice-president of the East St. Louis & Suburban Railway Company, on page 156 of the January 22 issue of the *ELECTRIC RAILWAY JOURNAL*. Upon inquiry at the close of his address Mr. Welsh stated that the energy supplied from the Keokuk hydroelectric development was very reliable; in fact, there had been no interruptions other than those to be expected in any transmission line. Interruptions, however, had been exceptionally few in connection with the service over this transmission line.

At this point President Blackhall briefly called attention to the possibilities of increasing efficiency in car operation. He said that railway companies had installed devices to check fare collections, and recent developments indicated that it was just as important to install instruments to check energy consumption.

G. T. Seely, assistant general manager Elevated Railroads of Chicago, then read the report of the sub-committee which considered power economy in car operation. Before reading this report, which is published elsewhere in the account of this meeting, Mr. Seely stated that his committee was one of three that were appointed to investigate the general subject of power economy in its relation to transmission lines, return circuits and in car operation. He said that the committee felt that so much had been written on the subject that any report would simply be a repetition. Therefore it decided to invite the various authors who had discussed this subject to deliver addresses.

In connection with this report Mr. Seely showed the relation between the energy consumption and outside temperatures with a lantern slide. He said that the energy used in heating cars can be very easily wasted in the spring and fall of the year when the temperature in the car is not regulated by a thermostat. The men are careless and frequently turn on the heat too soon or fail to turn it off when the temperature in the car has risen above that necessary for comfort. To meet this condition on the elevated railroads, dispatchers at the various terminals read the car temperatures and regulate the points of heat accordingly. He called attention to a record for January, 1915, which showed a reduction in energy consumption even though low outside temperatures prevailed. Mr. Seely was of the opinion that this saving was largely due to turning off the heaters as soon as the cars were placed in the storage yard.

Mr. Seely also mentioned the results obtained by installing coasting boards on the elevated lines. Such a system, however, could not be used on surface or interurban lines, but was applicable to elevated railroads that had definite stops. During the rush hours these coasting boards could not be observed as closely as during the off-peak hours if schedules were to be maintained. Mr. Seely said that the South Side division of the elevated railroads had saved about 5 per cent by installing coasting boards.

H. A. Johnson, master mechanic of the elevated railroads, said that between 9 and 10 per cent energy reduction had been obtained on the West Side lines of the elevated system by installing the coasting boards. Mr. Johnson also described the manner in which the locations for these boards had been selected. He said that a train was put on a test for several days, during which a careful record of normal operation was observed. Following this, the motorman was instructed how to save power and asked to coast as much as he could and still keep within the schedule. After several days of operation in this manner the coasting points were determined and the boards installed. This test train

showed a reduction of approximately 10 per cent in energy consumption over that recorded previous to instructing the motorman how to coast. The results of these tests were plotted, and B. I. Budd, then general manager of the West Side lines, sent it with a personal letter to each of the motormen, requesting their cooperation to reduce power, and instructing them how to do it. As mentioned before, the motormen responded to this request, and an average of between 9 per cent and 10 per cent reduction in the total power consumed resulted.

H. H. Adams, Chicago Surface Lines, opened the discussion by outlining his experience in the value of instructing trainmen how to operate cars efficiently. He mentioned a test made on the Metropolitan system of New York City, in which a line was metered for a week to obtain the average energy consumption per car-mile under normal operating conditions. The following week the motormen were instructed how to coast and otherwise operate their cars efficiently, and the third week the meters were again read. As a result of this instruction a reduction of 10 per cent was made in the watt-hour per ton-mile consumption. Mr. Adams also called attention to the importance of saving the energy frequently wasted by the electric heaters. He said that thermostats would automatically reduce the amount of power used for this purpose to a minimum, a fact which was demonstrated by the results obtained from a number of thermostats now in service on cars on the Chicago Surface Lines. The effectiveness of this device was especially emphasized during the rush hours when a reduction in energy consumption was most advantageous. He estimated that thermostats had reduced the amount of energy used in heating cars approximately 40 per cent.

J. B. Tinnon, engineer maintenance of way Chicago & Joliet Electric Railway, Joliet, Ill., described the results obtained by installing Sangamo meters on his company's lines. Mr. Tinnon's description is published elsewhere in this issue.

At this point the morning session was adjourned for the regular association luncheon, after which the afternoon session convened. This session was opened by a paper by J. F. Layng, engineer General Electric Company, on the relation between car operation and power consumption. This paper, with illustrations, is published elsewhere in these proceedings.

MR. CHAPPELLE DISCUSSES PRINCIPLES

C. C. Chappelle, consulting engineer and vice-president Railway Improvement Company, New York City, outlined the fundamental principles of efficient car operation. He opened with the statement that many operators thought that the energy-saving principles advanced by various engineers were only theoretical, but he wanted to emphasize the fact that their application was a practical operating proposition. Certain savings can be made by applying these principles to equipment purchased and later to its operation on a given line. Mr. Chappelle called attention to the importance of stop elimination and a reduction in the duration of stops to reduce energy consumption. He said there were certain limitations affecting energy saving, in so far as the equipment was concerned, and that the character and quantity of the service were equally important factors in limiting the results. He frequently called attention to the different phases of this subject, mentioned in his article published on page 117 of the Jan. 15 issue of the *ELECTRIC RAILWAY JOURNAL*. To illustrate his point concerning the effect of the number of stops per mile upon the energy consumption, he cited an average condition of seven stops per mile. He said a

change of 0.7 per cent above or below this number of stops per mile would increase or decrease the energy consumption proportionately from 12 per cent to 15 per cent. Mr. Chappelle then took up the question of the duration of stops and said that even with definite stops, such as obtain on subways and elevated roads, the length of the stop affected the schedule speed, which in turn controlled the energy consumption. He said that a difference of one second in the time consumed in making a stop meant an increase or decrease of 10 per cent in the energy consumption. The number of stops fixes the schedule speed with given motor characteristics. The speaker then emphasized the importance of carefully analyzing the motor characteristic curves supplied by the manufacturers. He said these were very dependable and meant much in efficient operation. He also called attention to the increasing platform expense, and to the effect of heavy and light-weight cars on the amount of energy consumed. He mentioned one company which was operating at three different schedule speeds to obtain maximum efficiency.

Every company, urged the speaker, should carefully analyze its service conditions to determine the most efficient operation. This is not an especially difficult task, and it can be done for any property and to any class of equipment. The size of the motor controls the rate of acceleration, and the conductor largely controls the duration of stops. Acceleration is limited only by the capacity of the equipment, wheel slippage and the comfort of passengers. Certain rates of acceleration may be obtained by advancing the controller through the various points in a given number of seconds. Mr. Chappelle then stated that the operation of railroads was dependent almost exclusively upon time factors, and that these in turn affected energy consumption. He said the motorman thinks in terms of time, and, therefore, he should be checked in the terms with which he is familiar.

Mr. Chappelle then took up the effect of skip stops on efficient car operation. He believed that the public did not understand that the skip stop would increase schedule speeds, and the railway companies did not appreciate that the adoption of this practice would reduce energy consumption. He said that a change from ten stops to seven stops per mile would inconvenience only 30 per cent of the traffic. In other words, 70 per cent of the traffic would be at points where the cars regularly stop and the other 30 per cent would have to walk not to exceed one block to reach the stopping point. Mr. Chappelle was of the opinion that the present cost of service did not warrant the quality of service the railway companies were rendering to the communities they served. If the skip-stop plan could be adopted, it would permit railways to give 22.2 per cent more service in the case of reduction from ten stops to seven stops per mile, and at the same time reduce the amount of energy consumed 15½ per cent. He thought that the railways should make the value of the skip stop plain to the public, namely, that it would give them more service and thus their objection to this improved method of operation would be removed.

Mr. Chappelle again repeated his suggestion that all railway companies should thoroughly analyze their service conditions. This problem could be approached without the use of instruments, by taking into account the weights and kind of equipment, the grades, curves, schedule speeds and the service rendered. With this information the most efficient operation of the equipment involved could be determined, and then some instrument should be employed to indicate that the most efficient plan of operation was being followed. He was of the opinion that frequently results are not obtained

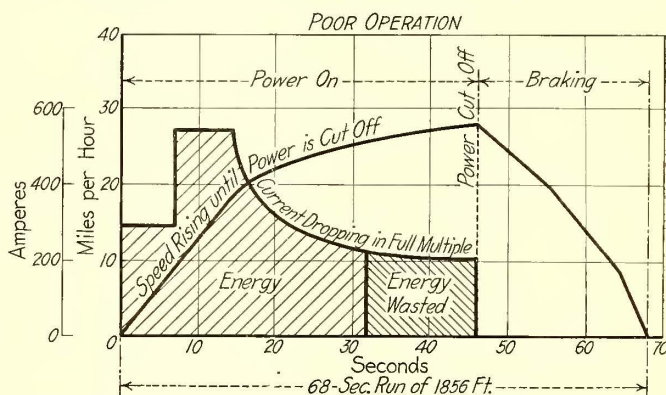
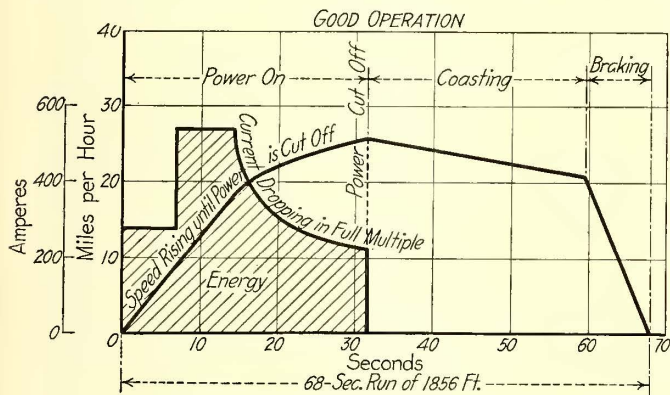
from a given set of conditions because the conditions were changed. He mentioned a case of where a campaign of efficient operation was undertaken which did not produce a reduction in the amount of energy consumed. Investigation revealed that during the period of this campaign the management changed the equipment from single-truck to double-truck cars, a fact which offset any improvement in the car operation. He said that the use of coasting boards was good practice, but they did not check the motormen. Mr. Chappelle closed his discussion with the statement that the value of instructing motormen in efficient operation was lost unless there was some checking system employed to see that they constantly observed these instructions.

MR. LANPHIER INTERESTED IN ENERGY SAVINGS

R. C. Lanphier, general manager Sangamo Electric Company, Springfield, Ill., then outlined briefly the use of current and power measuring instruments to obtain car-operating efficiency. He said that as early as 1902 meters had been used on electric railways in France, but at first not to save energy. This was due to the fact that these meters were only intended to measure the power consumed, and no campaign to reduce the amount was inaugurated. In 1906 meters were installed on motor cars in England and were responsible for

per cent. He said that the experience of the first year had also produced data which would permit the company to effect further savings in the quantity of energy consumed. These data particularly brought out the effect of using different classes of equipment in different classes of service. He stated that on one line a saving of 35 per cent in the amount of energy consumed had been obtained by changing the type of equipment. Mr. Thompson said that his company had followed the practice of many others, namely, that of shifting old equipment to branch lines. Frequently this equipment was too heavy for the service and reduced materially the net earnings of the line so equipped.

Mr. Thompson said that a saving of 4.2 per cent over the same month of the previous year had been effected for January, 1915, for a given class of service, and January, 1916, showed a further reduction of 6.5 per cent. As much as 35 per cent reduction in energy consumption had been obtained for another class of service. Some of this saving had resulted from a change in the type of equipment, but if it had not been for the meters the company would never have realized the possibilities of such a change. He also mentioned the fact that brakeshoe cost had been reduced approximately 30 per cent for the first year's operation with metered cars. Mr. Thompson brought out the interesting point that



CHICAGO ELEVATED RAILROADS' CHARTS OF GOOD AND POOR OPERATION OF CARS, USED IN INSTRUCTING MOTORMEN

marked savings in energy consumption. Mr. Lanphier then said that the coasting clock was introduced in America in 1908 and meters in 1910. He was of the opinion that either instrument was just as effective in bringing about energy savings if equal intelligence was applied to the data they produced.

Mr. Lanphier then described the plan employed in grading men when meters were used, and he believed that the average of all the men in the various classes of service was a fair measure of their efficiency. He said that the ampere-hour meter was so constructed that it recorded the total ampere-hours consumed regardless of the voltage. The same general construction had also been applied to the watt-hour meter, and in it the error had been reduced to a very low point. In service the Economy meters had effected savings which paid for them in a relatively short time. In closing Mr. Lanphier stated that his interests were in common with the railways, namely, that of producing economy in car operation.

CHICAGO & MILWAUKEE ELECTRIC RESULTS

C. E. Thompson, auditor and general agent of the Chicago & Milwaukee Electric Railroad, Highwood, Ill., described the results obtained from Sangamo ampere-hour meters which were installed on the cars of his road in January, 1915. He said that up to the present time the average saving in energy consumed was 8.33

in some classes of service differences ranging from 60 to 70 per cent in relative efficiency of motormen obtained. He also mentioned that different classes of service affected the unit energy consumption. For instance, two cars of the same type, one in local and the other in limited service, showed a difference of approximately 39 per cent in the energy consumed on a given run. He said that he had recently started to make a comparison of his motormen by different classes of service and on a basis of the cost of energy per thousand car-miles. He said that the energy consumed by the limited trains varied from \$60 to \$90 per thousand car-miles, and that the difference in these two amounts would approximately pay one-half the wages of a motorman.

VALUE OF INSTRUCTION ON CHICAGO ELEVATED

H. A. Johnson, master mechanic Elevated Railroads of Chicago, outlined the experience of his road in effecting economies in car operation. He opened with the statement that there was a great field for power economies before the electric railway industry. The elevated railroads have given considerable time and study to their conditions to determine what could be accomplished. They had concluded that to get the most out of any plan for saving power a system of checking is of vital importance. It is also necessary to conduct a systematic campaign of instruction among the motor-

men. In connection with work of this kind, Mr. Johnson said that it had been his general observation that the rate of braking was not understood by most motormen. In order to inform the motormen in this particular, as well as regarding other points of efficient operation, the elevated railroads employ an experienced instructor who devotes his entire time to schooling the motormen. A chart setting forth the results of efficient and inefficient operation was posted at various points where it could be studied by elevated railroad motormen to assist them in this work. A reproduction of this chart is shown in the illustration on page 687. This chart was of educational value to the motormen, and it was largely responsible for the results produced in the economy campaign.

E. S. Gillette, electrical engineer Aurora, Elgin & Chicago Railroad, Aurora, Ill., took part in this discussion, and outlined his road's experience in instructing motormen in the efficient operation. Mr. Gillette's written discussion will be published in a later issue. President Blackhall then closed the discussion by emphasizing the importance of attention to the question of economy in car operation and the value of a system of checking. To bring out his point he said that Congress, legislatures and city councils could pass laws, but the public would not obey them unless there was some police system. He was of the opinion that some checking device on the car was absolutely necessary to accomplish the maximum results.

ILLINOIS ASSOCIATION COMMITTEES

President Blackhall has appointed the following committees of the Illinois Electric Railways Association to serve during 1916:

Membership committee: F. E. Johnson, the Ohio Brass Company, chairman; Marshall E. Sampson, president of the Central Illinois Public Service Company, and G. T. Seely, assistant general manager Chicago Elevated Railroads.

Electrical engineering committee: John Leisenring, signal engineer Illinois Traction System, chairman; C. H. Jones, assistant electrical engineer Chicago Elevated Railroad; G. W. Welsh, superintendent of power East St. Louis & Suburban Railway, and E. S. Gillette, electrical engineer Aurora, Elgin & Chicago Railroad.

Mechanical engineering committee: H. A. Johnson, master mechanic Elevated Railroads of Chicago, chairman; J. M. Bosenbury, superintendent of motive power Illinois Traction System, John Sutherland, master mechanic Tri-City Railway, and J. N. Graham, master mechanic Rockford & Interurban Railway.

Way committee: B. J. Fallon, engineer maintenance of way Elevated Railroads of Chicago, chairman; J. B. Tinnon, superintendent of way Chicago & Joliet Electric Railway, H. F. Merker, engineer maintenance of way East St. Louis & Suburban Railway, and W. F. Carr, engineer maintenance of way Chicago, Ottawa & Peoria Railway.

Traffic committee: W. P. Potter, general passenger agent Illinois Traction System, chairman; R. Breckenridge, traffic agent Aurora, Elgin & Chicago Railroad; C. C. Shockley, general freight and passenger agent Rockford & Interurban Railway; F. L. Butler, general manager and treasurer Chicago & West Towns Railway, Charles F. Speed, vice-president and general manager Evanston Railway, and T. F. Grover, president Terre Haute & Western Railway.

Safety committee: W. H. Heun, superintendent Chicago & Joliet Electric Railway, chairman; Joseph O'Hara, superintendent Springfield Consolidated Railway; Henry B. Adams, safety supervisor Aurora, Elgin

& Chicago Railroad; L. H. Moss, superintendent Elgin & Belvidere Electric; B. W. Arnold, superintendent of transportation Chicago, Ottawa & Peoria Railway, and Dr. H. E. Fisher, medical examiner Chicago Elevated Railroads.

Publicity committee: E. E. Soules, manager publicity department Illinois Traction System, chairman; J. M. Strasser, vice-president Illinois Light & Traction Company; H. E. Weeks, secretary and treasurer Tri-City Railway; F. C. Eckmann, general manager Aurora, Plainfield & Joliet Railway; R. H. Hayward, general manager Galesburg & Kewanee Electric Railway, and W. W. Crawford, secretary Chicago & Interurban Traction Company.

Program committee: L. E. Gould, ELECTRIC RAILWAY JOURNAL, chairman; H. J. Kenfield, *Electric Traction*; J. W. Busch, Westinghouse Electric & Manufacturing Company; A. P. Jenks, General Electric Company; J. H. Bliss, Jr., general manager Chicago, Aurora & DeKalb Railroad, and W. V. Griffin, secretary and treasurer Chicago Elevated Railroads.

Economy of Power Consumption in Car Operation*

BY G. T. SEELY

Assistant General Manager Chicago Elevated Railways

The cost of power for the propulsion, heating and lighting of cars has increased greatly in the last ten or fifteen years. This is due to heavier car construction, higher schedule speeds, a higher standard of heating in the winter months, where electricity is used for heating, and more profuse illumination. The cost of power is one of the largest items in the total cost of operation of electric lines, varying from 10 per cent to 22 per cent of the total expense.

As an illustration of the increase in the cost of electrical energy per car-mile on the South Side Elevated Railroad, in 1900 the consumption was 2.5 kw.-hr. per car-mile, in 1905, 2.9 kw.-hr., and it is now from 3.4 to 3.5 kw.-hr. There has been no increase in the size of the car, and at least one-half of the cars are those which were in operation in 1900, the increase being due to higher schedule speeds, which necessitate heavier motors and heavier cars for the newer equipment, and a more liberal use of current in the winter months for heating.

The amount of current used to operate any system of cars is affected by two main elements: first, the design of each part of the car, and second, the operating methods. During the last two years the question of economy of power consumption has received a great deal of attention from operating officials and manufacturers, and there have been a number of very excellent articles published in the electric railway papers and in the publications of the various manufacturing companies which have covered practically every phase of both the proper design of each part of the car and also the proper operating methods. For this reason the committee has not considered it advisable to abstract these papers, but will give an outline only of the various items that should receive attention.

EFFECT OF DESIGN ON CURRENT CONSUMPTION

The various factors having a bearing on current consumption that are affected by the design of the various parts of the car are as follows:

1. *Weight.* The largest part of the energy consumed in propelling a car is used in overcoming the inertia of the car and load. The energy required is determined

*Report of Engineering Committee Illinois Electric Railway Association.

by the formula $F = \frac{1}{2} MV^2$, where M represents the mass of the car and load, and V represents the maximum velocity of the car in feet per second.

2. *Motor and Control Design.* The motor losses include the I^2R losses, the iron losses, friction and windage, and the gear and axle-bearing losses. The control losses are principally those occurring in the rheostat.

3. *Train Resistance.* The train resistance includes the resistance of journals, the resistance of the air, curve resistance and track resistance.

4. *Current Used by Accessories.* This includes the use of current in electric heaters, lights, headlights, air compressors, fans for ventilators, etc.

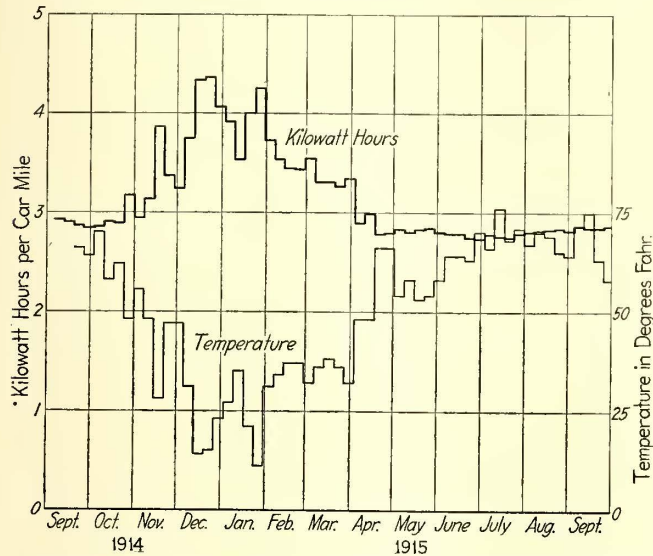


CHART SHOWING EFFECT OF HEATER LOAD ON UNIT ENERGY CONSUMPTION

5. The length of the stop has an important bearing on the current consumption for any given schedule, and therefore the proper design of the entrances and exits of cars so as to reduce the car stop as much as possible is important.

The committee has not attempted to discuss in detail the various phases outlined above, nor to indicate the possible savings to be made by better design, as this will be covered very fully by the papers to be presented later.

EFFECT OF OPERATING METHODS ON ENERGY CONSUMPTION

The following are a number of the ways in which power may be saved on the average road:

1. By efficient work of the motorman.
 - (a) Where hand control is used the proper rate of acceleration of the car is important, as current may be wasted in the resistance when the controller is not fed up promptly.
 - (b) Proper braking of the car is important. The motorman should stop the car in the minimum distance consistent with the comfort to the passengers.
 - (c) The maximum amount of coasting consistent with maintenance of the schedule will give minimum energy consumption. The amount of coasting depends upon the rate of acceleration and braking of the car, and will be fully treated in the discussion.
 - (d) The motorman should give proper attention to time points, not running ahead of the schedule. If the motorman exceeds his schedule at any point, he must either loaf during the latter part of the run or arrive at the terminal ahead of time, in either case wasting energy.

2. By proper attention to the use of current by equipment accessories. This includes care in the use of

electric heaters, especially in the spring and fall, and when cars are laid up in the yards. Air, also, may be wasted by excessive whistling or by "fanning" of the air valve by the motorman. Care should be observed in the use of lights on the cars, turning them off when the cars are laid up.

3. By the reduction in the number of stops on any run to a minimum. Each unnecessary stop increases the amount of power required to make any given schedule.

4. By the arrangement of the stops in hilly country so that none will be made at the foot of a grade.

5. By attention on the part of the crew to the length of stops in loading and discharging passengers.

6. By the adjustment of the brakes to prevent dragging on the wheels.

7. By the use of the most efficient cars possible.

Use of Ampere-Hour Meter and Results Obtained by Chicago & Joliet Electric Railway

BY J. B. TINNON

Engineer Maintenance of Way Chicago & Joliet Electric Railway Company

The principles of efficient car operation have been known to the railway engineer for a number of years, and have been brought out here and in many excellent articles in the technical magazines, but it has been only in the last few years that practical data have been available to show what is being accomplished along these lines. I shall briefly outline the experience of the Chicago & Joliet Electric Railway in the use of ampere-hour meters, the method of bringing the principles of efficient operation before the men, and the results which are being accomplished.

The power for this company is purchased from the Public Service Company of Northern Illinois at its Joliet plant, and it is distributed to our three substations located at Joliet, Lemont and Summit. There are from nineteen to twenty-three cars in regular operation on the eight city lines and from four to eight cars on the interurban line. In November, 1913, forty-three of the passenger cars were equipped with ampere-hour meters, and within another month all of the passenger cars will be equipped with the newest type of meter.

A motorman makes out a meter slip for each car and line on which he operates, noting his meter readings and the trips made on that car and line. The energy consumption and mileage are calculated and noted on this same slip. Twice each month these slips are sorted and totaled for the various lines and motormen. From these figures an average of the ampere-hours per car-mile is computed for each class of car and each line operated. Then, by comparing each man's consumption with the average consumption for each line, a total percentage or "figure of merit" is obtained, showing whether he is using more or less power than the average man. Total power and mileage data are obtained at the same time, and from these curves are plotted for comparison. Once or twice each month a meeting is arranged for the men, when these percentages and curves are discussed with them. The principles of efficiency are pointed out to them by means of blackboard illustrations of speed-time curves explained in as simple a manner as possible. Any questions brought up by the men are also discussed for the benefit of all. This method of instruction has been found to be more effective than the attempt to show each man the fundamental points while he is operating a car.

For the purpose of comparison of the savings made since these meters have been installed I shall use the figures of actual kilowatt-hours used or purchased at

the Public Service plant. The respective amounts of energy purchased for the years 1913, 1914 and 1915 are 9,629,960 kw.-hr., 9,250,210 kw.-hr. and 8,066,686 kw.-hr. The respective mileages for these years are 2,187,415, 2,212,796 and 2,143,287. Expressing these figures in kilowatt-hours per car-mile we have: 1913, 4.40 kw.-hr. per car-mile; 1914, 4.18 kw.-hr. per car-mile, and 1915, 3.76 kw.-hr. per car-mile, showing a decrease under the preceding year of 5 per cent for 1914, and 10 per cent for 1915, a total of 15 per cent for 1915 under 1913. January of this year has shown a decrease of 4 per cent as compared with the same month last year. February, however, showed an increase of 5 per cent over last year, but this was largely due to the bad weather conditions existing throughout this month.

It has been a doubtful question whether the increased rates of acceleration and braking which are essential to efficient operation would not offset the saving in actual consumption by increasing the peak-load charges. On the contrary, our peaks have been found to decrease. Using the same three years for comparison the peaks were 2244 kw. for 1913, 2148 kw. for 1914, and 2082 kw. for 1915; or, 1914 showed a decrease of 4.3 per cent as compared with 1913 and 1915, a decrease of 3.1 per cent as compared with 1914. Also only two of the peaks during 1915 occurred in the winter months, whereas in previous years nearly all of the peaks came in the months of December, January and February.

In conclusion, I might add that very material savings have resulted from the use of meters, in the maintenance of electrical and braking equipment, especially in the number of brakeshoe renewals.

Car-Operating Efficiency

BY J. F. LAYNG

Railway and Traction Engineering Department, General Electric Company, Schenectady, N. Y.

There are certain fundamental economies that can be obtained in operating motor cars. These result from variation in the running time, number of stops per mile, duration of stop, rates of acceleration and braking, and equipment weights. A careful study of each of these elements is necessary to determine if any road is operated at minimum cost and maximum efficiency. The facts can be demonstrated by the efficiency engineer, just as are all items of expense which are entered in the books of a railway.

The increase in the cost of producing transportation will cause the future successful management thoroughly

to study the conditions of operation of each particular division comprising a property. It is a regrettable fact that the number of stops per mile and the duration of stop are phases of operation which have received but scanty consideration. For example, how many managers know how many stops their cars make per mile? In investigations of requirements in connection with the sale of equipment manufacturers receive statements from managers of properties varying sometimes 100 per cent from the actual conditions. It is an almost invariable belief that a car makes more stops than an actual check shows to be the case.

To show just what these points mean in service, a number of calculations have been made and curves plotted therefrom, showing the results graphically. These calculations have been based on fundamental laws from which there is no appeal. It has been known that on test runs there are great differences in the power used by a car even when the service conditions are the same. With the same number and duration of stops, the energy consumption will vary more than 30 per cent when the car is operated by different motormen. This illustrates the differences which are possible to obtain by operating the car at different rates of acceleration and braking, the difference being, of course, in the amount of coasting which is obtained by the different methods of operation. A few years ago a number of investigations were made to determine some systematic method of securing the maximum coasting at all times. As a result the coasting-time clock was designed, and watt-hour and ampere-hour meters were used, with the idea of obtaining the maximum amount of coasting which will give the minimum of energy consumption.

To illustrate the above points calculations were made and curves prepared for a car weighing 18 tons complete with load, and equipped with two motors. The car is assumed to be geared for a free running speed of 22 m.p.h., the run to be 1000 ft., the schedule speed to be 10.65 m.p.h., and the stops to be of seven seconds duration. A resistance of 20 lb. per ton was used throughout the calculations.

Fig. 1 shows the results for accelerating rates of 0.75, 1.0, 1.25, 1.5 and 2.0 m.p.h.p.s. The corresponding watt-hours per ton-mile are 110, 90, 83, 79 and 76. The percentage of difference in energy used between 110 and 90 watt-hours per ton-mile is 18, while the successive savings between 90, 83, 79 and 76 are 7.5, 5.5 and 3.8 per cent respectively. This analysis shows that low rates of acceleration are exceedingly wasteful and inefficient, while the differences in energy consumption at

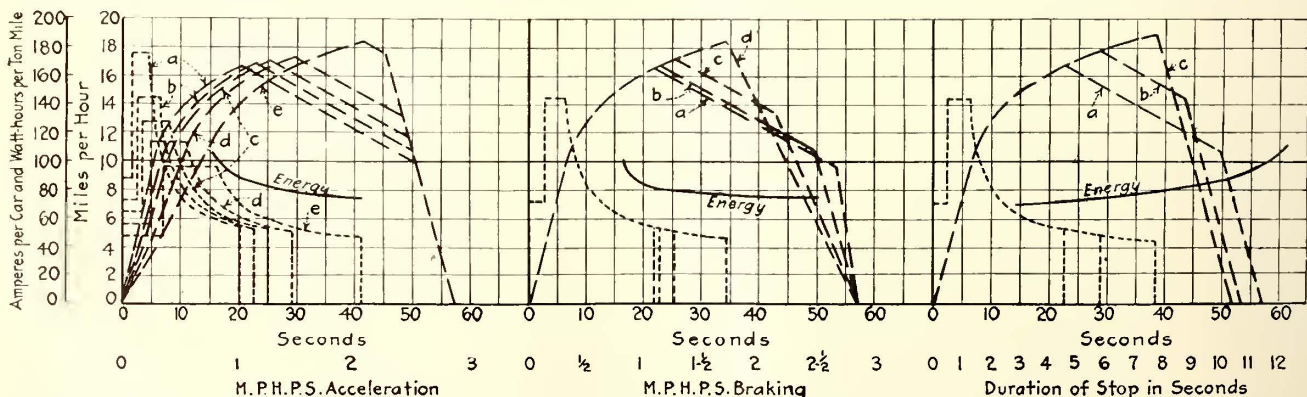
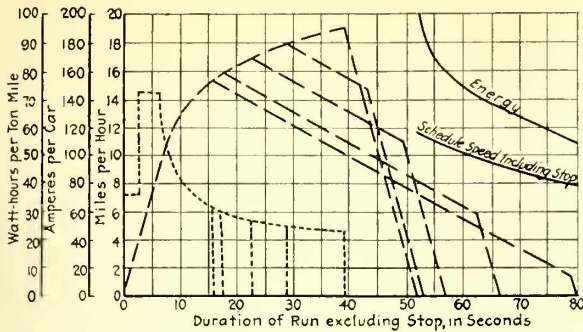


Fig. 1 Seven-second stop, 1.5 m.p.h.p.s. braking rate. Fig. 2 Seven-second stop, 1.5 m.p.h.p.s. accelerating rate. Fig. 3 1.5 m.p.h.p.s. accelerating and braking rate.

Data: Weight of car, 18 tons; run, 1000 ft.; resistance, 20 lb. per ton; schedule speed, 10.65 m.p.h.; time-current plotted in dotted lines, time-speed in dash lines, and rate of acceleration, rate of braking and duration of stop respectively plotted against energy in solid lines.

CAR OPERATING EFFICIENCY—FIG. 1—GRAPH SHOWING DECREASE IN ENERGY AS RATE OF ACCELERATION IS INCREASED. FIG. 2—GRAPH SHOWING DECREASE IN ENERGY AS RATE OF BRAKING IS INCREASED. FIG. 3—GRAPH SHOWING INCREASE IN ENERGY FOR GIVEN RUN AND SCHEDULE AS DURATION OF STOP IS INCREASED



Data: Weight of car, 18 tons; accelerating and braking rate, 1.5 m.p.h.p.s.; resistance, 20 lb. per ton; duration of stop seven seconds.

CAR OPERATING EFFICIENCY—FIG. 4—GRAPH SHOWING DECREASE IN ENERGY AND SCHEDULE SPEED AS COASTING IS INCREASED

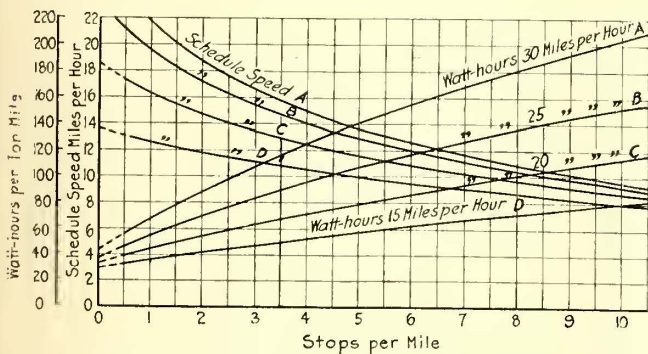
the higher rates of acceleration, while material, are not nearly so great. The total difference in energy consumption of 110 watt-hours per ton-mile, for acceleration at 0.75 m.p.h.p.s., and 76 watt-hours at 2 m.p.h.p.s. is 31 per cent. This is a larger saving than can be obtained in normal operation, as will be explained later.

It is evident that the use of a control which is automatic in its operation will enable the management to select a predetermined economical rate of acceleration with the assurance that it will be maintained in service.

Fig. 2 shows the effects of braking at the rates of 0.825, 1, 1.5 and 2.5 m.p.h.p.s. The resulting energy consumptions are 100, 85, 79 and 76 watt-hours per ton-mile respectively. The successive percentage differences between these figures are 15, 7 and 4.5 per cent, and the total difference between the extreme values is 24 per cent.

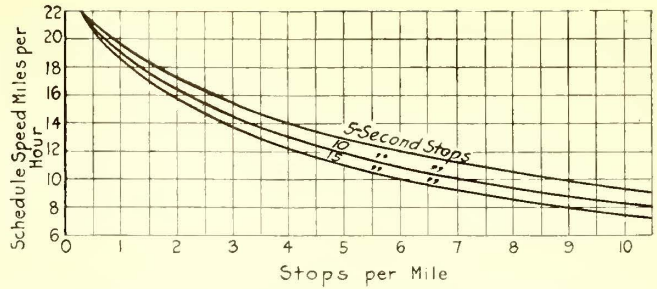
While the savings shown by these two sets of curves for different rates of acceleration and braking are not additive, it is possible to obtain either saving separately. With the lowest rate of braking and accelerating there is a point where the lines cross, which would make it impossible to keep the prescribed schedule.

In Fig. 3 is illustrated the effect on the energy consumption of lengthening the stop from 7 to 10.9 and 12.3 seconds, and still maintaining the same schedule. With the seven-second stop the energy required is 74 watt-hours per ton-mile, with the 10.9-second stop it is 81 watt-hours, and with 12.3-second stop it is 105 watt-hours. These results indicate the advantage of rapid loading and unloading of the passengers, and it brings in the consideration of the method of fare collection, the use of low steps and the general subject of the efficiency of trainmen.



Data: Weight of car, 20 tons; car geared for 15, 20, 25 and 30 m.p.h. maximum speeds respectively; accelerating and braking force, 150 lb. per ton; coasting 20 per cent of power-on period; duration of stop, five seconds.

CAR OPERATING EFFICIENCY—FIG. 6—GRAPHS SHOWING RELATION OF SCHEDULE SPEED AND ENERGY CONSUMPTION TO STOPS PER MILE



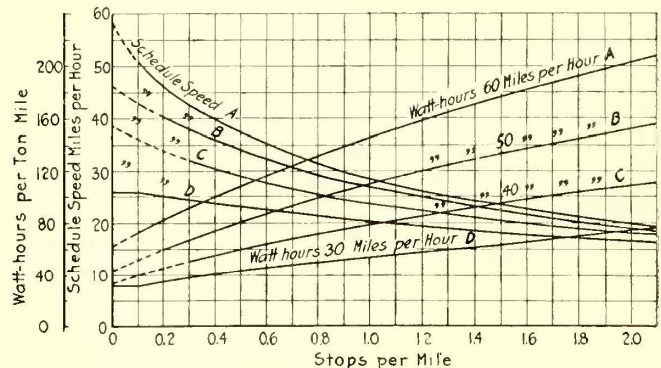
Data: Weight of car, 20 tons; accelerating and braking forces, 150 lb. per ton; coasting 20 per cent of power-on period.

CAR OPERATING EFFICIENCY—FIG. 5—GRAPH SHOWING RELATION OF SCHEDULE SPEED AND STOPS PER MILE

Fig. 4 illustrates the saving of energy by extending a given schedule. The energy saving shown by the curve will probably, however, be offset by the greater expenditure for platform wages. The tendency of progressive operators is to facilitate the making of high schedule speeds, and analysis shows that in general it is advisable to sacrifice power and maintenance savings for platform wages, since the latter represent such a large portion of the operating ratio. However, there are lines that have large leeway in the schedules, but on which conditions are such that changes in running time and service conditions will not allow a car to be cut out of the service. In this case the maximum amount of coasting can be procured effectively.

One of the important railway problems is to secure the maximum number of car-miles per hour. In order to establish a ready check as to what schedule speeds are possible with a given number of stops per mile, and the corresponding power consumption, the curves of Figs. 5, 6 and 7 are presented.

Fig. 5 is designed to show the influence of the duration of stop on the general efficiency of a system. In securing data for new equipments, it is found in different cities that the average duration of stop varies from five to ten seconds. The importance, from a power consumption standpoint, of shortening the stop to a minimum, with maintenance of a given schedule speed, has been shown in Fig. 3. However, there are conditions where, instead of maintaining the schedule speed, the running time is extended. To explain this latter condition the curves shown in Fig. 5 were made. With a car geared to a free running speed of 25 m.p.h., making seven stops per mile, it is possible to make a schedule speed of 10 m.p.h. with ten-second stops. With five-second stops the schedule speed will be increased to 11.2 m.p.h., or 12 per cent.



Data: Weight of car, 40 tons; accelerating force 120 lb. per ton; braking force, 150 lb. per ton; coasting 20 per cent of power-on period; duration of stop, fifteen seconds.

CAR OPERATING EFFICIENCY—FIG. 7—GRAPHS SHOWING RELATION OF SCHEDULE SPEED AND ENERGY CONSUMPTION TO STOPS PER MILE

The curves of Fig. 6 show data for a 20-ton car geared for free running speeds of 15, 20, 25 and 30 m.p.h. and the corresponding watt-hours per ton-mile are also shown. Fig. 7 gives the same information for a 40-ton interurban car, geared for 30, 40, 50 and 60 m.p.h. free running speeds. The relation of stops per mile, schedule speed and power consumption is clearly shown. With the 20-ton car, geared for a free running speed of 25 m.p.h., by comparing the services of seven and nine stops per mile, it will be noted that with seven stops per mile it is possible to make 11.2 m.p.h. schedule speed, and that the power consumption is 2.52 watt-hours per car-mile, while with nine stops per mile a schedule of 9.8 m.p.h. can be made with an energy consumption of 2.88 kw.-hr. per car-mile.

To illustrate the power and schedule savings that can be made we can assume that a car makes 40,000 car-miles per year and the energy costs 1 cent per kilowatt-hour delivered at the car. Then the difference between seven and nine stops per mile represents a saving of \$144 per year in power. A schedule speed of 11.2 m.p.h. corresponds to 3571 car-hours operation, while with a schedule speed of 9.8 m.p.h. the car would be in service for 4081 car-hours. These data illustrate the advisability of eliminating useless stops, and of inaugurating skip stops, near-side stops, etc. It is true that on some lines, even though the schedule speed was increased from 5 per cent to 10 per cent, it would not be possible to decrease the number of cars actually required for the service, but there are more cases where it is possible to take the full advantage of the savings to be obtained by operating at maximum schedule speed.

The advantages resulting from reducing the number of stops and thereby increasing schedule speeds do not all accrue to the railway, but they are shared in large proportion with the patrons. Assume that operating conditions have been so changed that it is possible to shorten a schedule by five minutes. If the car carries fifty passengers it is reasonable to assume that twenty-five of these benefit to the full extent of the saved time. On this basis the total time saved for one-half the passengers is 125 minutes. Some companies have adopted different schedule speeds economically to meet the varying conditions of traffic. One operates four different schedules, which apply to the morning rush, midday service, evening rush and the evening service. During the non-rush hours the schedules are speeded up and the number of cars is reduced, while the proper interval between cars is maintained.

The curves of Figs. 6 and 7 apply only to tangent level track, and do not allow for traffic delays. In ordinary practice the addition of 10 per cent to the schedule speed will permit the application of the theoretical values to actual conditions.

So far we have been discussing the savings which are possible to be obtained in operation. The savings possible through weight reduction are also attractive. The use of trucks and motors adapted for 24-in. wheels is an illustration. In one case a pair of trucks for the large wheels weigh 14,000 lb., and the cars are equipped with two motors weighing 3370 lb. each. By substituting four 900-lb. motors for the heavier ones, the total weight saving in the motors would be 3140 lb. By substituting 24-in. wheel trucks for those necessary with the larger motors, a further weight saving of 5400 lb. results, making a total reduction in car weight of 8540 lb. This reduction amounts to 20 per cent of the weight of the car, and much more than pays for the investment. There are in nearly all cars which were built some time ago certain elements for which lighter-weight material could be substituted at a small cost.

During the past year there has been a growing tendency to apply light-weight, one-man cars to many services. This is not confined to any particular district. On nearly every property which I have visited recently there has been a tendency to place small, light-weight, one-man cars in stub-end service. In many instances a car having a seating capacity of approximately thirty passengers would be large enough for practically all needs. On city systems there are usually several lines on which the receipts per car-mile are far below the average. These are the lines which drain the net earnings and constitute a necessary evil. The small car in many of these cases will transform deficits to net earnings.

By way of illustration a service where two cars were required may be cited. At present cars weighing 56,500 lb. are operated by two men. The company buys energy at 2 cents per kilowatt-hour. The conductors' reports showed that, with the exception of one trip a day, never were more than fifteen passengers carried. However, these cars were used to transport the workmen of a factory, which always closed at a definite hour, and at this period eighty passengers had to be carried. During the remainder of the day the load varied from two to fifteen passengers. The management of this company has practically decided to purchase four 10,000-lb. one-man cars, seating thirty passengers. The power bill will be reduced to approximately one-fifth, and the labor cost to slightly more than one-half. The preliminary analysis of one-man car operation by another progressive management shows that there will be (1) a saving of wages, (2) a saving in power, (3) a saving in maintenance cost, (4) a development of traffic due to more frequent service, and (5) a reduction in accidents.

Of course, it is not expected that these light-weight, one-man cars will be substituted for every class of service. There are certain service conditions, such as the congestion in the downtown city streets, which would make it inadvisable ever to attempt, or even seriously consider, the use of small cars. From the present indications it would seem, however, that a large number of places can be found where the installation of the small cars would pay 50 per cent or more on the investment.

The one-man car should be equipped with every possible safety and time-saving device, which should include air brakes, control with "dead-man's" release, which automatically cuts off power, applies the brakes, sands the track and opens the car door. When these features are properly applied, they are time savers and put the railway company in the position of having provided the public with the greatest possible protection against accident.

Civil Service Examinations Announced

The United States Civil Service Commission announces an open competitive examination on April 19, 1916, for the positions of junior electrical engineer and signal engineer at various places designated in a special list. From the register of eligibles resulting from this examination, certification will be made to fill vacancies as they may occur in these positions in the Interstate Commerce Commission. Positions will be filled as follows from the register resulting from this examination: Grade I, \$1,200 to \$1,680 a year; grade II, \$720 to \$1,080 a year.

Rating in the above examinations will be based 50 per cent on educational training and experience, and 50 per cent on theory and practice.



BROOKLYN ARTICULATED CAR—SIDE VIEW OF NEW CAR, 62 FEET, 10 INCHES OVER ALL

The Brooklyn Articulated Car

An Articulated Car Unit Has Been Built by the Brooklyn Rapid Transit System to Determine the Feasibility of Rebuilding Other Single-Truck Cars to the Same Type

THE Brooklyn Rapid Transit System has recently placed in service an articulated car unit made up of two single-truck cars and a low floor vestibule, similar to the type used by the Boston Elevated Railway.

Unlike Boston, Brooklyn has practically no narrow winding streets to favor the use of an articulated unit for topographical reasons, and it has only enough single-truck cars to make up forty-six such units in all. Therefore, in Brooklyn, the problem of using articulated units narrows itself down to these questions:

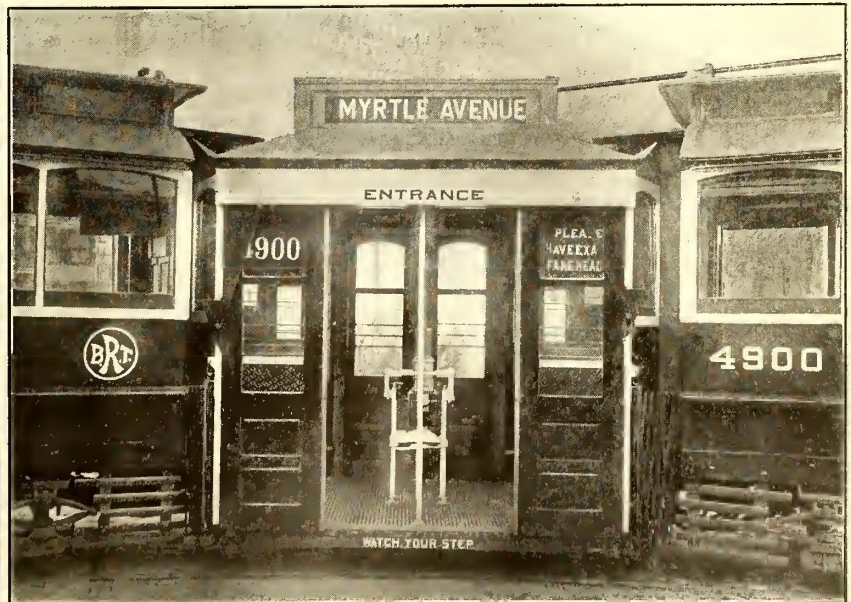
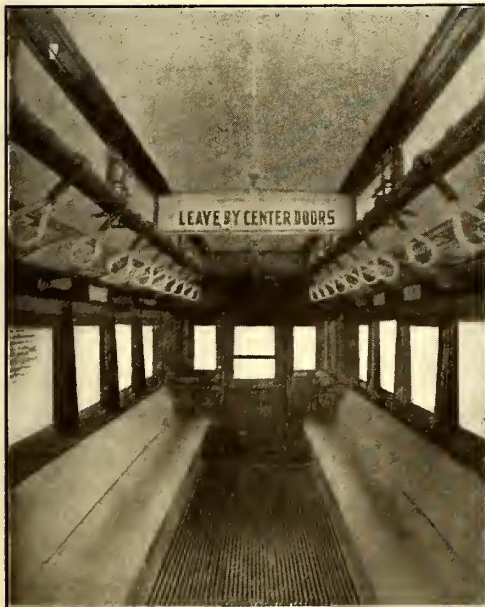
Will it pay to reconstruct and modernize these single-truck cars and buy center vestibules for them in preference to buying entirely new center-entrance cars of slightly smaller capacity?

Will it be possible to operate an articulated unit as efficiently as center-entrance cars in such features as running speed, length of stops, ease in passenger handling, etc.?

Will fare collection be as satisfactory as on center-entrance cars?

To answer these questions, the trial units will be operated over a number of lines. The results will be studied by a committee appointed by President Williams consisting of C. D. Meneely, vice-president and treasurer; W. Siebert, superintendent surface transportation, and W. G. Gove, superintendent mechanical department.

The articulated car unit is made up of two single-truck cars and one center vestibule. To adapt the car bodies for this service, it was necessary to cut off a 4-ft. 10-in. platform on each, leaving only enough of the hood at the inner ends to form the junction with the vestibule. The outer ends of the cars were vestibuled, but this did not change the length of the car. The length of the articulated unit is 62 ft. 10 in. over all, this being made up as follows: center vestibule 13 ft.



BROOKLYN ARTICULATED CAR—INTERIOR OF CAR; SIDE VIEW OF CENTER VESTIBULE

2 in. long, single-truck car bodies 20 ft. each, and vestibuled end platforms 4 ft. 10 in. each.

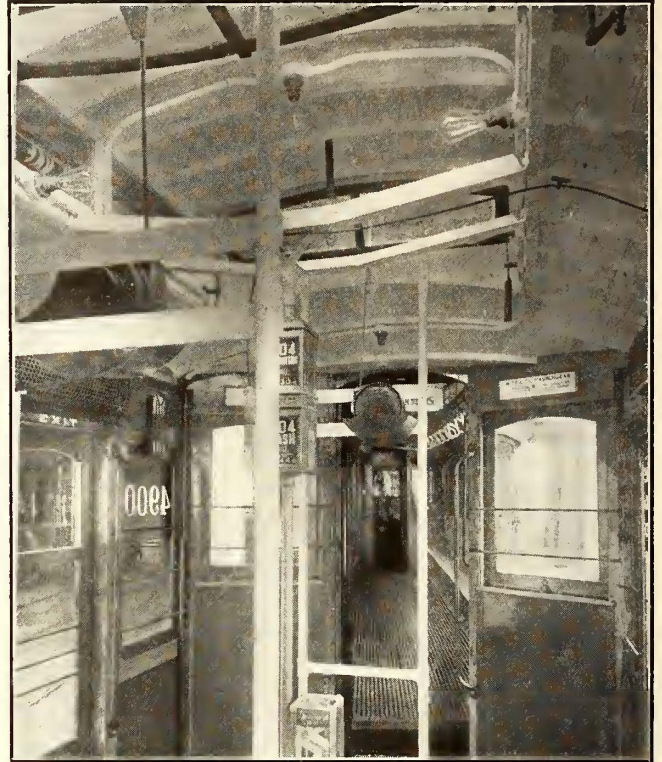
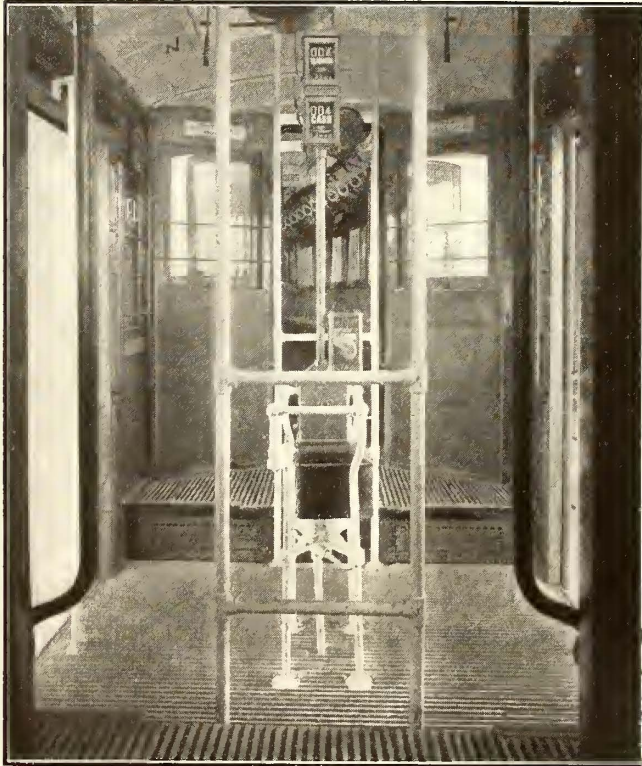
In addition to the work of cutting down and remodeling the car bodies as mentioned, the cars were also changed from the closed to the semi-convertible type. The seating was changed to the extent of placing four folding seats on each platform, of which only two are in use when the motorman is in the vestibule. When the corner vestibule seats are in place, the door behind them is locked. The doors on the opposite sides are of double folding type, but they would be operated for exit only during contingencies.

Externally the cars were renovated by painting them in the company's new standard color, Aurora red for the body, citron yellow for the posts and trimmings

and the wiring was placed in metal conduit with armored flexible cable connections to the center vestibule.

Other equipment which would go into the reconstruction cost of these cars are H. B. wheel guards, Wilson trolley-catchers and Gold heaters with thermostat control for each end section and separate switch control for the center section. As one of the illustrations of the center vestibule shows, the trolley catchers are in the vestibule. Each side of this vestibule is also provided with ladders to enable the conductor to reach the roof and to afford a hand-hold for the passengers as they leave or enter the cars.

The center vestibule is of the Laconia Car Company's standard type, with floor only 14 in. above the pavement. It is furnished with pneumatically-operated



BROOKLYN ARTICULATED CAR—VIEWS OF INTERIOR OF CENTER VESTIBULE—ON ONE THE MOTOR-DRIVEN COIN REGISTER IS CLEARLY SHOWN, THE OTHER ILLUSTRATES THE TWO TROLLEY CATCHERS WITH ROPES PASSING THROUGH CHUTES IN ROOF

and buff for the roof. Internally, the cars were renovated by finishing the ceiling in white enamel. Tungsten 23-watt lamps were also installed, thus adding greatly to the attractiveness of the interior.

Instead of using leather handstraps, the company has fitted this unit with a Rico tubular porcelain glazed metal hanger of B. R. T. design. This hanger has the usual tension spring by which it assumes an angle out of the way of the passenger when it is not being held vertically by him, but it has been improved in the manner of attachment to the rod, since it can be taken off merely by the loosening of a single nut. Faraday buzzer push buttons have also been installed for the convenience of the passengers.

Aside from these changes and additions, a number of other alterations were required. The brake-rigging had to be changed owing to the installation of Westinghouse semi-automatic air brakes, which are operated both from the motorman's valves and from the emergency valve at the conductor's stand in the center vestibule. Peacock geared brakes replace the original hand brakes. While no change was made in the motor equipment, the control was changed to K-28, the old resistors were replaced by E.M.B. unbreakable grids,

doors made by the National Pneumatic Company. These doors are operated from a handle instead of a push button. Faraday single-stroke bells are used for signals between the conductor and the motorman. To avoid the necessity of carrying too many circuits across the center vestibule, a separate switch panel is located in each car.

An exceptionally interesting feature is the use of one of the International Register Company's motor-driven coin registers of the type described in the *ELECTRIC RAILWAY JOURNAL* for Jan. 8 in the article on "Fare Collection Revolutionized at Boston." A comparison of the motor-driven coin register with the method of fare collection now used on the Brooklyn center-entrance cars should prove instructive. In the latter cars, the conductor is provided with a change-making table, the pedestal of which carries the various push buttons for controlling doors, giving signals, etc. The conductor makes change from the cash on the table and rings up the fares on the cash and transfer registers, by means of push buttons. He is therefore relieved of handling any pull-rope, just as in the case of the motor-driven coin register. However, the registration of the fares depends upon him rather than upon a coin register.

COMMUNICATION

Car Operation Efficiency: Energy Input Method of Determining Motormen's Efficiency

RAILWAY IMPROVEMENT COMPANY

NEW YORK, March 27, 1916.

To the Editors:

In the issue of the ELECTRIC RAILWAY JOURNAL for Feb. 19, 1916, C. H. Koehler suggests a possibility that the general fundamental principles outlined in my article in your issue for Jan. 15 are not controlling in the attainment of efficiency under practical operating conditions.

There are two possible methods for checking efficiency in the use of power. The results, *i.e.*, the power input to the car, may be measured, or the factors controlling and determining such results may be checked. Some undoubtedly believe that checking the result is the preferable system, and, as Mr. Koehler's criticism is based on such a belief, it seems desirable to analyze somewhat in detail his suggestions, and to show their relation to the general principles.

In his letter, Mr. Koehler overlooks two practical principles involved in this subject. The first is that the manufacturer and the user of motor equipment select equipment and gear ratio suitable for operation with the motors in multiple under normal average traffic conditions. The second is the basis for the application of the law of averages to the variation in such factors as length of run, duration of run, scheduled speed, etc., factors which are recognized as affecting practical operating results. In my article these averages were determined and their application was analyzed by means of the recognized and accurate method of plotting speed-time and power diagrams based on the characteristic performance curves for the motor equipment.

There is no doubt that with equipment selected for normal operation in multiple at a given scheduled speed and with a given average number of stops per mile, there are conditions where energy saving results from series running. This is particularly true in congested districts where stops are frequent. Here, if normal multiple operation is followed, the controller must be thrown off at or near the full multiple position. For such short runs, the rheostatic losses from full series to full multiple are so great relatively that a saving in power will result from series running.

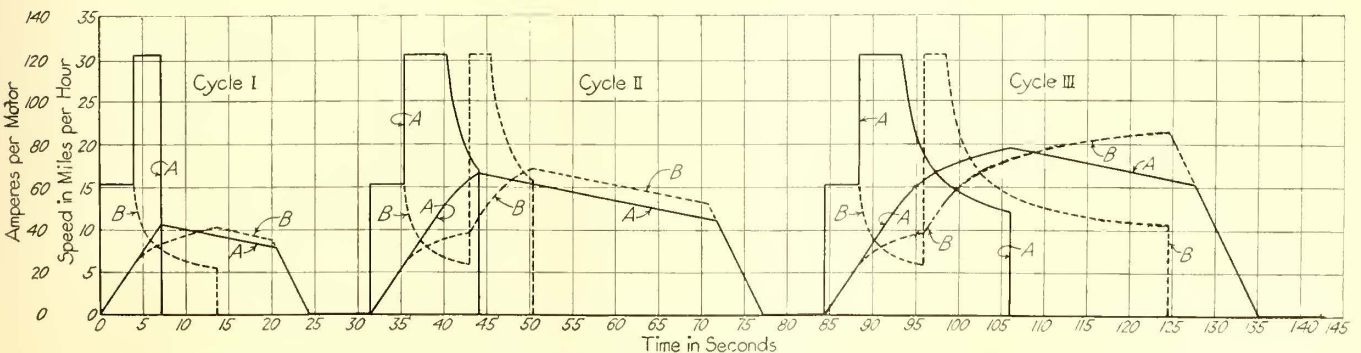
Between the normal mode of multiple operation and series operation, an intermediate mode of operation is possible, *i.e.*, pausing a few seconds in the series position, the notching up to full multiple. Under such con-

ditions, the general rules laid down in my previous article apply, although the general use of this mode under conditions in which multiple operation is contemplated will result in a loss, as it produces only an equivalent average lower rate of acceleration. There are, however, certain rather infrequent traffic conditions involving rather short runs, where the advantages of series operation are relatively small compared with multiple operation, under which pausing on the series position of the controller obviously results in saving. Practical operating results, however, demonstrate that the best results are secured with few and simple rules for the direction of the motorman. Increase in the rates of acceleration and braking results in increased coasting and corresponding reduction in power consumption. Therefore, pausing on the series position of the controller should be discouraged to attain the best efficiency in practical operation. As series operation and operation involving pausing on the series position of the controller seem to be the basis of Mr. Koehler's argument, it is worth while to apply his principle to average conditions.

In the accompanying Fig. 1 the application of these principles is shown in three sets of diagrams. Cycles I and II are Mr. Koehler's suggested runs of one block and three blocks respectively, making a total run of four blocks, with an average of ten stops per mile. The length of this run is 0.2 mile or a distance approximately only 5 per cent of the average one-way trip. He has assumed an average number of stops 11 per cent higher than those made upon one of the most congested lines in Chicago, the Madison Avenue line of the Chicago Surface Lines; 33 1/3 per cent higher than the average number of stops (seven and one-half) generally considered as typical of the average railway line, and just double the number of stops mentioned as the average for the particular equipment on the line of Company B in my article of Jan. 15.

In Fig. 1 is also an additional run of only four blocks, Cycle III, to be made immediately following Cycles I and II. This run is well within reasonable practical probabilities, for the three Cycles I, II and III aggregate only a total run of 0.4 mile, or approximately 10 per cent of the average one-way trip. In this total run the equivalent average number of stops is seven and one-half per mile, or approximately that encountered in average practice. In Fig. 1 Diagrams A represent the performance of Mr. Koehler's Motorman A defined as "after a coasting record." Diagrams B represent the performance of his motorman B represented as having definite anticipatory knowledge in reference to the stop requirements of traffic conditions. The cycles of operation of the two motormen may be summarized as follows:

Motorman A following the mode of normal operation contemplated in the selection of the equipment as suiting the average traffic conditions, notches straight up



CAR OPERATION EFFICIENCY—FIG. 1—OPERATING DATA FOR TYPICAL RUNS OF DIFFERENT LENGTHS

to multiple at the rate of 1½ m.p.h.p.s., gets bell to stop in 7.2 seconds after starting, throws off power, coasts 13.3 seconds, brakes at the rate of 2 m.p.h.p.s., and makes a seven-second stop at the end of the first block. Motorman B accelerates to the series position of the controller at the same rate, but in anticipation of a stop (or from general sluggishness) pauses on the series position, gets bell to stop 7.2 seconds after starting, continues in series until 13.6 seconds from starting, cuts off power, coasts 6.3 seconds, brakes at the rate of 2 m.p.h.p.s., and makes a seven-second stop at the end of the first block. This run is 259 ft. long.

In Cycle II, Motorman A accelerates at the same rate to full multiple, continues in multiple until he attains the speed which his experience and judgment have established as suitable for the probable traffic conditions considered in relation to the time-element factors controlling his ultimate efficiency, then throws off power, coasts 21.5 seconds, brakes at 2 m.p.h.p.s., and makes the seven-second stop called for, at the end of the third block of his three-block run. Motorman B accelerates in the manner and for the reasons outlined for Cycle I to the series position, pauses on the series position for 7.5 seconds (for the bell that came not), then passes to multiple and continues in multiple a sufficient time to make up for the delay caused by pausing on series, then coasts 20.4 seconds, brakes at 2 m.p.h.p.s., and makes the seven-second stop called for at the end of the third block of this three-block run. The length of this run is 791 ft.

In Cycle III, Motorman A accelerates in the manner and for the reason previously described to full multiple, continues in multiple until he has attained the speed his experience and judgment have established as suitable, as above, then throws off power, coasts 21.5 seconds, brakes at 2 m.p.h.p.s. and makes the seven-second stop called for at the end of the fourth block of this four-block run. Motorman B accelerates, in the manner and for the reasons previously described, to the series position, pauses on the series position 7.5 seconds (for the bell that came not), then passes to multiple. But the habit based on the wrong principles for normal operation has caused so much delay in time that in order to maintain schedule, power must be used (resulting in no coasting) until the application of the brakes is at the rate of 2 m.p.h.p.s. He makes a seven-second stop at the end of the fourth block of the four-block run. The total length of this run is 1056 ft.

Table I shows the data for the above cycles. From the table it will be noted that in Cycle I there is a considerable saving in energy from pausing on and continuing at only series position, as Mr. Koehler found. In Cycle II the two methods of operation pro-

duced substantially the same results, although I find a slight difference in favor of proceeding to full multiple at once. Cycle III shows a great advantage in favor of proceeding at once to full multiple, much more than offsetting the reverse result from Cycle I.

It is interesting to note that even for the relatively short run (Cycles I, II and III) the ratio of the increase in per cent coasting to the resulting per cent saving in power of A and B operation gives a ratio of 1 to 0.51. This illustrates the fact that there is a definite ratio existing between increase in per cent coasting and per cent saving in power, as was demonstrated from the fundamental principles in my former article.

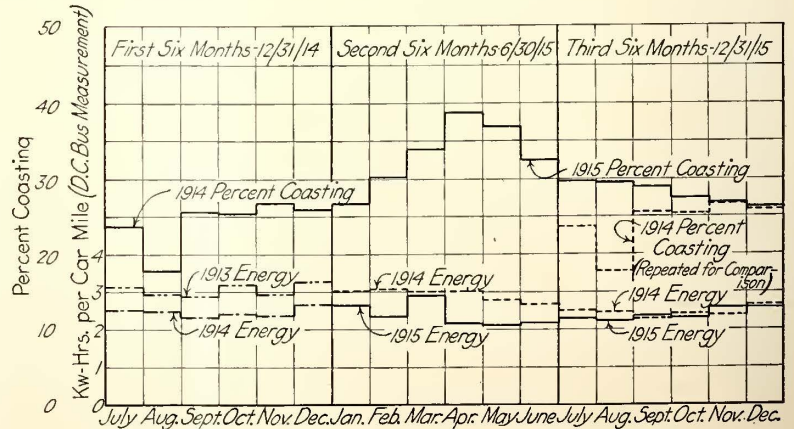
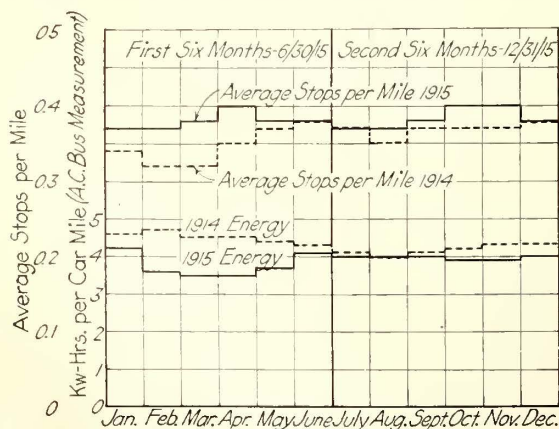
In the foregoing analysis the exact principles of operation suggested by Mr. Koehler have been conceded and applied for comparison. Every practical operator knows that regardless of the use or non-use of any effi-

TABLE I—SUMMARY OF DATA FOR DIAGRAMS SHOWN FOR CYCLES I, II AND III

	Cycle I	Cycle II	Cycle III	Total Run, Composed of Cycles I and II	Total Run, Composed of Cycles I, II and III
Length of run—feet.....	259	791	1,062	1,050	2,112
Corresponding number stops per mile.....	20.38	6.68	4.97	10.06	7.5
Schedule time A and B—7 stops 1 mile.....	31.40	53.0	57.85	84.40	142.25
Schedule speed A and B—m.p.h.....	5.62	10.16	12.50	8.48	10.12
Seconds coasting—A.....	13.3	27.6	21.50	40.9	62.4
Seconds coasting—B.....	6.3	20.4	.....	26.7	26.7
Per cent coasting—A.....	42.35	52.10	37.17	48.43	43.85
Per cent coasting—B.....	20.04	38.50	.....	31.63	18.76
Ampere seconds—A.....	641	1,183	1,720	1,824	3,544
Ampere seconds—B.....	540	1,205	2,240	1,745	3,985
Kilowatt-hours per car-mile—A.....	3.623	2.193	2.376	2.550	2.460
Kilowatt-hours per car-mile—B.....	3.053	2.232	3,093	2,440	2,767
Increase in per cent coasting A over per cent coasting B....	22.34	13.60	37.17	16.80	25.09
Per cent power saving for A over B referred to power for A.....	—15.72	1.86	30.2	—4.32	12.47

ciency checking device, other limitations control the operations of the motormen in congested districts where runs like that shown in Cycle I would be used. Therefore, under these conditions, the motormen rarely attempt multiple operation. The need is apparent, however, for impressing the motormen with the importance of the time element under these conditions, and this time element should be checked for the proper results.

In his communication Mr. Koehler calls attention to an apparent discrepancy in the performance of motormen, referred to in my article, all of whom would have a 40-per cent coasting record for the specified variations of traffic conditions. The schedule speeds and number of stops per mile for which this percentage of



CAR OPERATION EFFICIENCY—FIG. 2—ENERGY CONSUMPTION DATA, ANNAPOLIS SHORT LINE; FIG. 3—ENERGY CONSUMPTION DATA, CLEBURNE INTERURBAN LINE

coasting was shown with widely-varying ranges in kilowatt-hours input, closely approximates the actual conditions existing on a certain line of a well-known railway on which the daily services of some sixty-four different motormen are required. On this line, 40 per cent more cars are required for the evening rush hours than for the morning rush hours, and the number is nearly four times greater than that required at medium schedule for the service between the morning and evening rush hours. The night service with its smaller number of cars approximates the highest schedule.

The classifying and subdividing necessary equitably to compare the sixty-four motormen on such a line may be the simple matter that Mr. Koehler suggests, but it is evident that the 40-per cent coasting shown as being the measure of their efficiency for the particular conditions existing will appeal to the practical operator.

Fortunately, practical results are available from recent periodicals confirming the correctness of the conclusions established from the fundamental principles involved in car operation efficiency. The Feb. 26, 1916, issue of the *ELECTRIC RAILWAY JOURNAL* contains an admirable article by D. E. Crouse, entitled, "Ampere-Hour Meters on the Annapolis Short Line." Without any desire to detract from the value of Mr. Crouse's article, I have subdivided his first-year comparative results from the use of meters into two periods, *i.e.*, the first six months' use, ended June 30, 1915, and the second six months' use, ended Dec. 31, 1915. Fig. 2 shows in graphical form the comparative results (based on a.c.-bus measurement) for the respective first and second six-month periods.

The Stone & Webster *Public Service Journal*, January, 1916, issue, contains an article by R. E. Griffiths entitled, "The Coasting-Time Recorder and Its Operation." From the data in Mr. Griffiths' article Fig. 3 has been prepared, showing the comparative results (based on d.c.-bus measurement) on the Cleburne interurban line of the Tarrant County Company, for the first eighteen months' operation of coasting recorders, ended Dec. 31, 1915, the eighteen-month period being divided into first, second and third six-month periods of comparative operation.

Figs. 2 and 3 show results obtained in practical operation under somewhat similar conditions, *i.e.*, interurban service, which approaches more nearly uniform conditions for schedule speed, number and duration of stops, etc., than can possibly exist for ordinary street railway service.

Fig. 2 shows for the Annapolis Short Line a saving in power of 16.4 per cent from the first six months' use of meters compared with the corresponding period of the previous year. The average number of stops per mile was 0.04 greater for the meter period. Mr. Crouse states in his article that the work done is indicated by the relation of the average number of stops per mile. Similarly, Fig. 2 shows a saving in power of only 4.7 per cent for the second six months' use of the meters, although the comparative number of stops per mile increased only 0.01 stop per mile.

Fig. 3 shows for the Cleburne interurban line a saving in power of 19.6 per cent, with an average of 24.2 per cent coasting for the first six months' use of coasting recorders, compared with the corresponding period of the previous year. Similarly (see Fig. 3), there was a saving in power of 18.7 per cent, with an average of 33.1 per cent coasting, for the second six months' use of the recorders for the comparative periods and the third six months' use, which covers comparative periods with the coasting recorders in use, shows a saving in power, for the comparative periods, of 2.8 per cent,

with an increase in coasting from 24.2 per cent to 28.1 per cent.

The interesting feature of the cited data is that the saving in power on the Annapolis Short Line from the use of meters dropped from 16.4 per cent average saving for the first six months to only 4.7 per cent average saving for the second six months' use of the meters, although the traffic conditions were comparatively easier, based on the comparative increase in the average stops for the latter period.

On the other hand, the saving in power on the Cleburne interurban line for the first six months' use of recorders was 19.6 per cent, for the second six months 18.7 per cent, and for the third six months 2.8 per cent increase, compared with the results of the first six months' use, notwithstanding that the gross earnings per car-mile (another accurate measure of work done), I am advised, showed more than 6 per cent increase.

The foregoing actual results confirm the fact that the fundamental principles involved are as described in my previous article.

C. C. CHAPPELLE,
Vice-President.

Cost Efficiency

Efficiencies of Machines Are Misleading Except Upon a Basis Including All Factors of Cost

IN the current issue of the *General Electric Review*, H. M. Hobart discusses the subject of "Cost Efficiency," or commercial efficiency, in connection with prime movers, as opposed to the commonly-used "energy efficiency," or the ratio of energy output to energy input. The electric locomotive, he said, when operated at its rated load, and under normal service conditions, delivers to the driving wheel about 85 per cent of the electrical energy taken from the contact system. This figure, however, is affected by the weight of the locomotive which has to be hauled as part of the train. If, for example, a 100-ton locomotive hauls a 900-ton train, the "drivers-to-drawbar" efficiency is 90 per cent and the "pantograph-to-drawbar" efficiency is 76.5 per cent. However, taking into account the various kinds of work required of locomotives, one might assume a figure of 70 per cent as the over-all efficiency of the machine.

However, if the electric locomotive is supplied from a large generating station which sends three-phase current over a transmission line, say 100 miles long, to substations from which the railway is supplied, only about 13 per cent of the energy in the coal will be delivered to the transmission and converting system which will have an over-all energy efficiency of its own of some 72 per cent up to the locomotives, so that the latter will deliver only half of the energy in the coal at the drawbar. Thus, from coal to drawbar there is an efficiency of 6.5 per cent for electric operation. Tests have shown a typical steam locomotive to have an efficiency of 4 per cent but when the actual losses of service are considered the over-all efficiency is nearer 3 per cent. Nevertheless, these figures are utterly insufficient as criteria of the two systems. The "cost efficiency" must be considered.

For example, if the cost of electricity at the power station is 0.6 cent per kilowatt-hour at the step-up transformer which has an efficiency of 97.5 per cent, the true cost of the electricity delivered to the transmission line would be 0.615 cent per kilowatt-hour. But, as a matter of fact, proper allowances for repairs, interests, depreciation, etc., increase this cost by a further 0.012 cent, making the real cost 0.627 cent per kilowatt-hour, and against the cost of 0.6 cent per kilowatt-hour prior to stepping up. From this can be conceived the idea

of a "cost efficiency" which shall take all the cost factors into account in considering a machine. Thus, while the energy efficiency of the transformer is 97.5 per cent, cost efficiency is 0.6 divided by 0.627, or 95.6 per cent.

In the same way, the cost efficiency of the transmission line would become 78.6 per cent; that of the step-down transformers 94.5 per cent; that of the substations 70.6 per cent, and that of the direct-current distributing system 78.8 per cent, making a total over-all cost efficiency of only 39.6 per cent for the power supply of the electric locomotive, and thus it may be seen that the real efficiencies of the steam and electric locomotives are not so far apart after all.

The author then discussed the Diesel engine, which has an indicated thermal efficiency of 40 per cent, as against 23 per cent for the steam turbine, or 18.4 per cent when the 80 per cent efficiency of the boilers is considered. Including mechanical losses, the two efficiencies become respectively 32 per cent and 16.5 per cent. However, the cost of a heat unit obtained from crude oil at 4 cents per gallon, and from coal at \$4 per ton, will be respectively 0.33 cent per kilowatt-hour and 0.28 cent per kilowatt-hour of energy output. Therefore, notwithstanding that the steam turbine's efficiency is only half that of the Diesel engine, its fuel cost is actually lower under the assumed conditions. In addition, the Diesel engine has the disadvantage of great weight cost and complexity, weighing some 300 lb. per kilowatt of rated output while steam-turbine-driven sets weigh as little as 30 lb. per kilowatt, all auxiliaries being included in both cases. If the cost efficiencies were worked out the results would show very much to the disadvantage of the internal combustion engine, except under such conditions as very high-priced coal, or an exceptionally high load factor.

The efficiency of the human being as a prime mover was also considered on the basis that the food daily consumed by a man has a calorific value of about 4 kw.-hr. About 8 per cent of this represents the mechanical output of which a man is capable, which, averaged over twenty-four hours, represents about 14 watts. If the man compresses his efforts into one hour per day, he is presumably capable of an output of about 340 watts, or nearly 0.5 hp. On the basis of an output of 0.34 kw.-hr. per day as representative of a man's capacity as a prime mover, his total output in a working length of forty years would amount to 4850 kw.-hr. which at a price of 5 cents per kilowatt-hour, would be worth only \$243, whereas his cost to the community during his lifetime would be several tens of thousands of dollars.

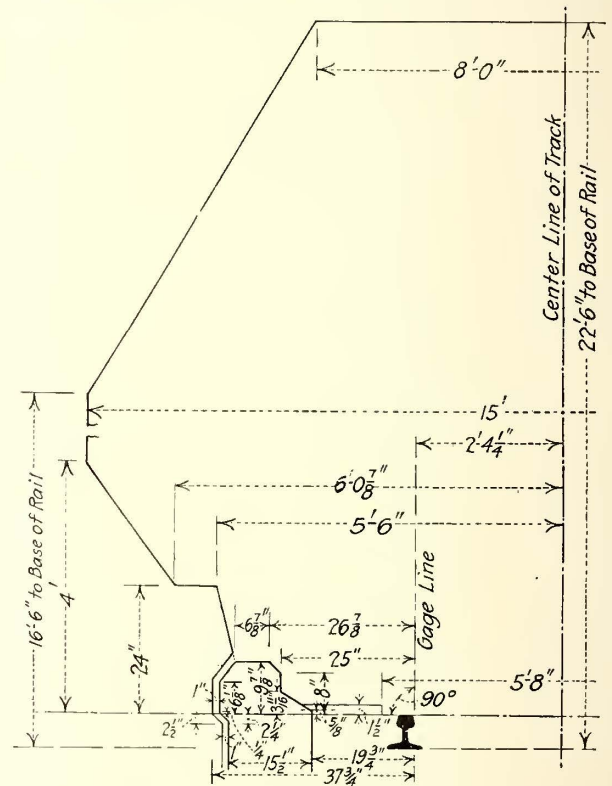
Clearance Diagram for Railway Structures

American Railway Engineering Association Adopts Recommended Form of Clearance Diagram for Structures—Nine Exceptions to Meet Various Conditions Are Noted

AT the convention of the American Railway Engineering Association, reported in the ELECTRIC RAILWAY JOURNAL for April 1, 1916, page 641, a recommended form of clearance diagram for structures was adopted. This diagram was made subject to considerable revision from the form originally proposed by the committee submitting it, and the changes have been incorporated in the diagram shown in the accompanying illustration, the most important one of them being the addition of the clearance lines for third-rail construction adopted as standard by the association at a previous convention.

As noted on the diagram, the clearance lines are subject to exceptions which have been introduced to meet conditions where it is necessary to encroach within the space included in the diagram. These exceptions are as follows: (1) Grade-crossing elimination work in cities. (2) Separation of grades in new construction work in cities or other restricted situations. (3) Loading platforms along side tracks, freight houses, warehouses, piers, etc. (4) Doors of engine houses and other buildings where the design makes the recommended clearances impracticable. (5) Coach or other yards where the available space is very restricted. (6) New work where the physical conditions make the recommended clearances impracticable. (7) Platforms at coach-floor level in subways and other similar situations. (8) Overhead clearances on tracks used exclusively for passenger service. (9) Other special situations requiring special clearances.

In the diagram as originally submitted by the committee no provision was made for the clearance lines for third-rail construction, and the omission was covered by a clause to the effect that the standard third-rail clearances should form the lower 24 in. of the general



A. R. E. A. CLEARANCE DIAGRAM FOR STRUCTURES INCLUDING THIRD-RAIL CONSTRUCTION

clearance diagram. The intersection of the line of demarcation between the general clearance lines and the third-rail clearance lines with the diagonal line forming the lower portion of the side of the original diagram comes at a point that cannot be expressed exactly in fractions of an inch. The position of this point is shown on the line cut as being 24 in. above the top of the rail, and 6 ft. 7/8 in. from the center line of track. Expressed exactly, this dimension would be 6.0714285 ft., the figure being a circulating decimal slightly less than the figure actually shown in the drawing. The dimension was expressed as a fraction of an inch for the reason that this does not affect any of the other dimensions in the diagram and simplifies the expression without introducing more than a really negligible change in the position of the point in question.

American Association News

Company Section No. 10 Is Organized in Dixie—Transportation-Engineering Committee to Report on One-Man Car Operation—Twenty-seven Company Members Have Joined the Association Under the New Constitutional Provision

First Company Section Formed in the South

Section No. 10 was formed in Hampton, Va., on March 31, by employees of the Newport News & Hampton Railway, Gas & Electric Company, with an initial enrollment of sixty. A preliminary organization had been formed under the chairmanship of G. H. Caskey, auditor of the company, which prepared plans and elected officers as follows: President, E. C. Kelly, shop foreman; vice-president, H. C. McAllister, motorman; secretary, W. Collins; treasurer, R. C. Tignor; directors, W. Stewart, secretary; G. H. Caskey, auditor; B. J. Megison, superintendent of transportation, and C. D. Porter, engineer.

A novel feature of the inauguration was the use of an original ritual for inducting the elected men into office and making clear to them the nature of their new duties. Mr. Caskey performed this rite for the president who, in turn, initiated the others. E. B. Burritt, secretary of the association, and H. C. Clark, editor of the association magazine, were in attendance and explained the work of the association to the men. Mr. Burritt laid particular stress on the relation of the sections to the association while Mr. Clark spoke of the social aspects of the section activity.

Short talks were also given by J. N. Shannahan, president; E. B. Peck, general manager; R. J. Booker, treasurer; B. J. Megison, C. D. Porter and E. C. Kelly. Good wishes for the success of the new section were expressed by Messrs. Lawton and Crossman, of the electric light and gas departments, respectively, which departments are forming sections of the N. E. L. A. and the A. G. I. After the talks questions were asked and answered and an oyster supper was served.

It was hoped President Charles L. Henry and company section committee chairman Martin Schreiber would be present. As they could not do so a resolution was passed inviting them to address a later meeting.

Mr. Clark reports that while this section is not as large as some, it promises to make up in enthusiasm for its necessarily limited size. He said that there was a fine spirit in evidence at the meeting. The questions which were asked indicated that the men wished to make the most of the opportunities which the section organization will provide.

Study of One-Man Car Situation

A meeting of the joint Engineering and T. & T. Associations committee on transportation engineering was held in Pittsburgh on March 24. Those present were W. A. Carson (co-chairman, T. & T.), Evansville, Ind.; C. F. Hewitt, Albany, N. Y.; P. N. Jones, Pittsburgh, Pa.; J. W. Allen, Boston, Mass., and F. R. Phillips (co-chairman, Engineering), Pittsburgh, Pa. The committee selected from its assignments the topic "Economics of One-Man Car Operation," concluding that the best results will be secured by concentration of effort. The several phases of the subject are to be considered by the several members and reports are due in Mr. Phillips' hands by May 1.

As indicative of the problems which the committee considers to be involved in this line, the following outline, approved at the meeting, is appended:

1. Conditions under which it is considered desirable to operate one-man cars: (a) On suburban lines tapping densely populated districts; (b) on streets where traffic congestion is great; (c) in jitney-bus competition; (d) on short belt lines; (e) on feeder lines.
2. Effect of frequency of service (made possible by the use of one-man cars) upon riding habit.
3. Reduction in cost of operation.
4. Possibility of furnishing transportation for the public (in districts not now possible) because of reduction in cost of operation.
5. Attitude of public.
6. Attitude of public service commissions.
7. Franchise stipulations.
8. Additional duties required of the operator, if any, and possible assistance from street inspectors.
9. Operation of one-man cars as night cars.
10. Difficulties of operation: (a) Grade crossings; (b) trolleys; (c) fare collection; (d) collection and distribution of transfers, making change, etc.
11. Advisability of operating on the same routes with cars of other types.
12. Proper size and seating capacity of car, considering loading capacity and ability of the operator to handle the number of passengers able to board the car.
13. Possibility of reduction in number of boarding and alighting accidents.
14. Design of the entrance and exit ways; separate or combined, controlled manually or by power.
15. Seating arrangement with reference to the effect upon the rapidity of taking on and discharging passengers.
16. Necessity for an emergency exit.
17. Brake operation, by power or manual.
18. Consideration of the use of automatic devices.
19. Consideration of the types of one-man car now in operation, with data.

"Manufacturers" in the Association Fold

Twenty-seven companies or firms have to date joined the association under the new provisions of the constitution. The complete list, with the names arranged approximately in the order in which the applications were made, is given below.

General Electric Company; Drew Electric & Manufacturing Company; ELECTRIC RAILWAY JOURNAL; Westinghouse Electric & Manufacturing Company; Aluminum Company of America; Railway Audit & Inspection Bureau; International Register Company; Trolley Supply Company; International Steel Tie Company; Kenfield-Davis Publishing Company; Ohio Brass Company; Chattanooga Armature Works; Sherwin-Williams Company; American Engineering Company; C. M. Koury Company (furniture dealers, Atlantic City); Archbold-Brady Company; Railway Improvement Company; Stone & Webster Engineering Corporation; Goldschmidt Thermit Company; Westinghouse Traction Brake Company; Tool Steel Gear & Pinion Company; Wheel Truing Brake Shoe Company; Curtain Supply Company; American Steel Foundries; Railway Materials Company; McQuay-Norris Manufacturing Company; Pantasote Company.

EQUIPMENT AND ITS MAINTENANCE

Short Descriptions of Labor, Mechanical and Electrical Practices
in Every Department of Electric Railroading

Contributions from the Men in the Field Are Solicited and Will Be Paid for at Special Rates.

Flange Oiler for Reducing Curve Friction on Interurban Railways

BY F. G. LISTER

Mechanical Engineer El Paso & Southwestern System, El Paso, Tex.

The Oregon Electric Railway, with headquarters at Portland, Ore., has tried some successful experiments with a pneumatic flange oiler for interurban cars and locomotives, designed and patented by A. W. Olsen, air-brake machinist for the company. The general plan and the details of the oiler are shown in the accompanying illustrations.

The oiler is operated by air pressure from the brake reservoir, and it consists of the following parts: (1) The lubricator proper, the function of which is to deliver a jet of mixed oil and air when the motorman admits air to it from the air-brake system. (2) An oil reservoir located in the motorman's cab near the heater. (3) A piping system consisting of an oil pipe, an air-pressure pipe and an air-equalizing pipe connecting the upper part of the oil reservoir with the mixing chamber in the lubricator.

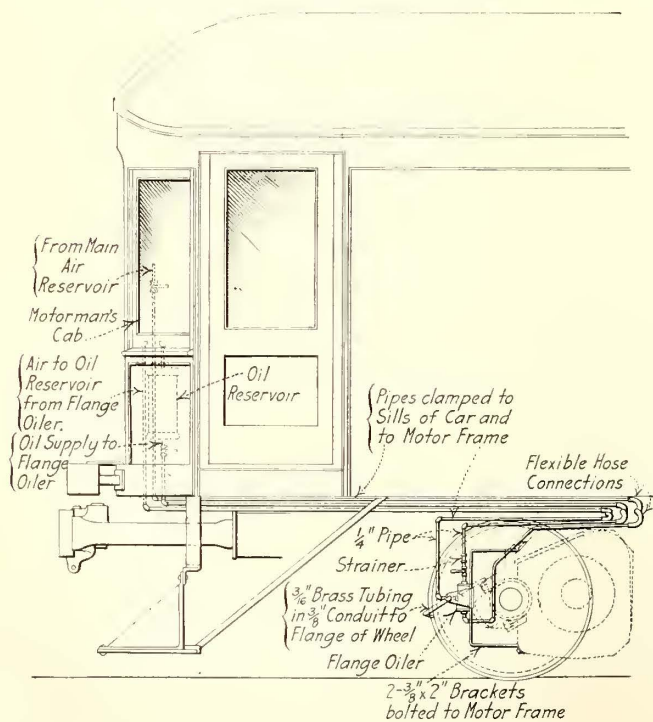
The lubricator consists of a cast-iron or brass body, fastened preferably on the frame of the front, or No. 1, motor. In the lower part is a piston operated by air pressure. In the upper part is an oil chamber, in the bottom of which is a valve controlling the supply of oil to a mixing chamber below. The oil valve is lifted by the air piston by means of a regulating bolt which projects upward from the latter. By adjustment of this bolt, the rate at which oil will flow into the mixing chamber can be regulated. Air reaches the mixing chamber through two small air ports connecting it with

the air chamber below the piston. In the ports are regulating valves by means of which the rate of admission of air to the mixing chamber can be adjusted. The air piston and the oil valve are seated by coiled springs.

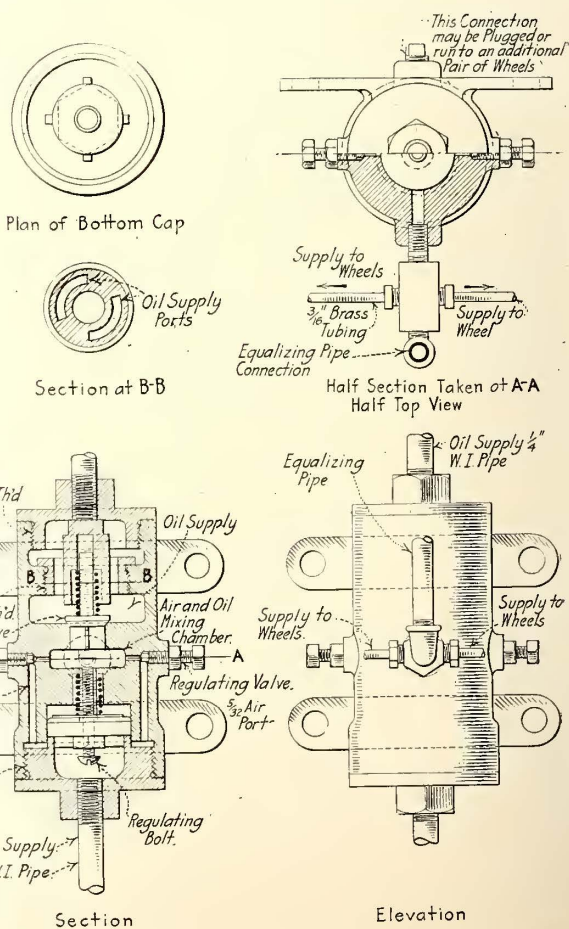
As stated above, the mixing chamber is connected with the upper part of the oil reservoir by means of an equalizing pipe. This permits the oil to flow by gravity from the oil chamber to the mixing chamber when the valve is opened. The mixture of oil and air is delivered to the wheel flanges through tubing drilled to 1/32 in., run through 3/8-in. conduit for protection.

In operation the motorman opens the cock in the oil supply pipe, and when he desires to oil the wheel flanges he admits air from the main air reservoir to the bottom of the lubricator by opening a valve. The piston rises and the regulating bolt strikes the boss on the bottom of the oil valve, raising it slightly. At the same time air is admitted to the mixing chamber and drives the oil out in the form of a spray. When the lubricator is spraying the air pressure in the mixing chamber is about 30 lb. per square inch.

When the oiler is shut off the air remaining leaks out through the tube to the wheels and through a 1/16-in. vent in the air valve operated by the motorman. The air piston and the oil valve then seat themselves



PNEUMATIC FLANGE OILER APPLIED TO MOTOR CAR WHEEL



DETAILS OF LUBRICATOR FOR PNEUMATIC FLANGE OILER

under the action of the coiled springs, and the operation is over.

The three pipes leading from the cab run close to the truck center plate, and flexible connections are inserted to permit movement of the truck. Two pairs of wheels can be lubricated at the same time, as there is a connection on each side of the lubricator. In the illustration it is shown applied to one pair of wheels only, the connection on the opposite side being plugged. The oiler as described is designed for clean crude oil, of which the amount required for oiling a curve is so small that it cannot be detected on the gage mounted on the oil reservoir.

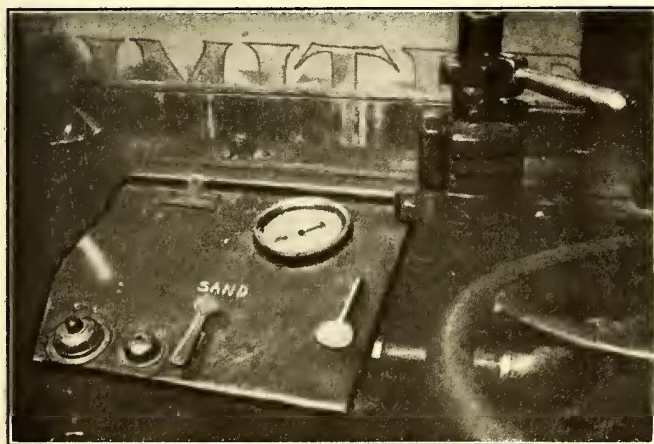
The device can be adopted to automatic operation by adding an incased gearing connected with transverse shafts attached to the truck and with a lever hanging vertically next to the right-hand rail. An extended lug attached to the outside of the rail, say 200 ft. from a curve, strikes this lever, turning the shaft and operating a cam mounted upon it. The vertical movement of the cam engages an air valve which automatically starts the flange oiler. On the left-hand side of the car is a lever on another shaft which acts in a similar manner to close the oiler when the car leaves the curve.

Motorman's Auxiliary Control Board

BY H. H. BUCHMANN

Master Mechanic Indianapolis, Columbus & Southern Traction Company, Greenwood, Ind.

Greater convenience and safety in the operation of cars has been obtained by mounting the air gage, sander and whistle valve handles, train order board and signal button on an auxiliary control board placed between the motorman's valve and the controller. A standard arrangement for all of these devices has been adopted, and auxiliary control boards have been installed on all the cars of the Indianapolis, Columbus & Southern Traction Company. A push button controlling the light



MOTORMAN'S AUXILIARY CONTROL BOARD IN SERVICE

for this board was also provided, and it closes the circuit against a spring which again breaks the connection when the motorman removes his hand. The standard arrangement of these devices makes them more convenient for the motorman to operate and, at the same time, gives an added factor of safety because he soon becomes so familiar with their location that he can place his hand on any one of them almost automatically. Incidentally the position of the gong push-pins and gong has been standardized for all cars. Six cars have been fitted with auxiliary control boards, and such boards will be added to all the interurban equipment operating over this line. The shelf is made of sheet steel, and it is fastened to the front vestibule

center panel with screws and supported with a knee brace. While standardizing the location of the various auxiliaries on this board, the height of the shelf as well as the method of making the various connections was also fixed so that the control boards could be easily detached and are interchangeable.

Electrical Repair Shop Methods as Applied to Platform Controller Maintenance

BY E. D. RANSOM, B.E.

The following paragraphs cover briefly the methods followed in overhauling controllers in the department of electrical repairs of a large railway system. The writer's intention is particularly to describe the short-cuts and improvements which have been developed in this department. On this system, although minor repairs and replacements are made in the maintenance shops, all major repairs and periodical overhauls are made in the department of electrical repairs. This insures careful workmanship by experienced men, who become expert through performance of the same routine and class of work.

On this system all controllers are overhauled on a two-year basis, the overhauling being done in accordance with the following procedure. These controllers are in operating condition and have been kept up in the local maintenance shops where they have careful attention on inspection, where they are lubricated and where minor repairs are made.

Stripping Controllers. The controller is placed on a bench to be stripped, the cover is removed, cleaned and shellacked inside, dents are removed and the cover is stood up to dry. The controller is then taken apart and the several parts are distributed as follows:

All brass pieces, such as dial caps, tops and copper wipers, which are in good condition, are acid dipped. The control cylinder wiring and reverse wipers and wiring, together with the bottom connection board, are removed and tested for mechanical and electrical strength.

As all of these connections are made permanently at the back of the controller connection board, special attention has to be given to this point as these terminal backs are only exposed at the period of each overhauling. This wiring and the board are then shellacked and are again ready for use, after any necessary repairs have been made.

The blow-out coil is then removed, tested for continuity and connection, retaped, shellacked and returned for assembling. Next the Vulcabeston arc deflector is thoroughly scraped down, removing all carbonization and copper deposits, new sections are installed where needed and, after tightening all joints, the arc deflector is ready for installation.

Control Cylinder. The control cylinder is thoroughly cleaned of all carbonization, and insulating material is scraped to a clean surface. The cylinder is then put in a jig and any loose castings are tightened by the following method: The castings are held in the proper position by clamps, the cylinder is heated up by means of gas jets situated so as to throw heat at the base of each casting, and the castings are given their proper seat. If the cylinder is defective the castings are removed by heating, as described, and the cylinder is built up section by section with new castings and insulating seats.

Reverse Cylinders. New reverse cylinders for replacement are turned out of properly dimensioned wood and segments are installed by means of a jig which

holds the cylinder in the proper position and locates the exact position of each segment by template fingers. Old cylinders are placed in the jig and are thus checked for any warping out of alignment.

Controller Back and Bearings. Control cylinder bearings, especially the top bearings, are subject to great wear due to the continued pull from the controller handles. It has been found economical to insert brass bushings in the upper castings, thus eliminating lost motion and frequent renewal of the entire casting.

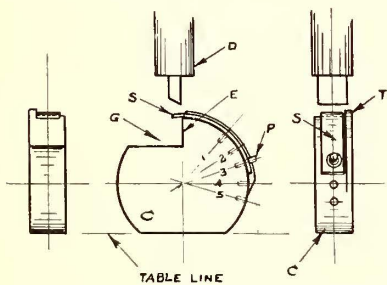
Pawl springs are replaced on overhauling, as well as on inspection. A great deal of trouble was experienced at one time from the breakage of pawl springs, but this was overcome by a very simple method. The old-style springs were hooked at each end by means of a reverse turn of the last coil. It developed that the breakage was always at this bend, where the spring was attached to the pawl, as all the strain and twist was concentrated at this point. To overcome this trouble the pawl spring is now pinned to the pawl by means of a swiveled metal strip, which, in turn is fastened to the pawl spring by anchoring it to the entire last coil, without necessitating any bending at all. This swivel action takes the twist off of the reverse turn, and distributes the tension evenly over the whole coil in a direction perpendicular to the diameter of the turns.

The controller back is next scraped out and a new fiber lining is installed. Due to an epidemic of controller flashes to the back of the controller with the cylinder in the series-multiple position, brought about by peculiar local operating conditions, it has been found advisable to place a layer of mica behind the fiber lining at the point where arcing repeatedly occurred.

Control Cylinder Wipers. All wipers not in good condition are, of course, replaced by new ones, which are manufactured in the machine shop very efficiently and inexpensively, as follows: By means of a die which has been developed in the shop, the wipers are stamped

out to the proper size and shape, bent to the proper form and stamped with the owning company's initials on the back, all in one operation. It is only necessary to feed properly dimensioned bar copper to the machine.

The wiper springs and bases are stamped out, punched and



JIG AND CUTTING TOOL FOR CONTROLLER SEGMENTS

shaped in a similar manner in one complete operation. Next the shunts and bases are machine-riveted to the wipers in three places and the complete wiper is ready for use. As the wear of the wiper is only at the point of contact with the segment, old wipers are scrapped with at least 90 per cent of the original copper remaining.

Control-Cylinder Segments. Old segments are cut down from larger to smaller sizes by means of a jig, as shown in an accompanying illustration. This is possible because the segments are worn extensively at only one end, there being a good end and hole left. A template section of the cylinder of radius C is placed vertically in a punching machine with the gap G directly under the cutting tool. On the circumference of this jig is a series of holes, 1, 2, 3, etc., numbered to correspond to the distances between holes for the several sizes of segment.

The segment to be cut down is placed on the jig, as shown in the figure at S , with a pin through the good

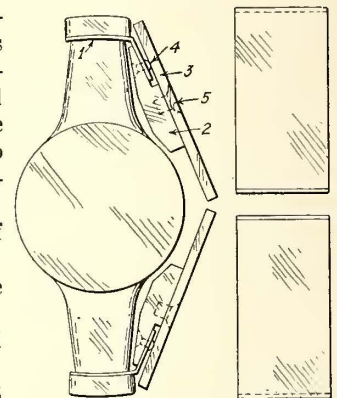
hole. This places the other end of the segment under the cutting tool to give the proper size corresponding to the hole used. The segment is held against the template edge T , and by operation of the foot pedal on the punching machine the segment is cut off at point E , giving a segment of the desired size, the remainder being scrapped.

This jig is also used in making new segments. Bar copper is run through the machine and is bent and cut to proper length and radius by the tool. The saving in new segments is considerable, as the large segments are sometimes cut down twice to successively smaller sizes, until all that remains is a small end.

General. Due to the flashing referred to earlier, additional precautions are taken at the finger board and the segments with the practical elimination of controller flashes. On four-motor equipment the trolley wiper is now inclosed by inserting a $\frac{1}{2}$ -in. Vulcabeston shield on each side of the wiper. Similar shields are installed between all wipers where there has been any tendency toward flashing.

In addition to this, and still more important, arc shields have been placed between the segments on the control cylinder at the series-parallel position, preventing flashover to the controller back due to improper operation at this point. The second illustration shows this shield in detail together with the method of attachment to the cylinder, the parts being as follows:

1. Shield support of sheet brass, U-shaped.
2. Shield back of white fiber.
3. Shield of asbestos and wood.
4. Rivet, No. 14 x 7/16 in., flat head.
5. Machine screw, No. 14 x $\frac{1}{4}$ in., flat head.



ARC SHIELDS FOR CONTROLLER CYLINDER

The U-shaped prong, 1, is inserted under the segment and held in place by the segment screw, the edge then being flush with that of the segment.

Finally, after all the parts have been cared for as described the controller is assembled, proper adjustment of all contacts and springs is made, an initial lubrication is given to the bearings, the cover is closed and painted, and the controller is ready for an additional two-year service.

An Inexpensive Steel Pole Line

BY W. K. PALMER
Consulting Engineer, Kansas City, Mo.

The use of wooden poles in interurban railway construction seems incongruous to the engineer with a sense of the fitness of things, and nearly as inconsistent as would a carpenter job as a part of a lathe or other machine tool, but up to within recently the only type of steel pole available, that used on city streets, has been prohibitive as to cost. Now, however, with the Bates one-piece steel lattice pole a satisfactory substitute for the wooden pole at a moderate cost can be procured.

The engineers of the writer's organization have designed a standard bracket construction and span construction for use with this pole. The bracket construction uses a member made, like the pole, of one piece expanded and has been adopted by the northern division

of the Oklahoma & Interstate Railway, 57 miles, in southeastern Kansas and northeastern Oklahoma. The company manufacturing the poles has accepted this bracket arm design as its future standard.

The details of the construction used on this railway are shown in the accompanying diagram. It was decided that pole spacing, for catenary overhead, could safely be increased to 200 ft. on tangent track, and that the reduction of number of poles more than offsets the increase of cost per pole so that an overhead system can

cost of an average 1 mile with the steel poles and brackets as shown in the diagram, was estimated as given in the first table.

The cost of 1 mile of 35-ft. Western cedarwood poles and standard bracket on tangent, with 150-ft. spacing of the poles, and a corresponding quality of overhead fittings, would be approximately as follows:

STEEL POLES	
Estimate of cost of 1 mile of construction using Bates steel pole and brackets, pole spacing 200 ft.	
Twenty-six poles at \$12.90.....	\$335.40
Twenty-six brackets at \$3.....	78.00
Twenty-six crossarms at 50 cents.....	13.00
Twenty-six messenger cable insulators at 10 cents.....	2.60
Twenty-six feeder cable insulators at 5 cents.....	1.30
Fifty-two telephone wire insulators at 4 cents.....	2.08
Twenty-six messenger insulator pins at 84 cents.....	21.84
Twenty-six feeder insulator pins at 16 cents.....	4.68
Fifty-two telephone wire insulators at 7 cents.....	3.64
Labor and material for concrete base on pole, twenty-six poles at 64 cents.....	16.64
Labor for digging hole, setting pole, unloading and distributing pole bracket, crossarms and fittings twenty-six poles at \$3.52.....	91.52
Labor for fitting bracket, cross-arms, insulators and pins, 1 mile.....	30.00
Total.....	\$600.70

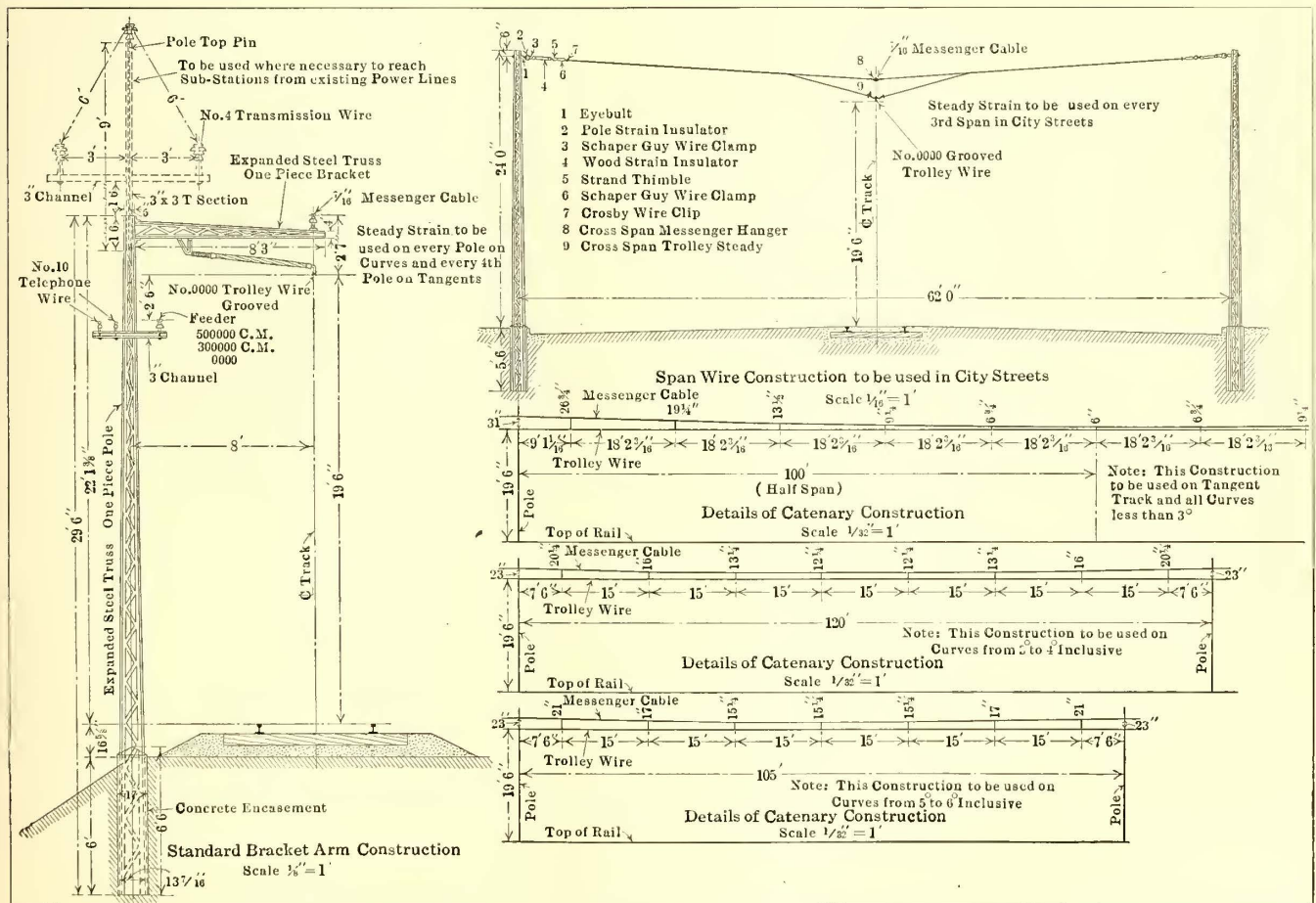
WOOD POLES	
Estimate of cost of 1 mile of construction using wood pole and standard bracket, pole spacing 150 ft.	
Thirty-five poles at \$8.60.....	\$301.00
Thirty-five brackets at \$2.60.....	91.00
Thirty-five crossarms at 25 cents.....	8.75
Thirty-five messenger cable insulators at 10 cents.....	3.50
Thirty-five feeder cable insulators at 5 cents.....	1.75
Seventy telephone wire insulators at 4 cents.....	2.80
Thirty-five messenger insulator pins at 84 cents.....	29.40
Thirty-five feeder insulator pins at 16 cents.....	5.60
Seventy telephone insulator pins at 7 cents.....	4.90
Labor digging hole, setting pole, unloading and distributing pole, bracket, crossarm and fittings, thirty-five poles at \$3.69.....	129.15
Labor fitting bracket, crossarms, insulators, etc., 1 mile.....	40.00
Total.....	\$617.85

The estimates given herein do not cover any wire equipment.

It should be recognized that the foregoing figures are for typical conditions for tangent track, and that these items will vary with curvature and local labor and material costs, so that they may be taken merely as showing what has been found possible in this particular case. But there is strong indication that this new construction may well be considered in connection with any new interurban lines with the expectation that initial costs will not materially differ from those for the old practice, in the aggregate, while at the same time a very real and economic advantage can be secured in added life and diminished maintenance.

actually be built for the same or for even slightly less first cost, using the new design, than when common wooden poles are employed.

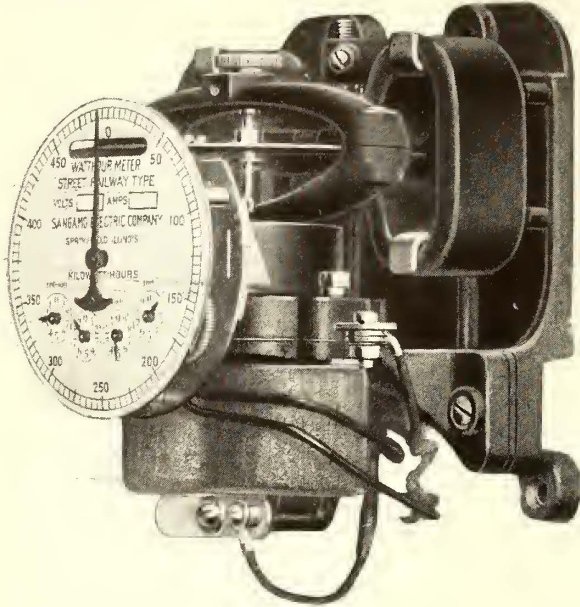
Estimates are always interesting to constructors, although not to be relied upon for too general application, so comparative schedules are given for the cost of construction, for pole line construction only, with steel and wooden poles, as determined for the particular division of interurban railway just mentioned. The



DETAILS OF INTERURBAN OVERHEAD CONSTRUCTION WITH PRESSED-STEEL BRACKET AND CITY SPAN CONSTRUCTION, OKLAHOMA & INTERSTATE RAILWAY

New Sangamo "Economy" Meter

More than twelve years ago the first attempt was made to apply Sangamo mercury-motor direct-current meters on electric railway cars. This was in Montreal, and some interesting observations were made on power consumption. But at that time the meter had not been



METER ELEMENT REMOVED FROM CASE

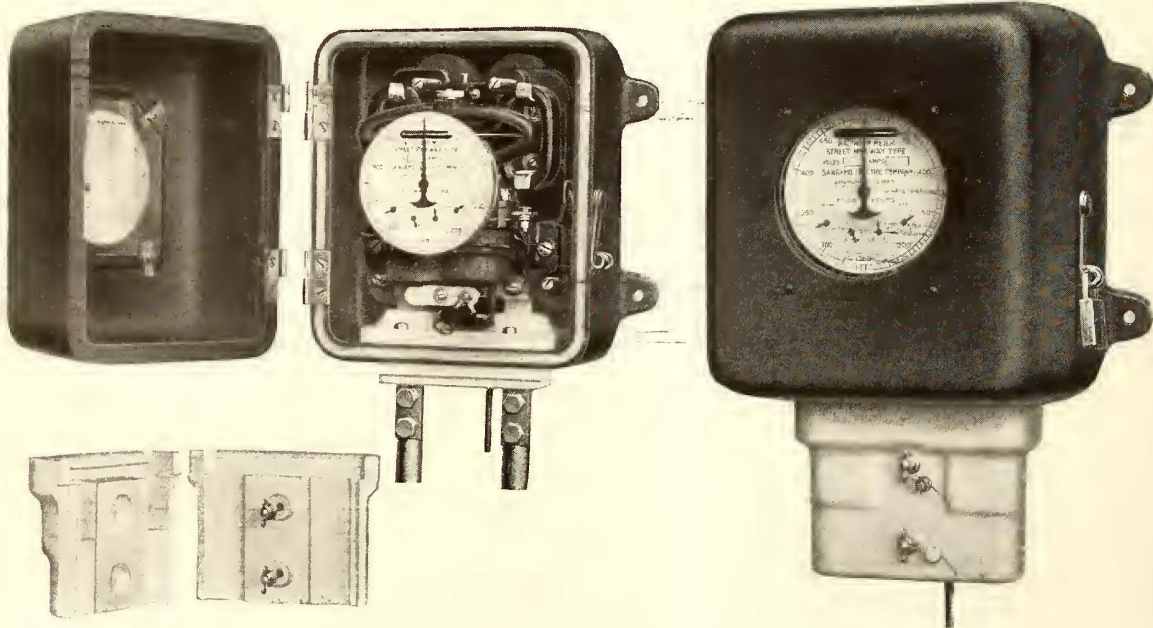
developed along the lines especially required for electric railway service, and nothing more was done with them for such service. Subsequently, meters of both the ampere-hour and watt-hour types, but principally the former, were successfully applied on many cars in Great Britain, and important economies in power con-

sumption, brakeshoe wear and equipment condition were effected. The meters are in successful operation to-day. Some of the results effected on this system were described in an article in the ELECTRIC RAILWAY JOURNAL of July 3, 1915, page 12.

Following this application, Sangamo meters were applied on a number of cars, and the term "Economy meter" was adopted for these electric railway meters to indicate the purpose of their application. The roads using them include the Chicago & Joliet Electric Railway, the Chicago & Milwaukee Electric Railroad, the Rockford & Interurban Railway, the Beaumont Street Railway, the Annapolis Short Line, the Tri-City Railway of Davenport, Iowa, and the City Railway of Dayton, Ohio. It is claimed that on these roads economies in power consumption of from 8 per cent to 20 per cent have been effected, besides marked savings in brakeshoe wear and in the immediate location of faults in equipment. All of these meters were of the Sangamo D-5 type, with large dials to show consumption per trip or per day, as well as dials for total consumption over any period.

During the past year it was found that the conditions of service could be better fulfilled with a meter especially designed and insulated, particularly in view of the advent of many 1200-volt and higher voltage direct-current systems. The new Economy meter, shown herewith, was accordingly designed. In general plan it resembles the D-5 watt-hour and ampere-hour types, but many details especially valuable for this class of service have been introduced. In order to obtain the desired high insulation, the meter is made somewhat larger than standard house-type Sangamo meters, and the terminals are protected by heavy porcelain blocks, so that the meter case may be grounded on circuits up to 3000 volts d.c. with absolute assurance that the operating mechanism will be safely and thoroughly insulated from the case.

It will undoubtedly be necessary in the very severe



STREET RAILWAY TYPE OF WATT-HOUR METER, CASE OPEN AND PORCELAIN BLOCK REMOVED, AND CASE AND BLOCK IN PLACE

sumption, brakeshoe wear and equipment condition were effected.

About four years ago an improved type of Sangamo meter was installed on several cars of the El Paso (Tex.) Electric Railway, and the preliminary results were so satisfactory in indicating economies that could be effected by proper co-operation of the motormen that

service on street railway or interurban cars to calibrate these meters at intervals of one to two years, and at intervals of about two years it is desirable to clean and replace the mercury. The new meter has therefore been designed, as shown by the interior views, so that the entire meter element, and not merely the motor or mercury element, can be removed without taking the

meter from the car. The cover is hinged and removable, and after this has been taken off, the meter element can be removed as a unit by the removal of six screws, readily accessible. This unit, which may then be calibrated completely in itself, can be immediately replaced by a similar unit, and as all units will be made interchangeable for drop, no calibration will be required on the car when a new unit is put in. The time required to remove a unit and replace it by a new one, including the time required for unlocking the padlock and replacing the cover and padlock, is less than five minutes.

The new type meter will be furnished either with the large circular dial and totalizing circles as shown in the cuts, or with large cyclometer dials giving direct reading figures which can be observed and read clearly almost the entire length of a car. The two patterns are identically alike, except for the dial arrangements.

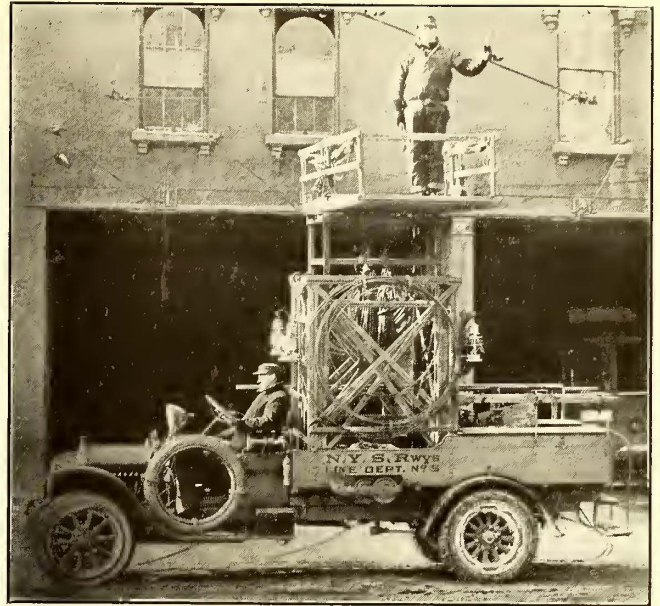
In addition to this improved meter, the Sangamo company has developed a complete system of records, beginning with the original reading taken by the motorman on the meter at the end of each trip or run, and extending to the final tabulation at the end of the month, which goes to the general manager and shows exactly what savings, if any, have been effected on the various lines of his system during the preceding month. The final tabulation also shows the relative value or standing of the various motormen. This standing is shown by a "figure of merit," which takes full account of the relative performance of each man under different service conditions and on different types of cars, so that the men will be fairly compared. By means of such records a keen but friendly rivalry for economy in energy consumption has been developed on the various lines where the meters have been installed and where this system of records has been adopted.

The Sangamo company also offers with the new meters an installation service and co-operation in the way of monthly posters, bulletins, etc., to encourage the men. It is expected that this will effect even more marked economies in the future where these meters are used.

Keeping Track of an Emergency Wagon

Some months ago the New York State Railways, Rochester Lines, purchased a gasoline-driven tower wagon for the line department and for general emergency use in the city of Rochester, this vehicle displacing the two horse-drawn emergency wagons that had previously been used. It was found that the running expense involved respectively in the two methods of operation balanced almost exactly, but that the power-driven truck possessed a very material advantage because of its higher speed and the consequent promptness with which it could be sent to any point where it was needed.

The truck, which is shown in the accompanying half-tone, is of the three-section type recently described in the *ELECTRIC RAILWAY JOURNAL*, and it has given thoroughly satisfactory service for line repairs. Thus far it has always been ready to go whenever a call came in, and only one case of tire trouble has been experi-

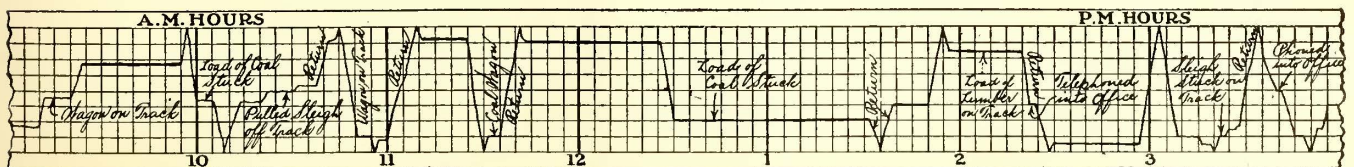


ROCHESTER EMERGENCY TRUCK AND TOWER WAGON

enced, the delay in this case being negligible because the wheels are equipped with detachable rims, which require only five minutes' time for making a tire change.

Although the operating expense of the gasoline truck balances that of two horse-drawn wagons, the overhead charges involved by the use of the former are, of course, increased materially, unless credit is given to the gasoline-driven machine for the greater mileage that it makes and the greater variety of work that it can do. It can be used to good advantage, for example, for helping vehicles that have become stalled in positions where they foul the railway company's tracks, the machine in one typical case having hauled a truck-load of pipe which was stuck in a mud hole beside the railway tracks into a position where it could move on. If only horse-drawn emergency wagons had been in service, insufficient power would have been available to haul the truck-load clear of the line, and considerable delay would have resulted owing to the necessity for unloading the pipe from the stalled vehicle.

Consequently, the mileage made each day by the gasoline-driven tower wagon became the dominating factor in the problem of its superiority over horse-drawn emergency wagons, and to determine this mileage, C. L. Cadle, electrical engineer New York State Railways, had the new truck equipped with a recordergraph manufactured by the American Taximeter Company, New York City. This instrument provides a graphical record marked upon a tape similar to that shown in the accompanying illustration. The tape is about 1 1/8 in. wide and about 5 ft. long. It is marked in cross-section to show five-minute sub-divisions of twenty-four hourly longitudinal divisions covering a day's run, while 1/4-mile transverse divisions show the mileage made. The tape is moved longitudinally by clock-work at a fixed speed, and there is connected to one of the truck wheels a pencil which travels transversely across the tape whenever the truck is in motion. The pencil moves



SECTION OF RECORDING TAPE SHOWING TRUCK OPERATIONS

to one side of the tape, and then reverses its direction, traveling to the other side, and so on indefinitely. Therefore, when the truck is stationary a horizontal line appears upon the tape, and whenever the truck is in motion an oblique line is drawn, the slope of which depends upon the speed of the machine.

Each day the tape is removed from the recordergraph and a new one substituted, the record on the marked tape being amplified by making pencil notes to show the reasons for each call made upon the emergency wagon. The used tapes are filed so as to provide a long-time record of mileage made, the truck movements being analyzed to determine whether the utmost use is being made of it. In the section of tape illustrated herewith the short section of horizontal line at the extreme left of the diagram indicates that the truck was in the barn. The short section at the middle of the tape was produced when the wagon was practically stationary in connection with a call that had been made to remove a stalled wagon from the railway tracks not far from the barn. The oblique line above this horizontal section indicates the return to the barn where the truck remained stationary for half an hour, as indicated by the longer horizontal line midway between the middle and the top of the diagram. At the end of this period the truck was called to get a load of coal off the track, and the oblique line running to the top of the diagram, followed by another oblique line descending to a point slightly below the middle, indicates that the run to this call was slightly more than $1\frac{1}{2}$ miles in length, because the complete movement of the pencil across the tape shows a run of two miles, the run in this case including the top quarter and the top half of the tape. The other entries on the illustrated section of the tape are self-explanatory.

It may be of interest to note the other calls made on the truck during the day to which the short illustrated section of the tape applies. These include, in consecutive order, the removal of a broken-down automobile from the track, also a stalled sleigh and a stalled load of coal, a broken trolley wire repaired, a broken guy wire tied up, another broken trolley wire, a load of hay removed from the track, a section of slack trolley pulled up, a broken trolley wire at a cross-over, and general repairs to a section of trolley wire which occupied about an hour in the early morning period.

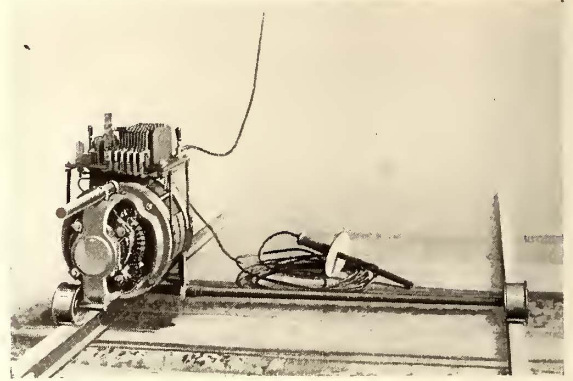
Since the gasoline truck has been in operation it has been found that it makes about 875 miles per month, or, say, thirty miles a day. The day in question, however, is an exceptionally heavy one, owing to the presence of heavy snow, and a more than usually large number of calls to haul stalled wagons off the railway tracks, and thus keep traffic moving. A mileage of fifty-six was, in consequence, made during the twenty-four hours in question.

Portable Bonding System Which Does Not Obstruct Traffic

A bonding process designed for non-interference with traffic and for reducing waste of power through the use of a portable motor-generator set has been devised by the Lincoln Bonding Company, Cleveland, Ohio. The process is used by the Cleveland, Painesville & Eastern Railway, Willoughby, Ohio. It is especially adapted for use on elevated railways and in subways.

The motor-generator for supplying the current for bonding, shown in the accompanying illustration, is designed to produce a current of 200 amp. to 300 amp. at 60 to 70 volts. The generator itself is 24 in. long and 16 in. in diameter and the machine weighs 400 lb. complete with switchboard. Two handles are provided for

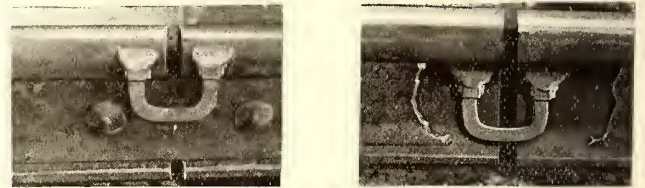
lifting it on and off the track and a third wheel is attached to a pole in such a way that it can be easily snapped into place or removed. The machine can be pushed along the rails, or, if more convenient, drawn along the pavement beside the tracks.



PORTABLE ARC WELDING BONDING MACHINE

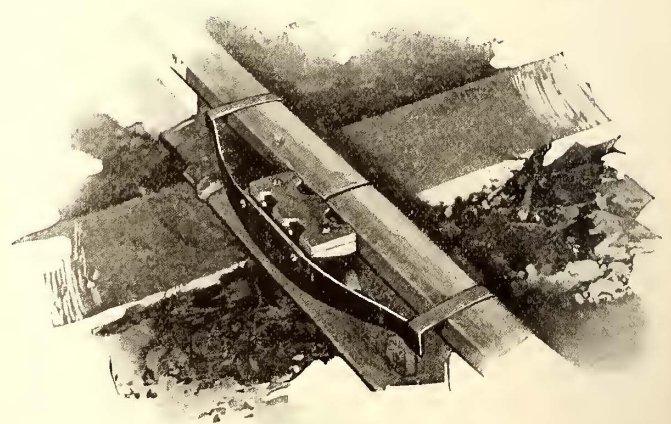
The process uses the electric arc as a means for supplying the heat to fuse the ends of the copper bond to the rail. U-shaped laminated copper bonds are used, with heads of a special design. In welding the bond is placed in a mold held in place with spring clips.

In actual practice, a crew of two men are said to have been able, with a week's experience, to put on



BONDS ARC-WELDED TO BALL AND WEB OF RAIL

bonds at the rate of thirty per hour on an interurban track with hourly traffic each way. This was done without extra effort and under conditions in which the machine was moved on the pavement beside the track. The manufacturers state that the best welds are made in about 20 seconds, with approximately 200 amp., and 40 volts across the arc.



MOLD, READY FOR ATTACHING BOND TO RAIL

Obviously the contact resistance of this bond is low, and it is not affected by expansion or contraction. The weld is so tough that the bond head can be flattened to a great degree without breaking loose. The bond head can be hit by wagon wheels or other objects even to the extent of pushing it down to the level of the pavement without its being broken loose from the rail.

NEWS OF ELECTRIC RAILWAYS

THREAT TO TIE UP ENTIRE TOLEDO SYSTEM

Conferences in Toledo Fail of Results—Men Insist on Right to Wear Union Button

Not a car of the Toledo Railways & Light Company was operated on March 29. In the afternoon President F. R. Coates of the company talked with Henry L. Doherty, chairman of the board, in New York over the telephone. Mr. Doherty said that there are so many conditions to be considered in connection with the strike that he could do nothing by telephone. On the same day shop men quit work when told that they must take off the union buttons.

A conference at the Council Chamber called on March 29 by Mayor Milroy was attended by city officials, company officials and representatives of the union. Mr. Coates stated that the men could operate the cars temporarily pending an adjustment of the dispute if they would do so without their buttons. Organizer Edward McMorrow asserted that other differences could be arbitrated, but that the men would not give up their buttons. He said that any attempt by the company to operate cars would be followed by calling out the men in all other departments.

Mr. Doherty arrived in Toledo on March 30 and went into a conference with the company officials.

The first conference between Mr. Doherty and the representatives of the union was held in the Council Chamber on the afternoon of March 30. Mr. Doherty reviewed the railway franchise controversy. The company wished to be fair to the people of Toledo. The Milroy franchise committee had informed him that the people would be satisfied with nothing short of municipal ownership. Although he disbelieved in municipal ownership, Mr. Doherty told the committee that he and the company would co-operate with it in bringing about any solution that might be decided upon. He said that the committee asked the company to do nothing about plans for organizing the men, and that it had respected the request. He supposed a similar request had been made of the men, and that both sides were to leave matters in statu quo to avoid any friction and labor trouble that might impede the franchise settlement.

Mr. Doherty characterized the action taken as enforced organization upon men who did not want it, and said that he requested at that time that no one be coerced into joining the union. He was opposed to the closed shop idea and he felt that no attempt should have been made to organize the men while efforts were being made to secure an agreement on a franchise. He had promised the men an increase in pay as soon as a settlement on the franchise could be reached. In closing he said he had hoped to deal with the men and not some one who has no interest in Toledo.

John Quinlivan, business agent of the Central Labor Union, objected to Mr. Doherty's statement that wearing the union button would be a discrimination against the men who were not members of the union. He insisted that the men could not go to work even temporarily without their buttons and said the people of Toledo were back of the men. Organizer Edward McMorrow said the Amalgamated Association had kept hands off while the franchise question was under discussion. He declared that he went to Toledo at the request of the men; that none of the non-union men would be harassed, and that all grievances upon which an agreement could not be reached could be submitted to arbitration. Mr. Doherty said he was willing to arbitrate other matters as soon as the button question had been settled. Mr. McMorrow then declared that the men would insist on wearing the buttons, which was a matter of personal liberty. Adjournment was taken until March 31 without any material progress having been made.

The conferences between the officers of the company and representatives of the men on March 31 also were futile. Neither side would yield on the matter of the men wearing the union buttons. Illness kept Mr. Doherty away from the conferences a portion of the time.

A conference called for 7 o'clock the evening of April 1

was postponed because of the illness of Mr. Doherty, who was compelled to seek his bed under a physician's advice. Another conference set for the afternoon of April 2 was adjourned because Mr. Doherty could not be present.

Mr. McMorrow announced on April 2 that the motormen and conductors of the interurban lines entering the city were ready to strike in sympathy with the so-called locked-out men at a moment's notice.

Following a conference between the company officials and representatives of the men on the forenoon of April 3, City Solicitor Commanger filed in the Federal District Court an amended and supplemental answer and cross-bill to the answer of the Toledo Railways & Light Company, and its own answer in the suit filed by Doherty & Company something like two years ago, asking for a receiver. In this legal paper the city claims to be a creditor of the company to the extent of \$119,600 for paving and \$485,250 for rental of the streets over which the company has operated since its franchises expired. Judge Killits, in permitting the city to file the petition, said that there were only two interests for the court to consider, the preservation of the company's property and the convenience of the public. He said that if a receiver was appointed, the court would take charge of all the property of the company.

Mr. Doherty appeared before Judge Killits at 10 o'clock on April 5 and asked that the company be granted an extension of time until April 6 to file its answer. The request was granted.

Further progress was made in the consideration of the tentative contracts on April 6 and another conference was scheduled for April 7. Judge Killits announced that if an agreement was not reached by April 8 Capt. John Craig, former president of the Toledo Shipbuilding Company, would be appointed receiver of the railway to operate the road.

At the office of Mr. Doherty in New York it was stated that there was no particular significance to the application by the city of Toledo for a receivership. The property was thoroughly solvent and had no outstanding obligations which it was not able to meet. The fact that the company had not been operating any cars since the middle of last week was being used as the basis for the city's receivership application. From another source it was pointed out that as the city maintains that the company has no franchise it cannot be compelled to operate except at its own discretion.

DALLAS ELECTION RESULTS

The voters of Dallas, Tex., at the election in that city on April 4 adopted all the propositions submitted to them relating to the lighting and traction problems. These propositions do the following:

1. Authorize the city to negotiate indeterminate franchises; permit franchises either upon a 4 per cent gross production tax basis or for service at cost, and authorize the city to buy the properties after ten years or require their sale to another licensee.
2. Permit the consolidation of all the street railway systems in Dallas.
3. Approve of model service-at-cost franchise, which the city will negotiate with the street railway.
4. Approve of service-at-cost franchise for the electric lighting company.
5. Sanction the issuance of \$500,000 of bonds for a municipal lighting plant.

The service-at-cost franchises are based on the report of E. W. Bemis and require service at cost, plus 7 per cent profits, based on valuation figures contained in the report submitted by Mr. Bemis. The valuation for the consolidated street railways is \$4,790,124 with \$48,000 additional as working capital and \$150,000 for interest charges.

Stone & Webster officials at Dallas declined to discuss the situation. They referred to their statements prior to the election. Charles F. Wallace at that time said the company would not accept the model franchises. The general opinion is that litigation will follow.

MR. GROUT BEFORE NEW YORK COMMITTEE

Edward M. Grout, formerly comptroller of the city of New York, one time law partner of ex-Mayor William J. Gaynor, was the only witness examined by the Thompson legislative committee on March 31. Mr. Grout was questioned at length regarding his services to the Interborough Rapid Transit Company during the subway negotiations of 1911, for which he asked \$25,000 and was paid \$17,500. He said he felt he had fully earned the money, as he held many conferences with company and city officials for about two months.

Senator Thompson, chairman of the committee, said on March 31 that in its final report to the Legislature of 1917, the committee would recommend the dissolution of the dual contracts between the city and the Interborough and Brooklyn Rapid Transit companies.

On March 31 the bills carrying out the recommendations of the Thompson committee were reported favorably by the Senate public service committee. The measures, which include one to place control of subway construction with a rapid transit commission, were advanced to the order of final passage.

The Interborough Rapid Transit Company was notified on March 30 by the Public Service Commission that it must furnish it with much fuller details of the items charged by the company to its Account 332, "other suspense," and especially with information as to the accounts to which each of these items has been actually carried.

NEW TOLEDO FRANCHISE SETTLEMENT PLAN

The sub-committee of the committee appointed by Mayor Milroy in November, 1915, to devise some plan of settling the Toledo franchise matter reported on March 31 to the committee of the Council on street railway settlement. Many public hearings were held by the sub-committee, which says that the so-called Dotson ordinance was voted down by the people because they did not believe it would finally settle the matter and that its passage might prevent rather than bring about final municipal ownership of the railways. In this connection the sub-committee says:

"Any proposed settlement that does not make it easily possible for the people to have public ownership when the laws permit it and the people are ready for it would be no settlement at all, but would mean instead a continued controversy until such final settlement was achieved."

The committee says that in considering various plans it was agreed that before any plan was submitted to the voters there should be a valuation of the street railway property. The committee told Mr. Doherty, chairman of the board of the Toledo Railways & Light Company, that the people of Toledo wanted public ownership of the street railway system. In this connection the sub-committee reports that Mr. Doherty was very frank with its members.

The committee then presents a bare outline of a plan of settlement. It provides that the company shall separate its railway property from its other property and that an opportunity shall be afforded to Toledo citizens at once for community ownership of the railways, with municipal ownership as the ultimate goal. This plan will be summarized in the *ELECTRIC RAILWAY JOURNAL* for April 15.

TRANSFER OF FUNDS FOR OVER-EXPENDITURES ALLOWED

A resolution presented by Councilman J. W. Reynolds was adopted by the City Council at Cleveland, Ohio, on the evening of April 3, authorizing the Cleveland Railway to transfer \$253,000 from the interest fund at once, to apply on the over-expenditures and deficits that have been accumulated through the past several years. The remainder of the amount will be taken care of by small monthly transfers. The same resolution denied the company's request for an increase in the allowance for the maintenance and renewal fund.

Fielder Sanders, street railway commissioner, made a statement to the street railway committee preceding the Council meeting to the effect that there may be additional over-expenditures this year, but that he will know by the end of the year whether an increase in the maintenance allowance is necessary.

Mayor Harry L. Davis and some of the other city officials were in Columbus on April 4 to consult with the State Tax Commission relative to a compromise settlement of the tax valuations placed on the property of the Cleveland Railway for 1913, 1914 and 1915. They range from \$2,500,000 up to \$24,000,000, and suits were filed each year to restrain the collection of the taxes on this basis. The City Council has authorized a settlement on the basis of a tax value of approximately \$20,000,000 for 1913 and 1914 and \$21,500,000 for 1915. The taxes held up by the suits now aggregate more than \$1,000,000.

On order of Mr. Sanders the company is checking the destination of patrons who board the cars in East Cleveland. This city has threatened to bring suit to enforce better service, but just what the commissioner expects to do with this data is not known.

FUNDS LACKING FOR SEATTLE VALUATION

The State Public Service Commission of Washington has advised members of the City Council of Seattle that there are not sufficient commission funds on hand to complete the valuation of the properties of the Puget Sound Traction, Light & Power Company, undertaken last year. This valuation may be necessary as a basis for the hearing on the petition of the company for relief from franchise obligations, which include paying 2 per cent of the gross earnings, paving between tracks, etc. The company holds that inasmuch as the commission interfered with what the company declares were franchise rights in the Alki and Fauntleroy routing matters, the commission has the power to relieve the company of such franchise provisions as work a hardship on the company.

Whether the city of Seattle will require a valuation to support its claims that the franchise requirements shall stand, regardless of the net return of the company, is a matter that must be definitely settled immediately. The valuation of the property of the company by the commission was undertaken more than a year ago, but the commission was unable to complete it, because of lack of funds. On advice of Corporation Counsel Bradford, an appropriation of \$5,000 was made by the City Council to assemble the valuation data of the commission for use in the hearing. Corporation Counsel Caldwell, recently elected, has under consideration a legal question whether a valuation will be necessary except in litigation involving the sale of 4-cent tickets and school tickets. At the hearing before the commission the city will contend that the commission is without power to alter franchise agreements. Early in the year Assistant Corporation Counsel Ralph S. Pierce filed a motion with the Public Service Commission to dismiss the request of the company for relief from franchise obligations which it considered unduly burdensome. He contended that the commission was without authority to act in a matter involving franchise agreements. This motion was denied by the commission. The city of Seattle has not filed an answer to the complaint of the company.

\$171,000.611 TRANSIT CONTRACTS OUTSTANDING

March 19 was the third anniversary of the signing of the dual system rapid transit contracts by the Public Service Commission for the First District of New York. In the three years that have elapsed the commission has awarded construction and finish contracts aggregating \$110,660,021. Before the contracts were signed it had awarded contracts in the amount of \$60,340,789, so that the total amount of contracts outstanding Feb. 1, 1916, was \$171,000,811. In the last three years the commission has also awarded miscellaneous contracts for rails, ties and other materials aggregating \$4,661,714, so that the grand total of city contracts is \$175,662,525. The city, however, is not pledged for the entire amount, as there is included in it a certain percentage of the contributions made by the two companies toward the cost of construction, namely, \$58,000,000 by the Interborough Rapid Transit Company and about \$14,000,000 by the New York Municipal Railway Corporation. Under the dual system certificates for the third-track and extension of the elevated railroads both companies have awarded construction and equipment contracts aggregating fully \$40,000,000. It is safe to say, therefore, that the total amount of construction

contracts already awarded on the dual system aggregates about \$215,000,000. The construction work is divided into eighty-nine contract sections. Of these seventy-five have been placed under contract, and plans for the remaining fourteen are nearly completed. Bids for several of these will be invited within the next six weeks, and before the end of the year it is expected that all contracts will have been awarded.

STRIKE ON BAY STATE STREET RAILWAY

The refusal of the Bay State Street Railway to reinstate Conductor John J. Martin of the Woburn division resulted in a strike being declared on the division by the local branch of the Amalgamated Association at midnight on March 31. Service in Woburn, Winchester, Medford, Lexington, Stoneham, Reading and Wilmington was involved. President Sullivan of the company issued a statement to the effect that Conductor Martin was discharged for admitted failure to operate a hand-thrown block signal, following a series of infractions of the rules. He pointed out his willingness to arbitrate the matter under the terms of the agreement with the union. The Amalgamated Association, however, refused to arbitrate the real question at issue, but confined its willingness to arbitrate to Martin's last violation of the rules. The company notified the State Board of Conciliation and Arbitration of the facts at the outset of the strike and requested the board to act in the matter.

The company made no attempt to operate cars on the Woburn division during the week. On April 4 President Sullivan issued a statement reiterating the company's willingness to arbitrate the difference of opinion on arbitration existing between itself and the union. The discharge occurred because the conductor "was a danger to the public." The company also set forth its willingness to reinstate Martin if the arbitrators find that he was discharged because of his union activities. The State Board of Arbitration sent a letter to the company and its striking employees recommending that the broad question of whether or not the company was justified in discharging the man should be arbitrated in accordance with the agreement existing between the parties.

The strike was declared off and service resumed on the division on April 6, following a conference of the company and union officials at the office of the State Board of Conciliation and Arbitration. It was agreed to arbitrate the case upon the basis of the reasons given for the discharge of Conductor Martin by Superintendent Donovan of the Woburn division. Public sessions of the arbitration board will begin in a day or two, one member to be chosen by the company, one by the union, and the third by these two.

Massachusetts State Ownership Bill Rejected.—By a vote of 128 to 82, with seven pairs, the Massachusetts House has rejected the bill providing for a referendum as to the acquisition and operation of street railways by the State.

New Working Terms Asked in Cincinnati.—The employees of the Cincinnati (Ohio) Traction Company have made a demand on the company for an increase in wages and a shortening of the time of service to secure the maximum rate of wages. The present wage agreement between the company and its men expires on June 30.

Brooklyn Tax Controversy Settled.—The Brooklyn (N. Y.) Rapid Transit Company will pay into the city treasury \$2,902,062 as the result of an arrangement brought about by the Corporation Counsel and Controller Prendergast on the recommendation of Attorney General Woodbury and the State Tax Commission. The payment will bring about a settlement of litigation over the company's special franchise tax.

Perpetual Injunction Asked to Prevent Municipalization.—The Merchants Loan & Trust Company of Chicago, Ill., has asked for a perpetual injunction restraining the municipality of Menasha, Wis., from acquiring the equipment of the Wisconsin Traction, Light, Heat & Power Company. The trust company is trustee for \$350,000 of mortgage bonds of the company operating the railway.

Elevated Extension Started at Boston.—Work has begun upon the construction of an extension of the rapid transit lines of the Boston (Mass.) Elevated Railway from Sullivan

Square terminal station toward Malden. The line will be elevated and double-tracked from Sullivan Square to Everett. It has not been decided whether the portion of the line from Everett to Malden will be elevated, surface or underground construction. The Mystic River will be crossed by a new steel and concrete bridge.

New York Constabulary Bill Amended.—The Senate of New York on April 1 amended the State constabulary bill, advocated by Governor Whitman, by cutting in half the appropriation of \$500,000 and the proposed number of the new police. The bill as it stands now provides for two troops of forty-five men each. The system is to be modeled after that of the State of Pennsylvania. The National Guard would not be called upon until the stage where the constabulary and the local police found the situation beyond their control.

Increase in Wages in St. Louis.—The United Railways, St. Louis, Mo., has issued a statement announcing an increase of 1 cent an hour in the wages of 3000 employees, or approximately \$100,000 a year. Heretofore conductors and motormen have drawn 23 cents an hour for the first year's service. The new rate will be 24 cents. After men have been in the company's service one year they will be paid 25 cents. Heretofore the rate has been 24 cents. The rate increases 1 cent an hour each year for five years, when the pay reaches 28 cents, the maximum.

Washington Valuation Nearing Completion.—Charles W. Kutz, chairman of the Public Utilities Commission of the District of Columbia, says that the valuation of the public utilities of the District which has been under way for some time will probably be completed by June 1. The public hearings will then be announced. Recently a resolution was adopted by a local civic body calling upon the commission to order the consolidation of the Capital Traction Company and the Washington Railway & Electric Company. Mr. Kutz said that this was beyond the power of the commission to do.

New York Subway Laborers Strike.—The claim of a new laborers' and timbermen's union for recognition and a simultaneous demand for an increase in wages, regular weekly payment and strict adherence to the eight-hour law have seriously affected construction work on New York City's new dual subway system. On March 1, 12,093 men were employed daily in construction on the subways, of whom, it is estimated, the classes involved in the strike number 7000. It is said that, altogether, 5000 men had quit work by April 5. The contractors claim that the prices at which the work was let will not permit them to grant wage increases.

Dr. Steinmetz on Commission Control.—The first of two articles on public questions which Dr. Charles P. Steinmetz will contribute to *Collier's* appears in the issue of that paper for April 8. Dr. Steinmetz sees in the present system of government regulation of corporations a step toward the taking over of such corporations by the public, at first, possibly, only so far as their management is concerned. As this process occurs he believes government service will attract men of ability to manage these enterprises and that the final result will be industrial socialism as represented by the national ownership of the means of production and transportation.

Abolition of Boston Transit Commission Favored.—Abolition of the Boston (Mass.) Transit Commission is favored by the special legislative committee on State commissions, according to an informal vote in executive session. The committee will probably recommend a bill which also abolishes the Boston Port Directors and the Massachusetts Harbor & Land Commission. In place of these boards it is planned to establish a Metropolitan Commerce & Transportation Commission to succeed the transit board and a Waterways & Public Lands Commission to supersede the Harbor & Land Board. A conference with Governor McCall will soon be held relative to the functions of the Public Service Commission and the Gas & Electric Light Commission.

Seattle Municipal Railway Deficit Problem Discussed.—The utilities committee of the City Council of Seattle, Wash., of which R. H. Thomson, former city engineer, is chairman, at a recent meeting discussed ways and means of escaping an annual loss of about \$40,000 on the operation of the Seattle Municipal Railway. It was generally agreed, first, that the extension of Division "A" to Ballard

would not bring in enough additional revenue to put Division "A" on a paying basis, unless an extension to some point south of the present terminus at Pine Street was provided; and, second, that the proposed extension by common user rights to Jefferson Street at the new Seattle-King County building would not be sufficient to pay the additional cost of operation of that distance, unless the extension to Ballard is made.

New Working Conditions Asked in Buffalo.—Demand for an increase in wages for platform men, electricians, car-house men and other employees affiliated with the Amalgamated Association of Street & Electric Railway Employees was served upon officials of the International Railway, Buffalo, N. Y., on April 1. The company has twenty-eight days in which to reply. While neither side will discuss the nature of the demands, it is understood that the men in the company's service the first year have asked for the biggest increase, which is believed to amount to almost 20 per cent. A change in hours of labor so that platform men will not be required to have their shifts too far apart and a change of other conditions are also asked for. The present wage scale has been in effect since the strike of 1913. At that time a three-year agreement was signed.

Boston Elevated Wages Discussed.—Press accounts from Boston, Mass., state that the local branch of the Amalgamated Association has formulated demands for presentation to the Boston Elevated Railway relative to the expiration of the existing wage agreement on May 1 next. It is said that the men will ask 40 cents an hour for platform work, a nine-in-eleven hour day, time-and-one-half for overtime, 60 cents an hour for snowplow work, and two weeks vacation with pay, annually, for motormen, conductors and other employees. The present maximum pay is 32 cents an hour on surface cars and 34 cents on the rapid transit lines. Neither the officials of the company nor of the union were prepared early in the week to make public the basis of negotiations. It has been estimated that the award of the Storrow arbitration board increased the wages of the union employees by about \$480,000 a year, dating from May 1, 1913.

New York Commission to Hold Departmental Conferences.—At the suggestion of Chairman Oscar S. Straus, the Public Service Commission for the First District of New York has begun the holding of departmental conferences in the offices of the commission. The first conference was held in the chairman's room on March 28, and it was decided to hold similar conferences every two weeks. The first conference was attended by all the commissioners, the chief engineer, counsel, assistant counsel, electrical engineer, engineer of subway construction, deputy engineer of subway construction, real estate expert, secretary of the gas and electric bureau, the gas engineer, and the secretary of the commission. The conferees spent two hours in exchanging views upon problems under consideration by the commission, and at the close of the meeting the chairman expressed himself as gratified with the result and hopeful that a continuation of such consultations would result in better co-ordination of the work and more effective co-operation among the different departments and bureaus.

All Composite Cars Withdrawn from New York Subway.—The time within which the Interborough Rapid Transit Company, New York, N. Y., was to remove the 478 composite cars from the subway expired on April 1. A report from the engineers of the Public Service Commission for the First District stated that all such cars have been removed, that the car trucks have been fitted with new all-steel car bodies, and that all but six of the converted cars are in operation in the subway or ready for operation. They have been introduced gradually as they were turned out of the shops. The six in question would have been completed but for the delay in receiving certain parts from the manufacturers. The original order for the removal of the cars and their replacement with cars of all-steel construction was adopted on Jan. 12, 1915. The company requested the privilege of retaining the heavy trucks and fitting them with new all-steel car bodies. This was agreed to by the commission, which subsequently gave the company the right to mount the composite car bodies upon lighter trucks and use them for operation upon the elevated railroads.

PROGRAMS OF ASSOCIATION MEETINGS

Railway Materials Association

The annual convention of the Railway Storekeepers' Association will be held at the Statler Hotel, Detroit, Mich., on May 15, 16 and 17. The annual meeting of the Railway Materials Association will be held at the same place at the same time.

Bureau of Standards Conference

At the invitation of the technical committee of the Affiliated Engineering Societies of Atlanta, Ga., the Bureau of Standards will hold a conference in that city from May 2 to 4 for the purpose of discussing the work of the bureau. A large attendance of city electricians, engineers of public utility companies and others interested is expected from Georgia and the neighboring States and other parts of the country.

The conference will occupy three days. The first day, May 2, will be devoted to the consideration of the National Electrical Safety Code. At this session representatives of the Bureau of Standards will outline the work that has been done on the code and give a statement of its principal features and the main changes that have been made in the course of its last revision, after which a general discussion of the code will be held.

At the second session, on May 3, an account of the work of the Bureau of Standards on electrolysis prevention will be presented, including the laboratory researches and field studies and surveys that have been made, and giving a discussion of the proper methods of procedure in making electrolysis investigations and in the mitigation of electrolysis troubles. This paper will also be followed by an open discussion.

At the third session, on May 4, the subject of grounding of low voltage light and power circuits will be discussed.

The chief purpose of the conference is to bring the cities and the public utility corporations of the South into closer touch with the work of the Bureau of Standards in connection with public utility problems. All persons interested in the subjects to be discussed are invited to attend the conference.

Southwestern Electrical & Gas Association

An attractive program has been prepared for the railway meetings at the annual convention of the Southwestern Electrical & Gas Association which is to take place at the Hotel Galvez, Galveston, Tex., on May 17, 18, 19 and 20. The railway sessions will be in charge of the street and interurban committee of the association and will be held on the afternoon of May 17 and the morning of May 18. The following program of papers and discussions was tentatively adopted by the committee at a meeting held in Dallas on March 24.

"Practicability of One-Man Cars and Their Operation," by D. R. Locher, general manager of the Corpus Christi Railway & Light Company; the discussion to be opened by W. W. Holden, W. A. Sullivan and W. L. Wood, Jr.

"Coasting Recorders, Their Effectiveness in Reducing Power Consumption and Operating Costs," by V. W. Berry, general superintendent of the Northern Texas Traction Company; the discussion to be opened by G. G. Morse and R. T. Sullivan.

"Practical Methods of Paving, as Applied to Street Railways," by W. M. Archibald, superintendent motive power of the Houston Electric Company; the discussion to be opened by W. V. Neal and C. H. Nandell.

"Scientific Selection of Employees," by P. W. Gerhardt, superintendent of transportation of the Dallas Consolidated Electric Street Railway; the discussion to be opened by Alba H. Warren and E. J. Emerson.

"Economic Maintenance of Cars, City and Interurban," by Fred L. Bennett, master mechanic of the Houston Electric Company; the discussion to be opened by M. B. Osborne, H. M. Smith and W. Silvus.

"Methods of Attracting and Developing Interurban Traffic," by J. P. Griffin, general passenger agent of the Texas Traction Company; the discussion to be opened by H. T. Bostwick and Rex Frazier.

Financial and Corporate

ANNUAL REPORTS

Public Service Corporation of New Jersey

The statement of income, profit and loss of the Public Service Corporation of New Jersey, Newark, N. J., for the twelve months ended Dec. 31, 1915, follows:

Operating revenue of subsidiary companies.....	\$37,471,228
Operating expenses, including amortization charges and taxes	22,094,678
Operating income	\$15,376,550
Non-operating income	419,073
	<hr/>
	\$15,795,623
Income deductions of subsidiary companies (bond interest, rentals and miscellaneous interest charges) ..	12,209,215
	<hr/>
	\$3,586,408
Public Service Corporation income from securities pledged (exclusive of dividends on stocks of operating companies) and from miscellaneous sources	\$2,437,874
Less expenses and taxes.....	86,065
	<hr/>
	\$2,351,809
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	\$5,938,217
Public Service Corporation income deductions.....	3,966,965
	<hr/>
	\$1,971,252
Net income	\$1,971,252
Appropriation accounts of subsidiary companies:	
Amortization of new business expenditures prior to Jan. 1, 1911.....	\$40,330
Adjustments of surplus account.....	3,100
	<hr/>
	\$43,430
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	\$1,927,822
Appropriation accounts of Public Service Corporation (exclusive of dividends)	81,517
	<hr/>
Net increase in surplus.....	\$1,846,305

The annual report of the company states that it had a good year. During the early part of 1915 the increases in the revenues of the subsidiary companies were all small, owing to the continued business depression and the European war. The properties quickly responded, however, to returning prosperity, and the increases in the latter part of the year were healthy. The operating revenue of the subsidiary companies reached a total of \$37,471,228, an increase for the year of \$1,781,395 or 5 per cent. In view of the substantial increase in net earnings and the very large additional amount set aside for amortization, the directors in December placed the stock upon a 7 per cent basis.

The operating revenues for the three major subsidiaries and their affiliated companies for 1915, with the amount of increase over the previous year and the percentage of increase for the year, are as follows:

	1915	*Amount of	Percentage
	Operating	Increase	of
	Revenues	Over 1914	Increase
Public Service Railway Co.....	\$16,569,443	\$259,188	1.59
Public Service Electric Co.....	10,425,852	1,132,190	12.18
Public Service Gas Co.....	10,475,933	390,017	3.87

*The increases are based on a reclassification of 1914 accounts to compare with 1915 figures, a change in classification having become effective Jan. 1, 1915, by order of the Board of Public Utility Commissioners.

From the foregoing figures it will be seen that the significant result of the year's operations was the large increase in the electric division, the gross business of which for the first time nearly equaled that of the gas company. The railway division, though providing the largest share of the total operating revenues, showed the smallest increase in both amount and percentage. The revenue passengers in 1915 totaled 313,923,363 as compared to 310,308,660 in 1914, an increase of 3,614,703 or 1.1 per cent. This compares with an increase of 1,323,420 revenue passengers or 0.4 per cent in 1914 over 1913. In 1915 the transfer and free passengers increased 3,529,423 or 3.5 per cent as compared to 1,543,389 or 1.6 per cent in 1914, so that the increase in total passengers was 7,144,126 or 1.7 per cent in 1915 and 2,866,809 or 0.7 per cent in 1914. Thus the percentage of passengers using transfers increased from 21.2 per cent to 21.5 per cent, while the average fare per passenger fell from 3.83 cents to

3.82 cents. The revenue from transportation decreased from 30.763 cents per car mile to 30.540 cents per car mile.

In regard to jitneys in the corporation's territory it is said that these first appeared in the spring in Camden and later in Newark, Hoboken and Jersey City. A few jitneys were tried in other cities served by the railway, but they were inconsiderable in number or were withdrawn after a short term. In the cities where they are still operating they are doing so in diminished numbers, many operators finding the industry unprofitable. The jitney movement, however, is said to have caused a substantial loss of revenue to the railway, but it is believed that within a reasonable time there will be proper regulation of these vehicles.

No comparative figures are presented for maintenance expenses during the year, but it is said that the amount, exclusive of ordinary maintenance, set aside for amortization was \$2,219,129. Adding to this the amount set aside for the sinking fund, under the terms of the mortgage securing the issue of the general mortgage bonds of the corporation, makes a grand total set aside during the year for amortization of properties and redemption of securities, of \$2,428,629. Taxes for 1915 amounted to 2,316,966, an increase of \$114,411 or almost 0.5 per cent. Fire insurance carried as of Dec. 31, 1915, amounted to \$30,219,679, an increase of \$1,209,855 over 1914. Premiums for 1915 amounted to \$102,700, a decrease of \$108. The average rate of insurance for the year was 34.0 cents per \$100 of insurance, as compared to an average rate of 35.4 cents for 1914.

The total expenditures of the welfare department for insurance, sick benefits, pensions and expenses for the year were \$76,105, a decrease of \$3,689. The decrease in insurance is accounted for by the fact that only fifty-six deaths occurred among the employees in 1915, as compared to sixty-seven in 1914. Illness among the employees was also less by 101 cases. The cost per case averaged \$20.67 as compared to \$21.83 in 1914. The cost of accidents arising under the workmen's compensation act, including expenses, was \$59,487 divided as follows: total payments as required by act, \$41,790; additional payments over and above those required by act, \$7,223, and expenses of department, \$10,473. The total amount spent by the railway claim department, including its own expenses for the year, was \$540,074 or 3.41 per cent of the gross passenger receipts. In 1906, when the receipts of the railway were much smaller than they are now, the expenditures were \$851,283 or 8.64 per cent of the gross passenger receipts.

New rolling stock added to the railway equipment during the year included thirty closed passenger cars, and twenty single-end double-truck open car bodies, which have sixteen benches, with a seating capacity of ninety-six persons per car. The company built 7.248 miles of track extensions during the year; 16.590 miles of track were reconstructed with the same rail, and 25.628 miles were reconstructed with new rail. The total railway mileage is now 882.266 miles. The net expenditures charged to capital accounts for the railway division during 1915 were \$4,605,355, this comparing with \$2,881,199 for the electric division and \$814,666 for the gas division.

West Jersey & Seashore Railroad

The total operating revenues of the West Jersey & Seashore Railroad, Camden, N. J., for the year ended Dec. 31, 1915, amounted to \$6,942,485, an increase of \$469,886 or 7.3 per cent for the year. Practically all of this increase came from increased freight revenues. Passenger revenue decreased \$37,928, or 0.9 per cent, chiefly on account of the general depression in the early months of the year and unfavorable weather conditions. The operating expenses totaled \$5,435,685, an increase of \$258,123, or 5 per cent, principally owing to increased maintenance charges. Transportation expenses were slightly reduced through efficiency in operating methods, while general expenses increased on account of federal valuation work and employees' pensions.

The benefits obtained from increased traffic and improved operating results, however, were practically nullified by the extraordinary increase in taxes and the reduced income from leased roads, so that the gross income of \$1,220,818 showed an increase of only \$56,016. The increase in net income was further cut to \$18,825 by the rise

in income deductions. The railway tax accruals at \$419,758 reflected an increase of \$86,614, or 26 per cent, on account of an increase in the assessed valuations in New Jersey and the imposition of a higher rate of taxation by that State. The taxes paid were equivalent to 6.05 per cent of the total revenues, and 4.31 per cent on the capital stock.

The income from leased roads amounted to \$59,769, a decrease of \$56,258, or 48.5 per cent. This was caused by the serious reduction in the receipts from the Atlantic City & Shore Railroad, the operator of the company's Atlantic City & Longport trolley line, on account of jitney operation on Atlantic Avenue, Atlantic City. That line and its equipment represent a large capital outlay, and in addition the West Jersey & Seashore Railroad and the Atlantic City & Shore Railroad have made substantial contributions for improving and maintaining Atlantic Avenue through Atlantic City and Ventnor. Both companies are heavy taxpayers, and their operations and expenditures make them material factors in the prosperity of the State and in preserving business and property values in Atlantic City and the adjacent municipalities. It is felt, therefore, that the Atlantic City & Longport trolley line should be entitled to such equitable regulation of the jitney traffic in Atlantic City as will enable the operating company to fulfill its duty to the public, through the continuance of a frequent and high standard of service on the Atlantic Avenue line, and as well protect the investment of the West Jersey & Seashore Railroad therein. The unjustly continued delay in instituting such reasonable regulation is said to be unwise from the point of view of public safety, and must inevitably prove disadvantageous not only to the companies but to the municipalities.

Lake Shore Electric Railway System

The comparative statement of income, profit and loss of the Lake Shore Electric Railway System, comprising the Lake Shore Electric Railway, the Lorain Street Railroad, the Sandusky, Fremont & Southern Railway, the People's Light & Power Company and the Bellevue Illuminating & Power Company, for the calendar years of 1914 and 1915 follows:

	1915	1914
Gross earnings	\$1,387,143	\$1,427,957
Operating and taxes	898,136	890,813
Operating income	\$489,007	\$537,144
Interest paid	432,203	426,659
Net income	\$55,804	\$110,485

The gross earnings of the Lake Shore Electric Railway, Cleveland, Ohio, for 1915 were \$1,097,042, a decrease of 2.07 per cent as compared to 1914, mostly on account of the smaller passenger revenue. The operating expenses and taxes totaled \$719,060. This amount represented an increase of about 2.2 per cent, brought about in the main by higher power plant expenses and higher taxes and general expenses. Other income remained the same at \$25,000, but interest increased 2 per cent, to \$336,444, so that the net income for 1915 at \$66,537 showed a loss of more than 40 per cent. The gross earnings per car-mile in 1915 were 32.63 cents, a decrease of 0.52 cent; the operating expenses and taxes per car-mile, 21.39 cents, an increase of 0.57 cent, and the net earnings per car-mile 11.24 cents, a decrease of 1.09 cents. The passenger traffic decreased from 5,715,083 to 5,210,750. The accompanying table presents some interesting comparative figures for the separate divisions of the Lake Shore Electric Railway:

LAKE SHORE ELECTRIC RAILWAY				
Division	Earnings per Car-Mile			
	1915	1914	1913	1912
Cleveland	35.65	35.87	37.38	34.28
Toledo	38.25	37.52	38.61	37.03
Sandusky-Norwalk	31.97	36.93	34.89	32.01
City lines	15.28	17.13	16.55	15.07
Division	Earnings per Mile of Road			
	1915	1914	1913	1912
Cleveland	\$8,677	\$8,853	\$8,927	\$8,307
Toledo	62.25	6,858	6,785	6,491
Sandusky-Norwalk	16.30	3,209	3,727	3,389
City lines	11.14	8,377	9,168	8,178
	150.13	\$7,307	\$7,462	\$7,456
				\$7,011

The gross earnings of the Lorain (Ohio) Street Railroad for 1915 were \$150,152, a decrease of 13.2 per cent, but

the operating expenses and taxes totaled \$104,126, a decrease of 10.6 per cent, so that the net earnings of \$46,026 represented a decrease of 18.7 per cent. The net amount after the deduction of fixed charges was a deficit of \$18,474, as compared to \$7,879 for the preceding year. The passenger traffic fell off from 2,937,644 to 2,543,530. The gross earnings of the Sandusky, Fremont & Southern Railway at \$76,687 were a decrease of 2.3 per cent, while the operating expenses and taxes increased 3 per cent to \$54,832. The net earnings amounted to \$21,855, a decrease of 13.6 per cent. The net result for the year was a deficit of \$10,395 as compared to \$6,952 in 1914. The number of passengers carried showed a decrease from 322,605 in 1914 to 299,746 in 1915.

BIRMINGHAM SUBURBAN LINE SALE DISCUSSED

General Opinion Favors Purchase by Birmingham Railway, Light & Power Company, with Reservation for Future Municipal Purchase

The statement made recently in regard to the proposed purchase of the Birmingham, Ensley & Bessemer Railway by the Birmingham Railway, Light & Power Company, Birmingham, Ala., has been very generally discussed in the city and the suburbs. While the consensus of opinion seems to favor the acquisition of the line by the Birmingham Railway, Light & Power Company, with a reservation on the part of the city to take the line over at any time within a given number of years, two of the members of the city commission have announced their opposition. Farney Johnston, attorney for the Birmingham, Ensley & Bessemer Railway, held a conference with the city commissioners, which gave rise to the report that the city was again contemplating the purchase of the lines. In statements issued after the conference, Commissioners Weatherly and Barber announced that the Birmingham Railway, Light & Power Company would not be allowed to acquire the line.

Mr. Johnston, however, is quoted as follows:

"The reorganization of the Tidewater will probably be completed by May 1. I think the company will remain in the hands of private owners after the plans are completed. Of course there has been some talk about the city of Birmingham taking over the property and operating the lines, but I do not consider that at all probable. There is some doubt about the legal right of the city to take that action. My recent conference with the city commissioners was largely of a routine nature regarding details in the affairs of the company."

F. S. Morris, Philadelphia, Pa., a member of the firm that financed the Birmingham, Ensley & Bessemer Railway, is said to be of the following opinion:

"If the city of Birmingham will take the line over on the basis of 50 cents on the dollar or can get any company to do the same, it would be entirely satisfactory to us. We have been trying for some time to get a purchaser, and it was only after hard and diligent work that we were able to get this offer from the Birmingham Railway, Light & Power Company. Street railway lines in the United States are not considered now to be good investments unless they are operated in connection with light, power and gas systems. Many things have happened in recent years to beat down the value of street railway properties. The Tidewater line pays out 75 per cent of its receipts for operating expenses alone.

"Under the terms of the proposed sale to the Birmingham Railway, Light & Power Company, the city can retain its right to buy the property at any time within an agreed number of years at the very low price now offered, without interest and without standing any of the losses which might have occurred in operating the system in the meantime. It seems to me that this meets every need and every requirement of those who oppose the sale on the ground that the city should own the utilities. This will give the city time to adjust its finances and complete the organization which will certainly be necessary before the utilities could be operated. For the city to attempt to operate the Tidewater line alone at this time would simply be a useless drain on the taxpayers of the city. If a corporation is unable to pay any interest on the bonds, how can the city expect to issue bonds, buy the line, operate it and pay the interest on those bonds?"

RETURNS FOR MONTANA LINES

The report of the Montana Board of Railroad Commissioners, which is *ex-officio* the Public Service Commission of that State, contains detailed figures for passengers, operating revenues, operating expenses and return on investment of Montana street railways for the year ended June 30, 1915. These figures are presented in part in the accompanying table. For combined light and railway properties only the transportation data are given. No explanation is given as to how "return" on investment is determined, but the "investment" seems to be the cost of plant and equipment and materials and supplies, while "return" is operating revenues less the figure given as "operating expenses."

STATISTICS FOR ELECTRIC RAILWAYS IN MONTANA FOR THE YEAR ENDED JUNE 30, 1915

Company	Revenue	Oper-	Average	Oper-	Average	Return
	Pas-	oper-	per Pas-	ating	per Pas-	Invest-
	sengers	ating	senger	Expenses	senger	ment,
	Carried	Revenue				Per Cent
Anaconda C. M. Co.	1,538,089	\$77,708	\$0.05052	\$59,114	\$0.03843	6.6
Billings Traction Co.	516,818	26,145	0.05058	32,520	0.06292	..
Butte Electric St. Ry.	9,057,567	456,936	0.05044	484,088	0.05344	..
Gallatin Valley Ry. . . . .	.....	.....	.....	.....	.....	..
Helena L. & Ry. Co.	1,706,457	90,694	0.05314	79,913	0.04682	3.0
Montana Power Co.	2,056,054	102,989	0.05009	71,379	0.03471	..
Missoula St. Ry.	1,171,877	74,756	0.06379	71,112	0.06069	0.5

RESULTS UNDER LONDON POOLING AGREEMENT

The reports of the railways working under the pooling scheme proposed by the Underground Electric Railways, London, have been issued. Although the scheme was assented to on Jan. 21 of this year, the agreement took effect from Jan. 1, 1915, so that the whole of the receipts of last year came under this agreement. The five companies concerned are the City & South London, the Central London, the London Electric, the Metropolitan District Railway and the London General Omnibus Company. Their aggregate gross traffic receipts in the past year amounted to £4,924,245, and, including other resources, the aggregate receipts of the companies were £5,481,144. Out of this last total the several companies reserve between them £5,029,778 for revenue liabilities, which include working expenses, prior charges, reserves and other items specified in the agreement. The balance of £451,365 was credited to the common fund authorized under the act, and this common fund was divided among the companies as follows:

Metropolitan District	£54,163	12 per cent
City & South London	9,027	2 per cent
London Electric	117,355	26 per cent
Central London	90,273	20 per cent
London General Omnibus	180,547	40 per cent

In reply to a suggestion that the fares should be raised on the railways controlled by the Underground Electric Railways, the chairman, at the annual meeting of the company, stated that the adoption of such a policy would encourage competition. The company was frequently attacked on the ground that it was a monopoly, but although it predominated in the railway traffic, it had no monopoly.

Auburn & Syracuse Electric Railroad, Syracuse, N. Y.—The Auburn & Syracuse Electric Railroad has applied to the New York Public Service Commission, Second District, for permission to issue and sell \$450,000 of short-term notes.

Chicago & Milwaukee Electric Railroad, Highwood, Ill.—The sale of the Chicago & Milwaukee Electric Railroad in Wisconsin and Illinois, which was ordered by the court for April 1, has been advanced to May 1 by Judge Landis.

Georgia Railway & Power Company, Atlanta, Ga.—James D. Robinson has succeeded the late Thomas Eggleston on the board of directors of the Georgia Railway & Electric Company, and Mell R. Wilkinson has been elected to fill the vacancy in the Georgia Railway & Power Company.

Mountain Railway, West Orange, N. J.—The rails of the Mountain Railway were sold at public auction on April 3 to the Federal Iron & Steel Company, Newark, for \$1,625 to cover unpaid taxes. Some time ago this company bought the overhead equipment, tools and two cars.

Orleans-Kenner Electric Railway, New Orleans, La.—The Bellevue Farms Land Company, Lethbridge, Can., has applied for the appointment of a receiver of the 12.5-mile Orleans-Kenner Electric Railway. The land company, which is a creditor of the railway for \$3,099, contends that the payment made to Johnson & Company for the construction of the road was excessive. The firm is said to have received \$250,000 of bonds of the railway and \$247,000 of common stock. A. S. Bowman has also brought suit for the recovery of eighteen shares of stock of the railway, which he claims he loaned to Johnson & Company. He says that these shares are particularly valuable in that they represent the balance of power between majority and minority interests and expresses the belief that they are desired by Johnson & Company in connection with an effort to transfer control of the company to Bertron, Griscom & Company, New York, N. Y., which interests are identified with the New Orleans Railways & Light Company.

Public Service Corporation of New Jersey, Newark, N. J.—Articles of dissolution have been filed by the Public Service Building Company with the Secretary of State of New Jersey. The company was incorporated on Dec. 23, 1913, with an authorized capital stock of \$200,000 for the purpose of making cars and undertaking other minor construction work in the interests of the Public Service Corporation of New Jersey.

Seattle, Renton & Southern Railway, Seattle, Wash.—John C. Higgins of Higgins & Hughes, counsel for Augustus S. Peabody, trustee for bondholders, and Peabody, Houghteling & Company, Chicago, Ill., have submitted a plan for the reorganization of the Seattle, Renton & Southern Railway to Judge A. W. Frater of the King County Superior Court. According to Mr. Higgins the bondholders propose to bid the property in on May 1, when it is sold under foreclosure under Judge Frater's order. The road has been in the hands of receivers Scott Calhoun and Joseph Parkin since the summer of 1912.

United Railroads of San Francisco, San Francisco, Cal.—In response to the recent declaration by Jesse W. Lilienthal, president of the United Railroads of San Francisco, that his company was prepared to consider an offer from the city for its entire street railway system, the Board of Supervisors, it is reported, has begun work on a plan of purchase to be submitted soon.

West Penn Traction Company, Pittsburgh, Pa.—Out of the \$5,295,000 cash deposited with the Equitable Trust Company, New York, N. Y., a part of the proceeds of the sale of \$8,500,000 of West Penn Power Company first mortgage bonds, to be used in retiring first mortgage bonds of the West Penn Traction Company, the trust company has bought \$6,620,000 of the bonds at an average price of 80, leaving \$5,465,500 outstanding. The purchased bonds will be retired. The outstanding bonds were issued for 90 per cent of the cash cost of property, and in addition to the property security have also deposited behind them the entire common stock of the West Penn Railways and \$2,300,000 of its second mortgage bonds. The entire common stock of the West Penn Power Company, now showing earnings of approximately 6 per cent, is owned jointly by the West Penn Traction Company and the West Penn Railways. It is stated that the recent financing by the West Penn Power Company cares for all requirements over a long period of both the electric railways and the electric lighting and power companies.

Winnipeg (Man.) Electric Railway.—F. M. Morse, secretary and treasurer of the Winnipeg Electric Railway, has issued the following notice in regard to the omission of the dividend: "At a meeting of the board it was decided that, owing to the financial situation, the practice of declaring a quarterly dividend should be discontinued for the present. In this connection I would say that the business of the company is showing an improvement, and for the current quarter the net earnings have been sufficient to provide for all accrued fixed charges and also a sum that would have been sufficient to enable the company to declare a moderate dividend for this quarter. The directors feel that at this time, in order to conserve the company's interests, a dividend should not be declared payable for the present quarter, and that the matter of further dividends for the year will be considered and dealt with at a later date."

DIVIDENDS DECLARED

Boston (Mass.) Suburban Electric Companies, quarterly, 5¢, preferred.

Citizens' Traction Company, Oil City, Pa., quarterly, 75 cents, preferred.

Columbia Railway, Gas & Electric Company, Columbia, S. C., quarterly, 1½ per cent, preferred.

Ottawa (Ont.) Traction Company, quarterly, 1 per cent, preferred.

Ottumwa Railway & Light Company, Ottumwa, Iowa, quarterly, ¾ per cent, preferred.

Springfield & Xenia Railway, Springfield, Ohio, quarterly, 1½ per cent, preferred.

Virginia Railway & Power Company, Richmond, Va., 1½ per cent, common.

Youngstown & Ohio River Railroad, Leetonia, Ohio, quarterly, 1¼ per cent, preferred.

ELECTRIC RAILWAY MONTHLY EARNINGS

BANGOR RAILWAY & ELECTRIC COMPANY, BANGOR, ME.					
Period	Operating Revenue	Operating Expenses	Operating Income	Fixed Charges	Net Income
1m., Feb., '16	\$62,406	*\$34,185	\$28,221	\$17,779	\$10,442
1 " " '15	60,380	*29,465	30,915	17,636	13,279
12 " " '16	791,812	*409,036	382,776	212,841	169,935
12 " " '15	782,428	*375,208	407,220	209,492	197,728
CHATTANOOGA RAILWAY & LIGHT COMPANY, CHATTANOOGA, TENN.					
1m., Feb., '16	\$96,183	*\$59,764	\$36,419	\$28,570	\$7,849
1 " " '15	77,848	*54,430	23,418	28,941	75,523
12 " " '16	1,125,769	*736,168	389,601	356,898	32,703
12 " " '15	1,056,377	*701,346	355,031	342,837	12,194
COLUMBUS RAILWAY, POWER & LIGHT COMPANY, COLUMBUS, OHIO					
1m., Feb., '16	\$280,700	*\$165,534	\$115,166	\$44,375	\$70,791
1 " " '15	248,596	*149,014	99,582	38,727	60,855
12 " " '16	3,167,944	*1,871,698	1,296,246	484,332	811,914
12 " " '15	3,071,080	*1,873,923	1,197,157	476,085	721,072
COMMONWEALTH POWER, RAILWAY & LIGHT COMPANY, GRAND RAPIDS, MICH.					
1m., Feb., '16	\$1,362,995	*\$709,410	\$653,585	\$408,330	\$245,255
1 " " '15	1,140,832	*594,403	546,429	362,301	184,128
12 " " '16	14,977,054	*7,978,108	6,998,946	4,603,102	2,395,844
12 " " '15	14,026,762	*7,525,642	6,501,120	4,244,490	2,256,630
CUMBERLAND COUNTY POWER & LIGHT COMPANY, PORTLAND, ME.					
1m., Feb., '16	\$198,398	*\$128,085	\$70,313	\$65,761	\$4,552
1 " " '15	182,301	*107,797	74,504	62,494	12,010
12 " " '16	2,671,434	*1,539,328	1,132,106	798,964	333,142
12 " " '15	2,537,562	*1,450,770	1,086,792	756,881	329,911
EAST ST. LOUIS & SUBURBAN COMPANY, EAST ST. LOUIS, ILL.					
1m., Feb., '16	\$227,472	*\$136,706	\$90,766	\$61,802	\$28,964
1 " " '15	187,792	*113,323	74,469	61,896	12,573
12 " " '16	2,529,856	*1,511,278	1,018,578	754,790	263,788
12 " " '15	2,581,426	*1,564,943	1,016,483	724,108	292,375
FT. WAYNE & NORTHERN INDIANA TRACTION COMPANY, FORT WAYNE, IND.					
1m., Jan., '16	\$139,795	\$84,122	\$55,673	\$55,016	†\$883
1 " " '15	152,083	83,281	68,802	55,073	†14,048
KENTUCKY TRACTION & TERMINAL COMPANY, LEXINGTON, KY.					
1m., Jan., '16	\$69,029	\$34,857	\$34,172	\$20,317	†\$18,013
1 " " '15	62,078	33,946	28,132	19,857	†12,676
7 " " '16	569,145	258,444	250,701	142,607	†120,845
7 " " '15	491,370	260,337	231,032	138,343	†108,251
LEWISTON, AUGUSTA & WATERTOWN STREET RAILWAY, LEWISTON, ME.					
1m., Feb., '16	\$50,574	*\$39,292	\$11,282	\$16,085	†\$4,803
1 " " '15	45,960	*35,105	10,855	15,578	†4,723
12 " " '16	745,820	*481,850	264,470	190,732	73,738
12 " " '15	687,556	*465,713	221,843	186,888	34,955
NASHVILLE RAILWAY & LIGHT COMPANY, NASHVILLE, TENN.					
1m., Feb., '16	\$185,318	*\$109,648	\$75,670	\$42,897	\$32,773
1 " " '15	169,450	*101,726	67,724	41,712	26,012
12 " " '16	2,171,809	*1,336,133	835,676	512,838	322,838
12 " " '15	2,233,329	*1,314,551	918,778	495,336	423,442
PORTLAND RAILWAY, LIGHT & POWER COMPANY, PORTLAND, ORE.					
1m., Feb., '16	\$409,331	*\$253,092	\$156,239	\$181,166	†\$24,927
1 " " '15	437,854	*247,296	190,558	182,551	8,007
12 " " '16	5,448,097	*3,075,752	2,372,345	2,206,371	165,974
12 " " '15	6,079,892	*3,235,308	2,844,584	2,189,429	655,155
REPUBLIC RAILWAY & LIGHT COMPANY, YOUNGSTOWN, OHIO					
1m., Jan., '16	\$318,315	*\$182,566	\$135,749	\$67,288	†\$68,716
1 " " '15	249,363	*155,578	93,785	53,390	†38,551
VIRGINIA RAILWAY & POWER COMPANY, RICHMOND, VA.					
1m., Jan., '16	\$488,780	\$218,142	\$270,638	\$147,106	†\$131,091
1 " " '15	436,196	205,144	231,052	137,720	†99,508
7 " " '16	3,274,747	1,526,094	1,748,652	1,004,654	†802,048
7 " " '15	3,068,902	1,467,164	1,601,737	948,283	†700,384

*Includes taxes. †Deficit. ‡Includes non-operating income.

Traffic and Transportation

YOUNGSTOWN JITNEY ORDINANCE UPHELD

The Court of Appeals of Ohio has upheld the right of the city of Youngstown to demand a \$5,000 bond of jitneys and otherwise to regulate them. The case was that of John B. Evans against the city of Youngstown. In June of last year the city of Youngstown passed a jitney ordinance, requiring licenses from those who operate motor vehicles for hire in the way generally understood by the word jitney. The plaintiff brought action to enjoin the city from enforcing the ordinance against himself and the other members of the Youngstown Street Bus Protective Association.

The ordinance contained a provision requiring a person who is operating a jitney to take out insurance in the sum of \$5,000 to protect the city and for the benefit of those who might be injured by the operation of the jitney. The ordinance also provided for the payment of a license fee of \$25. It was urged that this latter charge was so in excess of any expense or costs of issuing a license that it became a special tax. It was also urged that the city had what is known as a taxicab ordinance; that the plaintiff and those for whom he brought the action had complied with the provisions of this taxicab ordinance and had a right to operate a taxicab; that the jitney ordinance was in violation of this taxicab ordinance, and that if the owners were required to comply with the jitney ordinance it would be a violation of the contract entered into with the city under the taxicab ordinance.

Taking up first the provision which required a bond in the sum of \$5,000 the court referred to the previous decisions of the Supreme Court upholding a similar ordinance in the village of Independence where the sum of \$10,000 was fixed as a provision for operating a jitney in that village. The provisions in the ordinance in that case were somewhat different in form from the ones in Youngstown, but a bond of \$10,000 was sustained in that case. The Court of Appeals expressed the opinion that so far as an ordinance requiring a bond of \$5,000 was concerned the Supreme Court had settled that question in favor of the city. It also felt it could not say the fee of \$25 was excessive. With respect to whether the ordinance was in conflict with the taxicab ordinance, the Court of Appeals said:

"The City Council acts in two capacities, one legislative and the other contractual, providing for these ordinances. Now, it is a well-known rule that Council cannot be stopped from legislating in the future, so that if this legislation as to the jitney ordinance is in violation of the former ordinance, the remedy would be by injunction. They could not stop the enforcement of future legislation. The city could not violate its contract any more than an individual, but if it does, its liability would only be that of any other person who violates his contract. The city could not be enjoined from passing and enforcing future legislation because, perchance, it might conflict with contractual relations under a former ordinance. We think the city had a right to enact this ordinance and judgment is in favor of the city."

COMMISSIONER WHITNEY DISCUSSES TRAFFIC STANDARDS

Travis H. Whitney of the Public Service Commission for the First District of New York, in an address which he made in Brooklyn recently, said:

"This commission is practically the only commission in the country to which passenger service is relatively important. Elsewhere, and particularly with railroads, income and competition cause fairly good passenger service with little attention required of commissions. Freight service and rates are of more importance to them. Here congested population and intensive travel make passenger service a vital issue. The law requires 'adequate service.' What are the standards or the measure by which it may be

determined that adequate service is being rendered, that is, measured so that proof may be conclusive before a court, of a violation of an order?

"I am not trying to shift the great responsibilities I have assumed, but I do want to urge the importance of disinterested and intelligent study of the work of a board such as this. Public officers who are trying to do their full duty are, I hope, anxious to have enlightened criticism. I know I am one who wants his public actions scrutinized.

"The public of a great city, if it deserves home rule, should be capable of doing its own investigating, contemporaneous with the actions of its officials and of applying the necessary remedies if such actions are wrong, and not wait to be shocked by post mortem headlines. So far as this commission is concerned its meetings are public, its minutes and reports are printed and are distributed on request. Its records are available and assistance will be rendered to any who desire to study its work."

COMPANY PUBLICATION AT WILKES-BARRE

The Wilkes-Barre (Pa.) Railway has begun the publication of *The Optimist*. It is 4½ in. wide by 6 in. high, and contains twelve pages and cover. *The Optimist* is published "every little while." The whole thing is exceedingly well done. A sermon is a sermon. It may be in the polished periods of a Channing or the slang of a George Ade or a Billy Sunday. Here is one from *The Optimist*, fashioned after Ade and entitled, "The Citizen Who Got the Wrong Hunch," which deserves to go the rounds of the railway employees' publications:

"Once upon a time there was a Citizen who had a Good Job.

"He owned a little home, with a Batch of Flowers in Front and a back yard where his Wife raised Vegetables and the children raised Cain.

"In summer time he had the Good Air and in winter time he stood inside a warm car when the weather was Rough Stuff.

"Twice a month the Filthy Lucre came in regularly, and whenever the Kiddies Wanted new shoes there was Never a Kick.

"Altogether he was Pretty Happy and didn't think the Idle Rich had so much on Him.

"But one day there came along a Professional Mixer of Eighteen Assorted Kinds of Trouble for which he got Good Pay.

"S'here,' said the Professional Mixer, 'I need a Strike.'

"I don't," said the Citizen.

"What's that got to do with it?' said the P. M. and he called a meeting of the L. D., Counted the Ballots and the Merry War was on.

"Two months later the Citizen was Hanging Up the Grocer and when His Wife Wanted a New Pair of Shoes he told her she Had Better remember that He was a Member of the Union.

"Moral: When in doubt, use your brains."

JITNEY BUS BONDING LAW UPHELD

Judge Mark A. Fullerton of the State Supreme Court, at Olympia, Wash., on March 29, held constitutional the jitney bus bonding law, passed by the 1915 legislature and upheld the conviction of the Seattle Taxicab & Transfer Company of a gross misdemeanor for its failure to obtain an indemnity bond of \$2,500 as required by the law. Chief Justice Morris and Judges Mount, Chadwick and Ellis, concurred. The law is applicable to jitneys operating in cities of the first and second classes. The Supreme Court's decision affirms a decision by Judge Dykeman of the King County Superior Court at Seattle. Several assignments of error were submitted to the court by the appellant, the Seattle Taxicab & Transfer Company. The company insisted that the jitney bus law violated both the State and Federal constitution. The court, after reviewing all objections, upholds the law in every particular. The Taxicab Company contended that the law was unconstitutional. Discrimination was the main ground of the attack relied upon by the appellant, although particular attention was directed to the fact that street cars were exempt from its provisions. The Supreme Court says there are just grounds for the distinctions. In this connection the court said:

"Street railways must operate on fixed tracks, and expend large sums on visible and tangible rights, and they must make preparations for payment of damages, while the motor vehicle may represent the entire capital of the operator. This justifies the bond of indemnity not required of street cars."

JITNEY CRISIS IN LONG BEACH

Paul Shoup, president of the Pacific Electric Railway, Los Angeles, Cal., told a large gathering of traffic men at Long Beach recently that it is now up to the people of the cities in which the company operates to choose between the auto bus and the electric railway. He was quoted in part as follows:

"Your Long Beach city lines have fallen to the point where they do not only fail to pay ordinary operating expenses, but they do not even pay transportation expenses, that is, the power to move the cars over the tracks. Some of your tracks have disappeared, and others must go. It is up to the people of Long Beach to decide. If you want the Pacific Electric Railway to continue to maintain a system in this city you should impose the same conditions with regard to franchises, taxes and street regulation that are enforced upon the present railway lines on our present common carrier competitor. We have continued operations against this unequal competition without complaining, feeling that when it was fully understood by the people you would choose between the two, and choose justly, and without unfair discrimination. A crisis has been reached; the issue is before you."

JOINT TROLLEY AND AUTOMOBILE FREIGHT RATES AT LOUISVILLE

The Louisville & Interurban Company, Louisville, Ky., will shortly announce a joint rate involving its Louisville-Shelbyville line and an automobile freight truck line which will extend the freight service of the company into a rich territory lying beyond the railway. It is the expectation of R. H. Wyatt, general freight agent of the company, that service will begin on or about April 15, and he is preparing to file the tariffs very shortly.

A 4-ton service truck has been ordered and stations have been provided for at Mount Eden, Van Buren, Southville and other points on the route and stops will be made daily by the truck to take on and discharge freight. It is expected that the one truck will serve at the outset, and it will carry, it is stated, from 8000 lb. to 10,000 lb. of freight on each trip. Rates are to be based, in a general way, on mileage, with a low rate on the railway from Louisville to Shelbyville. The section to be served is an excellent fruit, diversified farming and dairying region, but heretofore all the freighting has been done by horse-drawn wagons, out of Shelbyville, Taylorsville or Lawrenceburg.

Hearing on Interstate Rates in St. Louis.—A public hearing on the proposed increase in rates by the Illinois Traction System between St. Louis and Granite City will be held in St. Louis on April 21 at the Planters Hotel before the Interstate Commerce Commission.

Massachusetts Northeastern Fare Increase Suspended.—The Massachusetts Public Service Commission, following a conference with the New Hampshire Public Service Commission, has suspended until July 1 the proposed increase in fares on the Massachusetts Northeastern Street Railway, which was to have gone into effect on May 1. The New Hampshire board also suspended the increase.

Skip Stop in Newark on April 10.—The trial of the skip-stop plan by the Public Service Railway, Newark, N. J., will be begun on April 10 on the company's Bloomfield line between Branch Brook Park and Caldwell. The original plan was to start the service on April 1. The trial period will be for sixty days. The service is to be established on recommendation of the Board of Public Utility Commissioners and on request of residents along the line.

Through Service Ordered for East Boston.—The Massachusetts Public Service Commission has ordered the Boston Elevated Railway to restore through service in the East Boston tunnel to and from Jeffries Point, effective April 8. With the opening of the Cambridge Street extension of the

tunnel recently a shuttle service between Maverick Square and Jeffries Point was inaugurated, and a public hearing was given by the commission to petitioners for the resumption of the former service.

Discussion in Trenton on Adequate Service.—At a conference on March 24 the adequacy of the service furnished by the Trenton & Mercer County Traction Corporation, Trenton, N. J., was discussed. The City Commissioners and City Counsel Bird represented the city and Rankin Johnson, president, and former Judge Macpherson, counsel, represented the company. Another conference is to be held. The question seems now to have resolved itself into one as to whether the courts should pass upon the no-seat-no-fare ordinance or whether the Board of Public Utility Commissioners should prescribe the service regulations.

Stoughton Fare Petition Heard.—On March 29 the Public Service Commission of Massachusetts heard the petition of the Bristol & Norfolk Street Railway, Randolph, Mass., for permission to increase its fares from 5 cents to 6 cents. The road is a single track line 6.318 miles in length, and operates between Stoughton Square in Stoughton and Holbrook Square in Randolph, with a branch line in the summer to Glen Echo Park. The main line of the road is divided into two zones with a fare of 5 cents on each zone. Free transfers are furnished during the summer to the branch line to the park. The commission reserved decision.

Tickets and Badges Discontinued in Kansas City.—The series of seven different sorts of tickets for sale and complimentary, and the metal badges heretofore carried by employees of the Kansas City (Mo.) Railways are to be called in by the company, and only two forms of tickets or passes will be issued hereafter. These will be a car pass for about twenty department heads, and single tickets for laborers and for general office employees. Each of the latter classes will get free transportation to and from work. The company will no longer sell tickets. These tickets have been sold for 5 cents each, no reduction for quantities, to the public.

Chamber of Commerce Takes Vote on One-Man Cars.—A referendum vote taken by the Board of Commerce of Lockport, N. Y., among merchants and manufacturers in that city was almost unanimous in favor of having the City Council withdraw its objections to one-man cars on the Lockport local lines in return for the construction by the International Railway, Buffalo, N. Y., of a new freight and passenger terminal in the business section. The Council adopted an ordinance requiring two men as a crew on all local cars, but an injunction was obtained by the company and the case is pending in the courts. It is expected that the Council will reconsider its action of several weeks ago and accept the offer of the company.

Decision Reversed on New Orleans Jitney Ordinance.—The State Supreme Court of Louisiana in a decision after rehearing the case brought to test the validity of the New Orleans jitney ordinance has reversed the decision rendered by the court last November on the original appeal and held the ordinance to be valid. The ordinance required a \$5,000 indemnity bond, signed by a surety company, for each machine operated. The justices stood three to two for upholding the ordinance, the same majority by which the measure was held void last November. Justice Provosty, who wrote the opinion against the ordinance in the original hearing, signed the recent majority decision. He stated further consideration of the case caused his change in opinion.

Arranging for Syracuse Conference on Safety at Grade Crossings.—Edward G. Connette, president of the International Railway, Buffalo, N. Y., has been appointed chairman of the committee on the physical surrounding of crossings for the conference for greater safety at railroad crossings to be held in Syracuse. Edgar J. Dickson, vice-president of the company, is on the committee for fixed signs and signals. Bert L. Jones, vice-president and general manager of the Niagara Gorge Railroad, is a member of the publicity and education committee. Mr. Connette is also a member of the executive committee. The appointments were made by Seymour Van Santvoord, chairman of the Public Service Commission for the Second District. The date for the conference has not been set.

Accidents in New York in March.—The National Highways Protective Society reports that twenty-two persons were killed by automobiles in the streets of New York in March. Twenty-nine were killed by vehicles in the city, six by trolleys, and one by wagon, compared with twenty-one by automobiles, four by trolleys, and five by wagons, in March, 1915. In the first quarter of the present year eighty-five persons were killed by vehicles in the streets of New York, fifty-eight by automobiles, sixteen by trolleys, and eleven by wagons. Of the total, thirty-three were children. In the corresponding period in 1915, eighty-eight persons were killed, thirty-nine of whom were children. In New York State, outside the city, last month ten persons were killed by automobiles, four by trolleys, and one by wagon, compared with nine by automobiles, two by trolleys, and one by wagon, in March, 1915. In New Jersey, seven persons were killed by automobiles, one by trolley, and two by wagons in March.

Floods Interrupt Service in Buffalo.—Flood conditions in the South Park and Kensington sections of Buffalo, N. Y., played havoc with the schedules of local lines of the International Railway operating in the flood district. Water on many of the streets was 5 ft. deep, necessitating the abandonment of schedules on some lines and the operation of a snowplow attached to a trailer through the deep water on other lines. The high water in the Buffalo River and the ice jams almost completely carried away the Bailey Avenue bridge, so that for two days the Lackawanna cars were withdrawn from service. Swan-Abbott cars are being routed over other streets until the bridge can be replaced. More than 20 miles of streets were under water, but the property damage was not heavy. The Seneca Street carhouse of the International Railway on the banks of the river was not reached by the high waters. The near-side type of pay-as-you-enter cars of the company could not operate through the deep water, and trailers attached to a snowplow were used on the Hoyt-Seneca line.

Responsibility of Trainmen Recognized.—The removal of the "Please report" signs from the cars of the Kansas City (Mo.) Railways has met with enthusiastic approval of the trainmen. The suggestion for the removal was made by the welfare department of the company on the ground that the signs were a slur upon the character of the men. It was instantly acceded to by President Philip J. Kealy. The signs asked patrons please to report to the general offices any incivility or misconduct of the employees. Often as many as seventy-five complaints were received in a day, but investigation disclosed that few were justified. Not only was a great deal of time consumed in listening to and investigating complaints, but there was a constant uneasiness on the part of the trainmen over the result of their judgment in handling delicate situations. As soon as the signs were removed, letters began coming in to the welfare department and the officials, expressing the appreciation of the trainmen at being put on their own responsibility.

Electric Line Increases Freight Shipments.—The Kansas City-Western Railway, Kansas City, Kan., has had a large increase in its freight business since June 25, 1915, when it reduced its rate about 8 cents a hundred, leveling them to the steam road rates. While the largest part of the company's freight business is normally farm produce, reaching its maximum in the summer, there is a steadily increasing volume of freight from the jobbing houses and manufacturing of Kansas City to the retail dealers of Leavenworth and other towns on the line. The company runs two trains a day. Each consists of a freight car and a box-car trailer. These trains touch Third Street and Grand Avenue, Kansas City, Mo., and Fourth and State Streets, Kansas City, Kan. The early train leaves Kansas City at 5.30 a. m., picking up milk on its return. The second train leaves at 11.30 a. m., and takes merchants' orders for current day delivery. In summer the volume of freight runs to 750,000 lb. a month. Many heavy freight orders are handled by special arrangement on flat cars. A recent shipment of this kind consisted of fourteen carloads of material for a large building in Kansas City, Kan., brought from Leavenworth. The company operates 45 miles of line. Its equipment at the present time for handling freight consists of twelve cars.

Personal Mention

Mr. G. F. Roach has been appointed superintendent of overhead lines for the Ogden, Logan & Idaho Railway, Ogden, Utah.

Mr. H. A. Genung has been appointed chief engineer of the St. Paul Southern Electric Railway, St. Paul, Minn. He will direct construction work on the proposed line south of Hastings.

Mr. N. S. Wiltsie, trainmaster of the Salt Lake & Ogden Railway, Salt Lake City, Utah, in addition to this position, has been appointed trainmaster of the Ogden, Logan & Idaho Railway.

Mr. W. H. Dinsmore has been appointed traffic superintendent of the Vancouver city and suburban lines of the British Columbia Electric Railway, Vancouver, B. C., to succeed Mr. James Hilton, resigned.

Mr. J. M. Read, superintendent of transportation of the Ogden, Logan & Idaho Railway, Ogden, Utah, in addition to his other duties, has been appointed superintendent of transportation of the Salt Lake & Ogden Railway.

Mr. J. J. Macdonald has been appointed superintendent of the St. Paul Southern Electric Railway, St. Paul, Minn., to succeed Mr. K. A. Schaller, resigned. Mr. Macdonald was formerly with the Great Northern Railway.

Mr. E. E. Eysenbach, formerly general manager of the San Antonio (Tex.) Traction Company and of the San Antonio Gas & Electric Company, has been appointed general manager of the Hartford (Conn.) City Gas Light Company.

Mr. Frank S. Washburn has resigned as chairman of the board of Alabama Power Company and as a director of the company and also as a director of Alabama Traction, Light & Power Company, New York, N. Y., and its subsidiaries. It is understood that this action was taken by Mr. Washburn because of press and other business.

Mr. Almoth W. Hoff has been appointed secretary to Mr. Travis H. Whitney of the Public Service Commission for the First District of New York. Mr. Hoff is a lawyer and since 1911 has been a member of the Assembly, for the last two years being chairman of the cities committee. During that time he introduced and secured the passage of a number of bills at the request of the commission.

Mr. B. H. Meyer has been elected chairman of the Interstate Commerce Commission for one year, effective on March 17, 1916. This is in accordance with the practice of the commission made effective a few years ago, that the term of the office of the chairman of the Interstate Commerce Commission shall be for one year and that the office shall be filled from year to year in the order of seniority of service. Chairman Meyer was appointed to the commission in 1911 and his term will expire on Dec. 31, 1917.

Mr. James Hilton, for more than four years traffic superintendent of the Vancouver city and suburban lines of the British Columbia Electric Railway, Vancouver, B. C., has resigned. Mr. Hilton began his railway career with the Montreal Street Railway in 1897. In 1908 he was appointed superintendent of the Third Avenue Division of the Third Avenue Railway, New York City, from which position he resigned in October, 1911, to become connected with the British Columbia Electric Railway. A handsome walrus-hide traveling bag and silver cigar case from the officials and a gold watch from motormen and conductors were presented to Mr. Hilton on the occasion of his leaving the company. Before again entering business Mr. Hilton intends to hunt in the interior of northern British Columbia.

Mr. Louis H. Palmer has been appointed general superintendent of the Eastern Pennsylvania Railways, Pottsville, Pa., by Capt. W. B. Rockwell, manager. The J. G. White Management Corporation are the operating managers of the property. Mr. Palmer was a member of the class of 1902 at Williams College. From 1901 to 1906 he was employed in the operating department of the Central Railroad of New Jersey at Jersey City. He entered the service of

the Metropolitan Street Railway, New York City, in the fall of 1906 as a clerk in the office of Mr. Oren Root, vice-president and general manager. In April, 1908, he was appointed assistant to the general manager for the receivers of that company, and in April, 1909, was made superintendent of transportation. He resigned from the Metropolitan Street Railway in November, 1912, to join the organization of Harrison Williams. In June, 1915, Mr. Palmer went to Baltimore, Md., to do some special work for the president of the United Railways & Electric Company. It is from this position that he has resigned to become connected with the properties at Pottsville. He served the American Electric Railway Transportation & Traffic Association as a member of the rules committee for several years and as chairman of that committee in 1914; as chairman of the committee on subjects in 1914 and 1915; as chairman of the committee on standards in 1915 and 1916, and as a member of the executive committee in 1916.

Mr. George Henry Payne was recently appointed assistant to the vice-president and general manager of the Wilkes-Barre (Pa.) Railway, in which capacity he is in charge of advertising, public statements and relations with the public. Mr. Payne is an author, lecturer, journalist and member of the firm of Oakman & Payne, architects. He was born in New York City in 1876 and was educated in the city public schools, later attending the City College and the New York University Law School and pursuing special courses at the College of Pharmacy. When he was eighteen years old he entered newspaper work as a contributor to the *Commercial Advertiser* of New York. He has always been interested in politics, and in 1897 took a prominent part in opposing the so-called Remson gas bills. He then went to Europe as correspondent for the *Saturday Evening Post* and brought out a volume of fiction called "A Great Part and Other Stories." In 1908 he ran for the Assembly in New York and in 1911 managed the literary bureau for Mr. Henry L. Stimson, then Republican candidate for Governor of New York. Previously he had been made political reporter for the *New York Evening Post*. In 1912 he was one of the campaign managers for Col. Theodore Roosevelt. Later he joined the staff of the *New York Evening Mail* as its Albany correspondent. Mr. Payne is the author of "The Child in Human Progress," a volume of 400 pages, said by the *New York Times* to be an interesting and important contribution to human history on its social side. At present he is delivering a series of lectures on "The History of American Journalism" for the Board of Education of New York City.

NEW PHILADELPHIA TRANSIT REPORT PRESENTED

William S. Twining, director of city transit of the city of Philadelphia, Pa., presented on March 29 to the Select and Common Council of the city his first report on the rapid transit problem there, together with an analysis of the plans proposed for its solution with suggested methods for their improvement. He said that the report was needed primarily in order to explain his motives and purposes in suggesting changes in the details and the financing of the plan for transit development now before the public popularly known as the Taylor plan, and also to make clear some of the technical and financial features of that plan and to advise the City Councils as to what methods of executing the plan he considered were rational and businesslike.

Mr. Twining said that his report was not to be considered in any way as either a personal or political attack or a criticism of plans originated under the former administration. It was made only to serve the best interests of the city. While in the report a program of construction was advised which called for the authorization at this time of only \$35,000,000, Mr. Twining felt that the determination of the amount that should be authorized was a matter that rested entirely with the citizens and their representatives in the Council. As all plans must by law be submitted to and finally approved by the Public Service Commission he suggested that in order to avoid delay the commission be requested to review the situation and render a decision as to the details as soon as possible.

On April 3 the finance committee or Councils approved an amendment to the loan bill providing for the main features of the Taylor system, thus rejecting the modifications suggested by Mr. Twining.

Construction News

Construction News Notes are classified under each heading alphabetically by States.

An asterisk (*) indicates a project not previously reported.

RECENT INCORPORATIONS

Birmingham Interurban Development Company, Birmingham, Ala.—Incorporated to construct an electric railway from Birmingham to the Warrior River and Jasper, via Dora and Cordova. Capital stock, \$5,000. Officers: W. A. Spencer, Wylam, president; A. S. Preston, Jasper, vice-president, and W. W. Shortridge, Birmingham, secretary. [July 10, '15.]

***Ashland-Greenup Traction Company, Ashland, Ky.**—Incorporated to construct a line to connect Ashland, Russell and Greenup, 11 miles. Capital stock, \$3,000. Incorporators, William L. Bybee, B. E. Tate and S. S. Willis, Ashland.

FRANCHISES

Oakland, Cal.—The San Francisco-Oakland Terminal Railway has asked the Council for permission to construct an extension of its Twenty-second Street line from Broadway through private property to Webster Street to connect with its Grand Avenue line.

Tampa, Fla.—The Tampa Electric Company has asked the Board of County Commissioners for a franchise to construct extensions into a number of subdivisions that are adjacent to the city of Tampa.

***Chicago, Ill.**—The Chicago, Fox Lake & Northern Electric Railway has made application to the Illinois Public Utilities Commission for a certificate of convenience and necessity to construct and operate an electric railroad from the end of the Ravenswood branch of the Northwestern Elevated Railroad in the northwestern part of Chicago, to Palatine, Ill., by way of the villages of Arlington Heights and Des Plaines.

Rockford, Ill.—The Rockford City Traction Company has asked the Council for an extension of its franchise.

Sinking Spring, Pa.—The Reading & Denver Street Railway has asked the Council of Sinking Spring for a fifty-year franchise to construct a line beginning at the western borough limits, extending on Commerce Street to the east end. The company proposes to construct a line from Reading to Denver, via Sinking Spring and thence to Ephrata. [July 24, '15.]

TRACK AND ROADWAY

Pacific Gas & Electric Company, Sacramento, Cal.—John A. Britton, vice-president and general manager of the Pacific Gas & Electric Company, recently appeared before the Railroad Commission of California and stated that the differences between the company and the property owners on J Street had been amicably adjusted and that the company is now ready to proceed with the extension of its line on that street. Mr. Britton stated that last year the company spent approximately \$200,000 on its system in Sacramento and he has asked for an appropriation of \$100,000 for further improvements.

Bay Shore Railroad, San Diego, Cal.—The contract for the construction of this company's proposed line on Mission Beach has been let to the Coronado Beach Company, and it is expected that the line will be ready for operation by June 1. The new line will be 2½ miles long and will extend along the beach from Bacon and Voltaire Streets, Ocean Beach, to the extreme end of Mission Beach. It is stated that the new line will be operated in connection with the Point Loma Railroad. [July 19, '15.]

Wilmington (Del.) City Railway.—This company will construct an extension along Fourth Street from East Fourth Street west of Pine Street to the wharf of the Wilmington Steamboat Company; also an extension on Fourth Street from East Fourth Street east of Church Street to the approach of the Third Street bridge.

Alton, Granite & St. Louis Traction Company, Alton, Ill.—This company will reconstruct the tracks on its East Broadway line, Alton. A new concrete foundation, new ties and new rails will be used.

Lee County Central Electric Railway, Amboy, Ill.—Plans are being contemplated by this company for the construction of an extension from a switch 2 miles west of Middlebury to Ashton.

Aurora, Mendota & Western Traction Company, Aurora, Ill.—It is announced that this company will build a line from Mendota to Plano, and it is said that there will be no further legal action by the Aurora, Elgin & Chicago Railroad to prevent the construction of the line. [March 4, '16.]

Union Traction Company, Anderson, Ind.—Thousands of ties have been distributed over the lines of this company, more than 1000 having already been replaced, and extensive relaying will be inaugurated.

***Columbus, Greensburg & Richmond Railway, Indianapolis, Ind.**—It is reported that plans are being considered to revive the project to construct a line from Columbus to Richmond, via Greensburg and Connersville. August M. W. Kuhn, Indianapolis, president.

Terre Haute, Indianapolis & Eastern Traction Company, Terre Haute, Ind.—Plans are being made by this company to extend its North Thirteenth Street line to the city limits.

Cumberland & Manchester Railroad, Barbourville, Ky.—The sub-contract for grading 8 miles of this company's proposed line which was recently let to T. J. Anderson has since been given to Dempster & McFarlane, Knoxville. The company plans to construct a line between Barbourville to Manchester, 24 miles. M. E. S. Posey, Barbourville, chief engineer. [March 18, '16.]

United Railways & Electric Company, Baltimore, Md.—Plans are being considered by this company for relocating its tracks on Pratt Street between Light Street and Jones' Falls for the benefit of vehicle traffic. The east-bound track will be moved south of the safety islands in the center of the street and the west-bound track north of the islands. Under the present arrangement both tracks are north of the safety islands.

Greenwood, Miss.—The Peoples Interurban Company, Inc., has been organized to make surveys and plans for a proposed interurban railway to connect Greenwood, Schlater, Itta Bena and Black Hawk, to be built for the Southern Finance & Construction Company of Memphis, Tenn. J. H. Parson, Nashville, president. [March 18, '16.]

Kansas City (Mo.) Railways.—Surveys are being made by this company to find the cost of building an additional car line to Independence. The plan is to extend the Fifteenth Street line from its present terminus at Centropolis to Fairland Heights, on the present Independence line, a little more than two miles further east; then to extend the Fairmount Park line east to the north end of the Independence cross-town line. This would make two complete lines from Kansas City to Independence, at an average distance of a mile apart.

United Railways, St. Louis, Mo.—The United Railways has appealed to the Supreme Court from the decision of Circuit Judge George H. Shields upholding the Public Service Commission of Missouri in ordering the company to make extensions of certain of its lines and other improvements to cost about \$500,000.

Great Falls (Mont.) Street Railway.—Plans are being made by this company to build extensions to both its north and south side lines.

Missoula-Polson Electric Railway, Missoula, Mont.—The Chamber of Commerce bodies of Missoula and Polson, have decided to organize and incorporate the Missoula-Polson Electric Railway Company, this being the initial step in the proposed construction of an electric line between Missoula and Polson. Committees have been appointed to proceed with the work of promoting the line.

City Electric Company, Albuquerque, N. Mex.—This company has under consideration the construction of an extension on North Fourth Street to serve the district within and beyond the city limits and extending to the United States Indian School.

Brooklyn (N. Y.) Rapid Transit Company.—Work has been begun on the second section of the Jamaica Avenue elevated line between Cypress Hills and Jamaica, by excavating for pillar foundations at Vine Street and Jamaica Avenue. The first section, begun last May, is nearly completed so far as concerns the main part of the structure, which has been carried from Briggs Avenue in Richmond Hill down to the Brooklyn Borough Line. It is expected that this section will be ready for operation in the fall.

International Railway, Buffalo, N. Y.—Construction work on the new Buffalo and Niagara Falls trolley line of the International Railway was brought to a stop a short time ago when it was discovered that the survey in many sections of Tonawanda and North Tonawanda was not accurate. Property owners whose lands adjoin the proposed new line claimed the survey is 12 ft. on their property. The route in the disputed sections is being resurveyed.

Piedmont & Northern Railway, Charlotte, N. C.—This company has announced that it will build a line between Gastonia and Spartanburg, 40 miles, if the increase in revenue is sufficient during the next six months to pay interest on the bonds necessary for the construction.

Northern Ohio Traction & Light Company, Akron, Ohio.—It is reported that this company has reached an agreement with the Pennsylvania Railroad and the Baltimore & Ohio Railroad to construct a \$1,000,000 viaduct from the end of North Main Street over the Little Cuyahoga River Valley to North Hill as a shorter route to Cuyahoga Falls.

North Easthope Township, Ont.—The hydro-radial by-law which was defeated last January will again be submitted to the ratepayers of North Easthope Township.

Southern Oregon Traction Company, Medford, Ore.—The proposition to build an extension from the Jacksonville terminus of the Southern Oregon Traction Company's line to the Blue Ledge mining district, 30 miles, has been submitted to the City Council for immediate action in the matter of appointment of railroad commissions, calling an election and otherwise vitalizing the project. Tentative arrangements agreed upon by both President Bullis, of the Southern Oregon Traction Company, and the city of Medford are as follows: Credit of the city to the extent of \$250,000 will be loaned to the Southern Oregon Traction Company for the purpose of constructing the first unit of 15 miles, the company to build a second unit of equal distance and to build the first unit from city of Medford, absolving the city from any cost in building the line.

***Pendleton, Ore.**—Plans are being made to construct an electric railway from Pendleton, Ore., to Walla Walla, Wash., and from Cold Springs Landing through Pendleton to Bingham Springs. C. W. Lefler and E. W. McComas, Pendleton, are interested.

Portland & Oregon City Railway, Portland, Ore.—Plans have been filed with the City Council by Stephen Carver, president of the Portland & Oregon City Railway, showing the proposed extension of the line from Oregon City to Portland. The specifications call for 72-lb. rails on the extension. The line will be rushed to early completion.

Southern Pacific Company, Portland, Ore.—Work has been begun on the electrification of this company's West Side line from Whiteson to Corvallis. The cost is estimated at \$800,000, not including the terminals at Corvallis.

Texas Traction Company, Dallas, Tex.—Plans have been completed by the Texas Traction Company for a park and modern swimming pool at Woodlake, a point half-way between Sherman and Dennison, Tex.

Ogden, Logan & Idaho Railway, Ogden, Utah.—To further decrease the running time of the Ogden, Logan & Idaho Railway trains between Ogden and Brigham City and Preston, this company has authorized the construction of 13 miles of new roadbed and track north of Hot Springs. The new track will approximately parallel the present line between Hot Springs and Brigham City, but the new roadbed will be more solid, will have a more even grade and heavier rails will be laid. With the completion of the new roadbed the present line will be used for trains making local stops, the through trains to use the new line, which will be west of the present tracks.

Seattle, Renton & Southern Railway, Seattle, Wash.—The City Council and Scott Calhoun and Joseph Parkin, receivers of the Seattle, Renton & Southern Railway, recently arrived at an agreement regarding the relocation of the company's tracks on Rainier Avenue, between Hanford and Edmunds Streets, where the city is filling the thoroughfare. Messrs. Calhoun and Parkin have agreed to relocate the track, paying the cost of the new rails that will be needed, and the city will pay the cost of filling at points where the new rails are to be placed. The railway company will deed the portion of the right-of-way to be abandoned to the city.

SHOPS AND BUILDINGS

Union Traction Company, Anderson, Ind.—This company has decided to install a filter plant at Broad Ripple Park.

Fort Wayne & Northern Indiana Traction Company, Fort Wayne, Ind.—It is reported that this company is negotiating for the purchase of the creamery building and grounds on the south side of Main Street, near the east city limits of Peru, Ind., as a location for a new carhouse and freight house.

Boston (Mass.) Elevated Railway.—This company will build a tie-treating plant to be located at the general yards of the company at South Boston. The treating cylinder for this plant will be 7 ft. 6 in. in diameter by 51 ft. 2 3/4 in. long, so that standard gage cars loaded with ties or lumber may be run into it. There will be two storage tanks for oil and a working pressure tank mounted on scales to record the amount of oil used in each treatment, also the necessary equipment for the operation of the plant. It is expected to have the plant completed about May 1.

Kansas City Railways, Kansas City, Mo.—The Kansas City Railways and the Kansas City Electric Light Company are disposing as rapidly as possible of the buildings and grounds which are no longer essential to operation, or which are now used jointly. There is a value of about \$1,500,000 on the property to be sold. One piece is the five-story building at Fifteenth Street and Grand Avenue, where the general offices of both companies are located, the Walnut Street side of which was built only four years ago and houses a substation. The property at Twelfth and Charlotte Streets, until a few years ago used as cable power house and carhouse, is being remodeled for convenient leasing or sale, and the stack is being torn down. The light company has a charging station on this property, which probably will be continued there for a time at least. This property is 124 ft. x 400 ft.

Northern Ohio Traction & Light Company, Akron, Ohio.—It is reported that this company has decided to construct a six-story terminal building on North Main Street, plans for which were completed three years ago.

POWER HOUSES AND SUBSTATIONS

Havana Electric Railway, Light & Power Company, Havana, Cuba.—This company reports that it has placed an order with the Westinghouse Electric & Manufacturing Company for two substation equipments, each consisting of two 1000-kw. rotary converters with O.I.S.C. transformers and switchgear, 13,200 volts a.c. (550-575 volts d.c.), 60 cycles, six-phase, to be erected this year.

Urbana & Champaign Railway, Gas & Electric Company, Champaign, Ill.—This company plans to install a 2500-kw. turbo-generator, 1000 hp. in boilers and a boiler feed pump.

Burlington Railway & Light Company, Burlington, Iowa.—Plans are being made by this company to construct a 45-mile transmission line to connect its plants in Des Moines and Louisa Counties with Burlington.

Interborough Rapid Transit Company, New York, N. Y.—This company plans to construct a new substation 60 ft. x 100 ft., one story high, on River Street, near 162d Street. The cost is estimated at \$40,000. George Pegram, 165 Broadway, New York, chief engineer.

Rochester Railway & Light Company, Rochester, N. Y.—This company has awarded a contract to the Port Richmond Iron Works, Philadelphia, for two 16,000-hp. turbines of the vertical-shaft, single-rotary type, to operate under a head of 130 ft. at a speed of 180 r.p.m. These turbines will be controlled by I. P. Morris governors.

Manufactures and Supplies

ROLLING STOCK

Nashville (Tenn.) Traction Company during the recent large fire in Nashville lost three street cars.

Chattanooga (Tenn.) Traction Company has ordered from the Southern Car Company two large center entrance cars.

Omaha & Council Bluffs Street Railway, Omaha, Neb., has started work on the construction of twenty-five cars, for operation by next fall.

Lewiston, Augusta & Waterville Street Railway, Lewiston, Me., has ordered from the Laconia Car Company two motor freight car bodies and trucks.

Arkansas Valley Interurban Railway, Wichita, Kan., owing to increased passenger traffic, will add several new passenger cars to its equipment.

Iowa Railway & Light Company, Cedar Rapids, Iowa, it is reported, will rebuild a trailer car into a combination passenger, baggage and smoking car.

Chicago & Milwaukee Electric Railroad, Highwood, Ill., has ordered from the Jewett Car Company fifteen all-steel passenger cars, 56 ft. $\frac{3}{4}$ in. over all.

Newport News & Hampton Railway, Gas & Electric Company, Hampton, Va., has ordered four single-truck center entrance cars from the Southern Car Company.

Scranton (Pa.) Railway, noted in the ELECTRIC RAILWAY JOURNAL of April 1 as expecting to purchase new cars, has ordered ten car bodies from the Southern Car Company.

Altoona & Logan Valley Electric Railway, noted in the ELECTRIC RAILWAY JOURNAL as expecting to purchase five new cars has placed this order with The J. G. Brill Company.

Cleveland, Alliance & Mahoning Valley Railway, Alliance, Ohio, has ordered two center-entrance steel interurban car bodies, 55 ft. over all, from the Jewett Car Company.

Reading Transit & Light Company, Reading, Pa., is renovating a large number of its cars. Forty-one open cars are being supplied with curtains by the Curtain Supply Company.

People's Railway, Dayton, Ohio, reported in last week's issue as being in the market for five new cars, has purchased five cars from The J. G. Brill Company. The order was placed through the American Railways Company, Philadelphia, Pa.

Binghamton (N. Y.) Railway, noted in the ELECTRIC RAILWAY JOURNAL of Feb. 5, 1916, as expecting to purchase sixteen new cars, has ordered this equipment from the Cincinnati Car Company, through the W. R. Kerschner Company, New York.

Stark Electric Railroad, Alliance, Ohio, mentioned in the last issue as having ordered three all-steel, center-entrance cars for city service, has placed this order with the Jewett Car Company. The cars will be 42 ft. 6 in. over all. In addition this railway company has ordered from the same car builder two center-entrance steel passenger car bodies, 55 ft. over all.

Northern Ohio Traction & Light Company, Akron, Ohio, which was mentioned in the ELECTRIC RAILWAY JOURNAL of Jan. 22 and March 25 as having recently ordered new cars, now has forty new cars on order. The original order was for ten interurban and fifteen city cars. The new contract calls for fifteen interurban and twenty-five city cars. The new equipment will be divided between Akron and Canton.

TRADE NOTES

Stone & Webster, Boston, Mass., have removed their New York offices from 5 Nassau Street to the Equitable Building, 120 Broadway.

H. N. Bartlett and John F. Yates have resigned from the Mitchell-Rand Manufacturing Company, to become president and secretary respectively of the Bartlett-Yates Insulation Company, Inc., 64-66 Murray Street, New York.

Holden & White, Chicago, Ill., have taken over the gen-

eral sales agency of the Joliet Railway Supply Company, Joliet, Ill., manufacturer of Hartman self-centering center-bearing plates and Perry anti-friction side bearings.

James F. MacMurray, for many years general manager of the Plainfield plant of the Niles-Bement-Pond Tool Company, has resigned from that company and is now connected with the International Arms & Fuse Company, Bloomfield, N. J.

A. D. Fishel, former manager of the distributing transformer section of the supply department of the Westinghouse Electric & Manufacturing Company, has been appointed commercial manager of the Adams Bagnall Electric Company, Cleveland.

Otis & Company, Cleveland, Ohio, has appointed Cyrus S. Eaton as a member of its banking firm. Mr. Eaton is president of the Continental Gas & Electric Corporation and is a director of a large number of utility companies in the United States and Canada.

James W. Moore is now at the head of the Moore Engineering Company, Birmingham, Ala. Mr. Moore was recently connected with the United Gas & Electric Engineering Corporation, and previous to that time with the Birmingham Railway, Light & Power Company, Birmingham, Ala. The firm does engineering work and sells electrical equipment.

Edison Storage Battery Company, Orange, N. J., on March 13-17 held the annual sales meeting of its salesmen and branch office managers at the factory and main office, Orange, N. J. The reports of the various salesmen showed a healthy condition throughout the industry and marked important developments made by the Edison storage battery, particularly in railway train lighting, railway signaling, electric commercial vehicles, electric industrial trucks, electric baggage trucks, electric safety mine lamps, storage battery gathering locomotives, etc.

ADVERTISING LITERATURE

Hazard Manufacturing Company, New York, N. Y., has issued a catalog describing the construction, electrical advantages, insulation resistance and service efficiency of its Keystone railroad signal wire.

NEW PUBLICATION

Holdings of Railroad Bonds and Notes: Their Rights and Remedies.—By Louis Heft of the New York Bar. Published by E. P. Dutton & Company, New York, N. Y. 419 pages. Cloth, \$2 net.

This is another excellent addition to the increasing number of books on corporation finance. While the book naturally deals with the rights and equities of the holders of railroad securities, it outlines railroad financing in its various phases and analyzes sixty-two different forms of such securities. The fact that the author is a lawyer should not militate against the reading or possession of the book by railway operating officials. For a volume of the kind it is unusually free from legal jargon. The author discusses the rights of security holders of all kinds in consolidations, mergers, receiverships, foreclosures and reorganizations, as well as the rights of such holders against issuing corporations, trustees of mortgages, reorganization committees, etc.

An anonymous communication has been received from a subscriber questioning a statement in the ELECTRIC RAILWAY JOURNAL of March 25, page 622, that the recent order of the Bay State Street Railway for 200 cars was the largest surface car order of this year. Our correspondent contended that the Pittsburgh Railways had ordered 265 cars and that the Cleveland Railway and the Detroit United Railway had also placed large car orders and therefore should also have been included in the list of large orders. In regard to Pittsburgh, we believe that our correspondent's figure includes a large number of cars which were ordered toward the end of 1915, and reported in our statistical issue for Jan. 1, 1916, as 150 motor and fifty trailer city cars and fifteen interurban cars. Similarly, large car orders were placed by the Cleveland Railway and the Detroit United Railway toward the end of last year, although reports show that the Detroit United Railway has also ordered since Jan. 1 fifty trailer and twenty-four interurban cars.