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The Busiest Day

Yesterday was the busiest day of the week, as all six of the associations represented at Atlantic City held meetings. In the morning all four of the affiliated associations were at work. The accountants began their convention, the claim agents concluded theirs, and the engineers and transportation and traffic officers were half way through their respective programs. In the afternoon the engineers met again, the American association held its second session and the manufacturers gathered together for the single meeting which they hold during the year. It was the peak load of the most successful convention which the American Street & Interurban Railway Association has ever held.

Data Sheets

Most of the committees report that only a small number of the member companies replied fully to the inquiries sent out on the data sheets. The members of the different committees make a great many sacrifices in time and comfort during the year in the preparation of their reports and should receive all of the co-operation possible. It is a handicap to them as well as to the association if they are obliged to work without exact information as to the technical conditions under which companies in other parts of the country carry on their service. Each company which fills out a data sheet is benefiting itself as well as every other company in the association and greater attention to the requirements of the committees in this respect would add materially to the value of the work which they can accomplish.

Committee Reports

In spite of the handicap from the lack, in many cases, of very much material to work from, the committees brought in splendid papers, and now that this condition is recognized it will doubtless be remedied next year. All of the associations have evidently come to recognize that committee work can be of a value with which no other part of the programs is exactly comparable. This is due to the fact that the report of a committee represents the different, sometimes conflicting, standpoints of a number of individuals. The committees in several instances have supplemented the knowledge possessed by their own members with information obtained by corresponding with outside companies. An individual, no matter with what pains he may have prepared a paper containing valuable material and presenting opinions that have been studied with care, cannot well bring to bear the same different standpoints which are presented in committee work. W. Caryl Ely referred, in his address to the Transportation & Traffic Association on Tuesday, to the need of comparative analyses of the operating results of various companies. Such analytical work the committees, not only of this new association, but of the other associations, will do well to continue.

Report of the Committee on Standards

The report of the Committee on Standards of the Engineering Association this year takes up only couplers, bumpers, steps and platforms, but after a careful review of the field by the executive committee, these subjects were considered the most important to standardize. The large table of dimensions which accompanies the report of the committee shows a wide variety in the dimensions of these parts of the car equipment. In a few cases where a number of roads are controlled by the same interests, an attempt has been made to adopt certain heights of couplers and bumpers, but there has been no concerted attempt in most parts of the country to bring about uniformity in this particular. To the isolated line, an effort to standardize these parts may seem hardly worth the expense but the lapse of a few years may witness the inclusion of such a road in a chain of properties and the operation of interurban cars over its tracks. The matter will then become of vital importance.

When analyzed, the report of the committee, so far as heights are concerned, will be found to comprise two principal recommendations: one relates to the height of couplers for city cars, the other specifies the height of couplers for interurban cars. The other dimensions, such as those for bumpers depend directly upon these. The height being settled, the type of the coupler remained to be determined. For interurban cars, the logical design is that which will automatically couple with the standard steam car coupler, but which will be provided with such additional attachments as may be necessary to keep the couplers from opening when on the short radius curves and sharp

changes in grade which are common on the average electric line. According to the report of the committee, such couplers are, or will soon be, available for use in a variety of forms.

On many lines, the question of the standardization of the height or form of the coupler possesses but little present interest. Outside of their occasional use for hauling disabled cars, the companies do not require couplers and under these conditions would probably not care to go to any great expense to install new couplers or to adopt the other recommendations of the committee so far as their existing rolling stock is concerned. The committee hardly expects this, but the present cars cannot last forever and there will be a distinct advantage in incorporating the proposed standards in any new cars ordered, as they will then not only be able to couple with those of other roads which have adopted the standard dimensions, but will possess a value for sale as second-hand equipment, which they would not otherwise have.

Report of the Committee on Education

The suggestion made by Prof. Norris last year of the need for the establishment of apprenticeship courses on electric railways led to the appointment by President Goodrich of the committee whose report was presented by Prof. Norris yesterday. Similar committees, it might be said, have been appointed by other technical organizations, and are doing excellent work, notably in the case of the Institute of Electrical Engineers and on the steam roads. Although the committee had no definite plan to propose yesterday, evidence of its work during the time since its appointment was shown by the statistics compiled of the apprenticeship courses in the steam railroad, gas and electric lighting industries. As the report clearly indicates, there has been a revolution in the opinion of those in charge of engineering enterprises of the value of the technical graduate. Part of this is due to the growing necessity for a knowledge of science and engineering in most large business enterprises of the present day, part is due to the fact that as there is a constantly increasing number of technical graduates in places of responsibility there is better appreciation of the instruction which is being given in the technical schools, and part of it is undoubtedly due to the schools themselves in better fitting their graduates for the requirements of business.

The large electrical manufacturing companies, whose work necessarily requires a high grade of scientific employees, have long been aware that the technical schools could provide them with a most desirable class of men, and in many universities the selection of the works of one or another of these large companies for "post-graduate" work has been considered for years as a matter of course after graduation from the electrical engineering course. Some of these men have finally found their places among the operating electric railway companies, but there seems to be no valid reason why they should not be invited directly into railway work, to the advantage both of the companies and the students. A similar plan, as indicated by Prof. Norris, is followed in the steam railway industry, and has been commenced in a modest way by two electric railway companies. The benefits of the system apply not only to the engineering department, but to other portions of the railway work as well. There is no reason why a knowledge of engineering should disqualify anyone from proficiency in those branches whose primary demands are for administrative ability rather than for a training in engineering. On the contrary, the mental training acquired by scientific study and in solving analytical problems and the confidence which usually accompanies knowledge, should be of equal benefit in managerial as in engineering work.

We have not touched upon the other features of the work of education mentioned in the report, that is the instruction in engineering theory given to those who have devoted themselves to the practical side of the work. This naturally accompanies the instruction in practice to the technical graduate, for a comprehensive plan on educational work should include both phases of the subject. Instances of the practice of the New York, Brooklyn and Boston Edison Companies are very instructive in this connection, and according to the testimony of those in charge, have been followed by satisfactory results.

Discussion or the Program?

Many of those who have attended the meetings of the Transportation & Traffic association have remarked on the interesting and full discussion which has taken place after the reading of all papers and committee reports presented before that body. This discussion has been so general and extended that it has obliged the officials to depart from the regular published program in several important respects. The interesting features of this program, however, will not be abandoned. They are simply postponed and carried out in regular order at the various sessions. It is always a question with a presiding officer whether the better plan is to carry out each day the program that was outlined before the session began or to permit such discussion to be heard as may be suggested by the opinions and facts brought out. If the Transportation & Traffic association had adhered to the program prepared in advance some of the most valuable discussions that have taken place at the meetings this year would have been lost. Next year it may be thought advisable to allow more time on the program for the discussions. It is certain that such time will be needed if the reports and papers in 1909 do not fall below the high standard set this year.

The Exhibits as Seen by an Outsider

A shrewd observer commenting on the exhibits, remarked in conversation yesterday, that while the general public is evidently interested as it strolls around from booth to booth of this fine exhibit, there is practically nothing that makes an appeal for direct purchase. An electrical exhibition, pure and simple, brings to notice more and more each year things that the consumer is solicited to buy directly and personally—even lamps. The growth of the central station industry is based partly on that co-operation of the public in the purchase of apparatus. But in the traction industry it is fundamentally different. The private individual is unknown who buys himself a trolley car. The public enjoys and realizes the service of the entire apparatus through the agency of a public utility corporation; and it is to those men—except engineers, managers, specialists—that the argument must be made. Possibly indirect pressure can be brought to bear by public opinion aroused in favor of some specific device, but it is a negligible quantity. The manufacturer who makes good in the electric railway field undergoes a fire of critical searching judgment unequaled in any other electrical art, and that alone sets a seal of emphatic approval. This may be one reason why the field is so seldom swept by crazes and fads, which sometimes invade the mechanical world quite dangerously.

Conventionalities

"The strenuous life." Seven meetings in one day. Whew!

Mr. W. M. McFarland, vice-president of the Westinghouse Electric & Manufacturing Company and a member of the Executive Committee of the Manufacturers' Association, who attended the first two days of the convention, returned home Wednesday.

The Stone & Webster Engineering Corporation, of Boston, Mass., is represented by D. P. Robinson, president; F. R. Coates, F. N. Bushnell, L. H. Parker, Mark Lowd, manager Southwestern office, and E. C. England, all stopping at the Hotel Brighton.

Alanson P. Lathrop, vice-president and treasurer of the American Light & Traction Company, of New York, is a shrewd, practical student of the exhibit on the Pier. This holding company operates traction properties at San Antonio, Tex., and Muskegon, Mich.

The Roller Chair Committee has arranged to have roller chairs stationed at the entrances of the Marlborough-Blenheim, Traymore and the Chalfonte Hotels to-night, between the hours of 7:30 and 9 p.m., for the use of delegates and guests attending the theatre parties of the evening.

Genial H. L. Shippy, the Roebling salesmanager, decided to come to the convention when he learned that the Shelbourne grill was still open. Otherwise his duties in New York would have been far too pressing and onerous. With him to greet a host of friends and customers were Messrs. Cockey and Bowman, of New York and Cleveland, respectively.

One of the "old timers" has asked us to request all other veterans of the electric railway business to meet at the Electric Railway Journal Booth at 3:30 p.m. on Thursday to have a group photograph taken. The invitation is especially addressed to Messrs. Smith, of Omaha; Goodrich, of Hartford; Akarman, of Newark, and Major Evans; but anyone who has been allied with the electric railway industry for an equal length of time is eligible.

Alex. Dow, immediate past president of the Association of Edison Illuminating Companies, came on to Atlantic City with Mrs. Dow, to recuperate from the fatigue of the recent highly successful convention at Lenox, in the Berkshire Hills. They are staying at the Marlborough-Blenheim. Mr. Dow is president of the Edison lighting interests at Detroit, and a distinguished leader in that branch of the art with which he has been so long and so closely identified. He has a host of friends in the traction field.

An entertainment for the ladies of the convention will be given on Thursday afternoon from 4 to 5, in the Solarium of the Marlborough-Blenheim, when Miss Amy Grant, who enjoys an enviable reputation as an accomplished artiste, will give a series of musical readings, *i. e.* recitations with music. The intellectual pleasure of the performance is quite unusual, and those who have never heard Miss Grant should not let this excellent opportunity slip. The admission will be by official badge.

An authentic rumor credits John G. Buehler with an intention of becoming a balloonist or aeroplanist. Ever since the two American aeronauts fell from 2000 feet up, last Sunday, the sport of "air climbing" has appealed to him irresistibly. That same day and hour he underwent the mortification of being towed in by McGowan after his auto broke down; and he and Vanderbilt have firmly decided no longer to chase the "bubble" reputation for speeding and scorching. Mr. Buehler's movements are shrouded in mystery, but it is understood he will leave Atlantic City by water, and sell his auto for use as a roller chair on the Boardwalk.

"It cuts dirt," is the phrase describing a piece of vacuum cleaning apparatus shown in the General Electric pergola. "Seems to me I'm in that class" said a railway president mournfully as he looked at the device and remembered the scorn and contumely he had endured of late because he had been trying to build up the community in which he lives and works. Taken as a body, there are no men in the country more devoted to the upbuilding of their local interests, than the railway managers—and in return they have often, too often, to "eat dirt."

Daniel M. Brady, of the Brady Brass Company, is a visitor to Atlantic City, as he makes it a positive rule never to let a railroad convention go by without being present. This principle applies both to steam and electric railway conventions, at both of which he has many friends. Mr. Brady is being accompanied to this convention by John W. Gannon, who is a son of Frank S. Gannon, formerly general manager of the New York City Railway. Mr. Gannon, Jr., is connected with the Brady Brass Company. Mr. Brady has with him a few boxes of his well-known pencils.

The theatre parties organized by the Entertainment Committee for Thursday night will be most delightful affairs. Two houses have been taken for the affair, the Savoy and the Apollo, and tastes both grave and gay will be gratified. At the Apollo Robert Edeson will perform in "The Call of the North," and at the Savoy, the light musical comedy will be given of "Gay New York," by a regular metropolitan company. Admission in both instances will be by official badge only, and there will be no reserved seats, except for the officers of the Railway Associations, who will occupy the boxes. Both performances begin at 8:30.

Elmer P. Morris is trying to get Stedman to write a dramatic poem around his fender dummies. None of the elements of a great tragedy are lacking. The amount of human intelligence infused into those dummies by Elmer is simply marvellous. It is said that one of them is beginning to talk, and it is whispered that when the Claim Agents opened their session the other morning, a dummy was found seated in the presidential chair, with a wistful look on its expressive face, as though burdened with a tale of woe and wrong. Stedman admits it is a great chance, but says that the trouble is that his tragic verse is to often mistaken for humorous.

H. M. Edwards, head of the accounting staff of the New York Edison Company, is here as a special conference committee on accounting from the National Electric Light Association, over whose accounting section he presided at the Chicago convention last May. Mr. Edwards is a strong believer in joint consideration and disposal of the financial methods, forms, etc., involved in the requirements of the various Public Service Commissions. He holds that the underlying questions are very much the same, and that a united front on the part of the public utilities will smooth away difficulties both for the corporations and for the commissions.

The afternoon tea at the Country Club, for the ladies, provided by the Entertainment Committee, was another of the distinct successes of this notable convention. Nearly 150 ladies went out on the touring automobiles provided, and found the ride very pleasant through the rural part

of Atlantic City, the existence of which many had not even suspected. During the afternoon there was clock golf, and a concert was given by a first-class team of Italian musicians. The links looked their best, as did the quaint little club house, with the gathering of women in gay garments, against the backgrounds of rich foliage. An early return was made to town on account of the shorter day, but the sunset was a magnificent finale to all.

Ray D. Lillibridge and wife were the guests of F. J. Baird, of Cleveland, touring from New York to the Marlborough-Blenheim in Mr. Baird's new Packard automobile.

R. D. Coombs, structural engineer of the Pennsylvania Tunnel & Terminal Company, was seen "walking the planks" on Tuesday under the ciceronage of W. D. Archbold, of the Archbold-Brady Company.

W. B. Cleveland, president of the Electric Railway Improvement Company, Cleveland, O., was unable to attend the convention this year. He had planned to be among those present but was detained at the last moment by business.

Ernst F. Hartmann of the Carbolineum Wood Preserving Company, decided at the last moment to come down with an exhibit. It is located on the south side of the pier near the Aquarium. Samples of treated cross arms are on exhibition.

The committee which has charge of the chair transportation upon the Boardwalk is so zealous that "pushers-in" are stationed at the various hotels to see that the members of the associations take full advantage of the chances to look like invalids. Many delegates fail to learn that these chairs are neither "pay-as-you-enter" nor "pay-as-you-leave."

J. K. Forrest, who has been visiting this country from England, came down to the exhibit on Monday with C. G. Young, of J. G. White & Company, and sailed for home Tuesday on the "Lusitania," saying that even in that brief inspection he felt he had put himself abreast of the best American practice. Mr. Forrest was, until recently, in charge of rolling stock and the overhead and feeder system of the Capitol & Buenos Aires Grand National Tramways, Argentine Republic. His headquarters are now in London.

William O. Hay, president of the Montgomery Traction Company, general manager of the Easton & Washington Traction Company and secretary of the Northampton Traction Company, of Easton, Pa., is at the Marlborough-Blenheim with Mrs. Hay. He is accompanied by D. L. Beaulieu, superintendent and purchasing agent of the Northampton Traction, and several other employes of the three companies mentioned. Mr. Hay's brother, Thomas A. H. Hay, president of the Northampton Traction Company, is expected on Wednesday. It is an interesting fact that the Hay brothers have been prosperous shoe merchants at Easton for many years, in fact they sold so many shoes that to reduce the undue consumption of their product they went into electric railroading, so they are sure to make money either way.

Roller chairs are, as usual, furnished free to all delegates and guests of the convention wearing official badges, for use between the hours of 9 a. m. and 6.30 p. m.; except Wednesday and Thursday, when the evening hour is 9 o'clock. The garage stations are at the main entrance to the Million Dollar Pier, the Marlborough-Blenheim and the boardwalk opposite the Chalfonte. In addition, details of the service cover reduced rates for special and private chairs, as set forth in the official programs. The entertainment committee has a roller chair sub-committee, of which R. F. Hayes is chairman; and a regular roster has been scheduled by which he and other members of the entertainment committee supervise the whole service and "check the checkers" at given hours.

AMERICAN ASSOCIATION—WEDNESDAY

Vice-president Shaw called the meeting to order at 2:15 o'clock. The first business was the report of the Committee on Education, which was presented by Prof. A. S. Richey, in the absence of Chairman Norris. This report is published elsewhere in this issue.

Prof. D. C. Jackson, of the Massachusetts Institute of Technology, sent a written contribution discussing the report. He said that but a few electric railway corporations had shops and construction organizations of such magnitude as to make it desirable to establish an apprentice organization, but that there were doubtless some companies who could carry on such a system. On the other hand, there are many companies which employ a large number of men who are without an advanced technical training. Such companies would find it well worth while to establish courses like those conducted by Prof. Sydney W. Ashe, for the purpose of stirring the employees' enthusiasm. He also believed that a plan similar to the Trustees Gas Educational Fund might give excellent results if adopted by a number of the electric railway companies, provided it was placed under wise and adequate management. But he wished to protest against the inference which the committees' report might leave on some, namely, that either of these two types of educational effort can serve to improve the usefulness of graduates of adequate engineering courses. It is possible that these processes might make such graduates more effective operatives, but it is manifest that they would do little more for them, and thus would cause a waste of time if applied to such an end. On the other hand, he expressed himself as a hearty believer in the cadet system of the United Gas Improvement Company, and he presumed the cadet work of the Rochester Railway Company and the Public Service Company was equally effective. It seemed likely that an extension of this cadet system amongst the various electric railway companies would lead to an ultimate enlargement of the body of competent and able engineering and executive officers which the companies have to draw from. To the development of the cadet work, the engineering schools ought to offer every assistance. To the development of apprenticeship systems the engineering schools can only offer advice and encouragement, because such arrangements belong to the production of skilled mechanics and operatives, and are outside of their normal and appropriate sphere of education leading to engineering in a broader and deeper sense.

C. H. Hile, Boston Elevated Railway Company, gave it as his opinion that through a co-operation of the railway companies with the technical schools and industrial schools the former could expect much help. He referred to the practice on the Boston Elevated system, which is to put a boy in one of the various departments of the company for a certain number of months to learn the business, a specified time in one place and a specified time in another. The boys keep shifting around but in the meantime are progressing and gradually advanced to higher positions, and eventually are selected to fill more or less important vacancies in the company's force. Some of them finally reach the higher positions. He thought that in the matter of industrial schools there was a great deal of help which could be given by night courses, and that the company should encourage the boys in attendance upon the night courses, and also should allow the boys to attend other courses, if necessary, permitting them to take a leave of absence of several weeks or months, at certain times of the year, so that they might progress in their studies. He thought that if these students

should specialize at all, it should be very near the end of the course, because they will have to learn many of the minor details when they start in business. They must start at the foot of the ladder, and with the development of their mental faculties they could take up special lines of work. He believed that the electric railway companies did not appreciate the importance, fully, of co-operation in these matters.

Howard F. Grant, Seattle, described the system employed by Stone & Webster, who had established some years ago what is called the "Student course." Stone & Webster, however, do not go into the matter of training shop men, or into any system of shop apprentices. They take from the technical schools, through careful selection aided by the professors of the classes, young men who have been at the schools for four or five years, a certain number of them each year. They are usually the merit men of the various colleges and technical schools who desire to take service with the firm. These young men are taken into the Boston office, where all the details of the various companies, some 30 in number, operated throughout the United States, are cared for. The young men are given an opportunity to learn the systems of reports and other details of operation of the firm. They are also given some engineering studies to work up. The usual pay to begin with is $60 a month, which is sufficient to enable the young men to live in a proper manner. These young men are sent to the various companies controlled by the firm. Some are put to work in the power stations, some in the sub-stations and some take up electrical engineering or mechanical engineering, while still others may go into the transportation department. The speaker believed that from the large number of men they take each year it is possible to discover those who have the requisite qualifications in engineering and can be made managers of one of the companies. There are four students who entered the service of the firm not to exceed six years ago, who are now handling small companies. All engineers do not have qualifications for business management, and such as lack this faculty are allowed to develop their talent along engineering lines in the various departments of railway work. The speaker believed it was absolutely necessary for the manufacturing concerns of the country as well as the street railway companies to foster technical and industrial schools to the fullest possible extent so that there might not be a dearth of capable men for the places to be filled.

L. S. Storrs, of Boston, remarked that Mr. Grant had substantially covered the points he had in mind. He endorsed Mr. Grant's statement that there was a dearth of properly trained technical men in many of the positions in the street railway companies and he also believed that the greatest possible assistance should be lent to the technical and industrial schools.

Mr. Ely then delivered an address on the subject "How can the American Street and Interurban Railway Association and its Affiliated Associations be made of the greatest value to the Member Companies?" Mr. Ely said that the work which the affiliated associations had to do was of great magnitude, and he believed that the different classes of work should be subdivided and committed to the care of various committees so that ample time could in that way be had to provide for the proper investigation of any subject which was pending before the associations. That the work done by the committees of the association up to the present time had been splendidly done has been evidenced by the results of the committee reports at the present meeting. He believed that all the companies that are members of the association should take a most active interest in its affairs and thereby secure the very great results which would follow from such concerted action, which would be of mutual advantage both to the public and the companies.

Arthur W. Brady, Anderson, Ind., then presented a communication from the Electric Railway Journal, that publication offering to compile and publish, free of any cost to the association, an electric railway dictionary, but requesting the association to name an editing committee, this committee to be an advisory committee on the publication of the dictionary. On motion, the proposition was approved by the association and the chairman appointed the following gentlemen as the editing committee: H. H. Adams, New York; Paul Winsor, Boston; Richard McCulloch, St. Louis.

On motion of Mr. Brady, the constitution and by-laws of the American Street & Interurban Railway Transportation and Traffic Association were approved.

A communication from the J. G. Brill Company was read, in which it offered a prize to students in the technical schools of the country for the best thesis on city and interurban cars, and requested the appointment of a judge to act in conjunction with S. M. Curwen and H. W. Blake, in awarding the prize for these papers. The association voted to authorize the incoming president to make this appointment.

The chairman appointed the following gentlemen as a committee on Resolutions: W. E. Harrington, chairman, Pottsville, Pa.; P. P. Crafts, Clinton, Iowa; H. C. Page, Springfield, Mass.; also the following gentlemen as a committee on nominations: Howard F. Grant, Seattle, Wash.; W. A. Smith, Omaha, Neb.; Albion E. Lang, Toledo.

The meeting adjourned until 2:30 o'clock sharp on Thursday afternoon.

ACCOUNTANTS' ASSOCIATION—WEDNESDAY

The twelfth annual meeting of the American Street & Interurban Railway Accountants' Association was called to order at the Chalfonte Hotel at 10:00 A. M., by R. N. Wallis, the acting president.

After approval of the records of the last meeting Mr. Wallis read the annual address of the president. This address is printed elsewhere.

Acting Secretary H. E. Weeks (Tri-City Railway Company), read the report of the executive committee, setting forth the work done by the committee and recommending an amendment to Section 1 of the By-Laws, as follows: "All past presidents of the American Street & Interurban Railway Accountants' Association, and its predecessor, the Street Railway Accountants' Association of America, shall be honorary members of the executive committee, without the right to vote." The appointment of a committee upon interline accounts was also recommended.

President Wallis, in speaking of the recommendation that a committee be appointed upon interline accounts to represent this association on any problems which may occur in connection with interline accounting of freight and passenger traffic, asked W. H. Forse, Jr. (Indiana Union Traction Company), to explain the reason for the recommendation.

Mr. Forse said that the Central Electric Accounting Conference, an informal association, composed of the accountants of various electric railways in the Central States, was organized in order that the accountants might get together and discuss matters of mutual interest at more frequent intervals than the meetings of the national association

permitted. At a meeting held some months ago a committee of members of that conference was appointed to outline a system of interline accounting, and plan a set of forms. That committee had not come to a final decision or made its report, but it is expected to make a report at a meeting in Ohio in November. At a meeting in Indianapolis about 10 days ago the subject was brought up and it was suggested that the American association be asked to act in the matter so that it would be broader in its scope and not only affect the railways in the Central States, but all the electric railways in the country that are interested in interline accounting. Action would be appropriate now because the Interstate Commerce Commission is promulgating rules of various descriptions regulating the business of interstate carriers, and held that a good many interurban railroads are interstate carriers. This commission has recently issued a bulletin on the subject of a uniform bill of lading, which conflicts with one of the Indiana statutes. This subject, when it does affect the interurban railways at all, affects them seriously, and the accounting feature is much simplified if the railways can agree upon a plan of freight and passenger accounting. The matter had been brought before the executive committee for such action as this association desires to take. If the national association would take action, it would be the means of drawing more closely together the interests of all these railways.

The chair was directed to appoint a committee of five to act on the subject.

Mr. Weeks then read the report of the treasurer, showing expenditures during the fiscal year of $1,794.66. Standard classifications sold during the year yielded $119.50.

F. W. Sweney, special examiner, Interstate Commerce Commission, was then introduced by Mr. Wallis. He said the commission had issued three classifications which will become effective on January 1, and he had the promise of copies before the convention is over. In connection with these classifications he would like to state that it had been the practice of the commission with other classifications which they have issued for rail carriers, to develop the classifications through questions which are brought up and through rulings issued by the commission, and if any were interested in the way the classification had been developed, he had a few copies of bulletins and circulars which had been issued, and would illustrate this method. He was satisfied that if there are any points in which the classifications, which are to go into effect on January 1 are not clear, they can be developed in the same manner, and he knew that the commission would be glad at any time to receive suggestions or to have questions in regard to any points which are not plain.

The paper on the "Organization of the Accounting Department of an Electric Railway and Light Company" was then read by A. R. Patterson, general auditor Stone & Webster Management Association, Boston, Mass. This paper is published elsewhere.

H. S. Swift (Toledo Railways & Light Company) said that in a general way Mr. Patterson had outlined methods corresponding to his, but he wanted to ask regarding one point. He noticed that one clerk apparently took care of 4,000 customers.

Mr. Patterson asked if the daily reading basis was followed.

Mr. Swift said it was; that the bills were divided into three sections, so that the meters were read continuously.

Mr. Patterson said that an average of somewhere between 250 and 300 bills a day were prepared by one clerk. A good deal depended upon the rates. If they were based on the right demand or sliding scale, naturally more assistance would be required.

P. V. Burington (Columbus Railway & Light Company) said he had about 10,000 customers, and it took a force of about 12, including the cashier, to take care of that business.

H. T. Bunn (Knoxville Railway & Light Company) said that Mr. Patterson's organization was similar to that of his company, with the exception that he had about 3000 customers, with one cashier and one meter reader.

Frank Dabney (Seattle Electric Company) asked if any of the members had had any experience with loose-leaf ledgers for lighting customers.

Mr. Weeks said that when the Tri-City Railway & Light Company took over the property in the tri-cities, loose-leaf ledgers were used by one of the companies.

The gas and electric acounts were divided, separate ledgers being used for gas, electric, coke, tar and sundries. This was found to be so cumbersome that it was changed to what is known as the Boston ledger, which is a loose-leaf ledger, but has 20 or 30 names to a page. This was found very satisfactory. The customers' entire bills for gas, electricity, coke, tar, or whatever else he purchased were placed on the page of the ledger opposite the folio number which contains the account. The single page was in fact, so cumbersome that it was too expensive to handle.

S. C. Rogers (Youngstown—Sharon Railway & Light Company), said that he had used the loose-leaf ledger during the past four or five years, having about 5,000 gas and electric accounts. The system was a little different from that followed by Mr. Patterson in that the accounting department issued the order for the installation and removal of all meters. The contract was given to the accounting department by the contract department, and then issued the order, indicating on the order the tag number or customer's number on the meter, and attaching a brass tag bearing that number on each meter. The meter readers, in reporting to the office, which they did on a separate, individual slip for each customer, took the tag number which indicated the page in the ledger in which the account is carried. The ledger leaf would hold a customer's account for four years, including both sides of the sheet. The account was kept with the individual, and no attention was paid to the location. If Jonh Smith was represented by tag number 100, his account in the ledger was page 100. If he moved to another location his number followed him. No meters were installed until that order had been issued.

Mr. Rogers said he also had a plan of keeping track of the mingled accounts by means of an extra stub on the electric light and gas bill, which was called a "bookkeeper's coupon." It was attached before the bill was mailed and immediately after the tenth of the month, which was the discount day, all the bookkeeper's coupons representing accounts that had been paid were eliminated, and the rest of the bills were turned immediately to the collection department. This obviated the necessity of waiting until the accounts were returned.

Answering questions, Mr. Rogers said that he carried a separate ledger for each account, and made a separate bill for each account. The ledgers were so arranged that each ledger was practically an independent unit and was balanced by itself.

Mr. Weeks had found that it was considerable work to handle so many different bills for one customer, and that in collections it made trouble because all the bills for one

customer were not secured at the time he came in to pay the company. Did not people who were disposed to delay payment on their bills take advantage in some instances of that circumstance, pay one bill and allow the others to go?

Mr. Rogers had not found this condition. By means of this extra stub on the bill the man who was a consumer of both gas and electric light, which sometimes occurred, but was not the usual condition, was represented by gas and electric light coupons, both of which were turned over to the collection department at the same time.

Mr. Dabney asked if the same reader took both the gas and the electric light.

Mr. Weeks said that was the practice in his company. The meter cards were arranged in lockbooks. The meter reader took the book and read both the gas and the electric meter at the same time and the bills were made together from the meter book, and then the readings from the meter book were copied in the ledger. The ledger was then totaled and the bills compared with the ledger in order to assur the accuracy of the entry. But in handling 20,000 meters it was found to be more satisfactory with the Boston ledger.

Mr. Patterson asked Mr. Weeks if he did not find sometimes that including three or four items in one bill let the customer take advantage of an excuse for delaying the entire bill for a petty item, such as a gas mantel.

Mr. Weeks said that in one of the cities a discount was not allowed. It was necessary to send out collectors to make the collections. In the other cities, where there were discounts, boys delivered the bills.

P. S. Young (Public Service Railway) asked Mr. Patterson in reference to the statement: "One man has read in one day 200 gas meters and, in addition, collected 25 per cent of these bills." Mr. Young wanted to know whether that was a record performance or an average performance.

Mr. Patterson said that in the way a record performance was meant, he should say no. As a matter of fact several men in the company had read 200 meters in six or seven hours and collected anywhere from 10 to 25 per cent, but it was in a mill community, in tenement districts, where meters were congested and could be read in a short space of time.

W. J. Tharp (Little Rock Railway & Electric Company), said the ledger he was using had some features different from those he had used heretofore. The ledger is a loose-leaf ledger, with 20 accounts to the page. There was nothing on the page except the customer's name and address. The ledger contained two short sheets which take care of the year's business. The object of having only the name and the address on this long sheet is that at the end of the year it would not be necessary to get up a new ledger. Two more short sheets could be inserted and the ledger continued for another year.

President Wallis introduced H. M. Edwards, representative of the National Electric Light Association and auditor of the New York Edison Company, and asked him to enter into the discussion.

Mr. Edwards said the discussion confirmed previous knowledge he had that possibly in rendering customers' accounts there is a greater lack of uniformity than in almost any other branch of the business. He had about started, among some of the larger electric light companies of the country, a method of comparison. In the New York Edison Company the system was elaborate; it must be, because it had now 80,000 customers connected. Up to the beginning of this year it was adding at the rate of about 20 per cent a year. During the last year there had been a little lull, and he had had time to look over the methods, etc., and see how they could be improved. A customer's meter record was started from the connection slip. The meter record showed simply the details of the meter as to type, size, wire, constant, etc., and gave the reading, and on the margin of the index the total amount of consumption was endorsed. This was then sent to the ledger clerk who entered the facts on the ledger; then to the billing clerk, who made out the bill. The ledger clerk in the meantime had calculated the bill; it was brought to him and a comparison made. This system was adopted because the rates were complicated, the calculations involved, and it was found necessary to check the footing of the various meters on the bill as well as the calculation of the rate. After the bill was made out and compared by the ledger clerk and checked by him as having been compared with the original entry in the ledger, it was sent to a tabulating machine, and all the total results, etc., were obtained on the tabulator.

Mr. Edwards said the company used a bound ledger. The ledger lasted three years. It was blocked out as well as possible at the beginning of the three years, but naturally the customers' names got out of the geographical layout as originally designed. Therefore, he had an index card giving the name and address of the customer and his ledger folio.

Mr. Edwards said he was partial to a loose-leaf ledger, but it had not the elements of security from an auditing standpoint. He wanted one bound record which would always fill the same place and be in the same position, so that in after years he could go back over past years' work, check and audit any account and prove up the work that had been done. Aside from the ledger, however, he wanted subsidiary loose records. The bills were made out with a billing coupon. When bills were mailed the coupons were clipped off, assorted in collection routes, and sent to the collection bureau.

All the bills were mailed, Mr. Edwards said. There was one weak point in the system, and in fact, in all electric systems. The company lacked a slot meter. The Consolidated Gas Company of New York City had Mr. Edwards thought, between 40,000 and 50,000 slot meters in existence. The New York Edison Company had 5,000 weekly customers. Of these 5,000 weekly customers, 40 per cent. waited for the cut-off man.

Mr. Weeks said that Mr. Edwards' talk had suggested a system which he used. He had a form of bill which was suggested to him by the form of billing by railroads for freight. He used a carbon sheet and made a carbon copy of the original bill on a stub. This stub was perforated. The bills were taken out by the collectors, and if the bill was not collected on the back of the stub the collector recorded the reason for not making the collection. The stubs were returned to the office. If the bill had been paid the stubs were accumulated and totaled on the adding machine and the collector had to account for the money called for by the stubs. If the bills were not paid the collector turned in the balance of the stubs to the credit clerk, who filed them in folio order, which was also the collection order, and the collector, after the entire route had been gone over once, took out the stubs, and if by the second time the bill had not been paid, he made a note.

Mr. Edwards said that of all the money taken in by his company, 65 per cent. was received through the mails, 25 per cent. through collectors and 10 per cent. paid over the counter.

Mr. Ham said his company had an arrangement with 12 banks in the city of Washington, where customers could pay their bills.

Will Browne of (Utah Light & Railway Company), said

he had found it very advantageous to save the customer's account on a card. He had found in making comparison of the clerical force necessary to conduct this system, that apparently there was some saving in it.

Mr. Wallis read a letter from Frank R. Henry expressing regret at his inability to be present, and wishing the association continued prosperity.

President Wallis appointed the following committees:

Nominating—F. E. Smith, H. S. Swift, Frank Dabney, W. H. Burroughs and C. L. Wight.

Resolutions: H. T. Bunn, S. L. Reichert and George A. Harris.

ENGINEERING ASSOCIATION—WEDNESDAY

President Simmons called the meeting to order at 9.30 A. M. and stated that Mr. Adams had something to say.

H. H. Adams, New York, said that he wished to move a vote of thanks to the Committee on Maintenance of Electrical Equipment whose reports were presented on Tuesday. He considered the two reports that this Committee had presented to the association were among the most valuable that had ever been received, and thought that the association should put itself on record. Mr. Olds seconded the motion which was unanimously carried.

The president then called for the report of the Committee on Standardization. Mr. Adams presented the report, which was read by the secretary.

DISCUSSION ON REPORT ON STANDARDIZATION

Mr. Adams referred to the recommendation in regard to bumpers and suggested that Mr. Doyle had been giving special attention to this subject.

Mr. Doyle gave an account of the steel bumper with which the subway cars in New York are equipped and which has been described in this paper. It is a steel casting with longitudinal corrugations which engage when two trains collide and prevent them telescoping. It has proved its practical worth in service.

Mr. Doyle said that he understood an application had been made for a patent, but that he was not personally interested in the device.

The president asked for a full discussion on the report of the Standardization Committee.

Mr. Olds commended the work of the committee. He considered the matter of automatic couplers as important as anything with which the companies have to contend to-day. He was interested in Mr. Doyle's device. His company had had a few collisions, but none had been serious. He did not see how the idea of a corrugated buffer could be patented and thought the device had been brought out some years ago. He thought that the type of automatic couplers as recommended by the committee, designed to couple with the cars of steam roads desirable. He also approved of the committee's recommendation of 35 in. in height for interurban cars.

W. J. Harvie, Utica, said he was interested in the arrangement for preventing interurban cars from riding over the platforms of city cars. The distance between bottom of the interurban bumper and the top of the city bumper was 12 in. and he asked what form of top casting for the city cars the committee had in mind.

H. W. Blake replied that the committee had decided upon no special design except that the casting should have a pocket to permit the coupling of city and interurban cars.

Mr. Doyle explained that with the corrugated buffer described by him the casting was placed on the ends of the sills and the construction of the car permitted the interlocking of the sills at their ends. It is then impossible for the car to telescope. If in the ordinary city car, which has a platform tied up to the main sills the interlocking device is provided, the value of the device is only at such low speeds as the strength of the platform will resist. The company had the device on a car of that construction. The device resisted the impact somewhat, the platforms were knocked down and the car bodies butted out, but there was only a slight movement toward telescoping. He did not believe it possible to generate speed that would destroy the alignment of long sills. The force would then go sideways or up and then the superstructure would break at the point of attachment to the sills, so that if castings were provided in the structure there should be some suitable material between the casting and the end of the sills to offer such resistance as is employed in couplers of freight cars. There should be a dampening spring, or other scheme for absorbing shock, otherwise passengers sitting in two steel cars coming together and stopping suddenly would be severely shaken up.

E. T. Munger, Chicago, spoke of a device used on the cars of the Hudson tunnel in New York which he thought would be useful in this connection and which he thought was not patented. He thought the question of height of steps an important one from the standpoint of the public, both city and interurban, as high steps are difficult for some people to surmount.

M. V. Ayres, Boston & Worcester Street Railway, called attention to the fact that the heights from top rail to bottom of bumper were 51 in. and 31 in., respectively for interurban and city cars. This would require a casting on the city car of 20 in. in height on the city car to reach to the top of the bumper and not to the bottom of the bumper of the interurban car. He thought this a formidable proposition. It should be a heavy steel casting with a bracket sticking up 20 in. above the floor timbers, in which it is bolted, in the city car. This would be a pretty secure thing to receive a heavy blow. The plan of providing timbers with interlocking ridges should have been adopted long ago. Where two flat bumpers, of almost the same height, strike each other, one of the cars will slide over the other and some interlocking device which will prevent that should be used. It had occurred to him that a simple way of doing that might be to use a good channel iron, bending it around the front end of the car, from sill to sill, with the flanges between, using the channel iron for a wide bumper and the flanges to prevent climbing. An I-beam could be used instead of the channel iron. The speaker said there were good arguments for all the recommendations of the committee, and if he came from Ohio or Indiana he would approve them all without hesitation. In Massachusetts there was little interchange of cars between steam and electric roads. His company had adopted a type of interurban car which was intermediate between the two types recommended by the report. It is a little higher than the ordinary city car, because the motors, contactors and proper arrangements for braking, etc., seem to require more room, but is not quite as high a car as the usual interurban. The cars also have wider platforms than most interurban cars. These cars do a great deal of city and suburban service, where there are very frequent stops and it would be impracticable to use many steps. For this service the sort of car used is better

The President said he understood that J. F. H. Wyse, engineer of the Ontario Railway & Municipal Board was present and wished to be heard on the height of car steps.

Mr. Wyse read the following statement:

Every street and interurban railway man must realize the great importance of this subject. Adopt proper standards, and capital, expenditure will be greatly reduced, and the cost of repairs infinitely cut down. Your data sheet sent to the companies of the Association does not seem to have met with any replies from my section, and with relation to one feature, namely, car steps, which your committee has under consideration, I desire to say a few words.

This feature of the subject of standardization is of especial interest to us in Toronto at the present time, as there is now before our Ontario Railway and Municipal Board an application to lower the steps of city cars.

It may be pertinent to explain that the Ontario Railway and Municipal Board has jurisdiction within the province of Ontario of a somewhat similar character to that of your state railway commissions here. In this application a number of our most prominent physicians have come forward, and stated under oath that the condition of high steps on the cars of the City of Toronto was injurious, if not dangerous. Some of these doctors hold important chairs or professorships in the University of Toronto, one of them is an ex-president of the British Medical Association, and now Dean of the Faculty of Medicine in the University of Toronto. Their evidence is very strong, and cannot be ignored.

The height of steps, regarding which this application is made, is practically the same your committee proposes to adopt as a standard. Taking this into account and giving due consideration to the evidence now before our Board, and the structural difficulties to be met with, it seems to me if postponing the adoption of your proposed standards, as to car steps, and going further into the question resulted in securing a lower standard than 17 in. for the first step on the city cars, the public's best interests would be served and an immense amount of expense to the operating companies will be avoided, and a cause removed which promises to be a source of great irritation between the civic authorities and the railway companies.

After the conclusion of these remarks President Simmons said he would read on, and while the subject of the height of car steps addressed to him as President of the Association by Howard A. Kelley, who is a very prominent physician of Baltimore, Maryland. The letter follows:

"To the President:

Dear Sir: I note that one recommendation to be made at your Congress is that the height from top of rail to top of tread of first step 17 in. May I enter a protest as a doctor against the height which militates against the safety and comfort of women, little children and the aged. A lower height would not only be a courteous concession on your part, but lessen the delays by expediting exit and ingress for those for whom I put in a word. I am, dear sir, faithfully yours,

"HOWARD A. KELLEY, M.D."

James Leach, of Toronto, chairman of the Ontario Board expressed his thanks and those of his associates for the opportunity of being present at the meeting.

Mr. Blake explained that the Street Railway Association of the State of New York had gone very carefully into the subject of car steps three or four years ago. A special committee was appointed on the subject, consisting of operating men and engineers and they reached the same conclusions as to heights of steps as the Committee on Standards. The latter committee, however, realized that all street railway companies might not be prepared to adopt these step dimensions, hence did not suggest them as standards, but as "good practice." Those who are interested in looking up the arguments in favor of these heights will find them in the proceedings of the New York State association.

Mr. Adams thought it well to state briefly some of the limitations on this step-height question, particularly with the city cars. In the majority of the Eastern cities the companies are limited in the width that they can build their bodies; hence are limited in the width across the sills, which is the vital point. Eight feet would be a good width, but that is not often practicable, and the fact that the width over sills is limited, limits the radiation of the wheels of double trucks.

Mr. Olds said that in Milwaukee a city ordinance provides that the height of the d.c. trolley wire must be 18 feet from the rail to the bottom of the trolley wire. With single phase interurban cars and a trolley base insulated for a.c. 3300 volts, the clearances are about as follows: Wheels 36 in., with the clearance for the flange below the bottom of the floor, 4 in., thickness of floor is 2 in. The sills do not go below the floor of the car, except in the center; so that the wheels come out under the side sill. By so doing a height is secured of 42 in. from the rail to the top of the car floor. The height suggested by the Committee brings the floor of the interurban car 51 in., or 9 in. more than in Milwaukee. The Milwaukee Company is also working to get the platform of the city car down to not exceeding 40 in., possibly 38 in.

In regard to the height of steps on city cars, all know, that some streets are not paved, and at times the surface of the ground to the top of the rail will be from 2 in. to 3 in., and possibly 4 in., which will increase the height of this bottom step to 22 in. or 24 in., and Mr. Olds said he fully agreed with the doctor that this is too high. In Minneapolis they are using cars in city service without a drop platform and prove very satisfactory. The Chicago City Railway is also endeavoring to reduce the height of the first step.

Mr. Winsor said that the report did not state whether the measurements are taken with a car light or loaded. He presumed they were with the car equipped but without any load. That means they are the maximum height. After the springs settle and the car gets out of adjustment the step will be less than 17 in. With the car loaded the height would be still lower. He thought the report should be amended to say when the measurements are taken; otherwise some people might not understand them. He also thought the dimensions should read "not to exceed."

Mr. Doyle suggested that with the steel car it might be possible to reduce the height of the platform by the dimensions of the main sills through utilizing that portion of the side of the car below the window sill as a truss, supplemented by the heater panels as sills. His company had worked up a design of car of that character.

Mr. Roberts, in reply to Mr. Wyse from Toronto, said his company had overcome the difficulty as to the danger between the modern built interurban car and the open style old city car by having on its new cars a drop steel front sill which takes care of all fear of telescoping between the interurban and the ordinary city car. His company is now practically getting around to the more modern type of convertible car. He believed in a low first step.

Mr. Olds mentioned the question of floors and said he thought the composition floor is a step in the right direction. This is being used on the interurban cars in Milwaukee.

Mr. Winsor made the motion that after the three items, "height of top rail to step," the words be added "not to exceed."

Mr. Blake said that the committee felt handicapped in presenting the report owing to the absence of Chairman Evans. The figures presented are not all recommended standards, and all to some extent depend upon each other. The first thing necessary was to start with the height of coupler, and for the interurban car it seemed advisable to make it standard M. C. B. height, which for passenger cars is defined as 35

in. loaded or light. With freight cars a specified variation is allowed. The height from top of rail to center of coupler for the city car was then made as low as possible, 20 in. From these, the next four dimensions naturally follow, that is the height of the top of the platform in each case, giving a width of buffer which was considered strong enough for the service. The first five dimensions in the list are really all that it is necessary to specify. These are the only dimensions which are necessary to standardize in order to interchange cars. The following dimensions (those for steps) are optional with any company. The steam railroads do not standardize these dimensions. Some steam cars may have three steps, others five and there is no trouble as to the interchange of cars. If the first step is made not so high, the heights of the others will have to be increased to get the 20 in. for the coupler on city cars, and the 35 in. for the height of coupler on the interurban cars, unless another step is added, which of course can be done.

The president put the question on Mr. Winsor's motion, which was carried.

Mr. McAloney, Denver, moved the committee be extended a vote of thanks and the report accepted as amended. (Motion carried.) [The report is published elsewhere in this issue as amended.—Eds.]

POWER GENERATION

The president then called for the report of the Committee on Power Generation, G. H. Kelsay, Chairman. Mr. Kelsay presented the report.

Charles Hewitt, Philadelphia Rapid Transit Company said that the company which he represented has seven different designs of turbines of various sizes, made by three different manufacturers, and there is a wide variation in economy in the pounds of coal per k. w. hour in the different turbines, due to the difference in size, the difference in design and the difference in conditions. Hence it was difficult to submit a categorical reply to a question as to the efficiency of a turbine. This condition affects more or less all the questions on turbines. He believed the greatest economy could be secured with an exhaust steam turbine in connection with a well-designed reciprocating engine greater than that of any straight turbine plant that could be built. He understood one of the large trans-Atlantic companies is designing, or has put into service, a steam vessel built on these lines.

Mr. Roberts said that much of the information was obtained from well known authorities on the topics treated, but that their personalities could not be made known from business reasons.

Further, the committee was necessarily somewhat handicapped in certain replies, especially the use of turbines and reciprocating engines in the same plant, by the fact that the turbines are in almost every instance confined to a smaller part of the operation of plants than the reciprocating units. His own plant contains a 500 kw. and a 2,000 kw. d.c. turbine and a 1,500 a.c. turbine. On the other hand, the company has reciprocating units possibly four times as powerful as all the turbine units placed together, so that while it has been making observation on the operation of the turbines, he couldn't compare exactly reciprocating units and turbines of the same size. He was impressed, however, with the overload capacity of a steam turbine in good condition, with a good head of steam and a reasonable amount of superheat. There seems to be almost no range of power within the possibility of the strength of the material of which the turbine is constructed at which the turbine will not work.

R. H. Rice, General Electric Company, Schenectady, N. Y., expressed his hearty appreciation of the great value of the study which the committee had given to the practical operation of steam turbines as compared with reciprocating engines in power stations. Information of the kind contained in the report is of the utmost value from the manufacturers' standpoint. It is only from the people who are operating the apparatus that they can derive the necessary information for the improvement of the apparatus. Far from feeling that criticism is detrimental to business, they believe it to be of inestimable value. In getting the information the committee has been brought face to face with almost insuperable difficulties. Unless two plants are compared which are giving the same output and which are entirely separate, it is almost impossible to obtain data in steam consumption which will be of very great value. Obviously most street railway plants are not so situated that this comparative information can be obtained. On the whole, however, the consensus of opinion seems to be favorable to the steam turbine, and the speaker believed that future reports of the committee would be still more favorable to the turbine because some of the units reported on were among the first shipped. Certain types of steam turbines, particularly the impulse type, give an increased efficiency under overload and the best economy of such a turbine is at the maximum load. It is to the advantage of users of this type of turbine to put on it all the load which the generator can carry without overheating. The General Electric Company has recognized this fact by establishing a maximum turbine by which the user will know the maximum and by operating under those conditions get the most economical result. The rating of an engine is different in that it is necessary so to proportion the cylinders that maximum economy is obtained at some point not at the ultimate capacity of the engines. Considerable work is going forward at the present time in the direction of simplifying auxiliary apparatus, a matter of the utmost importance to the success of the steam turbine.

Mr. Thomas, Baltimore, said that on occasions, in his station, when the reciprocating engines dropped out, the load was so great on those remaining that the turbine took practically all the load, and he thought it is very important that engineers should give greater protection to the mechanical strain on the coil supports and the coils. With a reciprocating engine generator this is not so necessary.

STEAM METERS

At the suggestion of the president the subject of steam meters was then taken up.

Mr. Kelsay said the committee had obtained the information on steam meters contained in the report from the manufacturers and by asking them where the steam meters were located. They may be subject to some error because the committee had been able to get information of only those locations where they have been satisfactory.

Mr. Harvie said it seemed odd, when an electric power station is so fully equipped with electrical measuring instruments, that there is such a large gap of unknown conditions between the electrical side of the generator and the coal pile and the water fed to the boilers. If steam meters had been in more general use during the past few years, the data on the economy with reciprocating engines and turbines would be much more full. There are many places in a modern steam plant where it would be desirable to have steam meters in continuous operation. They cannot be considered as taking the place of an indicator on an engine. Their object is quite different. He thought

if power station operators would only show any interest and desire to use the instruments there would be a very great development in them within a very short time.

FLUE GAS ANALYSIS

The president asked if any delegates wished to take up the question of flue gas analysis.

Mr. Windsor said in his stations they weighed the coal and recorded the electrical output, but between the two had almost nothing to work from. They need methods of knowing how they are burning the coal, what the boiler is doing and what the various units are doing. The paper under discussion shows that a start has been made by the manufacturers in that direction, and that the companies are interested; and he hoped that the work of this committee would be carried forward next year.

Mr. Kelsay said two of the leading manufacturers of instruments for the determination of flue gas had furnished him equipments for test preparatory for this report, but it was absolutely impossible to get the information in time to go in the report. He had found some valuable things, one of which was that in his operating condition the air supply is entirely too large. It was a condition which he did not expect.

Mr. Hewitt said he had had two flue analyzers in service some little time, and while willing to admit that the results have been beneficial on the whole, he had to confess that they had been somewhat inconsistent. He learned very early that it made a very considerable difference as to where the sample of gas was taken out. In the report he thought the conclusion was reached that it is satisfactory to take the sample out from the stack or near the stack. His own conclusion was diametrically opposite to that. In a battery of five boilers, for instance, working on one stack, no indication can be had of any individual boiler by taking the gas from the stack. As a general principle the nearer one approaches the stack the less CO_2 he gets. That is borne out by the tests of the National Fuel Committee at St. Louis. The speaker had found that the only reliable indication which he could get was by taking the sample of gas from about the middle of the combustion chamber. They had tried various means of abstracting it, and had finally settled on a T-shaped idea. A pipe is run down the chamber and then completely across it, and the pipe is perforated with holes, so an average sample all the way across the combustion chamber is obtained. He had also found that the banking of a boiler in one bank very materially affects the gas in the flue, and in some cases he had found that the banking of one boiler affects the other, although it may not be banked. A possible reason for this is the infiltration of air from the banking of the boiler through the party wall. He had had instances in Philadelphia where the party wall, so far as was known, was perfect, yet if the sample of gas was taken near the chamber or near the flue, the banking of a boiler adjacent to another boiler will affect the CO_2 of these results. He also discovered, somewhat to his surprise, that the fireman on a flat fire had very little to do with the CO_2. That may not be true with soft coal fires, but with anthracite buckwheat it does not seem to be possible for the fireman to make very much difference in the CO_2. Of course, if he leaves the fire doors open the air rushes in and will affect it. He had tried every method of firing that could be thought of, but they appeared to make very little difference in the CO_2. He had succeeded in reducing the amount of CO_2 at the time of cleaning fires, but with that exception there has been no marked change. The two principal things which the CO_2 recorder has revealed to them are the excessive infiltration of air between the stack and the combustion chamber, and the apparent lack of air passing through the coal bed.

Upon motion of Mr. Doyle the report of the committee was adopted, and a vote of thanks was tendered to this committee for its report. The subject was also referred to the incoming committee for action.

WEDNESDAY AFTERNOON SESSION

President Simmons called the association to order and asked for the report of the Committee for Control. This report is published elsewhere in this issue. Owing to its length the report was not read.

DISCUSSION ON REPORT OF COMMITTEE ON CONTROL

Mr. Winsor, in opening the discussion, called attention to a slight error in the printed copy of Mr. Case's paper. [The correction is made in the paper as printed in this issue—Eds.] He then referred to the diagram of current feeding shown in the paper, which he said was very interesting to him, because his company, during the last year or so, had changed the resistance steps on all of its equipments. Even then it could not get so smooth diagram as shown. As a result of the change the motormen can handle their cars very much better than before. The authors had mentioned 3 m. p. h. p. s. as possible acceleration and Mr. Cooper might be inferred as saying that the acceleration could be 5 m. p. h. p. s. Mr. Winsor did not think such acceleration possible, but his company was trying to get a greater acceleration. He believed strongly in the automatic features of control, but thought improvements yet possible. With automatic control the company is now getting about 1.5 m. p. h. p. s. acceleration on the level, but less with a heavily loaded car and on a grade. He said he was glad to see improved platform controllers on exhibition and thought a platform controller preferable where it could be used. The Boston Elevated has also been experimenting, in connection with acceleration, with the alarm bell system of the General Electric Company. In this a relay closes a little bell circuit when the current rises beyond the maximum which should be used. That is, if the motor ought to take 75 amp., as a starting current, the relay can be set at 120, and if the motorman feeds up too fast he will get a buzzer or bell that will warn him. The conductor and anybody on the car that is interested, also knows that he does not feed correctly. The system has not been in use long enough yet to determine its real value, but the indications are that there is something in it.

Mr. Doyle said that on the Interborough it had been found there was a difference of from 30 to 35 per cent in the amount of current used by different motormen in operating under similar conditions, as nearly as they could be measured. He thought if controller designers could get up something that would indicate the extent of coasting of trains and the character of the acceleration it would reduce the fuel expenditure. The company's method of making these determinations was to insert an ordinary time clock in such a way as to measure the coasting time; that is, the time after the motorman has shut off his controller. When the controller was shut off this clock would start to operate and stop when the controller was opened. The coasting time, as stated, varied from 30 to 35 per cent among different motormen operating under similar conditions. He moved that the Committee on Control or Maintenance should give the subject consideration.

The motion was seconded by Mr. Adams and carried.

Mr. Munger said his practice, in reducing the peaks of the different points of the controller, was to place an ammeter in circuit with the motors. This is done when the car has been overhauled and is about ready to be placed in service. The car is taken out on the track by a couple of shopmen and a direct reading 500 amp. ammeter is placed in circuit. One man handles the car while the other watches the ammeter to see that each point is of equal strength at the peak. If the car does not notch up satisfactorily, it is taken back to the shop and the resistance is adjusted until the car will accelerate perfectly. In this way the performance of every car is uniform on the points. His company for about a year had been using "coasting boards." These are useful in keeping down the consumption of current. He was a firm believer in the merits of automatic accelleration. His company operates about 1,700 trains a day, a large majority of which have only one car, yet the reports of failures of the controller to notch up properly are rare. Even these, when sifted down, will usually be found to be not founded on any fault of the controller.

Mr. Case in replying to questions said that occasional sticking of the dash-pot has been due to the condensing of moisture in dash-pots and its subsequent freezing when the car is laid up. As the clearance between the plunger and the gravity is so small it requires only a small amount of moisture to do that. His company has recently made up a relay which will entirely overcome this trouble because when the relay is at rest there is no space within the dash-pot and consequently there is no moisture to be precipitated and freeze. The clearance of the plunger in the dash-pot has also been increased.

Wm. Cooper referred to Mr. Winsor's remark that a certain rate of acceleration was only possible when running down hill. He thought it could be easily attained on almost any part of the Boston Elevated because the co-efficient of friction of the wheels on the rail is quite sufficient. It would be very difficult to attain, however, without a more perfect control, but it would be possible. He made some braking tests recently in which he got deceleration of five miles an hour per second without any uncomfortable jolting.

Mr. Winsor (Boston Elevated) said that relays in both controls was what caused trouble. If the time limit is desired it must be obtained in another way. The cylinders of the Westinghouse apparatus are operated by compressed air, and one way to get a time limit is to throttle the air as it is admitted to the cylinder. The valves can be made smaller to do this, but he also has a special time limit relay which is used in some cases. There are other ways, however, of determining the proper regulation current so that it will be possible to handle trains of cars on heavy grades as well as on a level. In some cases where there are only a few light grades on a line but a number of heavy steep grades, it is not desirable to set the current limits so that the car will accelerate rapidly on the maximum grades. He had also installed two current limits in some instances, the second limit of which can be brought into action when desired. The practice of the Boston Elevated is exceptional on account of getting out of the grades in the tunnels; in most cases where train control and automatic acceleration is employed, one set of current limits is sufficient to cover all normal conditions. He called attention to the fact that perfect acceleration can only be secured by something like a water rheostat control or by a control with an infinite number of steps. A certain minimum number of fifty-seven steps should be used for the sake of simplicity, and no more than is necessary to keep the fluctation in acceleration down to what is comfortable.

E. T. Munger (Metropolitan West Side Elevated, Chicago) said that he used an ammeter and stop watch together in adjusting limit relays. He adjusted the rate of acceleration by the stop watch but tried to adjust the resistance so that every tooth and peak is the same. The point at which the current is cut in is pre-arranged by the weight of the relay armature. The aim was to make the peak reach the same place every time on each motor and then to adjust the weight of the relay armature to the current limiting relay so as to get a certain acceleration, which on his road was fixed at 11 seconds, starting from the time the current is turned on until the last point or the peak of the notch is reached. The current runs anywhere from 210 to 220 amp. for each motor. When they are in series it is 210 to 220 amp., and in multiple it is double that. The relays are adjusted within 2 amp. on those peaks. Adjustments of that kind are made every 60,000 miles.

W. J. Harvie asked whether any companies operating multiple-unit control equipment had any difficulties with snow, and if so, what has been the most effective means of preventing such trouble? The trouble he had had was due to snow sacking in behind the forward plate of the contact box and behind the middle of the contact device, and depositing enough moisture on the contact to at times put the equipment out of service. He expected to have a good deal of such trouble this winter.

On motion the report of the Committee was accepted.

The president appointed the nominating committee: E. T. Munger, (chairman), Charles Hewitt, J. M. Larned, Ayres and W. J. Harvie. This committee is to report on Friday afternoon.

COMMITTEE ON POWER DISTRIBUTION

W. J Harvie, chairman of the committee, presented the report.

R. D. Coombs (Pennsylvania Railroad), presented a written discussion on heavy catenary construction.

G. W. Palmer, Jr. (Boston & Northern), referred to the committee's statement that for low tension feeders, the standard practice is to use paper insulated cables. He asked if the committee had given any attention to the use of varnished cambric for low tension cable insulation. In some respects he thought it promised better results than paper insulation, particularly where the sheaths are subject to electrolysis, in which case the cambric insulation is not as liable to fail as paper. He had found a crying need for something in the way of a strain insulator which could be used in connection with potentials of 13,000 volts and over. To date he had not found an insulator which could be used in the ordinary way of cutting the insulator in on the line.

James Heywood (Philadelphia Rapid Transit Company) did not think that varnished cambric had yet come into very general use for underground work. The value of varnished cambric in a lead-covered cable is rather doubtful. Paper insulation is much cheaper and has sufficient dialectic strength for the work. He doubted whether varnished cambric would resist the influences which act on the insulation when the sheath is punctured much better than saturated paper. One company has discarded lead covering on underground cables and is using rubber insulation without lead, depending entirely on the insulation to resist water.

Wm. Roberts (Northern Ohio Traction & Light Company) asked if any steps had been taken to ascertain the bearing of State laws on the height of the trolley wire. He had ascertained that the Ohio law required a height of trolley wire of 21 ft. 6 in. He suggested that this might be a mat-

ter for the committee to take up at some future time in order to have a definite record of the requirements of the various state laws.

W. J. Harvie replied to Mr. Roberts by saying that the committee found that it could not hope to influence in any way the height of trolley in special cases like railroad crossings, bridges and culverts. As a rule steam railways require a height of 22 ft. at crossings. The standard of 19 ft. was suggested in order not to have too great a difference between the maximum height and the lowest point to which the trolley would have to go.

Secretary Corning replied to Mr. Heywood's request for information as to the use of non-leaded cable, by saying that the Boston Elevated has had some non-leaded cable, rubber insulated with three triple grades, in use for two or three years. Except for some trouble due to badly made joints where the cable lay in wet ducts he had had absolutely no trouble with it. Much depends on the quality of the insulation, as to how long that cable will last in the ducts and be of service. In Springfield, Mass., some of this cable has been in for about five years and has caused no trouble whatever.

Mr. Reed said he did not know of any cables laid for railroad purposes without the lead sheath except a little a long time ago in Washington and Brooklyn. Lead is used principally on rubber covered cable for mechanical protection. He did not see why a protection cannot be obtained with a proper wrapping of either cotton, or in the shape of braid, or a wrapping of jute if it should be saturated with some preservative compound.

Mr. Ayres doubted the value of catenary construction. It seemed to him to introduce more hard points to be hammered by the trolley wheel or bow, but if used, a steel conductor, as on the New Haven, is better than copper. He favored a sliding contact of iron against iron, and an auxilliary conductor looped over an upper horizontal messenger, as in some European catenary work.

LEAD SHEATHED CABLES

A discussion then followed on the subject of lead sheathed cables, in which Mr. Windsor, Mr. Thomas, Mr. Reed and Mr. Heyward joined.

Mr. Windsor said his reason for objecting to a cable with a lead sheath was that in case of a bad short on a cable the trouble did not stop there. Other cables were affected, sometimes at the same time, but generally a few days or even weeks later.

Secretary Corning said that to guard against such cases of delayed burn-out they had instituted the practice of cutting the lead sheath in each manhole, taking a ring out of the sheath about ¼-in. wide and filling the space in with rubber tape, and heating it. This makes what is called a rubber joint at that point. The sheath is made continuous again by a short copper wire around the joint to take care of the return current on the sheath, so that if the cable burns out the small wire is fused. This limits the bad section, and naturally prevents a heavy flow of current to adjacent cables.

Mr. Palmer believed that if the lead sheath could be done away with, a great many of the troubles on feeders would be avoided. Lead is generally thought necessary, however, to maintain the integrity of the insulation, particularly where saturated paper is used for insulation. He said that cambric cable is being employed more extensively than perhaps some of the members of the association are aware. A number of large orders for this cable have been placed lately.

HEIGHT OF TROLLEY WIRE

A discussion then followed on the height of trolley wire. Mr. Kelsay said his extremes were 14 and 22 ft.

Mr. Heyward thought a State law which required that the wire be maintained at 22 ft. at the crossings, introduced an element of danger rather than eliminated one, as the pole is liable to come off the wire. He did not see why a trolley wire need be any higher than the clearance allowed under a bridge.

Others expressed the same opinion.

Mr. Munger moved that the paper be accepted and the committee given a vote of thanks. The motion was seconded and carried.

The meeting then adjourned until 9:30 a.m. Friday.

According to the "Electrical Engineer" the London and North-Western Railway has been conducting some experiments with regard to the electric lighting of trains. In the case of five trains (amounting to 20 coaches with 480 cells) which run between Euston and Wolverhampton on day and night services, and on which the coaches are always lighted owing to several tunnels, not one cell had to be removed from the batteries during the twelve months that the cells were in use. Stone's system was in use. Lead-armoured cable is generally used for all the underneath and roof work. The mains on the roof are usually outside all covering, and tappings made to the compartments through junction boxes, which are filled in with bitumen. The lamps are fixed singly in the roof in different positions, or else in brackets at the back of the seats, so as to get maximum light to the part where the traveller sits. Carbon-filament lamps have been used of 8 candle-power, 10 candle-power, and 12 candle-power. These are of special strength, and little trouble is caused by broken filaments. Recently Osram lamps have been introduced for the purpose with marked success. For dining, sleeping, and other special saloons, distributing switchboards are used, giving control over the various compartments. On "corridor" coaches switches are fixed in the end of the coach, which can be operated inside the corridor by a train attendant when traveling, or from outside by the station staff. A "non-corridor" vehicle is fitted with a switch at the end of the coach, which is operate with a bar from either side of the vehicle, similar to the method of turning "on" and "off" gascocks. When the storage cells of railway coach electric lighting plant fail, their chief defects are found to be: short-circuiting of plates, due to pieces of paste falling away; abnormally sulphated, caused by over-discharging and buckled plates from overcharging; and leakage to the lead lining of the cases.

According to the "Electrician" the Interlaken-Lauterbrunnen-Wengern Alp-Grindelwald rack-and-pinion railway, which is at present worked by steam, is in process of conversion to electric traction, and it is stated that the system to be adopted is the overhead trolley with continuous current. The line is about 15 miles long and rises to a height of 6700 feet above sea level. The conversion to electrical working is being made largely with a view to fuel economy, since ample water power is available for the generation of electrical power.

The amateur theatricals of the Brooklyn Rapid Transit Company's employees held at the East New York clubhouse form the subject of an interesting article in the "New York Press" of Oct. 11.

TRAFFIC AND TRANSPORTATION ASSOCIATION—WEDNESDAY

President Allen in the chair, called for a discussion on the carrying of U. S. mail.

General Harries, of Washington, said he felt very strongly like congratulating Boston upon its philanthropy in dealing with the government.

In common with all railroads the post office administration desires to drive a good bargain with respect to mail service; to get an improved service for, if possible, a lesser amount than was expended on wagon service. In the post-office eye, steam and electric service were precisely alike. There was no distinction above a 20-mile line between an electric carrier and the steam carrier; and the only distinction below the 20-mile road was, that the electric carriers received even less than the steam.

There was but one mail car running in Washington and that was not operated by any of General Harries' companies.

Action by Congress would not be taken so long as companies could be found that would carry mail at the existing rates. The responsibility for the present situation was on the carrier who insisted on doing business without profit. The situation would never be bettered so long as companies accepted contracts that did not pay. There never could be any reason why the government should not pay as a customer.

Mr. Hippee said that his company, the Des Moines City Railway, carried U. S. mail in pouches, and also carried mail boxes on the cars. The mail carriers also were carried and the road was paid for all it did. The mail carriers' fare was at about the same rate that anybody else paid on the cars. The government bought transportation for them. A theoretical appropriation was made by the Postmaster every year, and when that was used up the postmen walked. The last Congress made an appropriation that paid for the mail boxes. Every car in Des Moines was equipped with two mail boxes, and carried and collected U. S. mail. It is taken from the cars at the main station by the government mail carriers. Pouch mail was carried to the sub-stations and to the East city. It was put on the cars by the representative of the post office department and taken off by the post office, and the company has an understanding with the postmaster that a car shall carry say three or four pouches, no more than that, thrown on the front platform, and on the road does not allow passengers to ride on the front platform. If there is an extra heavy lot of mail it is divided among the different cars.

Arthur Brady (Anderson, Ind.), said that his company (the Indiana Union Traction Company) had had no experience in the handling of mail on city lines; but that it had had a limited experience in handling mail on interurban lines.

He had found that if they extended the service, no matter whether the amount of mail carried was double and the responsibility was increased to that extent, yet they received nothing for the additional service that would be rendered.

D. A. Hegarty (Little Rock, Ark.) said his company handled mail from the depot to the post office in bulk. The only advantage he could see in handling U. S. mail was the protection given in the case of strikes.

Mr. Ross said that the Montreal Street Railway had had no experience with handling mail.

Mr. Hile, of Boston spoke as follows:

It would appear from what General Harries has said that the burden of proof falls on the Boston Elevated, from the fact that we are doing a great deal of business. In studying this subject, I was surprised at the general lack of unity in what ought to be done, and in the feeling towards this matter. There is a large amount of sentimental feeling as to its value, some, perhaps, in the benefit that would accrue to the community in doing something that benefits everybody, and a great many others on the advantage that might accrue in case of labor troubles. I rather observed that those who had labor troubles could see no value; those who had not, did think there might be some value, and my observation and conclusion was that that was absolutely a sentimental idea, and it perhaps was the fundamental idea that made the railroad go wrong in the start-off in this business. Now, as to what could be done: Taking our own case, our road has all along seriously thought—and it is a big institution in the community and undoubtedly means considerable disadvantage and incommoding of the people, and it is persistently hoped that we might be also able to have convinced the post office people that reasonable renumeration could be given by the government, and that the roads could continue to give this service, which is undoubtedly a great advantage to a community.

As brought out here, the carrying of the mail is considered in some cases an operation without any additional cost. That may be an accommodation to the community but, so long as the roads view that proposition as we are doing it, it is a help; but it is wrong—your business is to sell transportation, and there are a great many roads doing that which are entirely indifferent to the question. There again is where the railroads do not seem to get together and impress their feelings upon the post office people of what they have a right to have, and it seems to me there is a general lack of getting together in the investigations that are going on. I believe there is an investigation now under way on this subject of trying to get at what is reasonable compensation, and the problem will come up, I presume, at the next session of the legislature. All the reports in reply to my inquiries, which I went over, of the different railroads, gave me the impression that a large burden rests with the railroads to get together.

James Anderson, Sandwich, Windsor & Amherstburg Railway, speaking of conditions in Canada, said that the post office department was operated at a profit. In the United States the postal department was operated at a loss. The postal department in the United States was perhaps a little more economical than in Canada. He was perfectly satisfied that in Canada the postal department was prepared to pay a fair price for good service. His arrangement with the post office department was very satisfactory.

A. L. Eastman then read the report of the committee on Freight and Express. The report was supplemented, before the discussion, by a paper entitled: "Progress to Date in Carrying Freight and Express Matter by Electric Roads—Some Mistakes That Have Been Made, and Their Remedy," by C. V. Wood. As Mr. Wood had been called away from the convention, the report was read by G. W. Parker.

[This paper is printed elsewhere in this issue.—Eds.]

The president called for a discussion on the subject of Freight and Express. E. H. Hyman, Cleveland, thought that the question of freight and express was entirely one of local conditions, depending wholly upon the territory through which the electric line ran. Advocates of express business had always maintained that there is no money in the freight business; that the rates were too low and that the roads had to carry too much tonnage to make any money. Exponents of the freight situation, on the other hand, said that although the express rates were high, that the delivery service was expensive, and that the delivery service itself ate up a great deal of the price. Mr. Hyman felt that either the freight or the express business, but not both, could be made to earn money.

He thought that a line running through a very populous territory with large cities for terminals, or that served a territory that had a large number of manufacturing towns

along the road, should have an exclusive express business with a delivery. The express rate in most cases is about 300 per cent higher than the freight rate, and when one got that rate he could certainly afford to pay a little more for the wagon service in order to get the increased rate.

The main thing, after deciding whether the business was freight or express, was to charge against earnings of either freight or express the actual expenses incurred in carrying that freight or express. For some years past very few roads had charged any of the legitimate expenses—or very few of them—against the earnings. There ought to be separate vouchers or a separate company, so that the owners might know just exactly what the earnings were. Until that was done, it would be a serious question whether any of the roads would know if they were making money.

Mr. Hyman thought that a road that operated freight would find it very advantageous to enter into a contract with some old line express company on a percentage basis of the gross receipts for carrying express.

An old line express company, operating on a line, would not conflict with freight carried at the same rate as by steam railroads. If a contract is entered into with old line express companies, he suggested that a minimum amount per year or per month be inserted into the contract. There is usually no objection, in fact it is often an advantage, to make a contract with an old line express company for carrying on a tonnage basis the shipments on that line—prohibiting the express company, however, from doing any local business which would conflict with the package freight business. There is an agreement among express companies dividing the business at the point of origin. The business they obtain for 10,000 or 15,000 offices through the contract with the electric line more than repays them for the amounts they pay out.

B. E. Wilson (Rochester Railway Company) said that in general the basis of rates or the arrangement by which an electric company should handle express is entirely local. If a road has terminal facilities such that it can handle car load lots; if it has sidings that will hold trains of four and five cars, then only car load business is practicable, and should be figured on; but where a road has only short sidings and is not allowed to move ordinary box cars into a city, it is out of the question to consider car load business. The Rochester & Eastern Rapid Railway, and the Rochester & Sodus Bay Rapid Railway do not do any strictly freight business. Their business is divided into Class A and Class B express. Class A includes pick up and delivery in Rochester and outlying villages; Class B is equivalent to the ordinary straight freight of other companies. Rates are considerably higher than the parallel steam road rates to the same stations. There is a demand on the part of the merchants in the towns reached by these electric lines, however, to patronize the trolley roads, for the reason that they can get quicker service by express, and they are willing to pay a higher rate for that service. The Rochester & Eastern Rapid Railway formerly handled foreign cars at two interchange stations. Some time ago it withdrew from that business, because the company did not wish to be under the jurisdiction of the Interstate Commerce Commission.

H. A. Nicholl (Indiana Union Traction Company), said that the recommendations made in the report of the Committee on Freight and Express coincided closely with his ideas and resembled the methods adopted on his line. The company handles general merchandise in less than carload lots and in very few instances handled carloads of horses, live stock, etc. All of the freight cars are operated as extra trains. No attempt is made to schedule these trains. Most of the freight trains are operated at night so as to avoid congestion of the road during the business hours of the day. At the larger terminals the company has its own freight houses, with ample side tracks in charge of salaried freight agents; at the smaller stations the freight and passenger business were handled jointly. The freight department is well organized, with a general freight agent and two division freight agents. These men not only solicit business, but take care of the filing of tariffs and have general oversight over the whole freight business. There is no interchange of freight with the steam roads, but such interchange is made with electric roads, and in some instances through trains are operated over other electric lines. The earnings per car per day average about $60. The freight business represents 8 per cent of the gross receipts. To the freight account is charged about every conceivable expense that is thought to belong to the freight department. The company operates also what is termed a merchants' dispatch, which resembles the express business on most lines. For this service the charge is one and one-half times the first-class freight rate. No delivery business is done. It was felt that the express business can be operated jointly with the freight traffic. One does not interfere with the other in the least, as all the express is handled from passenger cars. A proper contract with an old line express company might be more profitable than the direct handling of the express matter, but such a contract would have to be made according to conditions that could be negotiated with the express companies, and he did not know whether it would be better to handle express in this way on the basis of percentage of receipts or by tonnage.

Mr. Hile asked whether in charging against the freight account a percentage on the power plant investment was included.

Mr. Nicholl said the cost of the power was charged, not the cost of the investment.

P. P. Crafts (Iowa & Illinois Railway), said that his company has a contract with the American Express Company on a tonnage basis, to haul all of the express originating on the Chicago & Northwestern Railway and billed via Clinton through to Davenport, Rock Island and Moline, but the American Express Company is not permitted to do any local business between the terminals of the electric road. A compensation of 20 cents per hundred pounds carried is paid. He would not advise any road having the same conditions to enter into a contract of that character again, because the railway company does not receive sufficient compensation for handling such articles as are carried in the messengers' safes, nor for currency handled. The express companies usually get a very high rate for such commodities. He thought a percentage rate would be more satisfactory. There is one feature in keeping the old line express company from doing local business over the electric lines that he is trying to eliminate. If an American Express driver calls at some place in Davenport to receive a package for New York City, there may be also a package at that place for Clinton. The driver cannot accept that package for Clinton and the shipper may refuse to send either package by the American Express Company. He is now endeavoring to make an arrangement with the American Express Company by which it will be permitted to handle local shipments to any point on the I. & I., but must pay the same rate as is received for any other haul of the same mileage. His freight rates are based on the Iowa distance tariff and classifications.

His company handles about 3 to 3½ car loads of l. c. l.

freight per day, about 50 per cent. of which is local, the balance being through shipments, which go West on the Chicago & Northwestern from Clinton. It has no carload lot interchange arrangement with the steam road and has always received a rebuff whenever that matter has been brought up. The electric road can give a quicker delivery than any other road out of Davenport to points on the Northwestern, and much of its tonnage is secured on the basis of time alone. On l. c. l. interline freight the electric road receives 80 per cent. of the whole rate to points within the State and straight division of through local rates to points outside the State. This is a very profitable business, earning, with the American Express income, nearly $20,000 per year. Deducting from that all operating expenses, charging in power, track maintenance, car maintenance, and 3 per cent. of the gross freight earnings for accidents and damages; and also including a proportion which is paid to the city railway company for the privilege of operating over its tracks: the net income is $9,500.

To accomodate a shipper who is in a hurry, his company takes whatever can be handled on any passenger coach. Each motor coach has a small baggage room about 6 ft. long, but baggage invariably takes precedence even over American Express matter. The motor handles all of the local business, pick up and delivery. A trailer car attached to a passenger coach, handles nothing but through business. He believed, in conclusion, that any line built on a private right of way, which has a profitable passenger business, can operate a freight business or an express business at a profit.

J. H. Pardee (J. G. White & Co., New York City), referred to a point brought out in the report of the committee on freight and express of the Street Railway Association of the State of New York, that it was absolutely impossible to obtain a uniform rate all over even one State which would be fair and equitable to all.

W. G. Ross (Montreal Street Railway) asked for information on restrictions which cities place on handling freight, and whether any companies pay a tax or percentage on their earnings?

G. W. Parker (Detroit United) explained the conditions in Detroit, which are very peculiar. When the present system of rates was inaugurated in Detroit, an ordinance was enacted for the operation of cars in and out of the city which required (1) that no cars other than those similar to passenger cars can be operated; (2) that cars cannot be operated going in the same direction, excepting one every two hours; (3) for every car running into and out of Detroit, the company is compelled to pay a tax of 50 cents or $1 per car per round trip. The two-hour schedule requirement is up to 8 o'clock p.m., after which time cars can be operated at any interval. The fine for violating the ordinance is $250 for each offence.

Mr. Potter (Seattle Electric Railway Company) described the operation of cars between Seatle and Tacoma. Under the ruling of the State authorities this line is the same as a steam road, and the tariffs and the regulations are identically the same as for steam roads. In Seattle, which is distinctly a city system, his company operates individual freight cars. Certain commodities classified as first, second, third and fourth class, are handled under a varying tariff from station to station. The company does not do any delivery. Freight is delivered to it at terminals; and it is delivered at terminals or at stations or platforms along the line which the shippers provide. It also does considerable car load business between 7 p.m. and 6 a.m. In addition to that it does a switching service from the yards of the various steam lines entering Seattle to sidings which are provided by the shipper. That is done at a nominal price per car. The argument advanced at the beginning of the discussion is particularly applicable in the case of this company. The rates received are wholly determined by the peculiar conditions in Seattle. Express business, that is, receiving the goods of the consignee and delivering them to the consignor has not been entered into. The policy has been to encourage every one to bring the goods to the terminals.

"THE POSSIBILITIES OF A WELL CONDUCTED PUBLICITY DEPARTMENT"

A. W. Warnock (Twin City Rapid Transit Company) opened the discussion on "The Possibilities of a Well Conducted Publicity Department," referring to the relations of electric street and interurban railways to the public press. He thought that too much emphasis cannot be placed on the need for cordial relations to be established between public service corporations and the daily press. The clamor for cheap rates is in the air; the muck-raker is abroad. The muck-raker is only the illegitimate child of the "public-be-damned" policy. That policy is not common today. The newspaper men, too often, have been abused or have been patronized; there has been too much evasion of facts. The spirit of today is to be perfectly frank and confidential. Too much stress cannot be laid upon the point that the most friendly relations should always be established with the press.

The man to represent the company in dealing with the press should be constituted to properly represent his company as far as the press is concerned, should be a man of character, a man of ability and a man of diplomacy. Such men do not come to the office and fill out application blanks. They are men who can enjoy and who get good salaries. They are not in the motormen class; and usually they have come from a long training in the newspaper field. A newspaper man has a supreme contempt for a snob, and very little respect for the so-called great man. He does not tremble in his shoes before a millionaire any more than he trembles in his shoes before the beggar on the street. He is usually a good judge of people. The inclination has been in the past to patronize the reporter. The publicity man cannot patronize him today, or think he can be bought off with a five-cent cigar.

A publicity man should be an editorial agent. The average operating man does not know the value of words. The average newspaper man handles words the way a carpenter handles nails.

Charles E. Flagg of the department of publicity of the Inland Empire System of Spokane, then read the first paper on the subject of Publicity. This will be found in another column. He was followed by J. H. Pardee, who read the paper prepared by B. R. Stephens, general traffic manager, Illinois Traction System.

Vice-President Warnock, then announced that the other papers on the program would be read Thursday morning beginning at 9.30 o'clock.

The appointment of a nominating committee, consisting of R. E. Hunt (Chairman), Utah Light & Railway Co., Salt Lake City, Utah; C. D. Emmons, Fort Wayne & Wabash Valley Railway Co., Fort Wayne, Indiana; R. E. Danforth, Public Service Railway Co., Newark, N. J., was announced, after which the meeting adjourned until Thursday morning at 9.30.

ORGANIZATION OF THE ACCOUNTING DEPARTMENT OF AN ELECTRIC RAILWAY AND LIGHT COMPANY*

BY A. R. PATTERSON, AUDITING DEPARTMENT, STONE & WEBSTER MANAGEMENT ASSOCIATION, BOSTON, MASS.

Through my connection with the auditing department of the Stone & Webster Management Association, an association which has the general management of electric light, power and railway companies of varying sizes, in different parts of the country, it has been possible for me to choose, for the purposes of this paper, a company which, in my judgment, reflects the requirements of the greatest number.

A brief outline of the company to be treated with is as follows:

Annual gross earnings, railway department	$450,000.00
Annual gross earnings, light and power department	350,000.00
Total annual gross earnings	$800,000.00
Population served	70,000
Miles of single track	65
Cars operated	45
Light and power customers	4,000
Number of employees	300
Length of time company has operated	10 years

The man in active charge of the acounting department is herein given the title of assistant treasurer, in recognition of the fact that the treasurer is usually a man of larger responsibilities in the financial world, and in addition to his interest in the railway and light company, is probably identified with other enterprises in the city, and, therefore, can give little time to detail work. With this explanation, the following plan of organization is submitted, the figures representing the monthly rate of salary:

Assistant treasurer	$200.00
Chief clerk	100.00
Storekeeper	75.00
Storeroom porter	45.00
Line order and billing clerk, light and power department	75.00
Customers' ledger clerk, light and power department.	75.00
Two collectors, light and power department:	
One at	75.00
One at	65.00
Voucher and payroll clerk	70.00
Two meter readers, each	65.00
Cashier, light and power department	65.00
Conductors' trip-sheet clerk	80.00
Railway cashier	65.00
Car register reader, etc	60.00
Transfer and ticket checker	30.00
Stenographer	55.00
Office boy	15.00

A summary of the above office force will give a total payroll of $1,289 a month, a trifle under 2 per cent of the gross earnings.

Having given titles to the various office employees, it is now in order to describe the principal work allotted to each one.

ASSISTANT TREASURER

A salary of $200 per month should attract a man whose make-up should include the following qualifications; Integrity, respectability, cordiality, ability to intelligently open up or close a general set of books, especially in connection with a consolidation or reorganization of companies; impartial treatment of capable clerks and a desire to apply civil service rules, encouraging each clerk, in a proper way, to learn the work of the man next above him. To do this, the assistant treasurer must educate each man to voluntarily come to him for other work when his regular duties are done, and each clerk should be made to see the advantage to be gained by gladly undertaking any line of work which he may be asked to do, whether his regular work may be finished or not.

Such an assistant treasurer should command the respect of all, especially the general manager. Hearty co-operation between these officials is frequently the means of bringing about increases in earnings and reductions in expenditures. Conferences entered into, in the right spirit, between the general manager and the assistant treasurer become a habit. Then it is easy to arrange for conferences at stated periods, say twice each week, or more frequently, if necessary. At such times the assistant treasurer will give the results of his studies along the following principal lines:

Comparison of daily analysis of railway earnings. This will sometimes furnish a barometer indicating a leakage on certain routes to which two or more conductors are assigned. Sometimes, through a transfer of men on a certain run, a new man turns in each day several dollars more than the old man, or possibly several dollars less. The comparison is of interest either way.

In the customers' ledger it may be noticed that certain large light or power customers show decreases in their monthly charge. This may be attributable to meters running slow.

In the miscellaneous accounts receivable ledger it may be noted that no bill has been made against the junk man for two or three months. Possibly the scrap copper, brass, etc., may have got into the wrong channel.

An examination of supplies issued or returned slips may reveal the fact that too many car brasses are being used, or that linemen are taking out a supply of copper wire and not accounting for the unused portion.

In approving vouchers, the attached invoices may suggest extravagant methods of purchasing, either through buying at exorbitant prices, or in quantities too large or too small. The assistant treasurer should realize, possibly more than any official, that his approval is not a mere formality; neither should prior approvals relieve him of his sense of responsibility. His signature in his official capacity means dollars to the company, even though checks and vouchers require a countersignature.

The right assistant treasurer can, without assuming a disagreeable manner, question the merit of any bill which may have been approved for payment by the general manager.

A study of the cash book and careful estimate of the receipts and expenditures may indicate that there will not be enough money on hand two or three months hence to meet bond interest, a dividend or a note if the company's resources are not carefully handled. Vouchers should be paid, not with the simple idea of getting them out of the way, but with the philosophy of taking the full length of credit due the company. After considering those involving a cash discount, those ranging from $10 to $50 each can be disposed of. The comparative few that are left can be given more mature consideration.

The assistant treasurer can also make himself more valuable to the general manager by closely following the monthly results of operation. To do this it is essential that he should make the postings to the general ledger. He should also prepare the first copy of the monthly financial

*Paper read before the American Street and Interurban Railway Accountants' Association, Atlantic City, N. J., October 12, 13, 14, 15 and 16, 1908.

report. This monthly report should show, among other things, the following:

Earnings and expenses, monthly and cumulative, current year and previous year, segregated according to standard classification.

Balance sheet, current month and previous month.

Condensed statement of cash receipts and disbursements.

Detail of suspense and accrual accounts.

Brief remarks relating to abnormal increases and decreases in earnings and expenses.

Detail, by requisition number, of charges to property account. (No charges may be made to property account unless supported by an approved requisition, authorizing the expenditure.

The finished preliminary report furnishes food for thought for both the assistant treasurer and the general manager, and after the general manager has listened to the assistant treasurer's intelligent explanations of increases and decreases in the various accounts, he is encouraged to talk about the interesting events which have ocurred in the operating department for the month.

The conference ends with the two officials made mentally stronger and of greater value to the company, through this mutual exchange of knowledge.

Before leaving the subject of financial report it might be well to state that with the information suggested above, the financial report has all the elements of a trial balance, and the assistant treasurer can determine from the figures which he has entered upon it whether or not his general ledger is in balance. The accounts in the general ledger, incidentally, should be opened up practically in the same order as they appear in the financial report.

It seems more logical, in treating with the other members of the force, to recognize the work from its inception to its completion, and with that idea in mind we will take up, first, the

LINE ORDER AND BILLING CLERK, LIGHT AND POWER

The principal duties of this clerk are as follows:

Daily recording, on customers' cards, of "cut-in" and "cut-out" advices received from the contract department.

The advices should be progressively numbered in two series, one for "cut-ins" and the other for "cut-outs," in order that missing advices may be readily located.

The customers' cards should be of different colors to represent the various classes of service; such as power, light, fans, etc., and so ruled as to provide for the following information: Customer's name and address; ledger reference number; type of meter, with adequate space for dates of, say, six possible changes of meters. The remaining space is allotted to cumulative monthly readings, net readings, rate and gross amount of bill for a period of 12 months. The back of the card may be printed in a similar manner, thus giving a life of two years.

This clerk also enters, on these same cards, meter readings received from the meter readers and the consequent computations representing the charge against the customer.

It may be well to state that another set of cards is on file in the contract department, giving such information as connected load, class of business, date of "cut-in," life of contract, etc.

The balance of the line-order clerk's time, under normal conditions, is devoted to the making of customers' bills.

METER READERS

The title is self-explanatory, and with the daily reading system, two men would be occupied with 4000 customers.

We are experimenting in one of our gas companies with a patent system for the reading of meters, arranged by the Albree Self-Figuring System Company, of Boston, Mass., whose business it is to eliminate detail figuring and recopying of figures in mills, factories, etc., obtaining immediate results by the punching of patented cards, etc.

The system, as arranged, consists of a meter card which records the various readings of the meter in connection with a folded bill made up of three parts; the bill proper, the cashier's coupon and the auditor's coupon. The bill and the meter card are addressed by machine. The meter card is placed in a certain position on the bill and a hole punched on a number corresponging to the reading of the meter. The punch is provided with a small battery lamp. The auditor's coupon is then detached and returned, with the meter card, to the office for record and information, where it is possible to arrange it into a card-ledger system.

The charge for electricity or gas used, and also the charge less the cash discount, and the number of kilowatts or number of feet consumed having been automatically figured and recorded on the bill, it is handed to the consumer.

One man has read in one day 200 gas meters, and, in addition, collected 25 per cent of these bills.

By this system the bill reaches the consumer at the time of the meter reading; it saves all copying of readings; it figures the amounts and saves all expense in the delivery of bill to consumer.

This is simply an outline. The Albree Company would undoubtedly be pleased to answer letters from interested parties asking for full details.

CUSTOMERS' LEDGER CLERK

The 4000 customers are taken care of in two bound ledgers, with sufficient capacity to take care of development during the life of, say, 18 months. Each page is ruled for 30 customers, and so interleaved as to cover a period of 18 months. Columns are provided for power, light, cash payments, rebates, etc.

The ledger clerk makes the original entry from the customer's bill, which has been figured twice. The entry is then checked against the entry made by the line-order clerk on the customer's card.

This clerk is also responsible for keeping the customers' ledgers in balance with the balance account in the general ledger. For this purpose a recapitulation book, made from spare leaves provided for at the time of ordering the ledgers, is used for taking off ledger page totals each month to obviate the necessity of cumulative totals in the ledgers.

The rest of the ledger clerk's time is spent each month in preparing a delinquent list and in studying the condition of all unpaid accounts.

It is a good plan to arrange for opening up new ledgers at some time other than the close of the fiscal or calendar year, in order that the task of transferring may not come with a congestion of other work. Of course, by the use of loose-leaf ledgers the work of transferring is materially reduced. There are many advantages in connection with loose-leaf ledgers, and some disadvantages. For the purpose of this article, however, the bound book was selected.

CASHIER, LIGHTING DEPARTMENT

Having selected for this important position a person with the necessary qualifications, such as integrity, courtesy, etc., it is well to have him fully understand that the company is charging for something which it has really delivered to the customer. From some points of view current

is so intangible that an inexperienced cashier is ready to agree with a customer when he tells him the bill is not right, as the method of preparing it is as much of a myth to him as it is to the customer. If the cashier can only understand that current equals plant investment plus salaries, labor and material, he is better equipped to handle the average minor complaints which are brought to him. The more serious cases should be referred to the contract department for adjustment.

For this reason it is wise to have the cashier's cage near the contract department and away from the rest of the office force, and on the street floor, if possible.

The cashier records his collections in a subsidiary cash book, properly ruled to show cash received and discounts allowed, the daily totals being transferred to the general cash book. Rebates and discounts other than for prompt payment should be recorded in a separate book, the reasons for the allowance being entered against each item. The journal entry at the close of the month can be more intelligently approved if it is supported by such a record.

The cashier should have some spare time, which can be devoted to odd jobs, such as figuring payrolls, invoices, etc.

COLLECTORS

Light Department.—The assistant treasurer, with the aid of his delinquent list, can map out each day the more important calls to be made by the collectors the following day. The collectors should be required to make a notation against each item on these lists furnished them by the assistant treasurer, concerning the attitude of the delinquents in the event of non-collection.

The collector will be given to understand that he must use his own good jurgment in his daily work: that is, if he feels that he can collect an account not on the list he should understand that he has the authority to do it, providing it does not conflict with the work of another employee.

Meter Department.—The employees of this department were not included in this organization as they report to the operating department. There is a close relation to the accounting department, however, due to the fact that the meter department keeps the meter history cards which describe the style, size, constant, company number, date of last test and location of every meter owned by the company. These cards should be accessible at all times to the assistant treasurer, in order that he may compare with his own records, to verify constants, etc., and to see that meter tests are made with reasonable frequency, especially in connection with large power customers. In line with this check there should also be considered the advisability of a yearly check of the company's connected load; the result to be compared with the customers' cards, that reasonable assurance may be had that all parties connected to the company's lines are being charged for the current used.

CASHIER, RAILWAY DEPARTMENT

This man is stationed at the car barn and acts in the dual capacity of cashier and night barn foreman.

The conductors turn in their cash collections to this man, together with a deposit slip. The money is counted and checked against the deposit slip, in the conductor's presence.

During the quieter hours of the night the cashier prepares a statement of his receipts and also gets the cash into shape for bank deposit. Everything is enclosed in a locked box and taken to the assistant treasurer each morning, together with another locked box containing trip sheets and transfers. The cashier does not have access to the trip sheets.

TRIP-SHEET CLERK

The first work of this clerk each day consists of a superficial examination of the trip sheets and the preparation of a statement showing the cash collections. This statement is referred to the assistant treasurer, who compares it with the statement turned in by the railway cashier. The differences are pointed out to the trip-sheet clerk who adjusts, through the medium of an over and short fund. These adjustments are the basis of the first entries on the daily over and short report.

The railway cash is now ready for deposit, together with the lighting department collections for the previous day. The daily deposit, as reflected by the bank passbook, should be in agreement with the total collections as shown by the general cash book. To accomplish this the assistant treasurer should have a petty cash fund of from $200 to $500 for the payment of trivial charges against the company. Invoices in excess of $2 or $3 should be paid by check.

After the bank deposit has been made, the trip-sheet clerk makes a complete audit of the trip sheets, recording differences on the over-and-short report and notifying all conductors affected concerning their errors. Daily adjustments by conductors should be insisted upon.

This clerk spends the balance of the day in preparing the analysis of railway earnings and the condensed daily report of earnings in comparison with the same day of the previous year. He also tabulates car mileage statistics, etc.

TICKET AND TRANSFER CLERK

The work of counting and checking transfers is all done by one girl, except at times when a complete check of transfers is made.

REGISTER READER

This man is located at the barn and prepares the daily list of register readings, and counts and lists the number of envelopes containing transfers deposited each half trip by the conductors in the car boxes. He also does some work for the operating department.

The revenue branch of this organization seems fairly busy, and we, therefore, can give attention to the disbursing and general branch.

STOREKEEPER AND ASSISTANT

In an organization diagram covering the whole company there would be lines from the accounting department to the purchasing agent and store keeper, but the accounting department does not have jurisdiction over the purchasing department, and sometimes no authority over the storekeeper. The advantages of giving the accounting department authority over the storekeeper outweigh the objections. The storekeeper, by one interpretation, is a cashier who receives and issues converted dollars, and the assistant treasurer cannot be said to hold a good receipt for the expenditure until he gets a supply issue receipt, properly signed, stating that the material has been used in operation or construction.

So much difficulty has been experienced in attempting to keep a proper record of supplies on hand that some officials have concluded that it is absolutely necessary to install an elaborate system of accounting. Really the chief aim is to have a systematic and conscientious man in charge of the supplies, to whom the necessity of having a well-arranged storeroom will appeal. A storeroom equipped with shelves

and bins for the reception of the several classes of supplies is one requirement, and it should be the duty of the storekeeper to certify all invoices for material received by him. The invoices should be stamped "Charge Stock, Approval No.....08." The invoices are then returned to the accounting department and after the necessary approvals have been secured, are passed through the voucher register to the debit of supplies.

At the close of the month the storekeeper should forward a statement to the assistant treasurer, giving the approval numbers, names and amounts of all bills assumed by him, in order that the same may be checked, to determine whether or not all bills have been received which have been thus approved. He will then be given credit for the amounts of the numerous requisitions which he has honored from day to day, based on the invoice prices as shown by his price-list and the difference between the aggregate amount of the invoices and the requisitions should approximately represent the value of supplies on hand.

In order that there may be no great disparity between the book value and the actual value of material on hand, periodical inventories, superintended by the assistant treasurer, should be made.

If it does not seem wise to refer the invoices to the storekeeper, a special blank could be substituted for his use and the pricing done in the accounting department.

It is rare to find a man capable of issuing supplies in a thoroughly intelligent manner and at the same time competent to keep a complicated system of stock accounts. If a storekeepr is capable and anxious to adopt an accounting system it might be advisable to allow him to do it, but under ordinary circumstances the accounting system, such as cards, should be limited to a few classes of material.

VOUCHER AND PAYROLL CLERK

This man makes up and classifies all the vouchers from information appearing on the invoices. (The company would average about 150 vouchers each month.)

He also prepares and later classifies the payrolls for all employees, excepting the general-office payroll, and devotes the balance of his time to classifying stock issue and return slips which are turned in by the storekeeper.

STENOGRAPHER

Letter writing, filing correspondence, statement work and balance of time on clerical work.

OFFICE BOY

Setting up names and addresses on addressing machine for customers' bills, running errands and other duties of this general nature.

CHIEF CLERK

The chief clerk has been mentioned practically last, as the work of all subordinates is referred to him, and having been passed upon by him is, in turn, submitted to the assistant treasurer for final disposition.

This man should, of course, have a complete knowledge of the detail work of the office and spend a good deal of his time in keeping in touch with the work of every man in the department, lending a hand where necessary and seeing that each day takes care of its fair share of the month's work, rather than postponing such things as classification of stock slips until the last of the month, when time is sorely needed in closing the accounts for the month.

The chief clerk should keep the general cash book, voucher register, miscellaneous accounts receivable ledger, subsidiary construction ledger, and all miscellaneous journal entries.

In connection with journal entries, it might be said that a good deal of work can be saved and uniformly secured, by the preparing of a blanket journal entry covering all the stereotyped entries for the month, such as gross earnings, bond interest, taxes, etc. The draft of this entry could be made by the stenographer, who would make four or more copies at one operation, thus furnishing material for as many months. Journal entries prepared on the typewriter usually contain more information than those written in longhand.

The chief clerk should be a man with a sufficient ambition, and should be given the opportunity to fit himself for the position of assistant treasurer.

This sems to be a fairly complete summary of the principal work to be cared for by an acounting department of a combined railway and light company.

It is, of course, understood that practically all of the men mentioned should be bonded and their work subject to a periodical examination by an outside auditor.

CONVENTION PROGRAM FOR TO-DAY

Transportation and Traffic Association

(GREEK TEMPLE)

9:30 A. M. to 12:30 P. M.

Paper—"The Operation of Multiple Car Trains on Interurban Roads," by D. F. Carver, Receiver, Trenton & New Brunswick Railroad Co., Trenton, N. J.
Report of Committee on Passenger Traffic.
Report of Committee on Rules for City Operation.
General Business.
Report of Nominating Committee.
Election of Officers.
Installation of Officers.
Adjournment.

Accountants' Association

(AQUARIUM COURT HALL)

9:30 A. M. to 12:30 P. M.

Paper—"Interline Accounting of Interurban Railways," by W. H. Forse, Jr., Secretary and Treasurer, Indiana Union Traction Company, Anderson, Ind.
Paper—"Accounting Methods of a Holding Company," by P. S. Young, Comptroller, Public Service Railway Company, Newark, N. J.
Report of Committee on "Standard Classification of Accounts and Form of Report."
Report of Committee on "International Standard Form of Report."
Appointment of Nominating Committee.

Engineering Association

9:30 A. M. to 12:30 P. M.

Inspection of Exhibits.

2:00 P. M. to 5:00 P. M.

Inspection of Exhibits.

American Association

(GREEK TEMPLE)

2:00 P. M. to 5:00 P. M. (Executive Session.)

Reports of Committees.
(a) Insurance.
(b) Welfare of Employees.
(c) Municipal Ownership and Public Relations.
(d) Nominations.
Election of Officers.
Installation of Officers.
Resolutions.
Unfinished Business.
Adjournment.

PROGRESS TO DATE IN CARRYING FREIGHT AND EXPRESS MATTER BY ELECTRIC ROADS—SOME MISTAKES THAT HAVE BEEN MADE AND THEIR REMEDY*

BY C. V. WOOD, GENERAL FREIGHT AND PASSENGER AGENT, NEW ENGLAND INVESTMENT & SECURITY CO., BOSTON, MASS.

The electric railways have now before them the problem of meeting a demand for transportation facilities, which is simply one more step toward the advancement of civilization and the creation of increased facilities, an object that is ever present in some form or other.

Some years ago the street railways answered this call in a feeble way, and we note its growth from the carriage of a small parcel of merchandise handed on to a car and thrown off at some house or store, as verbally directed by the sender, to the various and variegated methods of the present time, some of which are very good, others ill-conceived and badly executed.

THE TON MILE

No one can deny the lack of uniform action and unity of purpose in this line. Some of the roads follow steam railroad freight practice, simply warehouse receipt and delivery; others, the system of old-line express companies, entailing horse and wagon pick-up and delivery; while in many cases there is a mixture of both plans operated on the same line. Owing to the method of accounting, it is difficult to analyze and arrive at an intelligent understanding of comparisons between different lines, the average gross earnings per car mile ranging from a ridiculously low figure to one abnormally high. Right here we should consider the value of the car mile as a unit of operating earnings and expenses. This is something that is subject to a great variey of modifying conditions, greatly limiting its usefulness. Except for some few items of information we could abolish it as the unit. The capacity of cars used on some roads is totally unlike that of those used on others; in fact, few lines operate all cars of one standard; hence there can be practically nothing in common as between the car of one type and that of another. The ton mile unit, meaning one ton of freight moved one mile, is one that is probably as staple and uniform as anything we can use for the unit of freight transportation. This unit, however, requires close study and analysis to enable us to arrive at an intelligent understanding of results.

COST

In the cost of freight transportation, the terminal handling being a fixed expense to the ton, it will apply as a decreasing expense to the ton mile, with each added mile of haul. Only so long as the volume of business remains the same can we estimate what proportion of the haul affects the expense values to the average ton mile. This terminal expense per ton mile will range from 5 to 50 per cent of the direct cost of moving a ton of freight one mile, in accordance with the length of haul. The cost for labor in handling merchandise and parcel freight is from 7 cents to 40 cents per ton, according to the conditions of labor, facilities, etc.

The question is often raised as to the possibilities of an electric line handling freight in an expensive car, with a train crew of two men to each car, constituting a train unit of one car, as against steam roads with a train unit of 25 to 50 cars, each of which represents a much smaller investment than the electric car. In considering this phase of the question we should not overlook the fact that the steam railroad figures are given as a whole based on all the commodities handled, and that a certain proportion of their freight is high class, taking a rate much higher than that of the low class commodities, varying, of course, with the territory in which operated.

Taking as extreme examples, let us refer to the annual report of a steam railroad 600 miles in length in the Middle West; also one in the Eastern States, which shows as follows:

	WESTERN Per cent	EASTERN Per cent
Products of agriculture	2.42	6.50
Products of animals	0.33	1.00
Products of mines	70.36	2.30
Products of forests	1.90	10.00
Manufacturers	18.77	19.50
Merchandise	6.22	60.50

The Western grain carrying railroads will, of course, make an entirely different showing.

The first mentioned line operated in a zone of unusually low prevailing rates, the average revenue received for each ton handled being 50 cents, and per ton mile, 5 mills; the second, $1.29 for each ton handled and 1½ cents per ton mile. At first glance one would say that, inasmuch as the first territory produced in comparison such a small percentage of commodities other than mine products, there would be no necessity or call for electric railway express and freight transportation. As a matter of fact, it is quite to the contrary, because it matters not so much what the local industries are, wherever man's activities create a business of any considerable volume the people are there to be fed, clothed and housed and their transportation needs are ever present. Electric railway carriage not only affects the present rail carriage, but goes still further in the opening of new territory heretofore not having access to modern means of transportation, replacing ancient horse and wagon haulage, which in importance can fairly be compared to the substitution of rail transportation for stage.

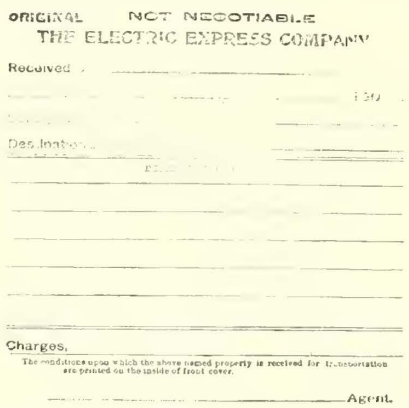
Bulletin No. 49 issued by the United States Department of Agriculture, showing the cost of hauling farm products to shipping points, gives a summary for the United States with the averages for 23 products ranging from 15 to 31 cents per ton mile.

A large percentage of this cost could be saved to the farmer by electric haulage, and still leave ample profit on the transaction. Wherever this new high-speed, motor-driven tool of business has been put into systematic use, the wholesalers and retailers have not been slow in adjusting their business to the new conditions.

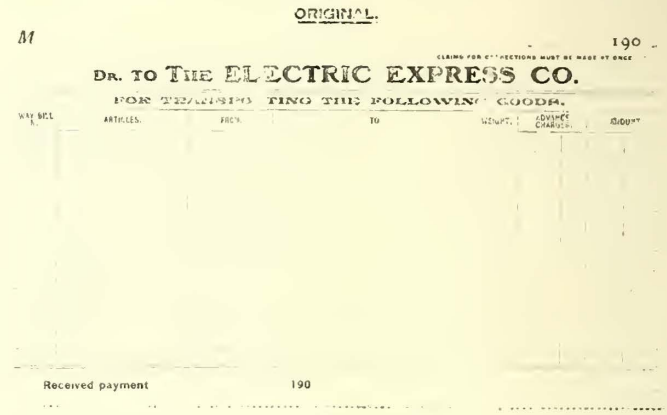
The lack of general interest and study on the part of financiers, as well as executive and general officers of street railways, is to be wondered at, in view of the great future before them. This, I would say, is the first of some mistakes that have been made. It has appeared to some to be an entirely new thing, impossible of analysis, with no beaten trail to follow, when, as a matter of fact, it is only a changed condition confronting us—another necessity to be supplied and an extended facility demanded. Some of the railways have recognized this, and have met the demand in the organization of a service which has been put upon a remunerative basis. I will venture to say that in each case where this has been done with due diligence and intelli-

*Read before the American Street and Interurban Railway Transportation and Traffic Association, Atlantic City, N. J., October 12, 13, 14, 15 and 16, 1908.

gently modeled, in so far as is possible, on the system of older transportation companies, not only is a satisfactory business now being done, but the prospects for the future are bright. On the other hand, companies which have just permitted or suffered this kind of traffic cannot see anything in it. Imagine, if you can, one of our large commercial industries placing a certain line of their manufactured product in the hands of their employees, with the understanding that in case of an occasional demand for that particular article they were to dispose of it at a guess


ORIGINAL NOT NEGOTIABLE
THE ELECTRIC EXPRESS COMPANY
Received
Destination
Charges,
Agent.

Progress in Carrying Freight—Form No. 1, Shipping Receipt

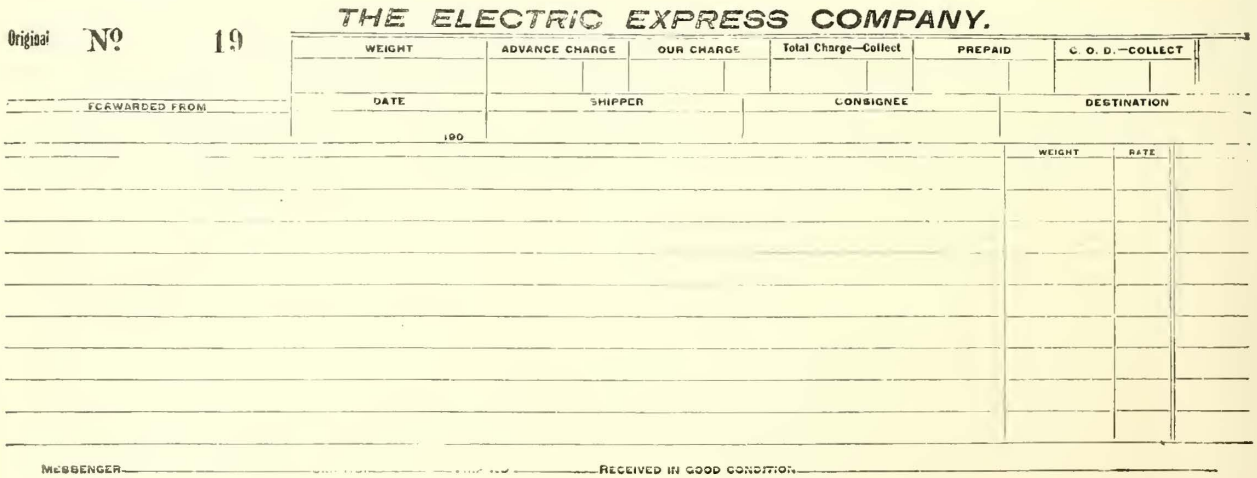

ORIGINAL.
190
Dr. to The ELECTRIC EXPRESS CO.
FOR TRANSPORTING THE FOLLOWING GOODS.
ARTICLES. FROM TO WEIGHT. ADVANCE CHARGES. AMOUNT
Received payment 190

Progress in Carrying Freight—Form No. 3, Express Bill as Rendered

rate, and ring it up on the register irrespective of the cost of manufacture, or what the commodity would bear. This is just what some of us have been doing and still contemplate continuing.

Electric railways were conceived and constructed primarily for the handling of passenger business, but this is no reason why it should continue. It is often said that electric lines are not in a position to handle a large amount of freight business. This is true, if we use as a comparison the freight ratio of steam roads. However, we need never

to stimulate trade, as well as being generally remunerative to the carrier. We must not lose sight of the fact that the electric railways have already made their initial investment. The first thought is that every use served should be charged at once with an equal proportion of all the outlay, however remote. In securing this new traffic we must in a sense go on the theory that every ton of freight hauled is so much money earned. Paradoxical as it may seem, this is largely true. Some of the money was spent long before the transaction. We have but to reimburse our-


Original No. 19
THE ELECTRIC EXPRESS COMPANY.
WEIGHT ADVANCE CHARGE OUR CHARGE Total Charge—Collect PREPAID C. O. D.—COLLECT
FORWARDED FROM DATE 190 SHIPPER CONSIGNEE DESTINATION
WEIGHT RATE
MESSENGER RECEIVED IN GOOD CONDITION

Progress in Carrying Freight—Form No. 2, Small Way Bill

fear that the steam road ratio of freight to passenger will ever obtain on electric railways, as there is a large class of freight that, owing to the rates, etc., will always be handled on private right-of-way lines.

With certain exceptions, such as switching car loads, etc., and the straight steam railroad business conducted by a few electric lines, the electric railways should look principally to the carriage of the high-class commodities. A good percentage of the short-haul merchandise distributed throughout the country requires a more rapid handling. Heretofore this has been impossible, as the close margin between cost and selling price does not permit the high express charge necessary to insure this quick movement: hence slow freight has been a necessity.

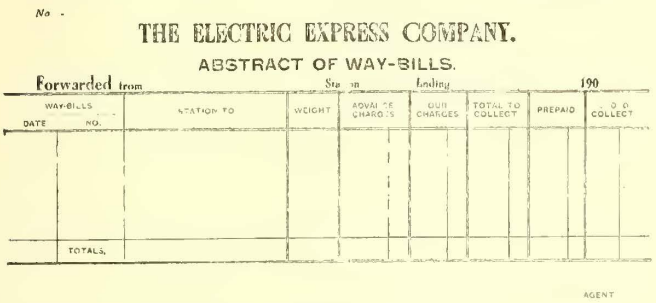
The Question of Rates

In considering the rate question, it is, of course, well understood that all rates must be founded on economical laws, or what the article will bear: rates must be such as

selves for the direct cost of handling this particular business, which is a cost that would not otherwise have been incurred, and we are even on the transaction, and this cost being so small a part of the great bulk of the expense that our rate can be very low before that point has been passed.

As to the question of express as against freight rates: The so-called old-line express companies could ill afford to maintain horse and wagon pick-up and delivery, even at their

high rates, were their business purely local. This expense is minimized as to ratio on account of long hauls on which a large rate is obtained. As a matter of fact, the American Express Company, operating throughout a large part of the United States, pays out for operating expenses 97.5 cents for every 100 cents taken in, handling $1 worth of business for 2.5 cents profit. Applying this to electric railways, it



No.

THE ELECTRIC EXPRESS COMPANY.

ABSTRACT OF WAY-BILLS.

Forwarded from Station Ending 190

DATE	WAY-BILLS NO.	STATION TO	WEIGHT	ADVANCE CHARGES	OUR CHARGES	TOTAL TO COLLECT	PREPAID	C. O. D. COLLECT
	TOTALS,							

AGENT

Progress in Carrying Freight—Form No. 4, Abstract of Way Bills Forwarded

would seem unprofitable to enter into this scheme of handling. Freight rates covering car transportation alone, while much lower than express rates, ordinarily show a better return. They bring out the maximum volume, which it is impossible to do with high rates. Hence it is the difference between a full car as against an empty one at the same operating cost per car mile. It is probably unnecessary to show specific instances of this, as all of us have had access

THE ELECTRIC EXPRESS COMPANY
REMITTANCES TO TREASURER

$.....
..... 190....
..... Station
..... Agent

(Enter number of each denomination of bills and amount of each check)	Dollars	Cts.
Bills.....20s,		
.....10s,		
.....5s,		
.....2s,		
.....1s,		
Gold.....		
Silver, etc.....		
Checks, viz.		
.....		
.....		
.....		
Total		

..... Station
Total Remittance, $.....
Date of Remittance.....190....
As entered on remittance slip sent herewith

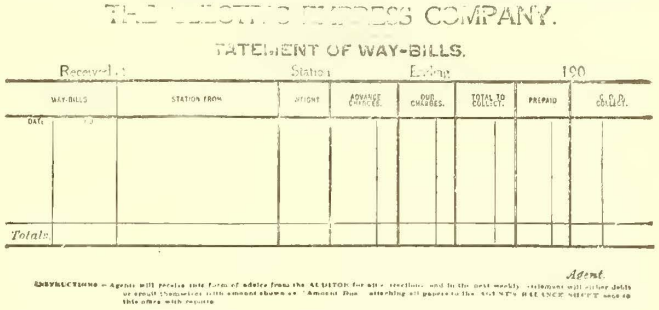
Receiving Teller will, on receipt, acknowledge by official stamp in above space or note errors and return.
If Agent desires to retain a copy of this remittance he should take a press copy.

Progress in Carrying Freight—Form No. 6, Remittance Slip

to detailed reports published in the railway journals, showing the splendid results of some of the companies on the Pacific Coast, in the North and Middle West, as well as the Eastern States.

INTERCHANGE

Some day electric railways will be called on to handle an interchange business, not only between themselves, but with all others transacting public carriage. Should we not profit by the experience of steam railroads, in their many years of effort to perfect their carriage system, in substituting for a local billing, accounting and re-handling scheme the through interchange idea? While there is a limit to which electric railways may go in this direction, I believe it to be far beyond anthing we have realized up to this time. Therefore, it cannot be too strongly urged that at least a uniform basis be adopted by all electric lines, differing only insofar as it covers local conditions, and in this way, when the time comes for an enlarged and extended business all will not be



THE ELECTRIC EXPRESS COMPANY.

STATEMENT OF WAY-BILLS.

Received at Station Ending 190

DATE	WAY-BILLS	STATION FROM	WEIGHT	ADVANCE CHARGES.	OUR CHARGES.	TOTAL TO COLLECT.	PREPAID	C. O. D.
Totals								

Agent.

INSTRUCTIONS.—Agents will receive into form of debits from the AUDITOR for all receipts, and in the next weekly settlement will either debits or credit themselves with amount shown as "Amount Due," attaching all papers to the AUDITOR'S BALANCE SHEET sent to this office with report.

Progress in Carrying Freight—Form No. 5, Statement of Way Bills Received

chaos, as would be the case with conditions as existing to-day.

A few years ago I had come under my personal observation a line that was handling a purely local express business, having some 50 head of horses and many drivers and freight handlers, express cars, etc. Their business was being operated at a loss of approximately $300 per day. The horses and wagons were disposed of and a straight freight business

THE ELECTRIC EXPRESS COMPANY

AGENT'S BALANCE SHEET

Agent, at Office

Balance Sheet for days ending 190

DR.	
To Balance (as per last statement)	
To Advance Charges on Waybills received	
To Freight Collected on Waybills received	
To Prepaid Collected on Waybills forwarded	
CR.	
By Paid Through on Waybills received	
By Advanced Charges Waybills forwarded	
By Cash remitted Treasurer	
By Balance, as per Uncollected List	

I hereby certify that the above is a true statement of my account with The Electric Express Company, for the time specified, as shown by the books of this station, and that the articles of freight mentioned in the accompanying statement of uncollected bills are actually in my possession, or have been delivered to consignee only upon order of the Superintendent.

Agent.

This report must be signed by the Agent PERSONALLY, and not by his clerk or any other person, and MUST be sent to the Auditor at close of business on the 7th, 14th, 21st and last day of each month.

Progress in Carrying Freight—Form No. 7, Agent's Balance Sheet

inaugurated. In less than one year this company was earning at a rate of 18 per cent on the capital invested. The results on slightly higher than steam road freight rates were as follows:

Earnings car mile	62.58 per cent
Expenses car mile	53.57 per cent
Amount received per 100 lb.	14.9 cents
Average cost	12.7 cents

Recently, also, in a business that was being operated, as was the former, at a loss of $800 to $1,000 per month, the same action was taken as with the first mentioned, with the result that after the first 15 days' operation as a straight

AGENT'S NO. C. O. NO.

THE ELECTRIC EXPRESS COMPANY.

190

MR. A AT STATION

I HAVE MADE THE FOLLOWING CORRECTIONS ON WAY-BILL NO.

FROM TO DATE 190

WAY-BILL READS PREVIOUS TO CORRECTION:

Consignee and Destination	Articles	Weight	Rate	Advance Charge	Our Charge	Total to Collect	Prepaid
	Original Footing of Way Bill						

WAY-BILL READS AFTER CORRECTION:

Consignee and Destination	Articles	Weight	Rate	Advance Charge	Our Charge	Total to Collect	Prepaid
	Corrected Footing of Way Bill						

I HAVE FOUND THE ABOVE CHANGES CORRECT.

AGENT. AGENT.

Progress in Carrying Freight—Form No. 8, Agent's Correction Sheet

freight proposition a small net operating profit was shown; this has continued to increase, and the business is now on a substantial paying basis. In inaugurating an ordinary freight and express business on electric railways we should start at the very foundation, and, if found to be desirable

THE ELECTRIC EXPRESS COMPANY.

RECEIPT FOR CHARGES REFUNDED BY AGENTS.

Received ____ *Station,* ____ *190*

from The Electric Express Company, *per* ____ *Agent,*

____ *Dollars, being amount refunded to correct error*

in w/b dated ____ *190* , *from* ____

CHARGES READ PREVIOUS TO CORRECTION:

CONSIGNEE	ARTICLES	WEIGHT	RATE	CHARGES

CHARGES READ AFTER CORRECTION:

CONSIGNEE	ARTICLES	WEIGHT	RATE	CHARGES
			Difference.	

As per correction No. ____ *dated* ____ *190*

issued by ____

No cash is to be refunded without one of these receipts being taken and a duplicate thereof sent to the Auditor.
Agents must not make refunds without taking up or endorsing the original paid freight bill.

Progress in Carrying Freight—Form No. 9, Receipt for Charges Refunded

and profitable, take up side issues, such as store delivery, etc., letting this be an extension to the original groundwork.

ORGANIZATION

When necessary, franchise rights must be secured, and, unfortunately for the business community, this is brought about frequently only after much delay and often with much difficulty. However, public necessity and convenience are bringing about a right understanding of the subject, which should have its effect. The next step is to study the territory, its population by districts, and its needs, the distribution of manufactured products (whether local or otherwise), the farmer and his requirements, also possible connections and arrangements with other electric railways, boat lines and delivery men, all of which leads up to a correct conception of the demand we are to undertake to satisfy.

THE ELECTRIC EXPRESS CO.

____ *190* ____

EXPRESS CONDUCTOR'S REPORT.

Car No. ____

From ____ To ____

Left ____ M Arrived ____ M

Car No. ____

From ____ To ____

Left ____ M Arrived ____ M

Car No. ____

From ____ To ____

Left ____ M Arrived ____ M

CONDUCTOR	TIME	RATE	AMT.
MOTORMAN			
HELPER			

Note.—Conductors must make this report out at the end of the last trip each day, and leave it at the office.
Note on back cause of any serious detention.
No Time will be allowed unless this Report is received.

Form No. 10.

The next in order is an operating arrangement, whether a separate organization or handled jointly with the other general business. Wherever a large system exists, serving, with slight competition, an extended territory, I would favor the departmental organization, owing to the saving in taxes, joint employees, etc. When the territory is served by a number of small lines, in order that the business may be conducted uniformly and extended to its greatest possible limit, a separate company for the handling of express seems to best serve the requirements. In either case, the express department or company should be charged a fixed equitable amount. This should not be the car mile rate, the varying quality of which we have already discussed, and found to be one that should not be considered in this case, if its value is to be measured by a passenger car mile, as one is running continuously, making the maximum number of miles, while the other makes long stops

THE ELECTRIC EXPRESS COMPANY

OFFICE OF THE AUDITOR

Boston, Mass. *No.*

Correction Sheet *190*

Agent at *Office. Way-Bill from*

To *Dated* *No.*

	Consignee	Articles.	Advance Charges.	Our Charges.	Total to Collect	Prepaid.		
Way-Bill reads as follows								
		Total Footings of Original W. B.						
Way-Bill should read								
		Total Footings of Corrected W. B.						

REMARKS (WHY CORRECTED) Amount Due $

INSTRUCTIONS.—Agents will receive this form of advice from the AUDITOR for all corrections, and in the next weekly settlement will either debit or credit themselves with amount shown as "Amount Due" attaching all papers to the AGENT'S BALANCE SHEET sent to this office with reports.

Progress in Carrying Freight—Form No. 11, Auditor's Correction Sheet

for loading and unloading. Neither should it be the ton-mile unit, as the long and short haul, together with the heavy and light load element, enters too extensively into its make-up. In the percentage basis of gross earnings I believe we have the most equitable factor for a fixed charge. If this is not used, then a direct charge should be made for equipment, power, track, maintenance, labor, etc., and not too much on account of first cost of present plant.

This brings us to the equipment stage. It depends entirely on the plan of organization as to who is to furnish this. It is needless to say that it should be modern and

adapted to the work required of it and conveniently arranged and provided with sufficient power to handle the maximum load and keep out of the way of passenger cars.

In the natural order we now should consider blank forms. Please remember that while the freight business of the electric railways should be in system not unlike the steam railroads, insofar as its foundation is concerned, it handles that class of business which must be given quick dispatch, hence only a few of their many forms and slow methods can be followed. It is surprising to find how few of them are actually necessary. The business handled should be surrounded with proper records for tracing lost shipments, accurate accounting secured, and a stop made right there. Too much "red tape" will reduce the quick movement of shipments to the slow freight time. Loss and damage claims should be promptly investigated and paid or declined within 30 days from time of filing—a contrast to what is now being done that will be appreciated by the public.

FREIGHT AND EXPRESS FORMS

I have seen a freight business amounting to $150,000 yearly handled successfully with the use of the abbreviated forms described and illustrated below:

Form No. 1, Shipping Receipt.—This is in duplicate, and is put up in book form. It is to be filled out by shipper, showing the consignor, consignee and the articles contained in the shipment. This is signed by the receiving clerk and the duplicate receipt turned over to the billing clerk, who then makes out the waybill.

Form No. 2, Small Way Bill.—These are in duplicate and cover shipment to but one consignee. They should be put up in pads and used with carbon sheet or carbon back paper. The original is turned over to the loading clerk or messenger who checks the freight into the car. This way bill accompanies the shipment to its destination and is checked by the receiving agent, and, on delivery, the signature of the consignee is taken thereon. After being entered on the "Received" report it is filed, and is a record of the shipment and a receipt therefor. The duplicate way bill is retained by the billing clerk and forwarded reports are made therefrom, after which they are filed as a record of the transaction.

Form No. 3, Express Bill.—This is in duplicate and is put up in pads. It is a customer's bill and receipt for money paid the company for freight charges. The original can be used in a loose-leaf ledger and will represent bills collectible. The duplicate is turned over to the collector, and, when paid, transferred to a file. In this way the outstanding bills are at all times represented in the above-mentioned ledger.

Form No. 4, Abstract of Way Bills Forwarded.—This shows the station, the date and number of way bill, station consigned to, weight, advance charges, company charges, total to collect, and amount prepaid.

Form No. 5, Statement of Way Bills Received.—This shows the same information as in Form No. 4, and is made up at the receiving station. These two forms are then used in preparing the agent's balance sheet and are sent to the auditor for checking.

Form No. 6, Remittance Slip.—This is a receipt for cash to treasurer.

Form No. 7, Agent's Balance Sheet.—This shows the exact financial situation of the station.

Form No. 8, Agent's Correction Sheet.—This is used in correcting erroneous rates, etc.

Form No. 9, Receipt for Charges Refunded.—This receipt is used on account of overcharges, etc.

Form No. 10, Conductors' Time Slip.—Conductors are required to make out this report at the end of the last trip each day, and to leave it at the office.

Form No. 11, Auditor's Correction Sheet.—This is used for making changes on way bills on account of errors detected in audit office.

In addition to the above forms, agents require a cash book, ledger and c. o. d. record. The audit office, of course, will have voucher form blank and necessary record books.

In closing, I cannot refrain from alluding again to the importance of a uniform system, from which basis electric railways as a whole should start to build up and extend their freight business. This basis I believe to be car transportation alone. A delivery man, owning his own team, can perform this service cheaper than you can, owing to the fact of personal ownership and supervision. This also holds true when a number of teams are employed. You must bear the maintenance of a horse and wagon equipment sufficiently large to handle promptly your maximum business. Another factor entering into this is the many customers operating their own teams; the additional cost to them of calling for their shipments often is figured to be nil. However, these are but side issues that should not stand in the way or prevent the electric railways from getting together on some common ground of procedure, in laying the foundation for a system of cheap and speedy transportation of merchandise that will prove of universal benefit to civilization for all time to come.

ADDRESS OF ACTING PRESIDENT WALLIS TO THE ACCOUNTANTS' ASSOCIATION

The past year has been an eventful one for electric railway accountants. We left Atlantic City a year ago quite satisfied with the assurance that we had formulated a revised classification of accounts which, while not wholly satisfactory to us, was still reasonably consistent with the fundamental principles which we had regarded for many years as our guide posts. It was a classification which seemed also to meet the demands which the modern principle of governmental regulation required.

We were soon rudely awakened, however, by having thrust upon us for our consideration a classification which ignored the very fundamental principles which had proven their stability by years of critical use. Many of us believed the proposed schedule to be quite unfitted for our use. It was a time of much fearsome worry for all of us. But we found that our reasons for protest were so cogent and conclusive that those who have the power to enforce upon us a system of accounts were satisfied that the proposed classification was unsuitable. Your Classification Committee was called into consultation, as its report will show you, and a schedule was drawn up which, if followed, will be reasonably agreeable to those principles which we have believed to be fundamental and fixed by the nature of our business.

The work of the Accountants' Association and its larger comrade, the American Association, has been of great value to the electric railway industry, to every electric railway company, in emphasizing the necessity of fitting the coat of accounting to the body of electric railway practice. The sound theories which underlie our division of accounts would seem to be firmly established.

I cannot but speak with praise of the work of your Classification Committee, whose fairness, firmness and diplomacy have accomplished a great deal. This committee has put a large amount of time and effort into the part of our work which has fallen within their province this year and the results they have brought to you should compel your commendation.

As electric railway accountants, we may well pause and consider a rapidly growing tendency of the times which seems likely to run to an extreme. A committee of prominent railroad executives of the American Railway Association has just issued a circular in which it refers prominently to "the

refinements of accounting," a phrase which has also appeared in some discussions of electric railway accounting during the past year. This I interpret to mean accounting complicated to a degree which becomes unnecessarily burdensome upon the corporation which is compelled to pay the bills.

The figures which we accountants collect, compile and interpret are of value only in proportion to their use. We may gather and file stacks of forms, filled with interesting figures, but if the information so acquired is of no use then the labor is wasted. We should compile in convenient form and have ready for immediate reference such data as our superiors may require. Beyond the storing and supplying of such needful information or drawing required deductions from it our efforts are wasteful. We are uneconomical whenever we fail to reduce this work to its simplest possible terms. So sure as the straight line is the shortest distance between two points, just so sure is the accountant unsuccessful if he does not produce the desired information in the shortest and simplest manner possible. Insofar as we fail to eliminate the unnecessary our work becomes useless.

Inasmuch as we are public service corporations it is a recognized principle that the public is privileged to have such accounting information concerning us as will permit it to see that its rights are being protected. But the public has no privilege to require of us more detail of information than will reasonably secure it in its rights. I believe that information which informs is more readily obtainable from simplicity than from complexity of accounting.

The value of the figures furnished by us to the public lies in their use by that public. Their availability amounts to nothing unless they are used. To require information or statistics merely to satisfy the possible whim of some aimless investigator into interesting conclusions of little or doubtful value is indefensible. Moreover, the average seeker for facts in official reports is not expert enough to avoid having his view clouded in the haze of complicated accounting. The fundamental, larger principles in which the whole public is interested are much more easily obtainable from simple, accurate, apparent statistics, and conclusions so drawn are more intelligent and just.

I feel, therefore, that we may question whether the tendency of the times is not to an extreme in demanding an unreasonable division of accounts and detail of information in our business. If we believe so, we accountants should steadfastly point the way back to a more reasonable accounting, wherein simplicity should be the fundamental rule. This modern tendency leads us to produce figures and statistics which are not necessary; it leads others to require of us facts and figures which, when received, are of no practical use. It makes us divide the simple accounts which furnish ample information into many subdivisions which, while interesting, have not a value comparable to the labor involved in their preparation. It makes us hand to our laborer, to our mechanic, to our foreman a bewildering multitude of blanks for their use. Insofar as this labor fails to furnish information which is actually and urgently useful it is economically wasteful.

Moreover, to be useful, statistical information must be accurate from its source to its conclusion. The farther we wander from simplicity the less liable we are to obtain accuracy, especially from those whose training in accounting is of the simplest and does not stand the strain of complexity. Such is the condition among those upon whom, for the most part, we railway accountants are dependent for the sources of our information.

We, therefore, as accountants should discourage, whether within ourselves or within or without our corporation, any tendency to compile statistics, figures, information which are not entirely essential. Let us endeavor to avoid, and to have those whom our figures serve avoid, complication of accounting which leads to inaccuracy. Let us have always an open eye to the "simple life" of accounting.

It was with great regret that I received notice from the president whom you selected last year, Frank R. Henry, that because he was leaving the railway field he would no longer act as president. Mr. Henry has been active in this association since its start, and has done much good work for it. You had brought him into deserved recognition when you chose him for this high office. Mr. Henry had served through the trying times of last winter, and had largely mapped out the plans for this convention when circumstances forced him to retire. He had prepared a part of his address to you, and this, with due credit, I incorporate herewith, as follows:

"For 16 years prior to the formation of the Accountants' association, the managers of the street railways of the United States were associated together as a national organization, and were giving little or no attention to accounting problems. A few of the far-sighted accounting officers realized that if the accounting departments of the street railways were going to keep up with the rapid growth and development of the business, it would be necessary to form an independent national organization, embracing the accounting officers exclusively. The preliminary meeting for the formation of such an organization was held in Cleveland, Ohio, in March, 1897, and since that time, meetings have been held annually at the same time and place as the parent body.

"The constitution and by-laws of this association state the purpose of the organization as follows: 'To object of this association shall be to bring together those engaged in the accounting department of street and interurban railway companies, for the interchange of ideas, to promote the adoption of a uniform system of accounts, and to improve the work of the accounting department.'

"Eleven years have passed since its formation, and problems have confronted the individual members and the association which were not dreamed of prior to that time. It has been found that in most things the old lines proved too narrow, and things in the past that were all right for that time, would not do for to-day. This means progress; it means persons, plans, institutions, administrations—all these things are growing. With the phenomenal development of electric railway business in the past few years, you are all familiar. These things all being true, has your accounting department kept up with the progress?

"'Let well enough alone' has never been the motto of electric railway business in the past, nor do you believe it the motto of the future. Through co-operation, fellowship and investigation, the American Street & Interurban Railway Accountants' Association offers all of the opportunities for keeping up with the new developments. By co-operation, it has been possible to have a standard classification of accounts and form of report adopted by the State commissions, the United States census bureau, and by the electric railroads.

"It has been said that only a few railroads use the standard classification. This may be true, but it is safe to say that there are very few but what have used the standard classification as a basis for the classification of their accounts and for the form of their reports. To keep up with the progress and development of the business, a

new classification was submitted at the last convention, and a new standard classification will eventually be adopted along the lines therein defined.

"This is not all there is to show for the 11 years of work. Every phase of the accounting field, as applying to electric railway accounting departments, is gradually being covered, and reference to the indexes of subjects on which papers have been prepared, reports of committees which have been submitted, will show to what extent the work has, thus far, been carried. In this connection, the fact must not be lost sight of, that the discussion of the papers and reports is very frequently just as profitable and instructive as the papers and reports.

"Blanks and forms covering every department of the business have been collected by the secretary, indexed and arranged in convenient form in loose-leaf books. These books are exhibited at the annual conventions, extra copies being kept on file for the use of the members, which can be obtained upon request by a member of this association. This offers an advantage which cannot be obtained in any other way, and the study of this collection will save your company both time and money.

"The annual meetings offer many opportunities for increasing the usefulness and efficiency of your accounting officers; broaden their views and sympathies, encourage and strengthen them in their efforts. The friendships formed will bring more cheerful response to inquiries for information from a fellow accountant. One of the true assets of life is friends, and you cannot have too many of them; and in these annual meetings you find many original friends.

"It is said there are few original geniuses in the world, but there is a genius of another order that is quite as good. It may be called assimilative or appropriating genius. It consists of the ability to use wise and timely suggestions coming from whatever source. The annual meeting is a good place to develop this genius. One possessing this genius will attend the annual conventions and go home full of enthusiasm over the new ideas gathered, and this, coupled with the skill necessary to apply them, will derive the greatest amount of good from these meetings.

"You should be willing to contribute and do your part in the education feature of the work by giving your ideas, opinions and suggestions.

"No better evidence of the interest manifested in the Accountants' association could be produced than the record of attendance at the last meeting held in Atlantic City. This meeting was in every sense, the most successful and important meeting the Accountants' association has ever held, and careful reading of the proceedings will convince the accounting officers of the street railways that the objects as set forth in this constitution are being realized."

The advantages of the collection of blanks, forms, referred to by President Henry, depend upon its being kept up to date. With this in mind, an entirely new collection has been made and prepared this year with very successful results. The collection and its arrangement reflect great credit upon Professor Swenson's office.

The new collection is here, and from now on is available for the members. This collection represents now the latest ideas in the framework of electric railway accounting and is well worth some of your time and attention.

As the association grows older, the selection of topics for discussion becomes more difficult, without covering exactly some of the ground covered in previous papers and discussions. Of course, new topics and new phases are continually coming up and the old conditions change in the light of the progress of our industry, but the fact remains that there is not the virgin field of topics to be discussed that existed in the early days of the association.

There always remains (and this makes more prominent) in the work of the association at these conventions, what we have chosen to call this year the "get together" spirit. And as the membership grows this becomes more important, because with a few members universal acquaintance was practically compulsory; with the large membership of to-day it is difficult. Yet you will find you get more from the informal, close range exchange of opinion with those whom you meet here, if you go about it in the right way, than from any cut and dried feature of the program, no matter how good.

Do not imagine that the other fellow, no matter how big a property he represents, or how long he has been in the association, is not as anxious as you are to further this spirit. Take my word for it, he is. In and of this spirit, a luncheon has been arranged at the Marlborough-Blenheim to be held at the close of this session, and an attempt will be made to have this spirit prevail.

During his active work in the office of President, Mr. Henry resigned from the Committee on the Standard Classification and appointed W. B. Brockway in his place. Later, W. G. McDole, of Cleveland, resigned from the same committee, and I appointed W. H. Forse, Jr., which gave the so-called "interurban group" of railways a reserved place upon this committee.

We are entitled to three representatives at the convention of the National Association of Railway Commissioners, and I appointed as this year's delegates, W. F. Ham, of Washington; C. N. Duffy, of Milwaukee, and C. L. S. Tuigley, of Philadelphia.

I wish to thank you for your selection of me as your first vice-president, an office which this year has assumed more importance than usual. I wish also to thank the Executive and Classification Committees for their support in the work and those who have prepared papers and the many others who have rendered valuable assistance in carrying on the work during the past year.

ANNUAL RECEPTION

Nothing could have been more successful, or handled with more care and smooth precision, than the reception on Tuesday evening in the Solarium of the Marlborough-Blenheim. It began at 9 o'clock, when a receiving line was formed by officers of the railway associations and their wives; and the presentations were made thick and fast. By the time the eastern wing of the hotel had apparently reached its capacity, the musical program began with Margaret Keyes and Oley Speaks as vocal soloists. After an hour of excellent music, refreshments were served, and then dancing began, the card providing fifteen dances, although that was not the limit. Nearly six hundred ladies are attending the convention, and as almost all were present in rich and fashionable toilettes, the scene throughout the evening was one of notable brilliance. The general comment was that the Association had never had a more successful affair of the kind. Chairman Berry, of the Entertainment Committee, supervised all the details personally, and most members of the committee were present to lend their active assistance; while their ladies also contributed in no small degree to the success by their co-operation in presiding at the refreshment tables and in other appropriate and decorative ways. It was not until early morning that the function came to a close.

REPORT OF THE COMMITTEE ON EDUCATION*

BY H. H. NORRIS, CHAIRMAN, A. S. RICHEY, R. E. DANFORTH

On August 1, 1908, this committee was appointed to study and report upon such educational matters as might be considered as coming within the scope of the Association's work. The committee immediately outlined a plan of work which has been carried out as far as possible in the limited time. The committee will aim to inform the members upon the best practice in training present and prospective employees, and will formulate plans intended to increase the efficiency of employees.

In this report no definite plan is proposed. At the last convention, October, 1907, a plan for an apprentice course was tentatively suggested by a member of the present committee.† This plan was favorably received, although no official action was taken regarding it. Such propositions will naturally form a part of the work of this committee. For the present, however, the work is of a preparatory nature. A few general statements will prepare the way for the details of the report.

(1) The training of employees for more efficient service is incumbent upon employers.

(2) Such training will pay in financial returns, as well as in less tangible ways.

(3) The training should include employees of all grades of previous education and experience.

(4) The training is most effective for young employees and when closely related to the previous education and experience.

(5) The evidence of the foregoing statements is found in the successful experiments which have been tried by members of this and other associations, both individually and collectively.

The whole matter of training men for electric railway work falls under two general heads:

(1) Training preparatory to employment.

(2) Training during employment.

EDUCATION PREPARATORY TO EMPLOYMENT

Undoubtedly a certain amount of special preparatory training is desirable. This must be furnished largely by regular and special courses in the technical schools. Prof. Richey has prepared the following report upon this part of the subject. In securing data he addressed the following letter to the proper departments of a large number of schools:

Kindly give us information as requested below, same to be incorporated in a report of the Committee on Education to be submitted to the Atlantic City convention of the American Street and Interurban Railway Association.

1. Have you a specific course in Electrical Railway Engineering, or is such instruction given as a part of your regular Electrical Engineering Course?

2. When was such course established?

3. Give an outline of such course, showing number of hours devoted to electrical engineering subjects, as well as to strictly electric railway subjects, in junior, senior and graduate years.

4. What laboratory or other practical facilities have you available to supplement such courses?

5. What percentage of your electrical engineering students elect the railway course?

6. How many of your graduates are employed in electric railway work? What percentage of electrical engineering graduates?

7. In your opinion, in what way can the American Street and Interurban Railway Association best co-operate with the technical schools of the country, to their mutual advantage?

The replies to these questions were not definite enough to permit of a tabular compilation, but they indicate a great interest in the subject and a desire to co-operate with the Association. The correspondents requested information as to how the Association literature can be made available in the schools, and one or two wrote regarding railway apprentice courses.

ELECTRIC RAILWAY INSTRUCTION IN THE TECHNICAL SCHOOLS

The splendid system of technical schools in this country is the development of the past 40 years. There are to-day at least 40 colleges in the United States offering courses designed to fit their graduates for engineering professions. The growth of these schools, in numbers and importance, compared with the "classical schools," has been in step with the growth of the relative importance of the engineering profession. The building up of the great steam railway systems, the development of our mining resources and manufacturing industries, and finally the growth of our electrical industries, have each contributed to the call for the engineer. The combination of the last and first, that is, the application of electricity to transportation, has opened still further fields for the exercise of the engineer's abilities.

At the beginning of the period of extensive steam railroad development, this call for engineers resulted in the establishment of courses in railroad engineering, civil and mechanical engineering. Together with the development of large manufacturing industries, these calls resulted in the further development of such courses, and the foundation of the purely technical school, giving courses in engineering alone.

Graduates from such engineering courses, for many years, had difficulty in competing with men who had "worked up in the business"—the men "with no technical education, but lots of horse-sense, sir"—but they have gradually overcome the prejudice against the college graduate, until at present it is the rule, not the exception, to find college graduates at the head of work requiring engineering ability. The colleges have year by year bettered their courses, by benefit of experience, and better facilities have been given the graduate to secure practical experience after the completion of his college course, which practical experience, it may be remarked, he realizes to-day, better than ever before, is needed to round out his education before he is fitted for an engineering profession.

The development of the application of electricity has had much to do with the call for the engineer and the technical graduate. From the first the electrical engineering, manufacturing and construction companies have used technical graduates, as the raw material from which to develop their directing heads. As the development of the electrical industries has been to such a great extent due to the marvelous growth of the electric railway, the electric railway may be credited with a considerable part in the call for the technical graduate, resulting in the development and growth of the technical schools.

Geographically, the distribution of 40 representative technical schools or colleges giving instruction in engineering courses is as follows: New England, 8; Eastern States, 16; Central, 7; Southern, 3; Western, 6.

Instruction in the technical schools is generally so planned as to supply in as large a measure as possible the benefits of a liberal education. While this is not usually possible

*Read before the American Street and Interurban Railway Association, Atlantic City, N. J., October 12, 13, 14, 15 and 16, 1908.

†Proceedings A. S. I. R. A., Vol. I, 1907, p. 107.

to the same extent as in a college of liberal arts, it has been found practicable to include the essentials without encroachment on the time devoted to purely professional studies. Indeed, the so-called liberal studies are generally believed to be at the very foundation of professional, as well as liberal training. Such studies as are found to be common in all engineering courses comprise English, the modern languages, mathematics, chemistry, physics, economics and political science.

While it has not been possible, in the brief time allotted for the preparation of this report, to secure outlines of the courses in electrical engineering from all of the various technical schools, the following extract from the catalog of one of these institutions is fairly representative:

The four-year undergraduate course in electrical engineering is arranged to provide instruction along the broad and fundamental lines necessary for a young man who proposes to make engineering his life work. With this object in view, the subjects of the first year of the course are common with those of the other departments, and include work in mathematics, modern languages, chemistry, shopwork and drawing. The electrical engineer must be thoroughly trained in mechanical engineering subjects and, throughout the second and third years of the course, the students in mechanical and electrical engineering follow nearly the same curriculum. The principal difference between these two courses for the sophomore and junior years is a reduction of time devoted to shopwork by the electrical engineering student, which permits him to include in his course a larger amount of time for physics, chemistry, mathematics and electrical engineering. During the last two years of the undergraduate course, a large proportion of the time is devoted to the courses offered by the electrical engineering department, but required work is included in economics, vector analysis, kinematics, mechanics, steam engineering, thermodynamics and mechanical engineering laboratory work; and opportunity is given for electives in civil engineering, machine design, chemistry or hydraulics. In the senior and graduate years, extended courses are offered in the theory and technical applications of electricity, in laboratory work, in electric railway engineering and in electrical engineering design. Work in electric railway engineering, in fair proportion, is offered in the regular undergraduate course in electrical engineering and, in the graduate year, very thorough courses in this subject are available. Visits of inspection are made each year, not only to local points of interest, but also to important installations and manufacturing establishments at a distance. Frequent addresses by alumni or other practicing engineers and scientists increase the scope and value of the work.

Very few of the technical schools have established specific complete courses in electric railway engineering, but nearly all give such a course as a part of the general electrical engineering course. In such cases a student may, by a proper choice of elective studies, especially in the graduate year, select a course which will fit him to enter electric railway engineering as a profession.

Opinions and practice differ somewhat as to the use of the laboratory in connection with electrical engineering instruction. In a few cases the instruction is entirely by text-book and lectures. In most cases, however, these are supplemented by the use of more or less complete shop and laboratory facilities. Nearly all of the technical schools now give some sort of actual training in wood-working, pattern-making, molding and casting, machine-tool work and surveying in the lower classes. This is usually followed, in the electrical engineering courses, by laboratory practice in operating and testing electrical apparatus, some of the colleges having very complete equipment for such work. For example, one institution has available, in its "service plant," three engines direct-connected to generators, and aggregating 600 hp at normal rating, and in its laboratory some 50 generators and motors, ranging in capacity from a 300-hp motor and 200-kw generator down to machines of 1-kw capacity, the aggregate capacity being not less than 1500 kw. The transformer equipment numbers over 40, including the regular commercial types and several of special design. Among the latter are one giving 500,000 volts and two others of 200,000 volts and 100-kw capacity each. The collection of arc and other electric lamps is very complete, and contains lamps of wide variety of type by the various makers. The list of instruments for electric measurements is very large and includes examples of the best types to the number of over 200. The storage-battery room contains batteries of several different makers, including one of 160 10-amp-hour cells and another of 60 120-hour cells. There are also many pieces of special apparatus for work of instruction or investigation, including curve tracers, dynamometers, both electrical and mechanical, condensers, mercury-arc converters, recording instruments, oscillographs, etc. The railway equipment of this laboratory includes a large interurban car and track connections with a large city and interurban railway system, a dynamometer electric car testing stand, various types of braking, controlling, lighting, heating and signaling apparatus, so mounted that efficiency, reliability and operating tests and experiments may be made, besides several standard railway motors for test and experiment.

The laboratory cited, with its equipment and building, represents an investment of about a quarter of a million dollars, and is probably the most extensive college laboratory, for electrical engineering and electric railway engineering, in the country. As has been said, however, nearly all of the technical schools give some laboratory experience in the handling and testing of electrical apparatus, and supplement this by more or less frequent visits of inspection to manufacturing and operating electrical plants. Practical problems in design and estimating are also generally important features of the course.

The graduate, then, is familiar with the principles and theory of his chosen profession, and usually has had more or less experience with practical problems. No matter how thorough has been his training in these matters, however, he needs, in addition, the training which comes from actual contact with commercial work in his chosen line; contact with men engaged in the work; contact with things that are doing; actual experience in making one dollar do the work of two. Many graduates take advantage of the apprenticeship courses offered by some of the large manufacturing and operating companies, a few have had the requisite experience before and during their college course, while many get it by hard knocks and push with manufacturing and operating companies which make no effort to differentiate between the technical graduate and the uneducated laborer by his side.'

EDUCATION DURING EMPLOYMENT

Much can be learned along the line of training employees by a study of the experience of steam railway, lighting and other companies and associations.

As typical of these, the committee has selected the following:

(1) New York Central Apprentice Work.

(2) Master Mechanics' Association Report on Apprentice Systems.

(3) Administration of the Trustees Gas Educational Fund.

(4) Edison Companies Instruction Courses.

Attention is also called to the Cadet Corps of the Rochester Railway Company and of the Public Service Railway Company.

(1) The New York Central Apprentice System*

The New York Central Lines have developed a complete apprentice system apparently well adapted to steam railway needs. This is in charge of C. W. Cross, whose office is in the Grand Central Station, New York. Mr. Cross is a successful railway man, having been a shop superintendent and master mechanic, and he has also the requisites of a successful teacher. He is assisted by W. B. Russell, a graduate of the Massachusetts Institute of Technology. Mr. Cross has furnished information from which the following compilation has been made for this report:

Elements of the System

Briefly, the system adopted may be summed up under the following three heads:

1. It provides for the close supervision and instruction of the apprentices in the shop by an apprentice instructor.

2. A school is conducted by the company during working hours, the apprentice being paid for attendance, at which mechanical drawing is taught in a practical way.

3. A course of problems, carefully arranged to suit the needs of the apprentices, has been prepared, which they are expected to work out on their own time.

While the system differs radically in many respects from anything that has been done in this country, it follows more or less closely the general principles governing the educational system of the British Admiralty, which has been in operation more than 60 years, and, according to Sir William H. White, has produced the majority of the men who are now occupying the most prominent positions in the shipbuilding industries of Great Britain. In an article published in the January, 1904, issue of "Technics," he says of it: "It has given to private shipbuilders its leaders, who have risen from the ranks, while it has produced men holding many important and influential positions in all parts of the world."

The only system that has been carried out on a large scale in this country, which at all approaches the methods used on the New York Central Lines, is the General Electric Company's apprentice school at Lynn, Mass., which was described in a paper on "A Plan to Provide for a Supply of Skilled Workmen," presented by Magnus W. Alexander at the December, 1906, meeting of the American Society of Mechanical Engineers.

A special shop has been fitted up at Lynn, known as the "Apprentice Training School," and for the first 1½ or 2½ years' course, the boys work in this shop under the direction of competent instructors. The production of this department is of commercial value. The latter part of the course is spent on regular work in the shops. A school is conducted during working hours at the expense of the company, each apprentice receiving six hours' instruction a week.

Under the New York Central system the boys come into contact with the actual shop conditions from the very first.

Historical Notes

J. F. Deems, when he became general superintendent of motive power of the New York Central Lines, had under consideration the establishment of an adequate system of apprenticeship on that system, but the apprentice department was not inaugurated until March 1, 1906. On May 7, 1906, the first apprentice class, under this new plan, was started at West Albany Shop; it was, of course, realized that while there would be some advantages which would be almost immediately apparent, the most important results would not be noticeable for a number of years, and, therefore, before starting the organization, steps were taken to insure its permanency for a period of sufficient length to enable the results to be clearly demonstrated.

Although at the inauguration of the new plan there were 12 shops on the system, each of which had from 20 to 74 apprentices, apprentice schools of some kind had been carried on previously by the local managements at only four points, Elkhart, Ind., Jackson, Mich., Oswego, N. Y., and McKees Rocks, Pa.

About 35 years ago an apprentice school was started at the Elkhart shops on the Lake Shore & Michigan Southern Railway. The sessions were held in the evening, and the school was intended primarily for the apprentices, although anyone in the employ of the company was eligible for membership. This school was continued with more or less success, and in 1901, under the direction of Mr. Cross, the master mechanic, attendance was made compulsory for apprentices, and what was known as the "Apprentice Association" was organized. This association held meetings every two weeks, at which reports were made by committees who had visited other shops, or addresses were made by persons skilled in different classes of work. While membership was not compulsory, the greater number of the apprentices belonged to it and the meetings were well attended.

On July 28, 1886, evening class work for the apprentices was started at the Jackson shops of the Michigan Central Railroad. For the first few months the classes were held from 7 to 9 p. m., but this did not prove satisfactory and was changed to 5:15 to 7:15 p. m. Each class met one night a week from November 1 to April 30. Attendance of apprentices was made compulsory.

In January, 1904, an apprentice school was organized at the Oswego shops of the New York Central & Hudson River Railroad under the direction of W. O. Thompson, division superintendent of motive power. This class met for two hours, directly after the whistle blew at the close of the day, one day of each week. Attendance was compulsory for the apprentices and they were paid for their time in the class, thus making it possible to enforce a somewhat more rigid discipline.

About two years ago an evening school was organized at the McKees Rocks shops of the Pittsburg & Lake Erie Railroad, under the direction of L. H. Turner, superintendent of motive power, and W. P. Richardson, mechanical engineer. These classes met twice a week, and attendance of the apprentices was made compulsory.

Mechanical drawing was taught at these four schools, the method being the same as that ordinarily followed, including practice in lettering, geometrical exercises, projections, copying of drawings and blue-prints, making drawings of locomotive parts and making tracings.

Details of the New York Central Plan

The central organization deals with the general problems affecting the apprentice work, outlines the different courses, looks after the educational work, organizes new schools and keeps in close touch with all of the schools.

At each of the larger shops there are two instructors, a drawing instructor, who in most cases is the shop draftsman and who has charge of the school work, and a shop instructor who gives his entire time to instructing the ap-

*For complete information see "American Engineer and Railroad Journal," June, July, Sept., Oct. and Nov., 1907. Also Report C. W. Cross, 1908, to N. Y. State Board of Labor Statistics.

prentices in their shop work and to seeing that they receive the proper shop experience. Both of these men report directly to the local officers of the road, who keep in close touch with the apprentice department. The apprentices are instructed in drawing and in shop problems by a man already in the service of the company, on the shop property, during working hours and while under pay. They are instructed in the trade in the shop by a special instructor, who gives the whole or part of his time to this work, and who is responsible to the local shop management. The instruction in the grade is given in the shop on the regular tools and in the regular run of shop work. Apprentice schedules are followed, insuring a thorough training in the trade and giving the necessary variety and work.

The drawing and problem courses are arranged to allow each apprentice to progress as rapidly as he desires, but so as to enable a single instructor to handle the classes with as many as 24 students in a class. The character of the courses is such as to fit the standards of the road, to read in the language of the shop and to suit the special conditions existing locally.

The method of instruction differs radically from the ordinary methods of teaching in the following points:

Text-books are not an essential part of the plan.

There is no subdivision into subjects.

All the principles are clothed in problem form.

There is no arbitrary standard of the amount of ground to be covered.

No examinations are held.

The progress and the marks of the apprentice are based on the close personal touch maintained between the instructors and the apprentices.

Night Schools

The men in the shops, both foremen and workmen, have evinced considerable interest in the apprentice schools, and there has been a demand for evening schools to give them the same advantages. In response to this, evening schools have been started at a number of places, including McKees Rocks, October, 1906; Elkhart, November, 1906; Jackson, November, 1906; West Albany, November, 1906; Brightwood, December, 1906; Oswego, January, 1907, and Collinwood, February, 1907. These classes are open to all of the employees at all of the points; except Elkhart and McKees Rocks, they meet for an hour and a half or two hours directly after the shop whistle blows in the evening. At Elkhart the classes meet from 7 to 9, and at McKees Rocks from 7.30 to 9.30 p. m. The men are more regular in attendance and take a keener interest in the work when the meeting is held directly after the shop closes. In many cases the men live a considerable distance from the shop, and it would not be convenient for them to return after going home to their dinners.

The makeup of these classes is very interesting and will give some idea of the extent to which this work has been carried. At several of the schools where there is a full quota of apprentices and a waiting list the boys take places as helpers until there is an opening for them in the apprentice department. These boys usually enroll in the evening classes. Boys who have finished their apprenticeship also follow up their studies in connection with the evening classes. These classes are discontinued for three or four months during the summer. The men who attend them take the same course as the apprentices, but if they desire may skip the easier portions. As a rule, they prefer to take all of the work, reviewing that part with which they are familiar. They furnish all of their own material and pay the instructor (the apprentice school drawing instructor) for his time. The cost of tuition amounts to about $1.25 per month, which ordinarily includes nine lessons. The classes are held in the apprentice school room, the company furnishing this, with light and heat, free. Only the drawing work is done in class, the problems being worked outside.

These classes give the more ambitious men an opportunity for becoming more proficient and to fit themselves for better positions. They are especially valuable for foremen and for assistant foremen who desire to "brush up" their knowledge of drawing and mathematics. As a result of the classes, the shop men are becoming more familiar with the company standards and are being drawn into closer touch with the shop draftsmen.

Results of the Apprentice Work

While only two or three of the schools have been in operation for as long as two years, a number of practical advantages have become apparent. With the greater opportunities that are being offered, a better class of boys is being secured. Formerly it was difficult to keep up the full quota of apprentices at most of the shops. Now there is a waiting list for some of the trades at several shops and apprentices are being secured for trades formerly without them. In many instances high-school graduates have enrolled as apprentices. At shops where there is a waiting list it is not unusual for the boys to take places as helpers or wipers and enter the evening classes until an opening occurs in the apprentice department. This service is a sort of probation period and those who are unsatisfactory are sifted out.

The boys take a greater interest in their work in the shop, and because of the principles learned in connection with their educational work, are better able to understand the instructions given to them and to carry them out intelligently. Their earning power is thus increased.

The work of the shop instructor is especially productive of immediate returns. When the apprentice is shifted to a new class of work the instructor stays right with him until he understands it thoroughly. Under the old system the foreman was supposed to instruct the apprentice. He would almost invariably be interrupted a number of times and would probably hurry off after he had half instructed the boys, expecting to return shortly. The chances were that he would forget all about it and the boy would be left to shift for himself. As one shop tersely put it—under the old system a boy after working for two or three weeks might get to a point where he could produce one-half of a mechanic's output—now he can, on an average, turn out seven eighths of a mechanic's output after three or four days. When a workman does not report for duty an apprentice can be put on the job under the direction of the instructor and the output does not suffer to any great extent. The increase in the apprentice's output due to the above causes more than offsets the loss of time due to class work, which amounts, on an average, to 40 minutes per day for each boy.

The amount of spoiled work has been very greatly reduced by the advent of the shop instructor.

The brighter boys, after they have worked for several months in the drawing course, are used to considerable advantage for making rough sketches or simple drawings, either of a broken part, for transmission to the mechanical engineer's office or in connection with the shop practices.

(2) WORK OF THE MASTER MECHANICS' ASSOCIATION

A special committee of the Master Mechanics' Association has just presented a report dealing with the present situation in the training of young men in the trades necessary for steam railway work. Their committee summarizes the following conclusions under the title "Principles." They are suggestive as being applicable to electric, as well as steam railway conditions.*

Principles

To assure the success of the apprenticeship system, the following principles seem to be vital, whether the organization is large or small:

First: To develop from the ranks in the shortest possible time carefully selected young men for the purpose of supplying leading workmen for future needs, with the expectation that those capable of advancement will reveal their ability and take the places in the organization for which they are qualified.

Second: A competent person must be given the responsibility of the apprenticeship scheme. He must be given adequate authority, and he must have sufficient attention from the head of the department. He should conduct thorough shop training of the apprentices, and, in close connection therewith, should develop a scheme of mental training, having necessary assistance in both. The mental training should be compulsory and conducted during working hours at the expense of the company.

Third: Apprentices should be accepted after careful examination by the apprentice instructor.

Fourth: There should be a probationary period before apprentices are finally accepted; this period to apply to the apprentice term if the candidate is accepted. The scheme should provide for those candidates for apprenticeship who may be better prepared as to education and experience than is expected of the usual candidate.

Fifth: Suitable records should be kept of the work and standing of apprentices.

Sixth: Certificates or diplomas should be awarded to those successfully completing the apprentice course. The entire scheme should be planned and administered to give these diplomas the highest possible value.

Seventh: Rewards in the form of additional education, both manual and mental, should be given apprentices of the highest standing.

Eighth: It is of the greatest possible importance that those in charge of apprentices should be most carefully selected. They have the responsibility of preparing the men on whom the roads are to rely in the future. They must be men possessing the necessary ability, coupled with appreciation of their responsibilities.

Ninth: Interest in the scheme must begin at the top, and it must be enthusiastically supported by the management.

Tenth: Apprenticeship should be considered as a recruiting system, and greatest care should be taken to retain graduated apprentices in the service of the company.

Eleventh: Organization should be such as graduated apprentices can afford to enter for their lifework.

(3) THE TRUSTEES' GAS EDUCATIONAL FUND

A most successful work is being carried on by A. E. Forstall, a practical gas engineer, for the benefit of gas company employees. Similar work might well be carried on by the American Street & Interurban Railway Association for the benefit of the young men coming up in the ranks. Such work could be carried on under the direction of the secretary, if suitable financial provision could be made. Mr. Forstall has prepared for your committee the following suggestive summary of the plan:

The starting of the work was due to Walton Clark, third vice-president of the United Gas Improvement Company, of Philadelphia, who, in his address as president of the American Gas Light Association at its meeting in 1895, recommended to the association the appointment of a committee which should prepare and carry out a scheme for the establishing of a course of instruction in gas engineering for the benefit of the employees of gas companies who had not received an advanced education. This committee was appointed, Mr. Clark being made its chairman, and a class was formed and carried on by him during the years 1896 and 1897. At the beginning of 1898 Mr. Clark found himself unable to keep up the work, and the class was suspended until the committee in charge of it had secured subscriptions from gas companies and individuals interested in the gas business of a sufficient amount to enable them to employ a competent person to take charge of the class work. This fund, which has amounted to between $4,000 and $4,500 a year for the last 10 years, has been administered by a board of trustees composed partly of permanent and partly of ex-officio members. The permanent members now number four, and although they were originally appointed by the American Gas Light Association, are self-perpetuating and are responsible only to the subscribers to the fund. The ex-officio members are the president and junior past president of the American Gas Institute, this having succeeded the American Gas Light Association in 1906, up to which time the ex-officio members were the president and junior past president of that association.

The average number of subscribers to the fund has been about 100, and the subscriptions have been from $1 to $1,000, the average being between $40 and $45 per year.

The subscriptions have been made for periods of five years, the second of which has just expired and the work of securing a renewal of the subscriptions for another five years is now under way. During the 10 years the expenses have run somewhat below the amount subscribed and there is now a surplus fund of about $8,000, which is available for supplementing the subscriptions, should these fall below the expenses in any one year.

The work of the class is carried on entirely by correspondence, the questions being sent out four times a year and the students having two months in which to prepare the answers to each set of questions. These answers of the students are gone over carefully by the secretary of the trustees, who has charge of the class work, and criticised in a personal letter written to the student. This criticism is mailed to the student, together with a copy of the trustees' answers to the questions when the next set of questions is sent him.

Under the conditions which exist, it is impossible to take care of a class of more than a certain number, and, therefore, no attempt has been made to advertise the work, but in spite of this an average membership of 100 has been maintained. Beginning with the enrollment, Oct. 2, 1899, and adding the number who have been added to the class each year since that time, the total number of students who have belonged to the class for a greater or less time has been 901. Of these 125 finished the three years' course, and probably 30 more finished all of the course except the last two series of questions for their sections.

It has not been possible for the secretary to keep in touch with all of the men who have graduated from the class, so that it is impossible to tell just how much each one of them has been aided by the work of the class, but in looking over the lists of graduates given in the annual reports I have noticed the names of a dozen men who, starting in somewhat subordinate positions at the time they entered the class, are now holding much more important positions in their companies, seven of them being managers, although the plants which they manage are not very large, and others being either superintendents of the works or holding equivalent positions in the distribution department. All of these men say that if it had not been for the assistance given them

*For the full report see the Proceedings of the 1908 Convention Master Mechanics' Association.

by their membership in the class they would not have been able to qualify themselves for the positions which they now hold.

The following sample set of questions will give a concrete idea of the practical nature of the work.

Question 1. A net ton of one of two gas coals that are available for use yields 9200 cu. ft. of gas, 750 lb. of coke for sale, 10.5 gal. of tar and 4.5 lb. of pure ammonia, while a net ton of the other yields 9700 cu. ft. of gas, 850 lb. of coke for sale, 15 gal. of tar and 5 lb. of pure ammonia. The average make per retort per 24 hours is 8300 cu. ft. with the first coal and 8900 cu. ft. with the second. In both cases retort house labor costs $4 per each six retorts per 24 hours, and the prices for the products are: Gas, $1.25 net per 1000 cu. ft.; coke, $4 per net ton; tar, 3 cents per gallon, and ammonia, 5 cents per pound. The first coal costs $2.50 per net ton. What is the equivalent price of the second?

Question 2. Describe briefly and generally some method of charging and drawing gas retorts in which hand labor is assisted by mechanical appliances so arranged as to render the work easier and to enable it to be done by fewer men.

Question 3. Give a description, illustrated by sketches, of some form of hand pump used for pumping the drips on the inlet and outlet pipes of the gas holders in brick tanks.

Question 4. In the manufacture of carburetted water gas it has been found that with the ordinary methods of condensing and tar extracting, some vapors remain in the gas until the purifiers are reached and are then deposited in the purifying material with the effect of shortening its life. What has been found to be an efficient way of removing these vapors before the purifiers are reached?

Question 5. What is meant by electrolysis as applied to gas mains and what is its chief cause?

Question 6. What are the respective advantages and disadvantages of cast and wrought-iron pipes for use as gas mains?

Question 7. Give a description, illustrated with sketches, of some form of recording pressure gage used for taking street main pressures?

Question 8. How should persons overcome by gas be treated?

Question 9. In putting in gas piping that will be exposed to extreme cold, such as the risers in street lamp-posts or the portions of mains on bridges, what method would you adopt to guard against the obstruction of the pipe by frost?

Question 10. What is the "Principle of the Conservation of Energy," and how would you apply it to check up the claims made as to the results to be obtained from a new process for making gas?

Question 11. Describe the cycle or series of operations and the method of governing employed in each of the following gas engines: Otto, Westinghouse and Korting.

Question 12. Should the lining in the generator of a carburetted water-gas apparatus be made single or double? Give the reasons for your answer.

(4) EDUCATIONAL WORK OF THE NEW YORK, BROOKLYN AND BOSTON EDISON COMPANIES

The three Edison companies mentioned have demonstration courses in electrical engineering for the benefit of their employees. The lectures are at present given by Prof. S. W. Ashe, of Brooklyn. A comprehensive series of practical lectures has been given for several seasons in New York, and is now to be extended to Boston. Prof. Ashe states as follows regarding this work:*

In 1903 this work was started for the Brooklyn Rapid Transit Company, under the auspices of the Young Men's Christian Association. The work was more primitive than the extensive courses now being given for the Edison companies and was only continued for one year. Three years ago the Brooklyn Edison Company started this work on a comprehensive plan, and this fall will be their third season. Last year the New York Edison Company undertook similar work, expanding upon the Brooklyn Edison course by giving afternoon as well as evening lectures, and next fall will be their second season of activity. This spring the Boston Edison Company arranged to have similar work undertaken for them next year, their first season.

The object of these courses is to create self-development in the men. As you are undoubtedly aware, there is much in a college course that can be taught to practical men who have only a limited knowledge of mathematics. The scheme which has been followed is to lay out a general, elementary course of 20 lectures. The lectures are all experimental in nature, use being made of a special projecting lantern, projecting ammeters, voltmeters, wattmeters, etc., to perform experiments on a large scale. By this means it is possible to perform on the screen almost any experiment which can be done in the laboratory. Ordinary talks, lantern-slide lectures, or demonstrations of apparatus do not seem to maintain interest, but a definite course of experimental lectures presented in an interesting, practical manner seems to be the happy solution of the problem. There is nothing compulsory about the lectures, each individual being a free agent. The courses are free in most cases, and where a fee is charged it is usually small ($3), and this is done principally to limit attendance to those really interested.

The men attending the lectures are encouraged to supplement them by auxiliary reading, and by attending evening courses in technical institutions. The men are advised to carry on systematic study and to join the engineering societies. In fact, everything is done to draw the technical institutions and the companies closer together, as it is mutually beneficial to both. By properly arousing the enthusiasm of the men the courses have been made to accomplish their purpose.

*See also Electrical World, May 16, 1908, for a full account of this course.

APPRENTICE OR CADET WORK BY THE ROCHESTER RAILWAY COMPANY AND THE PUBLIC SERVICE RAILWAY COMPANY

An indication of the importance of work for employees is the attention now being paid to the matter by the members of this Association. R. M. Searle, of the Rochester Railway Company, writes:

It has been our practice every year to put on a number of cadet engineers at, say, $50 or $60 a month, the idea being to give them a salary that would clothe and board them, and let them maintain sufficient self-respect to take up that which for two years is ordinarily a post-graduate course.

About two men out of five stick or succeed along the channels we lay out. They are given everything to do from shoveling coal to actual executive work, and one of the chief things we teach them now is the necessity of having tact, not only with the men under them, but with the public.

The fact that we are continually approached by outside companies for our cadets after training is a gratification to us, and indicates that the lines we are following approach good practice. We have found that the average college graduate in true commercial lines at the outset of graduation is almost useless and hopeless, leaning too much on what he has learned at college and not using it to his advantage. It takes him at least two years to reach his equilibrium, and then if he has an initiative left he manifests to his colleagues or competitors the superior benefits of his technical education.

Mr. Searle's experience will undoubtedly be corroborated by others and it is hoped that an increasing number of railways will engage in similar work.

The Public Service Railway Company has for some time been engaged in training its employees, first, in the gas department, later in the railway department. H. D. Whitcomb, Jr., general manager of the gas department, states as follows:

In addition to the instruction of our employees through the Trustees' Gas Educational Fund, the Public Service has followed out the line of the United Gas Improvement Company in taking on each year a number of college graduates and starting them at the bottom in this work and training them up for the position of superintendent and engineer. All of the men in the employ of the gas departments in responsible positions have been through this course of training, including myself.

The general idea is to start them in the lowest possible position in the gas works and to give them a sufficient length of time, of from one to three or four months, in the actual making of gas on the machines and operating the various

other parts of the apparatus, working them finally into the position of foreman or assistant foreman at the works.

Our plan then contemplates taking them to the street department and going through exactly the same performance, making them actually lay mains and services and set consumers' meters, so that when they are finished with this course they are practically competent to handle any part of the business.

In the railway department of the same company a schedule for the cadets has been worked out and put in operation. The following statement of Mr. Danforth gives the principles and practice of the plan.

Prior to the formation of the Public Service Corporation, 18 railways covered the territory, each having its own organization. The various officials and heads of departments were probably well qualified to fill their respective positions, but when the properties were consolidated, few were considered capable of taking on greater responsibility and consequently the country was searched for men trained in the management of larger properties and in the work of consolidating into one large organization a number of smaller ones.

It is found that large systems produce specialists, while small systems often produce all-round men who frequently lack value to larger properties because of faulty training or ignorance of systematic methods.

Attempts have been made to train men in the various departments so as to have them available for promotion when vacancies occurred. This has been only partially successful, and for various reasons. Among the number of young men thus taken on as apprentices were college graduates. Prejudice against them being prevalent among a certain class of employees, discouraged some; others obtained more attractive positions with manufacturing concerns, but more proved to be unfitted for the business and dropped out.

Applications from graduates of technical schools have been regularly coming in for years, and as specially trained college graduates were being successfully employed as apprentices or cadets by the gas department of the Public Service Corporation, the management of the railway authorized the employment, and education along systematic lines, of a number of cadet engineers.

It has been found that college graduates having natural mechanical instinct, or being naturally inclined toward the railroad business, and with ambition, learn the rudiments of the road with great ease and rapidity and that after weeding out the constitutionally unfit, the remainder drop into positions in the organization where they become valuable to their superiors by reason of their loyalty, eagerness to learn, and to do well their various tasks. In order to make it unnecessary for the company to look outside for foremen, superintendents and other employees having the administration of the company's affairs in hand, an effort is being made to have in training an understudy for each foreman or head of department and to gradually work into the organization as many well-trained men as possible, so that eventually the leading positions of trust and responsibility shall be held, as far as possible, by those capable of further advancement.

The education of young men is now being carried on under two heads, "Apprentices" and "Cadets." The former are employed by the various departments and remain in such departments. The latter are given work in each branch of the business according to a fixed schedule, after completing which they may be used where they can be of the greatest service to the company. This work in the various departments gives them a broader field than that open to other employees and they may thereafter be moved from department to department as seems best.

Cadet engineers are at present working according to the following schedule:

Maintenance of cars and equipment.6 months, as follows:
- General repair shop.....5 months
- Car house pits.....1 month

Maintenance of way.....4 months, as follows:
- Timekeeper and inspector.....1 month
- Sub-foreman of track gang.....3 months

Maintenance of overhead line.....2 months, as follows:
- Repair wagon.....1 month
- Bond testing car.....1 month

Transportation department .....7 months, as follows:
- Car house.....3 months
- Inspector .....2 months
- In division superintendent's office.....1 month
- In general superintendent's office.....1 month

Claim department.....3 months
Power stations.....3 months

SUMMARY AND CONCLUSIONS

(1) The examples of the very recent and successful progress being made by the railway and lighting industries in the training of employees indicates the importance of such work.

(2) This Association is the natural center of information and interest regarding the development of employees.

(3) Some form of cadet or apprentice plan seems necessary to the best development of employees, but the plan must be adapted to local condtions.

(4) The question and answer system of the Trustees' Gas Educational Fund might prove useful to the members of this Association, if similarly adapted.

GENERAL REPORT OF BRITISH THIRD-RAIL ACCIDENTS IN 1907

The general report of the British Board of Trade upon accidents that have occurred upon the railways of the United Kingdom during the year 1907 states that contact with the live rails of electric railways caused the death of one employee and injury to 13 in 1907. In addition to employees of the company three persons have been killed and four injured during 1907 through trespassing on electrically-equipped track, making the total accidents for the year four killed and 17 injured. The details of these are as follows: Charing Cross, Euston & Hampstead Railway, one employee injured; Great Northern & City Railway, one employee injured; Lancashire & Yorkshire Railway, three employees and one trespasser; London & South Western Railway, one employee injured; Mersey Railway, one employee injured; Metropolitan Railway, two employees injured; Metropolitan & Great Central Joint Railway, one employee killed; Metropolitan & Great Western Joint Railway, one employee injured; Metropolitan & Metropolitan District Joint Railway, one employee injured; Metropolitan District Railway, one employee injured; Northeastern Railway, one employee injured, three trespassers killed, and three trespassers injured. In 1906 four persons were killed and 21 injured in this way, in 1905 two were killed and 18 injured, and in 1904, when only three of the above railways were using electric traction, eight persons were killed and 20 injured.

FIRST SINGLE-PHASE RAILWAY IN NORWAY

The first railway line in Norway to be converted to single-phase working is that from Thamshavn, on Orkedals Fiord, to the Lokken mines, a distance of about 17 miles inland, and was opened for public traffic on July 15 last. The line skirts the river Orkla for some considerable distance and then rises rapidly to Lokken. Power from a hydro-electric plant is supplied at 15,000 volts, 3-phase 50 cycles. The trolley potential is 6600 volts and the frequency 25 cycles. The rolling stock consists of three 20-ton locomotives and a motor car. The electrical equipment and catenary suspension were supplied by the British Westinghouse Company.

THE POSSIBILITIES OF A WELL-CONDUCTED DEPARTMENT OF PUBLICITY—SECOND PAPER*

BY B. R. STEPHENS, TRAFFIC MANAGER, ILLINOIS TRACTION SYSTEM, SPRINGFIELD, ILL.

The possibilities of a well-conducted publicity department for interurban railways should occupy the attention of all owners and operators of such properties.

The producer of any commodity, either a necessity of life, or an item of luxury, or an article filling a long felt want, can hardly hope to dispose of such a product unless those who need it are led to know of its existence through some avenue of publicity; it does not follow that the mere production of a certain superior article will dispose of it to the consumer, but the prospective consumer must be advised of its existence, led to know of its superior quality, not only by its being superior, but often must be made to believe, by publicity, that such an article is an absolute necessity to his existence and the reason for such necessity forced to his attention.

This same practice must also be followed in obtaining business for an interurban, particularly so with interurban roads which generally are built in territory long occupied by steam roads which have, through years of mere operation, installed into the minds of the patrons that their line is the one to use between certain points.

The publicity of an interurban railway first commences with the conception of the idea of construction. The local newspapers are interested as a news item, they write up fully the proposed route, the methods of finance, the granting of the franchises, the material to be used in construction, the progress of construction, the kind of cars which have been ordered, their length, furnishings, speed, frequencey of operation, the probable rates of fare and the opening of the line, all of which must be judiciously given to the newspapers which are anxious for items of interest to their subscribers and to the public in general; and don't neglect the opportunity of enlisting the good will of the newspapers, as they are your best friends; they will publish the number of passengers carried on your first day of operation and on your legal holidays, when the large crowds are always on the move for a day's outing, and as your operation progresses still keep the friendship of the newspapers. Other matters of interest may attempt to overshadow your importance to the public, but you have changes of schedule, new service, new cars, made necessary by the enormous increase of traffic, new parks opened, new excursion rates, new methods of safe operation, all of which are of interest to the public and are matters of publicity and continually calling attention to your property; no matter how large the city, how great the circulation of its newspapers, there is always a way to interest the railroad editor or reporter in your property and keep it on the front page, and this is due your property, if the best results are to be obtained.

In nearly every instance the editor or reporter of the railroad department will be exceedingly glad to co-operate with you if you are his friend. He is only endeavoring to publish a paper of interest to its readers and they are interested in your project, if you make them believe they are. You have a solid foundation for such interest in that you are operating a new and advanced method of transportation, one of the most vital integral parts of the growth of the nation; you cannot help but be in the light of publicity, through this avenue, if you will but meet the opportunity half way, and this avenue is so essential it must always be given first place in the list of publicity items. If we think of the things which sway our individual ideas in all matters of interest, we must recognize that we form our opinions, to a great extent, on the publication of an article in some newspaper; other people are not different from us in this business, but merely have a different point of view, that is, they look upon their own business from the point of familiarity and on ours, the interurban, as something about which they want and need information. The newspaper is the avenue of such information and whatever they read they accept, in a large measure, as the truth, and form their opinions accordingly. I do not mean by this that it is possible, in any manner, to receive the support and co-operation of any newspaper without a foundation of merit in the institution you represent.

Newspaper men are as wise as any people on earth and necessarily better generally informed, but having, as we do, the best, cleanest, most convenient and cheapest method of transportation, we are in a position to enlist the good offices of the newspapers and should we fail to do so, it is merely through lack of business judgment or diplomacy.

Again, it has become customary, in nearly all localities, to consult the newspapers for the time-cards of all railroads. We have yet to find any daily or weekly newspaper of general or special trade circulation which is not glad to publish our time-card on the basis of exchange of mileage on a regular valuation contract. The rulings of the Interstate Commerce Commission on this subject has, to some extent, curtailed such a practice, but wherever it is possible to follow this rule of carrying the local time-card in the local newspaper we have found it brings exceedingly good results, not only in the direct information to prospective patrons, but in making a friend of the newspaper publisher and, in fact, enlisting his services as a representative, to recommend your service personally, particularly so since the steam roads have almost entirely discontinued the practice.

FOLDERS

Early in our history, when we had but 65 miles in operation, we commenced the publication of a regular folder of four pages which gave only the local time-cards in detail and information as to passenger tariffs and special Sunday excursion rates: these were gotten out in the ratio of about one for every ten of the population we served at intervals of sixty days, and were distributed in stores and residences in the towns and cities into which we were in operation. We had the idea that if we continued this practice, of placing directly in the hand of the people interested the knowledge of the time of our cars and the rates we charged, that we would, in the course of time, entirely obliterate from their minds the fact than any other method of transportation was in existence in our territory and when they desired to travel to any point we reached they could think of no other route, and I firmly believe that we have succeeded in our efforts. We have continued the practice of issuing this folder every sixty days, now distributing 65,000 each issue, 22 pages each, and giving the local time-card of each division, through time-card of all through limited trains and their connections, information as to through rates, sleeper service, Sunday excursions and not forgetting to call attention to our express service.

It has always seemed strange to me that, without exception, steam roads have advertised and exploited, by every

*Read before the American Street and Interurban Railway Transportation and Traffic Association, Atlantic City, N. J., October 12, 13, 14, 15 and 16, 1908.

conceivable device and method, their passenger service, which generally represents about 10 per cent of their earnings, and are entirely silent on the subject of their freight service, although they claim that there are no net earnings in passenger business and they live entirely on the proceeds of the freight handled. I am aware of innumerable exceptionally fast freight schedules on different steam roads between important cities and have yet to see a single advertisement of such service. I believe that in this there is a failure to avail themselves of an opportunity, and so far as our company is concerned we intend to follow the method of advertising such service to as great, if not a greater, extent than our passenger service. We have done this and during the past year, while all steam roads have been suffering from decreases, our freight and express business has shown a 30 per cent increase on lines which have been in operation for five years and a much larger per cent of increase on the newer operating lines. In this folder there is no other advertisement.

We are absolute believers in individual advertising in such publications and have discontinued all advertisements in opera house programs, school graduation papers, church programs, wall cards, hotel registers, etc., which are merely gotten out for the benefit of the person selling the space, and with this idea in view we have sent out neat frames, with our monogram on, to all hotels and public places, containing our time-cards on a single sheet and change these as the time-cards are altered. We issue a calendar showing the map of Illinois and our lines distinctly marked with the cities and towns we reach to the absolute exclusion of any other railroad. We issue a series of postcards with cuts of our cars and scenes of interest along our lines and with illustrations of public, State and county buildings, a series for each large city, and distribute them gratis through our ticket offices. We issue special bills, 7 in. by 16 in., often in varied colored inks for special attractions, giving a separate issue for each individual attraction and a special distribution in the locality and among the particular people liable to be interested. We do this for circuses, Chautauquas, county fairs, for special Sundays at parks, poltical meetings, etc., and the distribution of such advertising, or I might say all advertising matter, is one of the most essential portions of publicity and one which is most liable to be neglected.

We have had a varied experience in our endeavors to reach the people with the advertising matter we have had printed and, although we tried the employment of distributing agencies and bill posters, licensed and otherwise, we frequently found that not one-tenth of the matter which we paid to have distributed had been put out to the public. We endeavored to remedy this fault by withdrawal of patronage and by reporting such delinquency of licensed advertisers to the secretary of their association, and although we have been repaid, in some instances, for the advertising matter wasted, we still could not be repaid for the loss of business occasioned by the breach of contract. We found the matter becoming so serious that we finally resorted to the employment of a man to devote his entire time to the distribution of advertising matter, a man who had been in the business for some years, and demonstrated to us that he, at least, was conscientious in his work, and who employs such help as is necessary to get out the advertising printed and stays with his men until the work is done and by this method we do reach the people. Looking back now over our former methods we wonder how much money we have spent for paper and printers' ink for no other purpose than to start fires or fill back lots or ash barrels. This is really an important item and one which should have serious consideration and attention, and every advertiser would do well to know whether or not the matter which he plans and pays to have printed is actually serving a legitimate purpose to the people he desires to reach.

Billboard advertising is used quite extensively by a number of interurbans and to very good advantage, particularly in the larger cities, and in this, as is true of almost all advertising, it is necessary to have your advertisement of a sufficiently striking and attractive nature to arrest attention and sufficiently plain and comprehensive to be read at a glance. Nearly all billboards are placed to catch the eye of the traveler and he must read the message you have for him at a glance. Probably 90 per cent of the people you reach by this method are the same, day after day, as about that percentage of travelers on street cars are regular patrons, using the same route daily, and by this medium, if you have attracted their attention and hold it, you are pursuing a method of education to produce, if you already have not done so, the result of eliminating the thought of any other method of transportation to the points you reach.

Diversion from daily routine is an essential part of existence and in this diversion the opera house occupies a prominent place. To encourage such attendance and travel from towns contiguous to large cities it is, of course, necessary that the opera house advertise along your line. In this the interests are identical and in consequence is it not fair, if the opera house furnishes the advertising matter and places it before the public, that you furnish its representative with transportation over your lines? This is practiced by a large number of interurban lines, and while it is a diversion from the general practice of transportation companies prior to the advent of the interurban system, it has proved itself a factor in the revenue obtained. This is true of picnics, circuses, Labor Day celebrations, lodge visits, political meetings and innumerable other attractions which are an excitement and a diversion for the people, occurrences in which they are interested and which you desire that they patronize from the viewpoint of revenue.

PARKS

The operation of parks by individuals or by the company interested is one through which a great diversity of results have been obtained. A public park, with attractions and amusements for its patrons, to be a paying investment to those operating the interurban, must be so situated as to be within reach of a sufficient population of a temperament desiring diversion, to pay the cost of park operation from the proceeds of its privileges. It is undoubtedly necessary for an interurban to make a low fare to any park to encourage attendance, and with this fact and the further necessity of advertising this rate of fare and the liability of personal injury to passengers, necessity of extra cars and additional expense in all departments of their operation, the interurban cannot afford, in addition, to bear any part of the expense of the operation of the park. The method of identical operation and of separate operation have both been tried, with the consensus of opinion in favor of the latter. That there must be co-operation there can be no question, and only by this can satisfactory results be obtained. Parks are beneficial not only in the revenue derived immediately from their operation, but from the fact that you are still pursuing the policy of education to travel to all points on your line via no other route.

Baseball games between teams representing cities and

towns located on your line are a great incentive to travel. Not only is this true of the leagues composed of teams representing cities from different States and of national interest, but exceedingly gratifying results may be obtained from the formation of a trolley league, made up of representatives from towns located within a short distance of each other and between which towns and their representatives there is more or less friendly rivalry. It is the purpose of your publicity department to excite this rivalry and keep it alive, as it not only brings results in this direction, but in the formation of friendly attachments between the residents of such towns and the consequent visits and trips via your line.

Your publicity department must not allow any town or city on your line to fall into a comatose condition. It must be kept alive and made to attract people from the surrounding territory; not only that territory reached by your road, but from the territory in opposite directions. The towns on your lines must be made energetic, attractive and progressive. If the citizens are not of the natural disposition to do so, they must be made to see the necessity of giving Fourth of July and Labor Day celebrations, street fairs, carnivals, band concerts and various other amusements to attract the people from the surrounding country. Other towns and cities not fortunate enough to be served by your line must be made to see its benefits, to be drilled into the habit of coming to some city or town on your line for their diversion, and to make such a city or town their starting point, via your line, for whatever destination they desire to reach.

EXPENDITURE

On steam roads, as a general rule, an allowance is made in the operating expense of 2 per cent of the gross passenger earnings for publicity purposes, and on the interurban roads it would appear that, approximately, one-fourth of this amount, or one-half of 1 per cent, is the allowance made for this purpose. This practice may be brought about from the fact that it is generally presumed that an interurban will handle, between any two given points, eight times as many passengers as were formerly handled by the steam road operating between those same two points, and as the steam road rates were formerly 3 cents per mile and the interurban usually 1½ cents per mile, the interurban is earning four times as much gross from its passenger business, and in consequence the one-fourth allowance is the same amount net in both instances. While this is true, it would not appear that the allowance given the publicity department of an interurban was sufficient. The interurban as yet is a new proposition, and while it is undoubtedly more than acceptable to the general public and fills a long-felt want, is a better, cleaner, more comfortable, and more convenient method of travel, it must, in a large measure, create 87½ per cent of its business. It must make this business; it must excite the people living along its lines to an extent that they travel because it is so convenient, and it must induce the people to spend in fares on its cars that portion of their earnings which everyone has for the purpose of diversion. This is no easy task, but requires constant thought, acquaintance with almost the individual disposition of your contiguous population, quick action in taking advantage of every opportunity arising which may induce that population to travel, and the entire elimination of the thought of any other method of transportation. These essential points are the ones by which the desired results may be obtained, and to produce them a sufficient allowance should be made to cover the cost.

THE POSSIBILITIES OF A WELL-CONDUCTED DEPARTMENT OF PUBLICITY*

BY CHARLES E. FLAGG, ADVERTISING AGENT, INLAND EMPIRE SYSTEM, SPOKANE, WASH.

The possibilities of a railway's department of publicity, it seems to me, depend largely upon the natural environments and resources of the city or territory to be exploited. Given a city like Spokane, Wash., in the heart of the richest agricultural belt of the Pacific Northwest, with the great Cœur d' Alene and Boundary mining districts near by, with its vast lumber interests in eastern Washington and northern Idaho and an outing region that comprises 30 magnificent mountain lakes and rivers, and it would be hard to imagine a more ideal field than that which the Inland Empire System's and the Idaho & Washington Northern Railroad's departments of publicity are endeavoring to bring to the public's notice.

The Spokane country, or the "Inland Empire," as it is known locally, extends from the Rocky Mountains on the east to the Cascade Mountains on the west, Spokane being the only city of importance between Butte, Mont., and Seattle, Wash., a distance of 800 miles. The area of Spokane's territory, extending over eastern Washington, northeastern Oregon, northern Idaho and southern British Columbia, is greater than all of New England, with New Jersey and Delaware thrown in. This Spokane country in 1907 produced upward of $100,000,000 worth of ores, timber and agricultural products, and its natural resources are as yet hardly touched. People that migrate to the Spokane country seldom ever send home for money.

The city of Spokane has something over 100,000 population, five transcontinental railroads, 104 miles of city traction lines and 200 miles of interurban electric railroads. The Inland Empire System, which now has 225 miles in operation, began less than five years ago as the Spokane Traction Company, city lines, and the Cœur d'Alene & Spokane Railway, interurban between Spokane, Wash., and Cœur d'Alene, Idaho.

The Spokane Traction division, which now has 36 miles of tracks in Spokane, reaches all the city's principal parks, including the Interstate Fair Grounds, and owns the Northwestern League Base Ball Park and franchise.

The Cœur d'Alene division of 50 miles furnishes easy access to the city's nearby lakes and also provides the main thoroughfare to the famous Cœur d'Alene mining district, connecting at Cœur d'Alene City, Idaho, with the "Red Collar" steamers. The "Red Collar" line traverses Lake Cœur d'Alene and the highest navigable stream in the world, the beautiful, shadowy St. Joe River, one of the delights of the tourists to the Northwest.

The Spokane & Inland division is operated by the Westinghouse single-phase alternating current system and was one of the first successfully operated alternating-current roads to be built capable of hauling heavy freight. This division has gained considerable publicity from the fact that representatives of five different foreign governments have been in Spokane to inspect its operation. The Inland Empire system handles heavy fright by electric power from its own power plant on the Spokane River and has traffic arrangements covering both freight and passenger business with the Great Northern Railway, freight business with

*Read before the American Street and Interurban Railway Transportation and Traffic Association, Atlantic City, N. J., October 12, 13, 14, 15 and 16, 1908.

the Spokane & International and passenger business with the Northern Pacific.

So, in brief, the Inland Empire System and the Idaho & Washington Northern are reaching out northward to the great timber belt and lakes, eastward to the mining country and more of Spokane's beautiful lake resorts, to the south to Colfax, Wash., and Moscow, Idaho, across the great Palouse wheat country, and now the latter is looking westward toward the Big Bend wheat belt and the upper Columbia River basin, and in so doing these lines provide every possibility that could be desired for the successful operation of a department of publicity.

MEANS OF PUBLICITY

Take in the order of expenditures, we utilize, first, the daily newspapers; second, illustrated folders, official time-tables and maps; then enlarged photos, billboards, street cars, postcards, souvenirs and any other means that appeal to us as opportune and likely to bring results.

NEWSPAPER ADVERTISING

Practical experience on newspapers in Eastern and Western States has proven to us that no two communities are susceptible to exactly the same style of advertising, for the reason that the newspapers vary in their typographical make-up. Spokane is just as fortunate in the way of newspapers as in other assets, our dailies being models, from a typographical standpoint. We have found it most practicable to use good-sized display spaces in the evening "Chronicle" and reading notices in the morning "Spokesman Review." Nine times out of ten an advertiser's idea is to fill his space with all the copy that can be jammed between the rules, in order to get his money's worth. We do not see it that way, however, for in our summer resort and excursion advertising we state as briefly as possible facts about our trips, beginning with a seasonable, catchy headline or illustration and leaving a good white margin, which brings out our announcement, in strong contrast to the other displays in the paper. In advertising our lake and river excursions we use a line cut of a steamer which is particularly noticeable when used in an inland city like Spokane. Our reading notices are also written with a catchy headline and are set in body type of the paper on a local news page. Agate liners are out of the question, as they are too small to be readily seen.

In each suburban town through which our lines pass we run a small display in the weekly newspaper, consisting of local time-table, varying this with announcements regarding excursion and colonist rates to and from the East.

FOLDERS AND MAPS

It is our belief that the first impressions of our system gained by the traveling public are most lasting, and all literature should, therefore, be strictly high grade and compare favorably with the excellent train service maintained. We often hear criticisms about the expensive literature issued, but we insist that one folder that is artistic enough to be kept and shown or mailed to others covers more ground and makes a greater impression than twenty common, ordinary leaflets which are generally glanced over and thrown away. We have never yet seen one of our folders discarded on the floor of our cars or depots.

A year ago I had the good fortune to attend the convention in this city and on returning west traveled several hundred miles by electric lines. Upon arriving at one of the principal trolley centers in the Middle West I was surprised to find there was no official time-table of the various lines available. In Spokane we have the official time-table folder, which contains all electric train time-tables, with those of connecting steamer lines as well as the time-tables of all steam roads; the foder also contains a skeleton map of all railroads radiating from Spokane, so that a tourist has all the information he may desire in concise form. This alone is, I believe, one of the strongest inducements for the tourist to stop over in Spokane and see the surrounding country via our lines.

Good color maps are very important, especially in a new country and where a system is continually making extensions. Nothing will put the traveling public straight so quickly as a map showing the principal points reached, distances and connections with other lines.

The cover of our official time-table folder is designed with border of electric trains in silhouette on background of "Ben Day" machine ruling, which, with the red display lines, makes practically a three-color cover with only two press runs. The oval halftone inserts on either side are changed monthly and give opportunity to feature terminals, trains, etc.

The past season the Inland Empire System issued a handsome color map, made by the well-known "Complete Press," of Buffalo; the map is in folder form, the reverse side being utilized for good-sized halftones of lake resorts and hotels, with brief explanatory lines under each. The same map printed on heavy plate paper we have also had framed for our depots and leading hotels.

Another map idea we are using is a mere skeleton of our lines, showing the principal towns and lakes reached, making it possible for patrons to understand at a glance our entire system. This we have framed and placed in the front end of each suburban coach at the right of the door on a level with the eye.

In the preparation of our folders, lake, hotel and farm booklets, we travel on the theory that first of all the cover design should be of such an original and attractive nature as will catch the eye and force the prospective patron to pick it up as something unusually interesting. It is the cover that makes the first impression and if vacation time is near, pictures of camp scenes, lakes, rivers, mountains and pine trees are sure to interest and suggest. Our "Hayden Lake" folder this season had the reproduction of an original photograph of pine trees on the covers and was mailed out with fresh pine needles in the envelopes to carry the balsam of the forests direct to the recipient and add to the effectiveness of the lake and forest views. We never issue a folder or booket with a blank back cover, as we believe one cover is practically as valuable as the other. We avoid, as far as possible, any retouching of our views, sticking closely to the reproduction of the original photograph. The pine tree cover design of our "Bozanta Tavern" folder is merely a photograph of the actual forest trees, as is also the yellow pine tree trunk of our "Idaho & Washington Northern" folder, the pine cones on our "Pend Oreille" picture and the rope design of our "Red Collar Line" folder.

Our object in the preparation of folder copy is to run our illustrations as large as possible and our type matter as brief and concise as we can. To crowd several pictures into a group is sure to lose the effectiveness of the entire lot. One good clear full page of halftone, with a line or two of descriptive matter, is worth ten pages of groups and as many pages of reading matter. The public will not stop to read. In my own experience I do not recall ever having read through a single page of the descriptive matter

so profusely used in the many booklets that have come to my notice. One thing lingers with us, and that is pictures that are above the ordinary, especially beautiful views of nature. When either the Denver & Rio Grande or the Canadian Pacific Railways are mentioned, one cannot help but think of the Grand Canyon of the Colorado and the Canadian Rockies, which have been so handsomely pictured by these roads.

PICTURE ADVERTISING

Now, while I am not selling cameras or developing papers, I am advocating picture advertising as the quickest and most convincing means of publicity. This may be partly due to the fact that there are such grand possibilities in Spokane's lake region for obtaining unusually beautiful views. Our lakes are picturesquely set in the rugged mountain ranges and our rivers and trout streams have swift waters and riffles that gladden the hearts of sportsmen. We have photographers, too, that can do justice to our scenery, as a glance at our albums will prove. Every summer our official photographers obtain a fresh supply of lake and river views for use the following season, and to secure the proper material it is found necessary for the publicity man to accompany them on fishing and camping trips, one of the pleasant features of publicity work.

Our chief argument in favor of picture advertising is no matter how busy or ignorant the person, a photograph can be read and the impression gained instantly. If the press of to-day could afford to use paper that would reproduce fine halftones, it is safe to say that the Inland Empire System and Idaho & Washington Northern would devote all of their newspaper publicity to the reproduction of views from along their lines.

We select our best views for enlarging and have them framed and hung in our depots and in good locations in public buildings. We also have complete photo albums in our general passenger and publicity departments, as well as on our parlor cars, with the idea of entertaining and educating the public.

Photography is also playing an important part in our claim department, showing as it does the relative position of the cars, crossings, etc., when accidents occur.

In the distribution of our literature we utilize mailing lists of all clubs, fraternal orders and special lists compiled by our agents. We are particular to supply all hotels with folders and to keep clerks well informed regarding our excursions and resorts, as they undoubtedly are able to steer a great deal of transient trade our way. Clerks in sporting goods stores are also kept posted regarding our fishing and hunting resorts. The transcontinental lines also help us in distributing literature in the east when receiving inquiries about the Spokane country.

BILLBOARD PUBLICITY

Our billboard posters this year are 16 sheets, containing only 24 words and reproduction of excursion steamer Idaho and one of our four-car electric trains, brevity being our aim. Small cards of the same wording and design are also used for tacking. With these posters we advertise our 200-mile daily and Sunday excursions to the beautiful, shadowy St. Joe River, via our Cœur d'Alene Division and connecting Red Collar steamers. The round trip of 200 miles is made in one day at a fare on week days of $4 and on Sundays of $2.50. Our advertising car, which has a 16-sheet space on either side, is used on our main streets during the noon hour and evenings, to advertise excursions, ball games, etc.

Still other means of publicity used are placards in street cars and various souvenirs, such as grip tags, drinking cups, etc. Our Pend Oreille River excursions we advertise by giving a beautiful color panel of Grand View Canyon to each excursionist.

THE DEPARTMENT ITSELF

The Inland Empire System's department of publicity is located in the Electric Terminal; its walls are completely covered with pictures of our equipment, lakes and rivers. Albums of views dating back to the inauguration of service on our several lines are open to the public at all times. There are days when the publicity man must needs spend his entire time entertaining and answering telephone queries about excursions, camping and fishing trips, and evenings when he can do his regular work.

To inject the proper amount of enthusiasm into my "outing dope" I find it necessary to spend some time, principally Sundays, camping and fishing. Then it is that we get our best pictures, for nothing appeals quite so strongly as views of campers and sportsmen actually enjoying their outings, boating, bathing, fishing and eating. It is also necessary to be ready at all times to tell just as good a fish story as any cheerful liar that may bob up.

Still another and very important feature of publicity work is putting the reporters straight. The average railroad man steers clear of the sensation monger, but when treated with some degree of consideration, the reporter is not such a bad fellow. He should, I believe, have some technical knowledge of the run he is covering, for this would very often prevent needless misstatements and wrong impressions creeping into headlines. I have in mind an accident that occurred on the Cœur d'Alene Division two years ago. A man had endeavored to whip up his horse and cross in front of our Shoshone Flyer, but just failed to make it, his horse running into the door of the baggage compartment of our No. 1 motor. It was such an unusual thing for a rig to run into a train rather than vice versa that it was 11.00 p. m. of the same day before I could convince the reporter of the facts in the case and then not until he was shown the indentation of the horse's teeth in the baggage car door. As a result, the story appeared in the paper correctly, laying the blame where it belonged rather than on the motorman as it otherwise would have been.

The possibilities of a department of publicity in the Pacific Northwest are almost limitless. The growth and development of the great Spokane country, in a large measure, depend upon publicity, and as the Inland Empire System and the Idaho & Washington Northern extend their lines north, east, south and west to help develop and to share in the rich resources nature has stored there, the possibilities and responsibilities of the publicity department are constantly increasing.

The members of the Accountants' Association had a "Get Together" luncheon on Wednesday at the Marlborough-Blenheim. President R. N. Wallis called on a number of those present to make short talks. Remarks were made by the following: F. E. Smith, W. F. Ham, C. N. Duffy, W. G. Ross, H. C. Mackay, H. M. Edwards, Frederic Nicholas, F. W. Sweney, W. E. Harrington, C. R. Cockle, Will Browne, A. L. Linn, Jr., F. Dabney, and W. H. Forse, Jr.

The Stone & Webster Engineering Corporation is largely represented by Mr. Potter, of Texas.

REPORT OF THE COMMITTEE ON POWER DISTRIBUTION*

BY W. J. HARVIE, CHAIRMAN, JAMES HEYWOOD, J. P. BOYDEN, G. D. NICOLL, W. H. MATHEWS.

As this is a new committee, it has seemed best to formulate a general plan or outline which might be followed by this and future committees, and to fill in portions of the outline with such deductions as the committee has made this year. In order to assist in the work, sets of questions covering a considerable portion of the outline submitted, were prepared and sent to member companies. These questions were responded to very promptly and by a large proportion of the members. Some companies, especially, have gone to considerable trouble in providing the committee with data, specifications and blue prints, all of which have been of valuable assistance to it in the preparation of this report.

It is respectfully suggested that the future work of this committee be carried on in accordance with the general outline here submitted, with such additions or further subdivisions as may seem advisable.

In the discussions of the committee it has developed that there is a large field for standardization of material and practice in the power distribution department of electric railway work, and some effort has been made along these lines by the present committee. It believes that the association will be benefited by continuing the consideration and recommendation of standards by this committee.

The outline submitted by the committee is as follows:

FEEDERS

I. HIGH TENSION.
  (a) Underground.
  (b) Overhead.
  (c) Lightning protection.
II. LOW TENSION.
  (a) Underground.
  (b) Overhead.
  (c) Lightning protection.

WORKING CONDUCTORS

I. ORDINARY TROLLEY.
  (a) Conductor.
  (b) Ears and clips.
  (c) Insulators and hangers.
  (d) Supports.
  (e) Lightning protection.
II. THIRD-RAIL.
  (a) Conductor.
  (b) Insulators.
  (c) Supports.
  (d) Protection of conductor rail.
III. CATENARY.
  (a) Conductor.
  (b) Suspenders and clips.
  (c) Messenger cable.
  (d) Insulators.
  (e) Supports.
  (f) Lightning protection.
IV. UNDERGROUND TROLLEY.
V. CONTACT SYSTEM.

RETURN SYSTEM

I. BONDS.
II. SUPPLEMENTARY COPPER.
III. ELECTROLYSIS.

CONDUIT SYSTEM

I. DUCT AND CONDUIT CONSTRUCTION.
II. MANHOLES.
III. VENTILATION AND DRAINAGE.

*Read before the American Street and Interurban Railway Engineering Association, Atlantic City, N. J., October 12, 13, 14, 15 and 16, 1908.

The attention of the present committee was confined largely to the following items in the above outline.

FEEDERS—II. LOW TENSION

(a) Underground.—It seems to be standard practice to use saturated, paper-insulated, lead-incased cables for underground work, the paper being 5/32 in. in thickness and the lead from ⅛ in. to 5/32 in. in thickness. Replies to inquiries show that one large company is using 5/32-in. rubber insulation with triple-braid cover, without the lead sheath. This company seems to indorse this method without hesitation. As this practice has been in use only about three years, the committee does not care either to condemn or to recommend it. A full discussion of the subject, however, is urgently invited.

It seems to be the general opinion that some kind of fireproof protection is needed on the outside of the lead cable sheath in manholes. Some roads are using asbestos, saturated with a solution of silicate of soda. A split-tile protection is recommended by one of the large roads. This is undoubtedly a superior protection and is advisable if local conditions permit its use. It is only fair to say in this connection, however, that the road referred to offers the above suggestion only as a proposed improvement, and has not yet installed the tile on its own property. The committee, however, agrees that the practice suggested is a good one, but realizes that it would probably not be practical to use it on systems already in service without rebuilding its manholes.

WORKING CONDUCTORS—I. ORDINARY TROLLEY

(a) Conductor.—The majority of reports received by the committee indicate the use of No. 00 round wire on city and interurban work. A number of companies, however, are using No. 0000 wire on interurban work and for renewals on city work. In view of the heavier equipments which are now being operated, the tendency toward the heavier wire is a natural consequence.

The matter of whether round or special shapes should be used, is, however, largely a matter for future experience to determine. The committee believes, however, that the so called "figure eight" wire should not be considered.

It is not the intention to discuss here the use of special alloys of copper wire for especially congested districts, as these cases form special problems for the engineer of each individual company to work out.

Regarding a standard height for trolley wire, the committee believes it good practice, and recommends, that the height of trolley wire above top of rail be standardized at 19 ft.

(b) Ears and Clips.—The majority of roads reporting show the use of clinch ears on work now in service. Some roads, however, on which grooved trolley wire is used, are using mechanical clips, but they find that when these mechanical clips are to be replaced it is usually necessary to substitute for them the clinch ear. This fact may in time influence electric railway companies in the determination of the type of wire to be used, as referred to above, and this has, therefore, been left for future committees to investigate.

(c) Insulators and Hangers.—It appears that electric railway companies are using all types of straight-line hangers and insulators with the round-top bell type predominating. This committee believes that further investigation should be made by our successors before making definite recommendations on this matter.

In strain insulators the use of wood is being favorably

considered by a large number of companies. This type of insulation has certain very marked advantages, principal among which are: low first cost, freedom from short-circuits and the fact that defects can easily be detected by visual inspection.

(d) Supports.—It is the experience of electric railway companies that both wood and iron poles are subject to excessive deterioration at the ground line. Many companies have begun the practice of using so-called wood preservatives for wood poles, but up to the present time none of these has been able to show definite results.

For iron poles the committee can, however, recommend without qualification the use of an iron sleeve shrunk on all iron poles at the ground line. This sleeve should be 2 ft. in length and so placed on the butt section as to have the middle point of the protecting sleeve at the ground line when the pole is set in place. It is good practice in reclaiming corroding iron poles to place a protecting sleeve like the above and 1 in. larger in diameter than the pole at this point, over the butt section at the ground lines, and then fill the space remaining with some self-hardening fluid which will effectually keep out moisture and restore the original strength of the pole. Your committee recommends that iron poles be purchased complete with this protecting sleeve.

II. THIRD-RAIL

(a) Conductor.—Six roads have reported on third-rail construction. Three of these are using the over-running type and three the under-running type of third-rail. One type of over-running only is described. This consists of the A. S. C. E. section weighing, in one instance, 85 lb. per yard and in the others 100 lb. per yard. Two types of under-running rail have been described: the Sprague-Wilgus type and the Farnham type. The former is the well-known bull-head type weighing 70 lb. per yard, and the latter is a U-shaped section, varying in weight from 55 lb. to 80 lb. per yard.

(b) Insulators.—Three kinds of insulation are used with the over-running type of rail: wood, reconstructed granite and composition. Four kinds of insulation are used in the under-running type: wood, porcelain, semi-porcelain and composition. The breakage of insulators for the over-running types reported is 2.76 per cent per year. The breakage on the under-running type is 3.36 per cent per year, based on the information now in the hands of the committee.

(c) Supports.—The spacing of third-rail supports varies without respect to the type of rail. The spacing most used is that of 10 ft., with a maximum in some instances of 11 ft. and a minimum of from 5 ft. to 6 ft. These locations are apparently governed by the lengths of third-rail and the standard tie spacing in use. The weights of brackets varies between 9 lb. with the over-running rail and 13 lb. to 20 lb. for the under-running rail.

The committee can see no reason for such great diversity in spacing of supports, and would recommend that a spacing of 10 ft. be used on all third-rail construction where 30 ft. conductor rail is used, and 11 ft. where 33-ft. conductor rail is used.

In all cases but one, the support for the bracket is an extended tie, which is also a part of the track structure. In the one case referred to it is entirely independent of the track structure. It might be well in this connection to note that the road referred to reports an absolute lack of insulator breakage, undoubtedly accounted for by the above condition of supports independent of track structure. The completed structure is illustrated in Fig. 1 for the benefit of those who are in a position to use this method of installation.

(d) Protection of Conductor Rail.—None of the companies reporting over-running third-rail type of construction has protection installed throughout, while the under-running type is protected by wood or fibre. The committee feels that in third-rail installation it is best practice, and it recommends, that protection be installed throughout, where clearances permit, irrespective of whether it be for use on surface, subway or elevated work.

III. CATENARY

The committee was instructed to give special attention to catenary forms of overhead construction. In following out these instructions, information has been obtained from companies which have this form of construction already installed. A valuable paper on the "Application of the Theory of the Catenary to Railway Work," which should be of service to members of the Association, has also been secured. This paper forms a part of the report and your committee takes this opportunity to acknowledge its indebtedness to the author, R. L. Allen, Engineer, Archibald Brady Company, Syracuse, N. Y. [This paper will be found elsewhere.—Eds.]

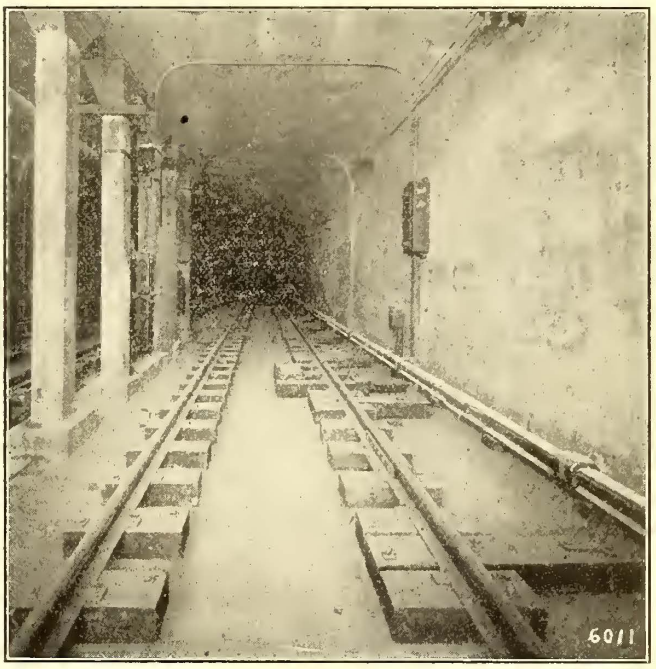


Fig. 1.—Power Distribution—Third-Rail Construction in Subway of the Philadelphia Rapid Transit Company

(a) Conductor.—The majority of companies reporting show the use of No. 0000 grooved trolley wire for catenary work, which size and shape the committee recommends. There has recently been adopted by the manufacturers of wire a standard section known as the "American Standard." After sufficient experience shall have been had with this section, it should either be adopted or modified by the proper committee, and passed upon by the Association for use as a standard.

(b) Suspenders and Clips.—All companies show the use of the mechanical clip and there seems to be no doubt but that this will continue to be modern practice.

A rigid form of suspender is recommended by the committee. The question as to whether the suspended should clamp the catenary is still an open one. In this connection

attention is called to Mr. Allen's paper in which he refers to a method adopted in Europe, designed to provide a sliding feature by means of an additional horizontal cable parallel to, and a few inches above, the trolley wire and supporting the trolley wire by sliding clips. This seems to be a step in the right direction and the committee invites a thorough discussion on this matter at the convention.

The present practice in suspender spacing varies from 10 to 46 feet. Mr. Allen's deductions are in favor of a spacing of from 20 to 30 feet. The committee would also like to have this subject further discussed in the convention.

(c) Messenger Cable.—Among the lines installed there is a wide divergence in sizes and quality of cable used. The committee recommends the use of the highest strength cable that can be obtained, in order to develop the full advantage of the catenary type of construction. The cable should be double galvanized and the committee submits the following specifications for galvanizing.

The galvanizing on the wires composing the cable shall consist of a coating of zinc, evenly and uniformly applied. The zinc shall be so applied that it will adhere firmly to the surface of the steel wires. The galvanizing shall be capable

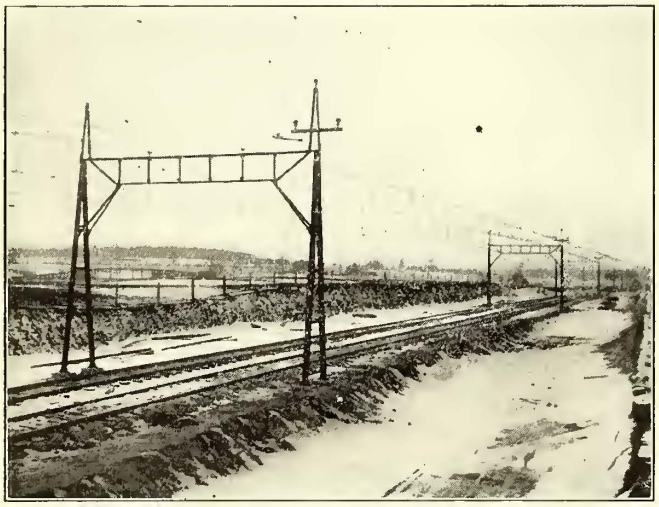


Fig. 2.—Power Distribution—Showing Light Type of Steel Bridge Supports Used in Catenary Construction

of the following test: The sample shall be immersed in a standard solution of copper sulphate for one minute and then removed, immediately washed in water thoroughly, and wiped dry. This process shall be repeated. If, after the fourth immersion, there should be a copper colored deposit on the sample, or the zinc should have been removed, the lot from which the sample was taken shall be rejected.

The standard solution of copper sulphate shall consist of a solution of commercial copper sulphate crystals in water. This solution shall have a specific gravity of 1.185 at seventy degrees Fahr. While a sample is being tested, the temperature of the standard solution at no time shall be less than sixty degrees Fahr., nor more than eighty degrees Fahr.

(d) Insulators.—The subject of insulating supports for the messenger cable on high tension service resolves itself into the use of porcelain entirely; the shape of insulators depending largely upon the voltage used.

Strain insulators for heavy strains should also be made of porcelain. For steady strains and pull-offs, the use of wood is permissible where moderate voltages are used, and a combination of wood and porcelain for higher voltages.

(e) Supports.—The more recent developments in supporting devices for catenary work indicate the use of structural steel bridges rather than poles, thus deriving the full benefit of the catenary type of construction in the matter of long spans. Fig. 2 shows the light type, as used on ordinary electric interurban service.

The opinion of the committee is that a bridge form of construction should receive very careful consideration at the hands of companies contemplating the installation of catenary, before final decision is reached on the type of supports to be used. This is made an especially important consideration in view of the recent experience in high maintenance costs, due to excessive deterioration of wood pole lines.

APPLICATION OF THE THEORY OF THE CATENARY TO ELECTRIC RAILWAY WORK*

BY R. L. ALLEN, ENGINEER, ARCHBALD-BRADY COMPANY, SYRACUSE, N. Y.

The term "catenary construction" has been applied to a method of suspending the trolley wire by hangers from a messenger cable. As this enables the use of a steel messenger cable having a unit working strength of over three times that of hard drawn copper we can have longer spans, fewer supports and a contact wire which is practically level. But to obtain these advantages the design must be carefully worked out in every detail as the strains are greater and the construction more complicated. In many respects an overhead contact wire may be considered as a track, the same qualities being desired and similar troubles met with as in the track work. The moving load is, of course, the upward pressure on the construction exerted by the trolley wheel or pantagraph. As in a track, it is desirable to have the contact wire slightly elastic in order to cushion the effects of the moving load. To obtain this cushioning effect uniformly at all points is one of the difficulties met with; the other is to take care of the expansion and contraction of the copper trolley wire due to change in temperature. These same points apply to the ordinary span wire construction. The strains due to wind and sleet are the least of the difficulties encountered, and can be readily taken care of with the materials at hand. In this respect it may be noted that while a span of about 300 ft. between supports is the limit at the present time, it is possible to use much greater spans without exceeding the safe working strength of steel cable. The question of the lateral swaying of the trolley is not so important as it looks on paper and may be taken care of by pull-offs. The supports may be wooden or steel poles, span wires, or steel bridges, each of which has its advantages and disadvantages, depending to a certain extent on local conditions. In general the use of long spans is desirable, especially when a high voltage is used on the trolley, reducing the number of insulators to be taken care of. This point applies where a steam traffic is to be maintained on the same tracks, as the exhaust is liable to cause trouble with the insulators. Where the foundations are in soft ground, bridges have the advantage in that each structure is stable in itself owing to the wide base. On the other hand, there are places where the use of brackets may be necessary because of obstructions on one side of the right of way. Where more than four tracks are to be crossed a span wire is probably the best solution, although this involves either a guyed pole or very heavy foundations. In certain parts of the country where good wooden poles are cheap and

*Presented as a part of the report of the Committee on Power Distribution of the American Street and Interurban Engineering Association. Atlantic City, N. J., October 12, 13, 14, 15 and 16, 1908.

readily obtainable, they will be found to reduce the first cost, although the saving is not a very large per cent of the total cost of the overhead construction.

It is suggested that there may be advantages in the use of long spans through city streets where there are usually great objections to frequent poles. The writer sees no reason why spans of 300 ft. or even more may not be used, especially where the line is straight. A construction of this kind would present a handsome appearance and would not be so liable to be cut in case of fire. The cost should not much exceed that of the usual 100 ft. span construction, as the cost of steel poles does not increase in proportion to their strength.

The loads to be considered in preparing designs, are the dead weight, sleet and wind load. Sleet is generally assumed at ½ in. thick on all cables. The wind may be assumed at 1 lb. per running foot of cable, as being well on the safe side. With these loads the structure should be so designed that the safe working stress is not exceeded. This should be about two-thirds of the elastic limit for steel, one-fourth of the ultimate strength for wood. In the writer's judgment, hard drawn copper may be stressed up to about 30,000 lb. per sq. in. under these conditions and an excessive load will cause it to stretch instead of breaking.

In stringing the messenger cable it is desirable to adjust it for sag before the weight of the trolley and hangers is put on. In order to do this the elasticity of the cable must be taken into consideration. The calculations are rather complex, involving a long cubic equation and, in order to obtain a quick method for practical use, the writer has worked out the graphic solution shown in the illustration.

This is not original, being based to a certain extent on methods suggested by H. W. Buck, of the Niagara Falls Power Company, and also by Harold Pender, Ph.D., in the "Electrical World."

By this method we find the true unstressed length of the cable by comparing two curves, one of which expresses the stretch of the cable under its own weight for various sags; the other, the difference in length between the true parabola and the chord between the points of support. The curves for stretch are derived as follows:

The center strain in any suspended cable is,

$$\frac{W\ L^2}{8\ d} \qquad (1)$$

Where W equals load in lb. per running foot,
L " span in feet,
and d " sag in feet.

By substituting in this the weight of a square inch of material one foot long, we obtain, for steel cable, the stress per square inch,

$$P = \frac{L^2}{2.35\ d}, \qquad (2)$$

and for copper

$$P = \frac{L^2}{2.08\ d}, \qquad (3)$$

The stretch is

$$S = \frac{L\ P}{M}, \qquad (4)$$

where "M" is the modulus of elasticity.

Combining (2) and (4), the stretch of a steel cable due to its own weight is

$$S = \frac{L^3}{2.35\ d\ M} \qquad (5)$$

and for copper cable

$$S = \frac{L^3}{2.08\ d\ M} \qquad (6)$$

Equations (5) and (6) are close approximations.

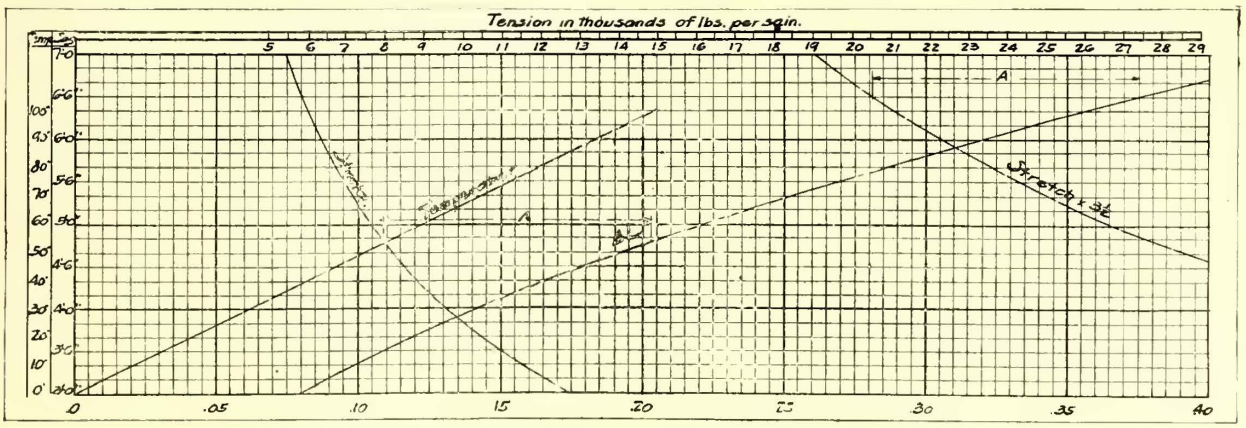
The length of a parabolic curve for a span "L" is

$$\frac{L + 8\ d^2}{3\ L}$$

and the difference between the chord and the curve is

$$\Delta L = \frac{8\ d^2}{3\ L}$$

In the curve sheet shown the sag is plotted on the vertical and the stretch on the horizontal scale. The straight line represents changes in length due to temperature. The point where the curves cross is that at which the cable will sag if its original unstressed length is the same as the span. The curves show that a steel cable 300 ft. long, string between supports 300 ft. apart, will sag down 3 ft. 10½ in. under its own weight. The horizontal distance between the curves represents the difference between the unstressed length of the cable and the chord between the points of support. For sags below the point of intersection of the curves the unstressed length of the cable is less than the chord, above this point greater than the chord. Where an additional load is put on the cable, as, for instance, the trolley wire and clips, we can express this load as a mul-



Theory of the Catenary—Curves for 300-Ft. Span of Catenary Construction

tiple of the weight of the cable itself and the stretch will be increased in proportion. In the case of a certain single catenary the messenger supports a dead load of 3½ times its own weight and has a net sag of 6 ft. 6 in. By plotting a new curve for stretch from the original, which may be done by the dividers or by direct multiplication of the abscissae at two or three points, we can obtain the new position of the cable since the horizontal distance "a" between the curves will remain constant—in this case at 0.09 ft.

For instance, if it were desired to string a messenger so that it would have a sag of 6 ft. 6 in. with an aditional load of 2½ times its own weight, it should be strung to a sag of 4 ft. 9½ in. In a similar way the effects of temperature may be ascertained. Since any variation in temperature affects the true length of the cable, we must add or substract this from the distance "A" and then find the point between the two curves to which it corresponds. If, in the example above, it were desired to obtain the effect of a drop in temperature of say 50 degrees, we find this will shorten the cable to 0.10 ft. The algebraic sum of +0.09 ft. and —0.10 ft. is —0.01 ft. and we find the curves are —0.01 ft. apart at 5 ft. 10 in. sag. It will be noted that the elasticity of the cable tends to reduce the effect of the aditional load and of the change in temperature. In the former case the fact that th load is multiplid by 3½ does not increase the strain in proportion and in the latter case the sag does not vary as much as might be expected.

As the stretch is a direct function of the strain per sq. in., this can be determined also by reading the scale at the top. The normal stress per square inch in the example given above at a sag of 6 ft. 6 in. would be 20,500 lb.

In preparing these curves the value of "M" for steel is taken at 22×10^6. The value commonly used is 29×10^6, which is no doubt correct for a steel bar but it does not take into consideration the fact that in a stranded cable there is a tendency for the wires to draw together under stress, which causes the cable to increase in length more than would a solid bar of like cross section. The modulus 22×10^6 is derived from several tests of steel cable, the stretch being measured on a length of 100 ft. in order to reduce the probability of error. The pull was measured by a dynamometer which was checked before and after the tests by lifting a pile of steel beams of known weight.

As regards the raising of the contact wire from the upward pressure of the trolley, some observations taken from a catenary trolley of 300 ft. span may be of interest.

The net sag of the messenger cable at that time (in winter) was 5 ft. 8 in., the contact wire being cambered 10 in. at the center, and was very tight; the hangers were spaced 10 ft apart. A scale was applied to the trolley at 5 ft. intervals along the span and lifted until it registered 25 lb. The net rise of the trolley was then measured. This increased gradually from ½ in. under the bridges to 2¾ in. at the center of the span. It may be noted that there was practically no difference between the stiffness of the trolley at the hangers and at a point midway between them.

The change in length of copper due to changes in temperature is one of the greatest difficulties in the maintenance of overhead work. A drop of 100 degrees in temperature will cause a copper bar to contract approximately 1 in. for every 100 ft. of length. If it be restrained at the ends this will mean an additional stress of 2,500 lb. in a No. 0000 trolley. In span wire construction this is partially taken care of by the variation in sag of the trolley wire. In catenary construction where the trolley is supported at short intervals there is no chance for the trolley to take up the slack by sagging, consequently it is liable to become very slack in warm weather. For this reason the writer believes that unless there is some counterweight devised for maintaining a constant tension on the trolley, the hangers should be spaced not closer than 20 ft. A system has been developed on the continent consisting of a single catenary with an auxiliary messenger which is parallel with the trolley and about 3 in. or 4 in. above it. This secondary messenger is hung at intervals of about 30 ft. by hangers from the supporting cable, and supports the contact wire by sliding clips located about 10 ft. on centers. The trolley wire is kept at a constant tension by counterweights located at long intervals. This construction also provides a practically uniform cushioning effect, as the trolley clips are very light and slide up and down on the secondary messenger.

It remains to be seen whether this complication is necessary and whether practically the same results cannot be obtained by a development of the single catenary system on the lines suggested above, as follows:

(a) The use of a light plow steel messenger cable strung to a small sag. This will allow full advantage of the elasticity of the material.

(b) The hangers themselves should be as light and flexible as is consistent with strength and durability. This will tend to prevent sparking at the points of support.

(c) The hangers should be spaced 20 ft. or 30 ft. apart to take care of the expansion and contraction.

(d) There is no reason why spans of 300 ft. or more cannot be used.

NEW APPARATUS OF INTEREST

The Westinghouse Electric & Manufacturing Company is showing two new interpole railway motors. The larger one is rated at 160 hp 550 volts, or 175 hp 600 volts. Several hundred of these motors are now in use on the Boston Elevated Railway. The smaller motor is rated at 50 hp 500 volts, or 60 hp 600 volts.

The purpose of the double rating is that the operator may not be misled in the selection of his equipment, 500-550 volts having been the usual standard railway voltages. At the same time, it permits of roads which can obtain approximately a 600-volt average taking full advantage of the saving in conductor and equipment cost made possible by the higher voltage. Great claims are made for the efficiency, overload capacity and commutation ability of this class of motor, of which the Westinghouse Electric & Manufacturing Company is manufacturing a full line.

The same company is also showing a large single phase motor of the same type and size as now used on a number of roads throughout the country. A very satisfactory condition is reported in the operation of this single phase system, especially in connection with heavy railway work. The New York, New Haven & Hartford Railroad is using more than 40 locomotives equipped with this system with success, both as regards operation and maintenance. Other successful heavy service installations have been made by the Grand Trunk Railroad Company for the operation of trains through Sarnia tunnel, by the Spokane and Inland Railroad Company, and by the Erie Railroad Company, on its Rochester and Southern division. The latest road to put in operation this system is the Chicago, Lake Shore & South Bend Railway Company, operating between South Chicago and South Bend, Indiana. One of the cars to be used on this line is now being exhibited on the track space by the Niles Car Company.

SPRAGUE-GENERAL ELECTRIC AUTOMATIC CONTROL*

BY F. E. CASE, ENGINEER OF RAILWAY EQUIPMENT, GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y.

When Mr. F. J. Sprague first suggested the use of several motor cars in a train, all controlled by means of pilot wires from the head car, he urged the adoption of automatic acceleration; that is, means for maintaining a definite amount of current input to the motors. In the first commercial installation of multiple unit control, on the South Side Elevated Railway of Chicago, each car was provided with a current limit relay for automatically governing the motor current, independent of the other cars in the train.

The form of multiple unit controller in universal use, both in this country and abroad, comprises separately actuated switch units, or contactors, each one having the function of a controller finger and its accompanying cylinder segment. The contactor manufactured by the General Electric Company is directly operated by an electro-magnet which derives a small amount of line current through the master controller.

The contactor type of controller has many advantages over the cylinder form, including the ability to provide a powerful individual magnetic blow-out for promptly extinguishing each arc, the isolation of the contacts, and the rapidity of making and breaking the circuit. As each contactor is a complete element, it has the further advantage of great flexibility in arrangement and grouping for obtaining various motor and resistance combinations to suit different conditions of operation and capacities of equipment.

Type M (contactor) control manufactured by the General Electric Company has already been made for use with motors ranging from only a few hp to the enormous size of 6,000 hp used in steel rolling mills.

For railway service the contactors may be grouped in a single box and located below the car floor, or, if on a locomotive, disposed about the cab in convenient places without using valuable space. When new conditions arise which require special circuit connections, there is little difficulty in arranging the contactors to suit.

In all the latest K type drum controllers the transition from the series to parallel connection of motors is accomplished by quickly inserting a portion of the original starting resistance in series with the two motors, and then shunting one of the latter. This shunting motor is then open circuited and connected in parallel with the other other motor and in series with the resistance, which is afterward cut out in several steps.

One of the important improvements in the operation of railway motors, first put into general use with contactor control a few years after its adoption, was the "bridge" method of motor and resistance connections for making the transfer from series to parallel. The exact method of accomplishing this will be described later and illustrated by a diagram.

Many of the type M, or contactor control, equipments furnished by the General Electric Company are of the hand or non-automatic type, in which the master controller is provided with definite points, the same as an ordinary street car controller, and the motorman notches up step by step in a similar manner. This form of control is the simplest in circuit connections due to the absence of automatic parts.

*Abstract of paper read before the American Street and Interurban Railway Engineering Association, at Atlantic City, N. J., Oct. 12, 13, 14, 15 and 16, 1908, as a part of the Report of the Committee on Control.

At the present time there are approximately 5500 Sprague General Electric type M control equipments in operation in this country and other parts of the world, of which number approximately 30 per cent are of the automatic type, in which the current input to the motors is governed by a limit relay.

The automatic form of control has been found desirable by different railways for the following reasons:

First, to prevent the abuse of the motors and equipment due to too rapid controller "feeding."

Second, to obtain an efficient and uniform acceleration.

Third, to insure the maximum comfort to passengers during this period.

It takes out of the hands of an indifferent motorman the ability to make a very jerky and disagreeable acceleration, and he can concentrate his attention to the track ahead.

Last year, in the report of Committee on Electrical Equipment, 42.6 per cent of motor commutator and brush holder troubles were attributed to fast feeding of controllers. It was recommended that automatic devices be used for limiting to a fixed maximum the amount of current the motors might receive. There appears to be no doubt about the injurious effects on motors when they are compelled to take an excessive amount of current during acceleration. Not only do the commutator and brushes not provided with commutating poles suffer, but also the gears and pinions, as a destructive hammer blow is imparted to them. Some roads have put time limiting devices on K type controllers for accomplishing the result in a different manner, depending entirely on delaying the movement of the controller cylinder, but this does not entirely accomplish the desired results.

The rate of acceleration of an ordinary street car may be anything up to the slipping point of the wheels. With the best condition of track and when the total weight is on the driving wheels a rate of 3 miles per hour per second may be reached for a brief period, but this is not comfortable to passengers if produced suddenly. In most instances where automatic control is used, the maximum acceleration is about 1½ miles per hour per second under normal conditions. It is obviously necessary to set the current limit so that under the varied conditions of load, grade and track adhesion an average acceleration will be secured which relieves the motors of excessive strains and yet produces a satisfactory acceleration.

However, under some conditions, it is impossible to set the current limit relay of the plain automatic control to take care of all the variables. For example, if the limit relay is set for an amount of current which will give the car the desired rate of acceleration when empty, on a level track, this amount may not be sufficient to start the car when heavily loaded, on a sharp curve or steep hill.

To overcome this obstacle several means have been employed. One is a switch for shunting the current limit relay and compelling the control to take additional steps irrespective of the current. A second method is to use two current relays having different settings. With this latter arrangement can be used either a master controller provided with extra positions, in which the current limit of higher setting will be cut into circuit, or a separate switch for accomplishing the same result.

With either of the latter two schemes the car or train will be normally accelerated with the relay having the low current setting, but with a heavy load on a curve or grade, where conditions require it, the second relay can be put in.

As another means for overcoming the objection to a single

current setting, equipments have been furnished with current limit relays provided with dashpots for producing a definite time lag. The principle of operation is that the car will accelerate or cut out all the resistance, in a certain minimum time under average conditions, the current setting of the relay being placed at a higher amount than will be reached during this normal acceleration. If the car is heavily loaded or other conditions require the motors to take a much heavier current to accelerate the car, the current limit relay will come into action and prevent an abnormal amount of current being taken.

Fig. 1 shows a typical current record of a lightly loaded car, equipped with four 75-hp motors, starting on a level

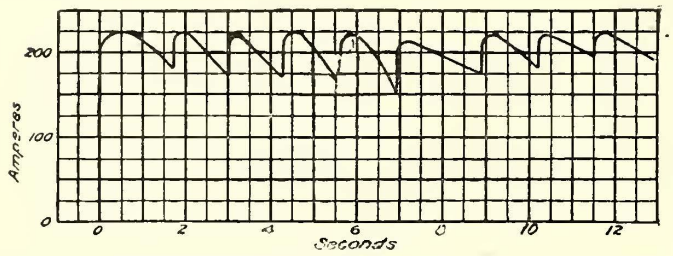


Fig. 1.—Automatic Control—Current Record of Light Car Starting on Level

track. The current obtained on each step in this case was below the setting of the current limit relay, and the notches were secured by a slight time element in the dashpot of the relay.

Fig. 2 shows a current record of the same car, loaded, while accelerating on a grade. In this instance the current limit relay came into action and prevented the maximum current from exceeding a safe amount for the motors.

As this is a four motor equipment there are two groups of motors, the motors in each being connected permanently in parallel, and each group is treated as a single motor in making the series parallel connections. The current record is the amount taken by one pair of motors.

Nine points are shown, on the first five the motors being in series and the last four in parallel. The switching point

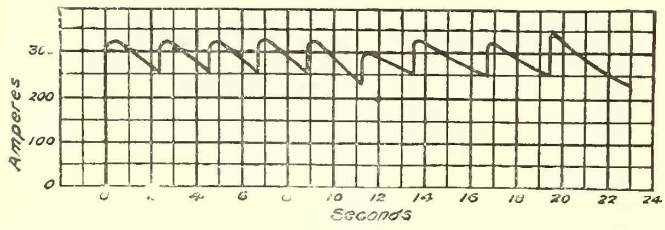


Fig. 2.—Automatic Control—Current Record of Heavy Car Starting on Grade

in series does not appear, this point being passed over quickly when operating automatically.

It will be seen that practically a uniform current is maintained on the motors throughout the range of acceleration and that in passing from series to parallel, full torque is exerted.

The question of accelerating with definite maximum current is one requiring considerable thought, as it can be readily seen that, if the torque required of the motor should vary over a wide range with the different conditions of service, there must be some method of compensating for the fixed current value of the limit relay. Otherwise the wheel will slip or the acceleration be too violent under conditions of lightest load and the motors will not be able to start the car with heavy load on a grade.

I will now show how the various motor and resistance connections are obtained with the automatic type of control.

In Fig. 3 are shown the motor and resistance circuits, in a simplified diagrammatic form, of a representative series parallel contactor control giving the "bridge" connections. In the key below the diagram the various connections effected by the contactors may easily be traced out. The crosses in the diagram represent the location of contactors and the letters and numerals identify them.

The cap plate of the master controller is provided with two series and two parallel points. When turning to the first point the reverser is thrown for the corresponding direction of car movement, if it has not previously been moved to it, and contactors L-1, L-4 and S are energized for giving the series connection of motors with all resistance in circuit. Interlocks prevent the motors taking current unless the reverser is in the correct position.

On the second point of the master controller the resistance is cut out in several steps. RR-4 contactor is first closed, cutting out the three sections of resistance adjacent to No. 2 motor. On the succeeding series steps, the sections of resistance adjacent to No. 1 motor are cut out separately. This ar-

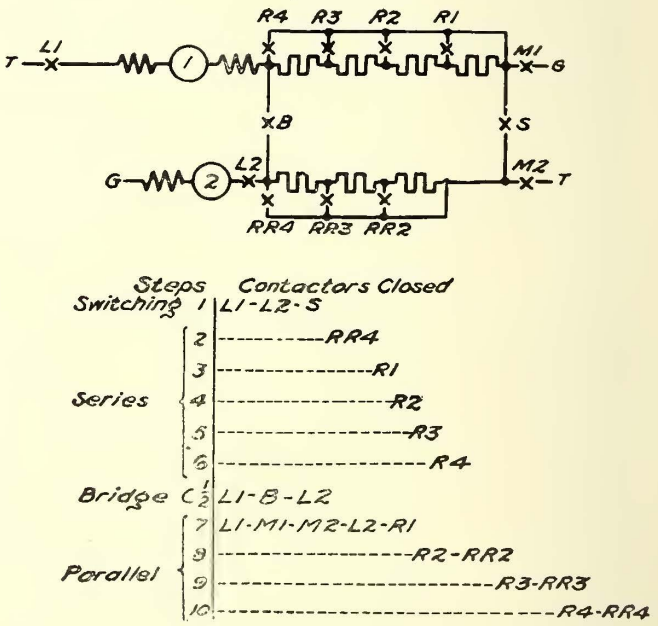


Fig. 3.—Automatic Control—Control Circuits

rangement of resistance steps permits maintaining a very uniform maximum current in passing from step to step. After the last series position has been reached, all of the resistance being short circuited, the "bridge" contactor B is next closed and automatically the series contactor S and the resistance contactors are opened.

On the third point of the master controller contactors M-1 and M-2 are closed, connecting the motors in parallel, the resistance for No. 1 motor being connected to ground by M-1 contactor, and the resistance for No. 2 motor being connected to trolley by M-2 contactor. With properly balanced resistance, the "bridge" contactor acts merely as a balance for the difference in current of the two motors and practically no current passes through it.

The "bridge" contactor, having completed its function of transferring the motors from series to parallel, is opened as soon as the transfer is made. This transition is effected automatically, with no interruption in the sequence, and interlock contacts on the contactors prevent any change in the order being produced accidentally. It will be seen from the diagram that, should contactors M-1, S and M-2 be closed simultaneously, a short circuit from trolley to ground would occur through them, but the automatic interlocking prevents the three switches from being closed at the same time and no incorrect operation can occur.

On the fourth point of master controller the resistance is again cut out in several steps. In operation the controller handle may be turned to fourth point immediately and the contactors will close in the proper order for first producing series and then parallel connection of motors.

It will be noted that the diagram and key show six steps in series and four in parallel, but the first step in series is of high resistance and intended merely for slow car movement required in switching and coupling and the current is of such low value that the current limit relay will not operate.

The general scheme of operation is that as each resistance contactor closes it transfers its operating coil from a lifting to a holding circuit and also connects in the operating coil of the contactor for the succeeding step. At the same time that the resistance contactor is closed the current limit relay, which is provided with a lifting coil in the contactor circuit, raises and interrupts the lifting circuit to prevent further progression of the contactors until it again drops. If the motor current flowing through the series coil is sufficiently high the relay will not immediately drop, and in this manner the automatic current limiting feature is secured.

Fig. 4 shows the control circuit connections from the master controller to the contactors and interlocks in a simple diagrammatic manner. The small double circles in

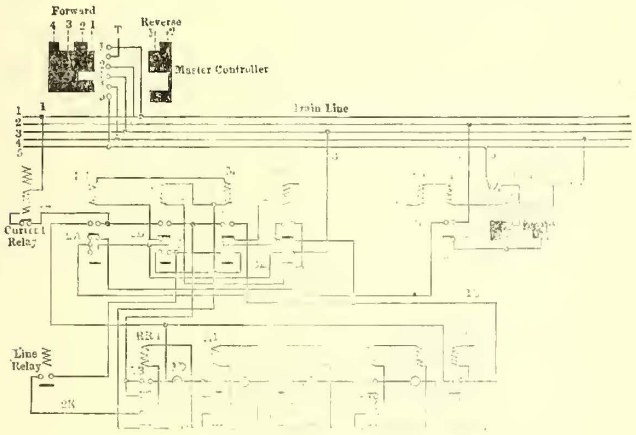


Fig. 4.—Automatic Control—Motor Circuits between Controllers, Contactors and Interlocks

the circuit represent resistances which have an approximate value equal to that of the contactor coil. These circuits operate the necessary contactors for connecting the motors in series with all the starting resistance in. The line relay is closed as it is connected across the motors.

When it is desired to notch up slower than the normal rate the master controller handle is brought to the first point and the car slowly started. To secure a slight increase in speed the handle is turned to the second point and returned quickly to the first. This operation will lift the current limit relay and the contactor for the second step, but, as it cuts off the lifting circuit, no more contactors will be closed until the movement is repeated. This method of operation can be followed until all resistance contactors are closed and full series is reached.

If desired to cut out the resistance slowly in parallel, also, the controller handle is then brought to the third point and the motors will be connected in parallel with all resistance in. By turning to the fourth point and back quickly to the third, a similar operation to that in series will result.

REPORT OF COMMITTEE ON EXPRESS AND FREIGHT TRAFFIC*

BY H. H. POLK, CHAIRMAN, C. M. PAXTON, W. S. DIMMOCK, J. L. LATHROP, A. L. EASTMAN.

In April, 1908, blanks containing 32 questions relative to express and freight traffic were sent by your committee to 303 electric railway companies in an endeavor to secure some valuable and interesting data bearing upon this subject. Of these, 128 companies failed to make reply; 77 companies returned the blanks, stating that they were not engaged in express or freight traffic; and 95 companies answered the questions, stating they were handling freight or express, or both.

These answers were, in most cases, very incomplete, showing either that many of the companies engaged in handling express and freight did not care to give the information, or that their records were such that the data desired was not available. The character of the answers received, together with the fact that so few companies replied, leads your committee to believe that the majority of the companies engaged in handling express and freight do so in connection with their passenger traffic and keep no separate records. Your committee deems it very important to keep separate records of the express and freight departments, showing gross earnings, operating expenses and net earnings derived from these departments, as in this way only is it possible to ascertain whether or not the handling of express and freight is profitable.

The following is a summary of the information received:

EXPRESS

Q. 1. Do you handle express? Q. 2. If so, is your express business handled in connection with one of the old line express companies? Q. 3. Do you operate your own express company? Q. 4. Do you make wagon delivery?

We find 61 companies engaged in the express business, 22 companies in connection with the old line express companies and 39 companies operating their own express. While 39 companies claim to be doing an express business, only four maintain a wagon pick-up and delivery. Just what would be considered an express service without wagon pick-up and delivery is rather confusing and we believe that this question could not have been thoroughly understood by the companies so answering.

Q. 5. Do you find it profitable to handle express in connection with the old line express companies?

Twenty-one companies find it profitable, while four companies find it unprofitable.

Q. 6. Do you consider it profitable to operate your own express company?

Thirty-eight companies find it profitable. Six companies find it unprofitable.

Q. 7. What per cent of your gross receipts are obtained from your express department?

The percentage of gross receipts reported by 19 companies operating their own express company are as follows: 0.02, 0.05, 0.5, 1.0, 1.5, 2.0, 2.0, 2.1, 3.0, 3.5, 3.7, 4.0, 5.0, 5.0, 5.83, 6.25, 6.3, 7.5, and 8.0. The percentage of gross receipts reported by 8 companies operating with old line express companies as follows: 0.05, 0.22, 0.4, 1.0, 1.8, 2.0, 2.5, and 13.6.

It is the opinion of this committee that, as a general proposition, with few exceptions, it is preferable to lease the express privilege to an old line express company on a percentage basis. We do not believe that a tonnage basis is a fair and equitable basis for an express contract. Our reasons for recommending a contract with an old line express company are as follows:

*Read before the American Street and Interurban Railway Transportation and Traffic Association, Atlantic City, N. J., October 12, 13, 14, 15 and 16, 1908.

(1) The old line companies are well established and recognized as carriers of express matter, reaching many more points than can be reached by an electric line or a combination of electric lines.

(2) The old line express companies have the proper equipment, such as experienced employees, wagons for pick-up and delivery and a complete and well organized business-getting system, extending the world over.

(3) Such a contract should be drawn to relieve the electric company of all liability for loss or damage to shipments or injury to employees of the express company. In case of an arrangement whereby a railway employee acts also as an express company employee, the contract should at least provide that the express company should be jointly liable for injury to such employee.

(4) When such express matter is handled on regular trains we believe that the electric railway will find it productive of more revenue than if handled by their own company.

This opinion is not concurred in by the whole committee, the exception taken is that there are cases when it is more profitable for an electric railway to conduct its own express department.

FREIGHT

Q. 8. Do you handle freight?

We find 56 companies handling freight, 43 in carload lots and 51 in less carloads.

Q. 9. What motive power do you use to handle freight?

We find 54 companies using electric power and two companies using steam locomotives.

Q. 10. Do you use electric locomotives for handling carloads, or do you handle carloads in express cars?

Twenty-nine companies use electric locomotives and 30 companies use express motor cars to haul carload business.

Q. 11. Do you maintain agents at all stations?

Twenty-four companies maintain agents at principal stations. Eighteen companies are conducting a freight business without agents.

Q. 12. Please state fully the organization of your freight department.

After a careful perusal of reports submitted the committee believes that it is demonstrated that a number of companies are handling freight and express without having a proper organization therefor, and we recommend that this question should have very careful consideration on the part of the management of those roads attempting to handle freight or express traffic.

Q. 13, 14, 15 and 16. Participation in joint rates and divisions with steam road connections.

We find 12 companies are participating with steam lines in interstate traffic, 10 companies participating in joint rates and divisions with steam roads as follows: 15- 2- 5- 1- 4- 2- 2- 3- 3- 4. Seven companies have been refused joint through rates.

Relative to joint rates between steam and electric railways we deem it advisable for all electric railways to join all possible connecting steam and electric railways in through routes and division of rates, thus enabling the electric line to handle a larger volume of business to a greater number of points.

Q. 17 and 18. Fund for securing proper recognition by steam lines.

We recommend that no such action be taken at the present time, believing that this question will solve itself to the satisfaction of all parties in less time than would be consumed in attempting to force such recognition. The Interstate Commerce Commission now has the authority under the Act to Regulate Commerce, after a hearing on a complaint, to establish through routes and joint rates and to prescribe the divisions when the carriers complained of have refused or neglected to voluntarily establish such through routes and joint rates, provided no reasonable or satisfactory through route exists. This will eventually result in general recognition.

Q. 19. Are your rates and classifications made by your state railway commission?

We find only 12 companies using rates and classifications made by state railway commissions.

Q. 21. What is your average rate per ton-mile?

Answers to this question were received from 11 companies giving the average rate in cents per ton-mile as follows: 1.0, 1.5, 2.0, 4.5, 7.0, 7.1, 7.5, 10.0, 11.0, 13.33, and 30.0.

Q. 22. What is your average gross revenue per ton-mile?

Answers to this question were received from 10 companies giving the revenue per ton-mile from 5 cents to 95 cents. We are of the opinion that some of the answers must be wrong owing to the great variation in the figures.

Q. 23. What are your average net receipts per ton-mile?

So few answers were given to this question that we have not given figures.

Q. 24. What is your average haul?

Twenty-four companies answered this question, giving average haul, in miles, as follows: 2.5, 3, 4, 6.66, 7, 8.25, 10, 10, 10, 12, 15, 16, 18.3, 20, 20, 20, 23.25, 24.16, 25, 26, 26, 40, and 60.

Q. 25. What per cent of your gross receipts are obtained from your freight department?

Thirty-one companies give the following figures: 0.3, 1.5, 2.0, 2.5, 3.0, 4.3, 4.6, 5.0, 5.0, 5.5, 5.5, 6.0, 6.3, 7.0, 7.8, 9.0, 12, 12, 14, 15, 15, 15, 16.6, 17, 18, 19, 20, 24, 25, 27, and 30.

Q. 26. Do you maintain a regular schedule for freight trains and are they shown on time cards?

Twenty-four companies maintain a regular schedule for freight trains.

Q. 27. Do you consider the handling of freight on your lines profitable?

Forty-four companies consider it profitable. Ten consider it unprofitable. Twenty-one companies do not answer the question.

Q. 28. What facilities have you in the way of terminals, yards, freight houses, etc.?

We find 20 companies doing a freight business without terminals, 11 companies failed to answer, 18 companies have freight houses, 21 companies have freight houses and sidings, 5 companies have freight houses, sidings and team tracks, and 2 companies have freight houses, sidings and team tracks and stock yards.

Q. 29, 30, 31 and 32. After a careful perusal of the answers received to the supplementary questions we believe we voice the opinion of a majority of the managers of companies engaged in the freight traffic, when we say that electric railways should adopt the classification and rates in use by the steam roads in the territory in which the electric line operates and that it is not practicable to attempt to secure a higher rate notwithstanding that electric railway service is usually better than the service offered by the steam lines.

We believe in offering every inducement possible with a view to securing industries on electric railways.

We believe in private right of way in so far as possible, as the operation through the streets necessarily restricts the volume of freight business which can be handled.

THE CARBON TRANSIT COMPANY

The Carbon Transit Company, Mauch Chunk, Pa., was recently purchased by a syndicate composed of the following gentlemen: J. M. Wolf, of Waynesboro, Pa.; J. F. Geyser, Waynesboro, Pa.; L. H. Mountney, Mauch Chunk, Pa., and C. H. Latter, of Bethlehem, Pa.

On Sept. 22 the Transit Company was organized with the following officers: Mr. Van Smith, of Waynesboro, president; C. H. Latter, vice-president; J. M. Wolf, treasurer; J. F. Geyser, secretary and general manager; L. H. Mountney, general superintendent. Directors, Horace Lentz, Mauch Chunk; J. Dolan; C. H. Latter; J. M. Wolf; J. F. Geyser and L. H. Mountney. The property will be put in first class condition, new rolling stock bought, storage battery system installed and Flag Staff Park will be improved.

REPORT OF THE COMMITTEE ON POWER GENERATION*

BY G. H. KELSAY, CHAIRMAN, WM. ROBERTS, GEO. B. DUSINBERRE, G. A. HARVEY, R. A. DYER, JR., C. F. BANCROFT.

The subjects given particular consideration by this committee were:

(a) The Practical Operation of Steam Turbines.

(b) Steam Meters.

(c) Flue Gas Analyzers.

At a committee meeting held at Buffalo, June 17, certain questions were prepared which were regarded as essential to submit to member companies and associate members of the association on the subjects under consideration. From the total of about 234 inquiries sent to member companies we received 32 replies bearing on the subject of steam turbines, 2 replying to the subject of steam heaters and 14 on the subject of flue gas analyzers.

(A) PRACTICAL OPERATION OF STEAM TURBINES

It was the aim, while investigating this subject, to obtain information as to the relative merits of the two types of prime movers from member companies which have had turbines in operation for some time, and which have also had experience with reciprocating units, in addition to obtaining replies to a few questions applying only to the turbines.

Of the total of 30 questions on the data sheet sent out on this subject we have tabulated for comparison replies on the more important questions asked, so as to give this information in full, as nearly as possible.

Of the companies receiving the data sheets, 32 responded in whole or in part. In the compilation of the information thus received, each company replying has been given a distinguishing number which is the same for all of its answers on the subject of steam turbines, thereby enabling one to connect the several answers of any one company. The compilation is as follows:

DATA ON EXPERIENCE WITH STEAM TURBINES

Co. No.	No. turbines cap. kw.	Length of service	Total cap. recip. units	Normal vac. in in.
1.	2 1000	6 mo	530 hp	26 to 27 summer
		1 yr., 5 mo		
2.	2 1500	3 yr., 6 mo	800 kw	27½
		1 yr., 6 mo		
3.	1 1500	2 yr., 6 mo	2500 kw	26
	1 75			
4.	1 3000	2 mo	8600 kw	27
5.	1 500	1 yr., 6 mo	1300 hp	26
6.	1 1500	3 yr.	1700 kw	28¾ to 29¼
	3 300	1 yr., 5 mo		
7.	1 2000	8 mo	3850 kw	28
8.	5 2000	4 yr.	5200 hp	28½
9.	2 1500	2 yr.		28 to 29
10.	1 500	3 yr.	1200 kw	27
11.	2 1500	2 yr., 6 mo		28
	1 500	3 yr., 7 mo	1800 kw	
12.	2 5000	1 yr.	3500 kw	1½ to 2 above absolute
13.	1 5000	5 mo	25,400 kw	27½ to 28½
14.	5 500	3 yr.		27½
15.	2 1200	2 yr.		28
	1 3000	6 mo	30,950 hp	
16.	1 400	6 mo		27½
	1 1000	1 yr.	1000 kw	
17.	1 1500	1 yr.		27 to 28½
	1 2000	1 yr., 6 mo		
18.	2 3000	2 yr.	4700 kw	No.
19.	2 1500	8½ mo	4700 hp	28.2
20.	1 1500	1 yr., 6 mo	250 kw	
21.	2 500	4 yr.		27
	1 1500	1 yr., 8 mo	3850 kw	
22.	2 1000	4 yr., 6 mo		26½ to 27
		4 yr.	1000 kw	
23.	2 1500	1 yr., 6 mo	2800 kw	26
24.	2 3500	6 mo	18,000 hp	28
25.	2 500, 2 1000	1 yr., 8 mo		27 to 28
26.	3 1000		3000 kw	28
27.	1 500	3 yr.		27
	1 400, 4 1500	1 yr., 6 mo	2500 kw	
28.	2 1000	3 yr.		28
	4 25	2 yr.		
	3 1500	1 yr.	3000 kw	
29.	2 400	4 yr.		26 to 28
30.	1 2000	3 yr. 5 mo	1500 kw	27¾ to 28¾
31.	2 800	1 to 4 yr.		27 to 28
	1 500			
	1 2000			
32.	1 3000	6 mo	17,450kw	28

*Abstract of report read before the American Street and Interurban Railway Engineering Association, at Atlantic City, N. J., Oct. 12, 13, 14, 15 and 16, 1908.

What is the difference between turbine plant and reciprocating engine plant in fuel consumption per kw-hour under like conditions of load?

1. About 25 per cent saving with turbine at 50 per cent load factor, engines at 65 per cent load factor. Engines not in best condition. Corliss would do better.
2. With high vacuum and variable load the turbines will do from 10 to 20 per cent better than engine plant.
5. Fuel consumption the same, turbine running condensing under 26 in. vacuum and engine running condensing.
6. General results for above period are in favor of turbines.
8. Turbines about 2.84 lb. Engine about 2.69 lb.
9. In turbine plant total cost of power is about 75 per cent of cost in cross compound condensing Corliss plant built 6 yr. ago, both plants being equipped practically the same, except engine plant has smaller units.
10. About the same.
11. In a well designed plant in favor of turbine.
13. About 15 per cent in favor of turbine.
15. With good first-class reciprocating engines, condensing economy in operation is approximately the same.
16. They are about the same, taking auxiliaries into consideration.
17. Turbine under similar load about 6 per cent in favor of engines.
18. About the same.
19. Turbine 19.35 lb. steam per kw-hour. Engine 30.96 lb. steam per kw-hour
22. Corliss require about 25 per cent more coal per kw. All depends upon the condition of engines and turbines. Have had tests where turbines required 15 per cent more coal than the engines, due to dirt on blades.
23. Very little, all conditions being equal as regards vacuum and superheat; taking into account auxiliaries in both cases would favor reciprocating plant.
24. All things being equal, there is a slight difference in favor of the turbine.
27. The turbine has an advantage due to high efficiency on a high range of varying load.
28. Engines a little more economical with us.
29. Cannot find any difference.
30. Turbine uses about 10 per cent more steam than the engine.
32. Practically equal.

	Do you consider it equally necessary for turbines and reciprocating engines to be heated up before starting, and which has advantage in time?	If not, which has the advantage in time, and how much?	Do you inspect your turbine systematically and to what extent and at what intervals?
1.	Same.		Every 10 months.
2.	Turbine can be started instantly and put to work. Engine should have several minutes.		Bearings twice a year. Wheels once a year.
3.	Yes	Reciprocating engine has advantage by one-half time of turbine.	No, inspect externally every day
4.		Turbine one-half time.	Six months.
5.	Both the same.		By taking out the intermediate and noting the erosion on blades about every 6 months.
6.	Yes		One turbine per month, with 4 turbines, 3 times per year.
7.		Turbine from 5 to 10 minutes.	Every 3 months to check clearance.
8.	Both the same.		Four times a year we examine the lower guide and step bearings.
9.	Both should be thoroughly heated, but think engine could be started in short time with greater safety than turbine.		Lift up top half of case once a year.
10.	Both the same.		Give it an internal examination every three months.
11.		Yes, but turbines have advantage.	For wheel clearance every 60 days, valves 2 to 3 times per year.
12.		Engines can be started more quickly.	
13.	Both the same.		Every four months.
14.	Both the same.		
15.			Approximately once a year.
16.	Both the same.		Open once every 4 months.
17.	Yes	Engine has advantage.	Every night by carefully looking over everything and gagging for step bearings.
21.	Yes	Turbine has some advantage.	From one to three months.
22.	Yes	Requires a little more time to start turbine because oil must be pumped up first.	Once every year. Examine all blades and clean all hearings; thoroughly clean blades after running three years.
23.	Yes	Slightly in favor of turbine.	Examine buckets and nozzles twice a year; step and guides four times a year.
24.	Yes		No.
25.			Machines are inspected about every six months.
26.	Yes	Turbine half the time	

27.	Yes, particularly turbines.	Engines have advantage.	Opened for inspection every 6 months, scale caused by the gland water is removed, and turbine clearance taken.
28.	Yes.....	Engines have advantage.	No.
29.	Yes.....		Every 6 months.
30.	Yes.....	Easier to start engines than turbines with auxiliaries.	Examine clearance about every three months; inspect blades for wear about once a year.
31.	.....		Every 3 or 4 months and oftener if possible.
32.	Yes.....	Turbine has advantage in time.	We intend to make inspection every six months.

Does your experience indicate that the erosion of turbine blades is going to be a material factor in their maintenance?

1. Cannot see any erosion in our blades.
2. At this time cannot state; no perceptible wear.
3. Had no trouble from this source.
5. Iron or steel blades, yes; bronze, no.
7. and 8. No.
9. No, and particularly if superheated steam is used.
10. It depends on quality of steam. No.
11. Cannot say; with three years' experience no trouble of that kind has developed.
13, 14, 15, 16, 17 and 18. No.
19. Have not had sufficient experience.
21. No.
22. We have not had any erosion of blades.
23. Not had sufficient time to determine.
24. No.
25. Experience too limited.
26. No.
27. No. We expect to remove several rows during October.
28. Not under favorable conditions.
29. No.
30. Not at all serious.
31. No.

Considering the decreased efficiency of the turbine under overload, to what extent is the use of the overload capacity justified in carrying the daily peaks of railway service?

1. Would figure on 25 per cent overload for railway peaks.
2. Full overload capacity can be carried on one hour's time to better advantage than putting in another unit.
4. Use reciprocating engine for peak loads.
5. About 33 per cent.
6. Would carry reasonable overload at peak, but not to invite interruptions.
8. To about 50 per cent overload.
9. Character of load and station conditions must determine this.
12. Under our conditions, 100 per cent overload.
13. Twenty-five to 30 per cent.
14. Thirty to 40 per cent for peak loads of ordinary duration.
15. For suburban practice, 50 per cent account character of load.
17. I do not consider there is any decreased efficiency on overload.
19. Have not carefully gone into the matter; depends largely on nature and length of peak load.
21. We find the overload capacity more economical than reciprocating units.
22. It is very important with us to have the overload features, as we frequently have an average load of 1100 kw per 1000 kw unit. Load is frequently 100 per cent over normal.
23. Forty per cent; we find little decrease in economy.
24. We use overload capacity only for breakdown service.
25. We consider the turbine far superior to reciprocating engine to carry a peak on a temporary overload; when an overload of from 50 to 100 per cent is suddenly encountered it is hardly noticeable to one in the turbine plant.
26 and 27. Fifty per cent.
29. In plant of this size, fully justified.
30. To the maximum possible extent. But, not economy when the peaks slow down the machine from overload.
31. Do not believe in overloading at any time except for emergency.
32. If overload can be carried without starting another unit.

Replies to the first three questions reveal that the period of observation extends in some cases over four years, the average being two years and three months. They show that our replies come from those who have had experience with reciprocating, direct-connected engines and also the older types of belt-driven units, ranging from 2700 kw down to 200 kw, and with turbines from 5000 kw down to 75 kw, showing a wide range over a satisfactory period of time.

With the above experience with turbine units operating in railway service it is conclusively shown, with very little evidence to the contrary, that the cost of repairs and maintenance and labor cost of operation is favorable to the turbine plant. Replies that do not confirm this are from one or two cases where apparently the turbine has been operated under some adverse conditions. We have observed that the economy of labor, cost of operation of the turbine over the engine, is hardly apparent on plants of less than 1000 kw, but on larger plants it seems to be an important factor. In one plant of good size this was given as 0.059 cent for turbines and 0.108 cent for engines. The same plant gave cost of repairs and maintenance as 0.0303 cent for turbines and 0.0407 cent for engines. These comparisons were made where both engines and turbines were of about the same size. They were the only exact figures which our inquiries elicited and, therefore, cannot safely be assumed as typical.

The difference between turbine plants and reciprocating engine plants in fuel consumption per kw-hour, under like condition of load seems to be favorable to the turbine.

The reliability of a prime mover in railway operation is one of the essential elements in its service, as a railway unit often has to endure extreme variation in the load impressed on it, and at occasional intervals while under adverse pressure conditions. Twenty out of 27 replies indicate that the turbine is considered equal to or preferable to the reciprocating engine on the score of reliability, while but five prefer reciprocating engines. For operation under varying steam pressure, the replies are not so decidedly favorable to the turbine, there being five of the 24 replies favoring the reciprocating engine.

Even though the turbine is a much simpler and possibly more reliable unit than the reciprocating type, the importance of high vacuum and superheat necessary to its most economical operation necessarily adds more complicated and less reliable equipment to both boiler and engine room. It is probably on account of this essential auxiliary equipment that a great many replies from users of the turbine are not more favorable to the turbine.

Steam-driven auxiliary equipment is preferred under most all circumstances, and especially so where the exhaust is needed to heat the feed water. From a few replies, engineers preferred electrically-driven exciter units and circulating pumps.

The condensers preferred by companies replying were necessarily of various types, as local conditions and quality and quanity of water available govern their choice.

The vacuum as obtained by railway companies operating turbines varies from 26 in. to 28¾ in., and one company reported operating as high as 29 in., and another at 29¼ in.

From 31 replies only nine companies reported that they do not superheat steam.

One of the earlier claims was that a turbine, on account of its simplicity, could be started much sooner than the reciprocating engine, but replies to our question do not prove this. Practically all users of turbines report it equally necessary to heat the turbine and a few report favorably to the engine on account of the complicated auxiliary equipment of the turbine.

Replies to the questions, "Do you inspect your turbines systematically by opening?" and "To what extent and at what intervals?" the answers are with but three exceptions that they are inspected systematically, but as to the extent of inspection there is a variety of practice. Some inspect externally once each day, while some companies inspect thoroughly, externally and internally, once every three or four months; the internal inspection being for the purpose of examining blade clearance and removing any scale formation.

At one time there was a feeling in some quarters that the erosion of turbine blades and buckets might be a material factor in the maintenance and also affect the economy, but if the experience of those who have replied on these points can be considered as representative of what may be expected, there seems to be little cause for uneasiness on this score. We note that those who have had turbines in

use longest report no erosion. It seems necessary, however, to provide proper means for separating entrained moisture from the steam in all cases. One interesting possibility is pointed out in two replies, in the formation of scale on the blades, which is sufficient to affect the economy. It would be interesting to know if this may not have come under the observation of others and what steps might be taken to correct it.

The replies on the question of overload indicate a wide range of practice, it being quite common to take full advantage of the overload possibilities of the units for peak loads as being deemed more economical than starting additional units.

STEAM METERS

In undertaking to offer a report on the subject "Steam Meters," your committee realized that reliable data on experience with these instruments would be difficult to obtain on account of the comparatively small number of plants using them. Inquiries were sent by the committee to all member companies of the association, but only two direct replies showing experience with steam meters were received, and the manufacturers' list of sales show that very few meters are in the hands of the electric railway companies.

A number of industrial concerns kindly furnished reports of their experience, however, and the tabulated data shown in this report was derived largely in this manner.

In the compilation which follows, each of the 20 users replying has been given a distinguishing number which is the same for all of the answers on steam meters. The tabulation does not contain information obtained from the manufacturers of such meters.

The meters that have been in use for more than a few months are mostly of small capacity, and are employed for measuring steam sold to small users, for determining amounts of steam consumed by various departments of manufacturing establishments, and for testing steam-plant auxiliaries. There are many "condensation meters" in use, but these are not regarded as coming within the scope of this report.

DATA ON EXPERIENCE WITH STEAM METERS

	Number and Type	For What Used
1.	One 2-in. St John	To determine cost of steam used in various operations.
2.	Two 2-in. St. John	Testing engines up to 50 hp, testing auxiliaries and measuring steam for various processes of manufacture.
3.	St. John	Measuring steam for a carpet mill where open butts are used.
4.	St. John	Measuring live steam.
5.	St. John	Measuring live steam supplied to tenant for plating room.
6.	450 St. John	Measuring live steam sold at 80 lb. pressure for heating purposes.
7.	Two 4E St. John	One for measuring steam at 100 lb. for use at a laundry 700 ft. from boilers; one for ice factory 200 ft. away.
8.	3-in and 4-in. St. John	Measuring purchased steam at 60 to 125 lb.; to devide steam charges to different departments.
9.	St. John	Measuring steam sold for heating.
10.	2-in. St. John	Testing.
11.	Sargent	Test and rating.
12.	Sargent	Testing.
13.	Sargent	To determine steam consumption of calico print drying machine.
14.	Sargent St. John	Measuring steam sold.
15.	St. John Dodge (G. E. Co.) Sargent	Measuring steam.
16.	St. John	Measuring 100 hp steam supplied to bakery; steam passes to meter through reducing valve at 100 lb. pressure.
17.	St. John Sargent	To determine quantity of steam used for different purposes in plant; to determine make-up water used in condensers; to measure steam sold.
18.	Dodge	Testing 3000- and 5000-kw turbines and measuring steam used by auxiliaries.
19.	Venturi type	Assigning proper charges for steam used in various parts of the plant.
20.	St. John	For the sale of steam.

	Used Continuously or for Short Periods	Whether Reliable or Not
1.	Short periods only, in testing	Reliable.
2.	Short periods only, in testing	Extremely reliable.
3.	Continuously	Not to be depended upon.
4	Continuously	Reliable.
5.	Continuous use since 1903	Entirely reliable.
6.	Continuously	Very reliable.
7.	Continuously	Reliable.
8.	Both	Reliable; shows accuracy within 2 per cent at 75 per cent load.
9.	Continuously	Fairly reliable; no exhaustive tests made, however.
10.	Short periods	Tested by condensing and weighing the steam and found meter from 3 per cent to 7 per cent low; steam not quite dry.
11.	Both	Unreliable.
12.	Short periods	Fairly reliable.
13.	For testing only	Reasonably reliable.
14.	Continuously	Unreliable.
15.	St. John continuously Dodge for tests	Reliable, qualifiedly.
16.	Continuously	Satisfactory.
17.	Continuously	Yes, if properly placed for given conditions.
18.	Short periods	Readings are consistent and apparently correct; will give results as accurate as elaborate condensation tests.
19.	Short periods usually	Yes, when pressure, quantity of moisture and degrees superheat are known.
20.	Continuously	Yes.

	Effect of Moisture	Effect of Superheat
1.	No experience but think correction required	No experience, but think correction required.
2.	No specific tests, but experience points to accuracy within 2 per cent	No information.
3.	Tendency to rust delicate parts.	No information.
4.	No effect	No effect.
5.	No effect noticed	No information.
6.	Inappreciable in practical operation	Correction must be applied.
7.	No information as to effect upon accuracy. No mechanical effect upon instrument	Boilers superheat about 180 deg. Does not effect mechanical operation, but don't know its effect upon accuracy.
8.	Ordinarily no effect. A large flow of water might affect it. Does not measure entrained moisture	No experience.
9.	No definite information; separator should be placed ahead of meter	No information.
11.	Bad	No information.
13.	None of the meters we have seen take account of moisture. Considerable moisture affects accuracy	No experience.
14.	No effect	No effect.
15.	Affects value of record	Correction required.
16.	No information	Correction required.
17.	No effect	Not noticed in St. John meter.
19.	Correction of formula required	Correction of formula required. Error for 20 deg. difference very slight.

	Effect of pressure variation
1.	Has to be observed by recording gage and correction applied.
2.	Same as above.
4.	Very little.
5.	Same as No. 1 above.
6.	No effect for slight fluctuations above and below normal, but meter should be calibrated for normal pressure on which it is to be used or correction must be applied.
7.	Within 5 lb. variation, no effect; for greater variation meter records high for low pressure and low for high pressure.
8.	Ordinarily no effect. Correction required for great variations. Recording pressure gage required also.
9.	Slight effect for moderate variation.
12.	No effect noticed.
13.	Sargent meter accounts satisfactorily for difference of pressure.
14.	Effect not marked; difficult to detect.
15.	Causes slight error.
16.	Slight variation not material; correction required for great variation.
17.	No effect on meters of proper design.
19.	Can be corrected for.
20.	A slight variation is not material.

Following are the manufacturers' descriptions of what appear to be the meters most generally known in this country:

ST. JOHN METER

These meters are made in various sizes for measuring steam for all purposes up to 1000 hp at 200 lb. gage pressure; they are built for continuous use. An extra heavy type is made for measuring superheated steam, compressed air and gases. They indicate on a dial, and also by a continuous curve plotted on a moving paper chart, the instantaneous values in boiler and rate, in weight of steam, per hour; the curve can be integrated by planimeter to give total steam consumption for a given period. The chart moves at the rate of ½ in. per hour. In taking instantaneous readings of the meter, the

height in inches of the curve above the zero line is multiplied by a constant to give the rate in pounds per hour; this constant must have proper correction factors applied if the steam being measured varies materially in pressure from 100 lb. gage, or if it contains superheat. Ten per cent moisture, by weight, in the steam makes the reading of meter 0.05 of 1 per cent high. The meter operates on either live or exhaust steam, and at pressures above or below atmospheric. A recording steam gage is required in conjunction with the meter if it is to be used on pressures varying materially from that for which it is calibrated. Each instrument is calibrated at the factory to within 2 per cent of accuracy by condensing and weighing the steam that has passed through it; a separator is connected ahead of the meter when calibrating. Several hundred meters have been in use for 10 years; calibration every two years is recommended. The principle on which the meter operates is that with a uniform difference of pressure on two sides of an orifice through which steam is flowing and a constant initial pressure, the quantity of steam passing bears a direct relation to the size of the orifice. The size of the orifice in the meter is regulated by a tapered plug-shaped valve, which rises (opens) in proportion to the steam used; a difference of about 2 lb. in pressure is required to operate the valve. The motion of the valve is communicated directly to the indicating pencil.

SARGENT METER

These meters are made for indicating directly the rate of flow in horse-power per hour, irrespective of pressure, of steam used for any purpose and up to any capacity that can be handled by a 6-in. pipe. The meter is intended for continuous service, but does not record or integrate. Each meter is calibrated separately on commercially dry steam to within 2 per cent of accuracy; very wet steam cannot derange the working parts, and moisture does not appreciably affect the accuracy of indications, but it is better to install meter as near as possible to the boilers to avoid condensation water and obtain a steady flow of steam. Superheat in steam introduces errors. The principle on which the meter operates is similar to that of the St. John meter in that the steam passes through an opening varying in size with the volume of steam used; the indicating needle is actuated vertically by the movement which varies the steam orifice, and it is also influenced by a Bourdon spring according to the steam pressure, so that the readings of the meter do not have to be corrected for variations of pressure.

DODGE FLOW METER

The General Electric Company has recently developed a meter showing the amount of steam or air flowing through a pipe, whatever the pressure or temperature. The meter is portable, and calibrated for any pipe diameter from 1 in. to 36 in. For steady flow one meter may, therefore, be used on any pipe line in a plant. For fluctuating flow this may be done provided the proper calibration curve is used. The meter is as well suited mechanically to the measurement of periodically intermittent steam flow, such as occurs when operating reciprocating engines, as it is for steady flow, such as occurs when steam is used for turbines, manufacturing purposes, heating, etc. The calibration for these two conditions is not the same. For engine use a special calibration is usually necessary after the meter has been installed unless the meter is sufficiently remote from the engine. The meter has been found to be accurate within 2 per cent under all conditions of pressure and temperature; 2 per cent of moisture does not affect readings.

The operation of the meter is based upon the action of the varying velocity of the fluid impinging on a modified Pitot tube. A plug containing funnels of desirable cross-section and form is screwed into the pipe in which the flow is to be measured. One funnel faces against the flow of fluid, and the pressure therein is equal to the static pressure in the pipe, plus the pressure due to the velocity head. The other funnel faces in the direction of flow and the pressure in this is accordingly less than the static pressure by an amount dependent upon the velocity of flow. The area taken up by the plug is not sufficient to cause an appreciable drop in pressure in the pipe.

Indicating Type.—This meter consists essentially of a U-tube of glass filled for part of its height with mercury and connected in a suitable manner to the above-mentioned funnels. The difference in pressure in the two funnels is transmitted to the connecting tubes and causes a difference in level in the two legs of the mercury column. This difference in level must always be the same for a given condition of pressure, temperature and flow. The inclination of the tubes from horizontal (10°, 20°, etc.) is fixed by means of a level. The difference of level is read directly in flow per hour per square inch of cross-sectional area of pipe on a cylinder under the mercury tubes. This cylinder is quickly adjustable for any size of pipe from 1½ in. to 18 in., for any desirable temperature range, and for any pressure from 75 lb. to 225 lb. gage.

Recording type.—The recording meter consists fundamentally of two main parts, viz: The moving member and the stationary member. The moving member is made up of two hollow cylindrical cups which are connected at their lower extremities. They connect at their upper extremities with passages in a block, which is supported upon knife edges. These passages are connected to the funnels by means of helically-wound flexible coils. Supported by the block is a scale beam upon which runs a weight which carries the recording pen. This weight is moved back and forth by a helical screw, which is rotated by a small electric motor fastened to one end of the beam. The motor is driven in either direction in such a way as to always keep the beam in a horizontal position. The stationary member consists of a suitable base upon which is fastened the supporting frame for the knife edges and the upper terminals of the flexible coils. The recording chart and clock are also fastened to the base and to the casing of the meter.

This type of meter has been used on turbines as large as 8000 kw suplied with steam through a 14-in. pipe.

SARCO METER.

The Sarco Fuel Saving & Engineering Company is about to introduce in the American market a set of indicating and recording steam meters which have been tried out carefully abroad. Their operation is based on the standard formulas of Zeuner and Napier, relating to the flow of steam from one vessel to another and the drop in pressure which is thereby occasioned, and which bears a certain relationship to the quantity of steam passing. These meters are easy to install, as all that is required to be inserted into the steam pipe is a disk having an opening through it slightly smaller than the inside of the pipe; this disk is placed between ordinary flanges that may be already conveniently located on the pipe. These meters are mentioned as showing that the development is being carried to such conditions that large volumes of steam can be measured at high pressure.

GENERAL CONDITIONS

The use of steam meters has so far been confined mostly to industrial plants where the steam consumption is comparatively small. The results have been fairly satisfactory. There are many purposes to which large power stations can apply reliable steam meters with advantage. Now that their use on heavy duty has commenced, the development will probably be rapid, and far better results will be obtained where they are under the skilled attention of power-plant engineers, who, as a rule, are of higher class than those connected with factories, etc.

It has long been considered advisable to keep accurate detailed record of fuel and water consumption and electrical output of power plants. Records of intermediate conditions, such as steam consumption by various units, have been scarce, largely on account of the difficulty of obtaining them. The steam records are also valuable, and it is to be expected that more will be seen of them in the near future.

Some of the benefits that may be easily derived from the use of steam meters are:

(1) Obtaining water rates of power units.

(2) Obtaining equal duty from various boilers.

(3) Dividing steam charges to various sections of a general power system, such as railway, lighting, power, heating, manufacturing, where these are all operated from the same power plant.

(4) Detecting leakage through traps, pumps, flanges, etc., and loss by excessive condensation.

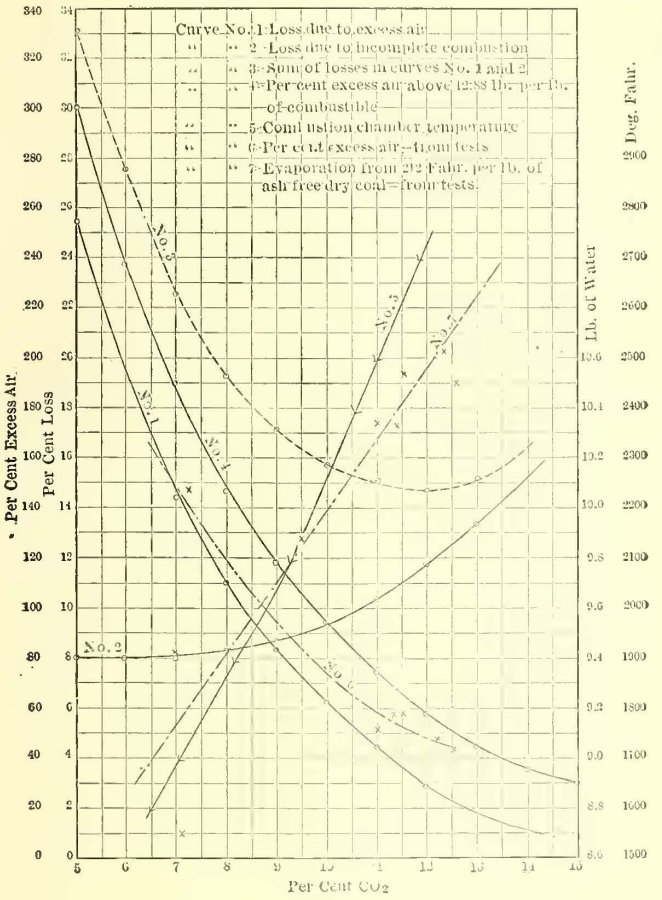
In addition to the tabulated answers included in this report, the same users of meters seem to agree that they have already found the instruments valuable for testing; for meas-

uring accurately small quantities of steam, and getting approximate divisions of steam used for various processes. Some complain of the high cost of the meters and the small variety of uses to which a given meter can be applied. They think, however, that there is a large field for a satisfactory instrument.

(c) FLUE GAS ANALYZERS

In taking up the subject of flue gas analyzers, your committee has endeavored to secure such facts in regard to the application and operation of instruments in use as would give a basis for ascertaining their practical value as a part of the usual railway power station equipment.

The result of the work we have been able to do indicates that these instruments are of unquestionable value and the records, when properly taken and interpreted, offer a means of detecting defects, both in the construction and operation of boiler furnaces which might not otherwise be exposed. Where only occasional observations are made, the results may be as beneficial as the occasional indication of the steam engine and possibly to a greater degree; and where continuous



records are maintained they offer a valuable indication of the character of the fireroom operation. In fact, some prominent engineers go so far as to suggest the practicability of determining accurately the efficiency of the boiler by means of the CO_2 recorder, flue temperatures and coal analysis.

Accompanying curves show the general way in which several factors vary with variation in per cent of CO_2. Curves No. 1 and No. 4 are taken from a chart computed by H. J. Westover and appearing in *Power*, of April 7, 1908. Curves No. 2 and No. 5 are taken from the report by Prof. L. P. Breckenridge on the St. Louis boiler tests. Curve No. 3 is the combination of No. 1 and No. 2. We appreciate that the curve No. 3 cannot be considered as accurate, and is only given to indicate the general conditions existing and that there is a point in practical operation where further reduction of the air supply may act to decrease the economy.

Theoretically an excess of even a small per cent of air over that necessary to furnish oxygen for all the combustible should result in no loss by incomplete combustion, but practically it is not possible to secure the thorough distribution of the air necessary to bring this about, and probably curve No. 2 more nearly represents the actual conditions existing. It is proper to point out that no set of curves of this character could be applicable in any specific case on account of the numerous factors which are peculiar to each furnace and kind of coal used. We have also plotted on this chart other data from tests by Prof. Breckenridge at the University of Illinois showing the actual excess air (curve No. 6) and the actual evaporation (curve No. 7), from and at 212° Fahr. per pound of ash free, dry coal. These two curves are related as being made from the same tests and there were variations between individual tests due to differences in the composition of the coal used, the flue-gas temperatures and other items. They seem, however, to be sufficiently uniform to indicate a definite form and direction, and to corroborate the points we have endeavored to bring out.

A number of questions relating to boiler plants were sent to the member companies, with, however, but comparatively few replies. Some of these questions and replies we give in tabular form and others are covered in our comments.

In the compilation which follows, showing the experience of various companies with flue-gas analyzers, the companies replying have been designated by specific numbers which do not, however, correspond to the serial numbers indicating the companies in the compilations previously shown on the subjects of "Steam Turbines" and "Steam Meters."

DATA ON EXPERIENCE WITH FLUE GAS ANALYZERS

Type of Analyzer	Months in Service	Boiler Horsepower Capacity	Boiler Horsepower Avg. Load	Do You Use Mech. Draft
1—Sarco	1	8,000	7,500	No.
2—4 Sarco recorders, 1 Sarco indicator	Recorder 24, Indicator 6	50,000	20,000	No.
3—Ados	24	2,000	1,800	No.
4—Sarco recorder	16	16,000	8,000	No.
5—Orsat	21	13,000	4,000	No.
6—Sarco	3	6,500	7,000	No.
7—Uehling compesimeter	12	40,000	....	No.
8—Uehling	6	100	....	No.
9—Jones-Julia and Orsat	years	2,450	1,000	Yes—partially.
10—Sarco	2	19,200	....	No.
11—Sarco	9	5,600	....	No.
12—Sarco	12	....	....	Yes, if crowded.
13—Ados	24	10,000	5,000	No.
14—Ados	24	....	11,000	Yes.

Hand Firing or Stokers	Find a Daily Correspondence Between High CO_2 and Low Coal Consumption Per KW Hour	Average Per Cent CO_2 Usually Obtained Using Recorder	Per Cent Obtained Prior to Using Recorder
1—Murphy and Roney stokers and hand firing	7	——	
2—Roney stokers 65 per cent and hand firing 35 per cent	——		
3—Hand firing	Yes, when recorder is operating properly	12 to 14	About 7.
4—Roney stokers	No	11	4 to 6.
5—Roney stokers		8 to 10	4 to 8.
6—Murphy and model chain grates	Have not as yet tested this out.		7.
7—B & W. chain grates	Yes	9 to 9.5	7 to 8.
8—Hand firing		12	11.
9—Chain grates	No record	10 to 13	8.
10—Chain grates		——	——
11—Chain grates	Yes	7 to 8.5	——
12—Hand firing	Not been able to detect	12	6 to 8.
13—Ross stokers	Yes	10	About 8.
14—Hand firing to limited extent and Jones stokers	No	9	——

Loss on Account of Insufficient Air or Excess Air	Make Coal Analysis? What Is the Analysis?
1—Excess.	1—Yes. 12,000 b. t. u., moisture 3 per cent, ash 11 per cent.
2—Excess.	2—Yes, abt. 14,000 b. t. u. per lb., 4 per cent moisture—6.5 per cent ash, 75 per cent fixed carbon, 18.5 per cent volatile.
3—Greater loss seemed to be from excess air. Hand dampers were open only about 50 per cent area after recorder was in use, without reducing capacity.	3—No—⅔ Clearfield M R approximate b. t. u. 13,500 to 14,000 1 3 semi. anthracite screenings approximate b. t. u. 9,000 to 11,000.

DATA ON EXPERIENCE WITH FLUE GAS ANALYZERS—Continued

4—Excess air.	4—Yes, 14,200 b. t. u.—8 per cent ash, 2 per cent moisture.
5—Excess air through holes in fire.	
6—Excess air.	6—Yes, 12,800 b. t. u. average moisture 4 per cent, asb 10 per cent.
7—Excess air.	7—Yes, b. t. u. 10,200—moisture 14 to 17 per cent. ash 14 to 20 per cent.
8—Excess of air.	8—Yes, b. t. u. comm. 11388, moisture 4.59 per cent, ash 17.97 per cent, average for 6 mos. No. 2 Buck.
9—First excessive air. Second, an irregular fire bed. Third, insufficient air.	9—Moisture, 250. Volatile matter, 40.50. Fixed carbon, 48.45. Ash, 8.55.
11—Excess air.	11—Yes.
12—Insufficient air through fire, excess air by infiltration.	12—12,000 b. t. u. ash 18 to 19 per cent.
13—Excess air.	13—Moisture, 1.78 per cent; volatile, 30.27 per cent; fixed carbon, 54.32; sulphur, 1.65; ash, 11.98.
14—All causes.	14—12,600 b. t. u.; moisture, 6.5 per cent; ash, 11 per cent; volatile, 29 per cent; fixed carbon, 55 per cent; sulphur, 1.5 per cent.

Where Several Furnaces Discharge Their Gases Into One Stack, Is It Necessary to Have a Continuous Record of Each Furnace, Or Will Not a Record of the Stack Gas Used Give All the Information That Is Usually Required?	Do You Find That Your Dampers Require Much More Frequent Regulation Than Before the Installation of the CO_2 Recorder?
1—Separate stack.	1—Have not observed any.
2—Continuous record on stack.	2—Indicators on each boiler.
3—Record of each furnace is best, but good general idea can be gotten from gases taken from stack or fuel.	3—Hand damper should be given more attention.
4—Continuous record for each furnace seemed best, but with experience not necessary.	4—Not since operators have become accustomed to proper appearance of fires.
6—We have individual stacks.	6— ——
7—Record of each furnace is best, as it indicates just where low CO_2 is.	7—Very little more.
8— ——	8—We use an automatic damper.
9—Each battery.	9— ——
11— ——	11—Yes. Draft gages and damper easy to adjust are valuable.
12—Not for individual boilers, separate records necessary.	12—No.
13—Record of individual banks of boilers are kept.	13—Yes.
14—Each boiler.	14—No.

In the Event of Finding That Recorder Indicates Unsatisfactory Conditions, What Steps Have You Taken to Improve Results?	Can Conditions of Firing Be So Regulated as to Give Good Results With High Per Cent of CO_2 in Flue Gases From Only a Frequent Analysis? Or Do You Regard it Essential That to Obtain Best Results a CO_2 Recorder Should Be Constantly Indicating the Per Cent of CO_2 in Flue Gases?
1—Stop leaks.	1—Yes.
3—Clean soot from gas connections pipes and stop air leaks if any. Also stop any air leaks through boiler settings.	3—Most satisfactory information can be gotten from constantly indicating apparatus.
4—Watch condition of fires, coal and boiler settings.	4—Constantly indicating seems best.
5—Improve fire, using care to stop holes.	5—Either method is satisfactory, but a continuous record is obviously better.
6—Stopped air leaks in settings and maintained better fires.	6— ——
7—Experimenting with different methods of firing; fire thicknesses, grate speed, etc.; change in furnace settings, overhauling stokers; eliminating leaks in settings.	7—Best results obtained with constantly indicating and recording instrument.
8—Regulate air supply. Generally too much air will cause most of trouble.	8—Record should be continuous.
9—Look for irregular fires. See if draft over fire is good. To correct thick fires and regulate air supply under grates.	9—Record should be continuous.
11—Watch fire closer, give usual attention more often.	11—Continuous methods good to teach firemen; afterwards an average for the day should keep him up.
12—Showed more air necessary for anthracite buckwheat; and large infiltration.	12—Have not been able to make any improvements by method of firing.
13—Investigate cause and proceed accordingly.	13—Continuous record necessary.
14—See some treatise on combustion.	14— ——

Has Maintenance of CO Recorder in Service and Operating Accurately Been Important?	Has Exeessive Attention Been Due to Struetural Defects or Laek of Proper Skilled Attention?
1—No.	1— ——
2—Very difficult to keep in operating condition.	2—Principally acct. instrument itself.
3—No.	3—Principal attention required is in preventing and repairing air leaks in connections.
4—No, slight.	4— ——
6—No expense.	6— ——
7—Required some time from a technical person, no factor in expense.	7— ——
8—No.	8— ——
9—No material expense.	9—Delicacy of adjustment. Trouble of flue vibration.
11—Young man who samples coal attends.	11—Only trouble caused by moving instrument from place to place.
12—No expense, attention trifling.	12— ——
13—Practically nothing.	13— ——
14—$2.00 per month per recorder.	14—Both causes.

In but one case were we able to secure data showing any definite results as to coal per kw-hour before and after using the recorder. This showed a reduction from 4 lb. to 3.5 lb. per kw-hour, and from other comments it seems evident that the use of it has generally been considered beneficial. In two cases the coal since using the recorder was given as 2.92 lb. and 2.9 lb. kw-hour.

While many improvements have been made in the design and construction of these instruments in the past few years, and while the reports do not indicate that the maintenance is a serious item, nevertheless it is hoped that further effort will be made on the part of the manufacturers to simplify them and make them less a laboratory instrument, so that they will feel more at home in the fireroom.

In order to get the most accurate indication of the action of the furnace itself, the gas collector should be as near as possible in the line of circulation to the point where combustion ceases. Tests should be made occasionally of the gas at this point to check against the record taken from the flue to indicate the air leakage, if any, between these points. The location for the collector usually seems to be preferred in the flue between the damper and the boiler tubes and placed so as to be in a flow of gas of average quality. The gas collector which seems to give best results is of ¾-in. or 1-in. pipe with ⅛-in. holes bored at frequent intervals throughout its length, and the end capped. Care should be taken that the total area of all the holes is less than the area of the pipe, otherwise more gas will be taken through the holes near the exit than through those at the outer end.

The consensus of opinion seems to be that the best results can be secured with a recording analyzer in the main flue, supplemented by an indicating instrument connected into the breeching of each boiler and the instrument placed so that the firemen can easily see the indication for each boiler.

It had been suggested to us that in order to improve the economy of a plant it would be a feasible plan to pay a bonus to firemen based on the CO_2 record, but we were not able to find any one who had actually tried this out. One reply indicated that they encouraged their men to get good records by a system of promotion.

It is easier to maintain a high CO_2 record with stoker than with hand firing owing to the unnecessary air admitted through the doors when stoking. The most common error in method of operation of furnaces, which the recorder shows, is the admission of too much excess air, and by watching the recorder and regulating the air supply or condition of the fire more frequently, a higher economy of operation may be secured.

In one reply only was the opinion expressed that a record of other gases than CO_2 was desirable as far as ordinary

operation is concerned. It can be imagined that for an exhaustive test on a boiler or on a particular coal it might be desirable to have a record of CO and O, but in ordinary operation it is felt that the record of CO_2 gives all the information that is necessary to secure a high economy. Only three replies indicated that the recorders were regularly tested. This should undoubtedly be done, as there is possibility of errors due to condition of receiving pipes, as well as in the solutions used and the instrument itself.

RECOMMENDATIONS FOR FUTURE WORK

The investigations of your committee have brought forcibly to its attention the apparently indifferent methods of operation practised in many power stations, and particularly in the boiler room. We believe that there is far too little attention given to economy in the boiler room and think that a careful and systematic use of apparatus available would result in a great saving.

We believe that the work of a Committee on Power Generation should be continued, and that further reports should be expected next year on the subject of CO_2 recorders in addition to an investigation into the use and merits of draft gages, pyrometers and systems of damper control. We also think that an investigation as to the merit of buying coal on a basis of analysis should at some date receive attention by such a committee, together with an investigation as to methods of making analytical tests of coal and the use of calorimeters.

CLAIM AGENTS' MEETING—WEDNESDAY

The closing session of the Claim Agents' Association opened at 9.30 a. m. President Goshorn who presided stated that the amendments to the by-laws and constitution proposed by the executive committee had been considered by the executive committee of the parent organization and a decision reached to refer them for action to the 1909 executive committee of the Claim Agents' Association.

The question box was taken up, but as the questions had been fully answered by letter and the answers printed, there was no discussion. A discussion of the "Medical Side of the Prevention of Accidents" had to be omitted, owing to the fact that Dr. Fairchild, of Iowa, and P. P. Crafts, who were expected to lead in the discussion, were not present. Under the head of general business, President Goshorn spoke in detail of the working of the index system in his office.

As reported yesterday, the nominating committee handed in the following nominations: President, C. W. Hardin, St. Louis; first vice-president, E. C. Carpenter; second vice-president, Julius S. Harrison, Jacksonville, Fla.; third vice-president, Dr. F. J. Ryan, Syracuse; secretary and treasurer, D. B. Davis, Columbus, Ohio. The secretary was then instructed to cast a unanimous vote for the officers as nominated by the committee.

President Hardin, after a short address, stated that in appointing the executive committee he would give special preference to New York as a geographical centre, and accordingly would appoint James R. Pratt, of Baltimore; John J. Reynolds, Boston; Mr. Brown, of Newark, and E. R. Roberts, of Knoxville, Tenn. The president appointed, as a committee on employment, H. R. Goshorn, of Philadelphia, chairman; T. B. Donnelly, of Connellsville, Pa., and J. E. Joyce, of Rochester, N. Y. As a committee on ways and means, the president appointed William Tichenor, of Indianapolis, Ind., chairman; S. W. Gunsalus, of Webb City, Mo.; R. H. Shonen, of Allentown, Pa., and S. W. Baldwin, of Fitchburg, Mass.

A rising vote of thanks was then tendered to the retiring president and also a vote of thanks to F. W. Johnson, for his work in preparing the entertainment and smoker of the previous evening, and to the secretary and treasurer.

SECOND ANNUAL DINNER OF SOUTHERN RAILWAY AND SUPPLY MEN

Last year the supplymen traveling south conceived the happy idea of entertaining during the convention then being held the representatives of Southern electric railways in attendance. The dinner given was a great success, and it was decided to make the event annual. On Tuesday evening the second annual dinner was given at 7.30 in the Chevy Chase room of the Marlborough-Blenheim, where the tables were arranged in the shape of a horseshoe magnet, in whose field of force all the elements of mutual attraction were strongly and immediately developed. A most admirable dinner was served, to the accompaniment of Sauterne and champagne, and then fragrant clouds of smoke from the Southern weed enwrapped the gathering as it indulged in the Southern gift of oratory. There were 37 present, and 36 eloquent speeches were made, all tinged with the spirit of fraternity and neighborliness. Optimism, too, pervaded the frequent references made to the outlook in the South for brighter days and a returning prosperity.

The list of the hosts and guests follows:

T. W. Passalaigne, toastmaster, superintendent Charleston (S. C.) Consolidated Railway, Gas & Electric Company; J. B. McClary, The Sheffield Company, Sheffield, Ala.; Geo. H. Harris, manager, and C. A. Avant, claim agent, Birmingham Railway, Light & Power Company; C. M. Cory, auditor, Birmingham Railway Light & Power Company; H. N. Hunt, superintendent, and W. T. Calquitt, general counsel, Georgia Railway & Electric Company, Atlanta; W. H. Burroughs, secretary and treasurer, Memphis Street Railway; S. A. Redding, electrical engineer, and Harry Flynn, auditor, Georgia Railway & Electric Company, Atlanta; E. A. Longmire, master mechanic, Norfolk & Portsmouth Traction Company, Norfolk, Va.; Geo. E. Willis, Sterling-Meaker Company; D. A. Hegarty, general manager, Little Rock Light & Railway Company; H. M. Bengler, Ford, Bacon & Davis, Birmingham, Ala.; C. R. Caskle, secretary, Nashville Interurban Railway, Nashville, Tenn.; C. B. Buchanan, general superintendent railways, and C. C. Johnson, purchasing agent, Virginia Passenger & Power Company, Richmond, Va.; W. A. McWhorter, Galena Signal Oil Company, Birmingham, Ala.; Jas. R. League, general manager, Augusta-Aiken Railway Company, Augusta, Ga.; Chas T. Doerr, purchasing agent, Birmingham Railway, Light & & Power Company, Birmingham, Ala.; Jack L. Thurston, Hildreth Varnish Company; Percy Warner, president, Nashville Railway & Light Company, Nashville; F. H. Coalidge, American Brake Shoe & Foundry Company, Atlanta; Sid Wales, National Brake & Electric Company; A. M. Moore, master mechanic, Georgia Railway & Electric Company, Atlanta; S. C. Watkins, Atlanta Car Wheel & Manufacturing Company, Atlanta; Ross F. Hayes, Curtain Supply Company; D. A. Proctor, chief engineer, Nashville Interurban Railway; D. C. Frost, superintendent, Lynchburg Traction Company; Thos. B. Gay, secretary and purchasing agent, Norfolk & Portsmouth Traction Company; J. E. Slimp, Ohio Brass Company, Atlanta; W. H. Glenn, vice president and general manager railways, Georgia Railway & Electric Company, Atlanta; Geo. B. Morton, Galena Signal Oil; A. B. Skelding, general manager, Tidewater Power Company, Wilmington, N. C.; F. L. Markham, J. G. Brill Company, Atlanta; S. G. Turner, Atlanta Car Wheel & Manufacturing Company; W. M. Bisel, National Brake & Electric Company.

During the evening a good flash-photo was secured, of which F. L. Markham, chairman of the dinner committee, will be glad to send a copy to every one present, as a souvenir of a very happy and auspicious occasion.

REPORT OF COMMITTEE ON STANDARDIZATION*

BY W. H. EVANS, CHAIRMAN, H. A. BENEDICT, R. C. TAYLOR, H. H. ADAMS, M. O'BRIEN, J. M. LARNED, H. W. BLAKE, C. B. FAIRCHILD, JR., L. E. GOULD.

At a meeting of the Executive Committee of the American Street and Interurban Railway Engineering Association, held in New York City, on Jan. 30, 1908, a canvass was made of the subjects to be taken up for standardization this year, but your committee found that the topics suggested were entirely too numerous to consider in the intervening time. It was therefore decided to select those which appeared to be the most important and apparently demanded the earliest consideration. The committee finally chose for discussion this year the following subjects, all of which have a close relation with each other in connection with the establishment of a standard height of car equipment above the level of the rail:

(a) Standard Height of Couplers for City and Interurban Cars.

(b) Standard Automatic Couplers for Interurban Cars and Radial Draft Rigging.

(c) Standard Height of Platforms.

(d) Standard Height of Car Steps.

(e) Standard Height of Bumpers and such other minor subjects as the committee might see fit to take up for consideration.

LAST YEAR'S REPORT

Your committee is pleased to be able to state that it has no recommendations nor suggestions for changes to be made in the standards already adopted by the Association as the result of the report of this committee at the convention at Atlantic City in 1907. These standards seem to have met with a very general approval, and it is gratifying to this committee to be able to report that the standards then adopted are being seriously considered by various electric railway companies and rapidly adopted by others throughout the country. This applies particularly to (1) axles, journal bearings and journal boxes; (2) brake shoes, brake shoe heads and keys, and (3) standard section of tread and flange of wheels.

It is gratifying to note also that they are not only being adopted by the operating companies, but by car builders and manufacturers generally. Your committee takes this opportunity to express its appreciation of the cordial support of manufacturers and commercial concerns generally in bringing about the use of these common standards in electric railway equipment.

MEETINGS DURING YEAR

For the purpose of thoroughly considering the subjects taken up for standardization this year, the committee held meetings at Pittsburg, Pa., on May 7 and 8, and at Niagara Falls, Ont., on June 29 and 30, the latter meeting being held in conjunction with the 28th annual convention of the Street Railway Association of the State of New York. At this time the committee was favored with quite an extensive exhibit by the various manufacturers of those parts of the equipment which were under consideration for standardization, especially of automatic couplers for interurban cars. Another meeting was held in New York City, on Aug. 21, for the purpose of finally considering and drafting this report.

Your committee recognized that the establishment of standard heights was a most important matter and that it would not be advisable to proceed without full information in regard to the latest practice and any standards which had been adopted by individual roads throughout the country. A data sheet was consequently sent to all member companies of the association, and the information thus secured was tabulated and considered before deciding upon the recommended standards, which are herewith submitted. A copy of the data sheet sent out is appended to this report, together with the compiled information and an index of the companies which replied.

At each of the meetings of this committee representatives of the various manufacturers of the equipments were present and materially assisted the committee in arriving at the recommendations embodied in this report. Abstracts of the discussions at these meetings have been printed and widely circulated, with the result that the progress of the work of the committee from time to time has been reported to the public generally and, so far as the committee is advised, the recommendations have not met with any decided unfavorable comment.

(a) STANDARD HEIGHT OF COUPLERS FOR CITY AND INTERURBAN CARS—INTERURBAN

The consideration of the question of a standard height of couplers for interurban cars disclosed the fact that there is no general accepted practice in this respect at present. The heights vary from that ordinarily used on city cars, say, 20 in., to somewhat above the standard for steam railroad equipment. The development of the interurban railway business, particularly throughout the Middle West, has demonstrated that it will be most desirable to make the height of couplers for interurban cars the same as that which has served as standard for steam railroads for a long period of years. This will permit the two classes of cars to couple automatically, an important consideration.

Your committee, therefore, recommends that the standard height of couplers for interurban cars, from the top of the rail to the center of the coupler, should be 35 in. This is the standard adopted for all steam railroad passenger cars.

The committee's investigation also developed that there had been little, if any, effort to standardize the height of couplers for electric cars in city service, there being a great variation in the height between cars of early and of recent construction. This is objectionable, because it is frequently necessary to couple them together, especially in cases of disabled cars, in order to clear the line. A standard height is also necessary so that proper connecting bars or coupling arrangements can be provided between the high interurban cars and the lower city cars.

Your committee recommends that the standard height of couplers for city cars from the top of the rail to the center of the coupler be 20 in.

In considering the type of coupler to be recommended as standard for city cars, your committee finds that the most common form is a bar and pocket pin coupling, of practically the link and pin type, largely because there has been a very wide variation in the height of couplers on city cars. A number of automatic couplers of the link and pin type have been devised, however, and some of them have given good satisfaction in city service. Your committee believes that an automatic coupler of some type could be used and would often be desirable for city cars as well as for interurban cars, and if the height of city couplers was stand-

*Read before the American Street and Interurban Railway Engineering Association, Atlantic City, N. J., Oct. 12, 13, 14, 15 and 16, 1908.

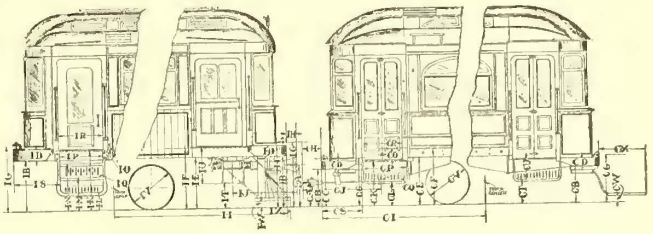
ardized much less trouble would be experienced in obtaining such a coupler than has been the case in the past. It has been suggested that a coupler similar to that recommended for interurban cars, but reduced to one-half or three-quarter size, could be so used and would be of a design and type that had been thoroughly tested both as to strength and the necessary operating mechanism. Your committee, however, does not feel that couplers for city cars have been sufficiently developed at this time to allow it to make a positive recommendation as to a standard for city cars, and recommends that this subject be continued for consideration for at least another year, or until a coupler has been developed of sufficient merit to meet with general approval and suitable for adoption as standard. It should further be understood that it is not within the province of this committee to recommend for adoption by this Association a type of coupler whose manufacture is restricted by patent rights.

(b) STANDARD AUTOMATIC COUPLERS FOR INTERURBAN CARS AND RADIAL DRAFT RIGGING

In selecting a proper type or pattern of coupler for interurban cars, your committee has been considerably handicapped from the fact that as yet no form of automatic coupler and attachment has been developed in practical service by which interurban cars can be coupled together and can also be directly coupled to standard steam railroad cars. The chief difficulty has been caused by short radius curves in city streets over which the interurban cars have to operate. A number of designs of couplers which claim to overcome this difficulty have been submitted to the committee; some of them were favorably considered, but it is the opinion of the committee that the design of a coupler for interurban electric railway conditions has not progressed sufficiently yet to warrant your committee in recommending a particular type or pattern as standard. Your committee, however, does recommend that for interurban service, including baggage, express and freight cars, a type of coupler head should be adopted which will have the same contour lines of knuckle and guard arm and will couple automatically with steam railroad couplers of the vertical plane type, but of some improved design or with some attachment which will prevent the couplers from "buckling out" when heavy interurban cars are pushed around short radius curves. The committee believes and has been assured by a number of manufacturers that such a coupler can be developed, and, if possible, samples will be exhibited by various manufacturers at this convention.

Your committee, therefore, recommends the adoption as standard for interurban railways of a coupler of a vertical plane type which will have the same contour lines of knuckle and guard arm and will automatically couple with standard steam railroad couplers.

The draft rigging and drawbar supports for these couplers should also be such that, with sudden changes in the grade,



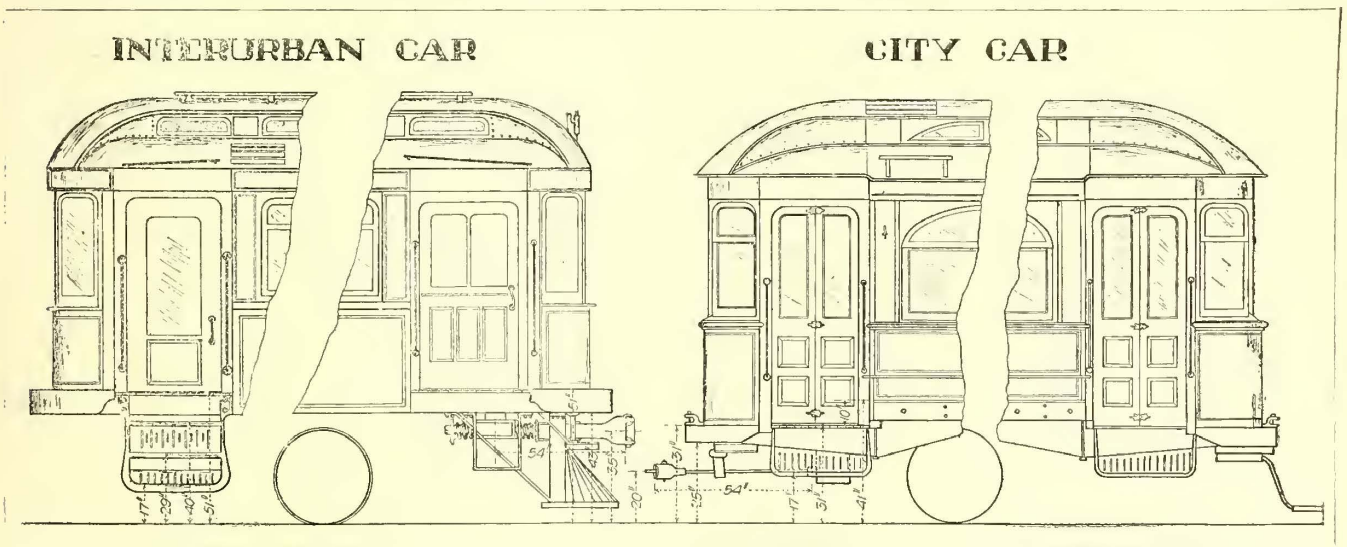
Standardization—Diagram Accompanying Data Sheet

the vertical displacement of the couplers with reference to each other will not be sufficient to cause the knuckles to become disengaged.

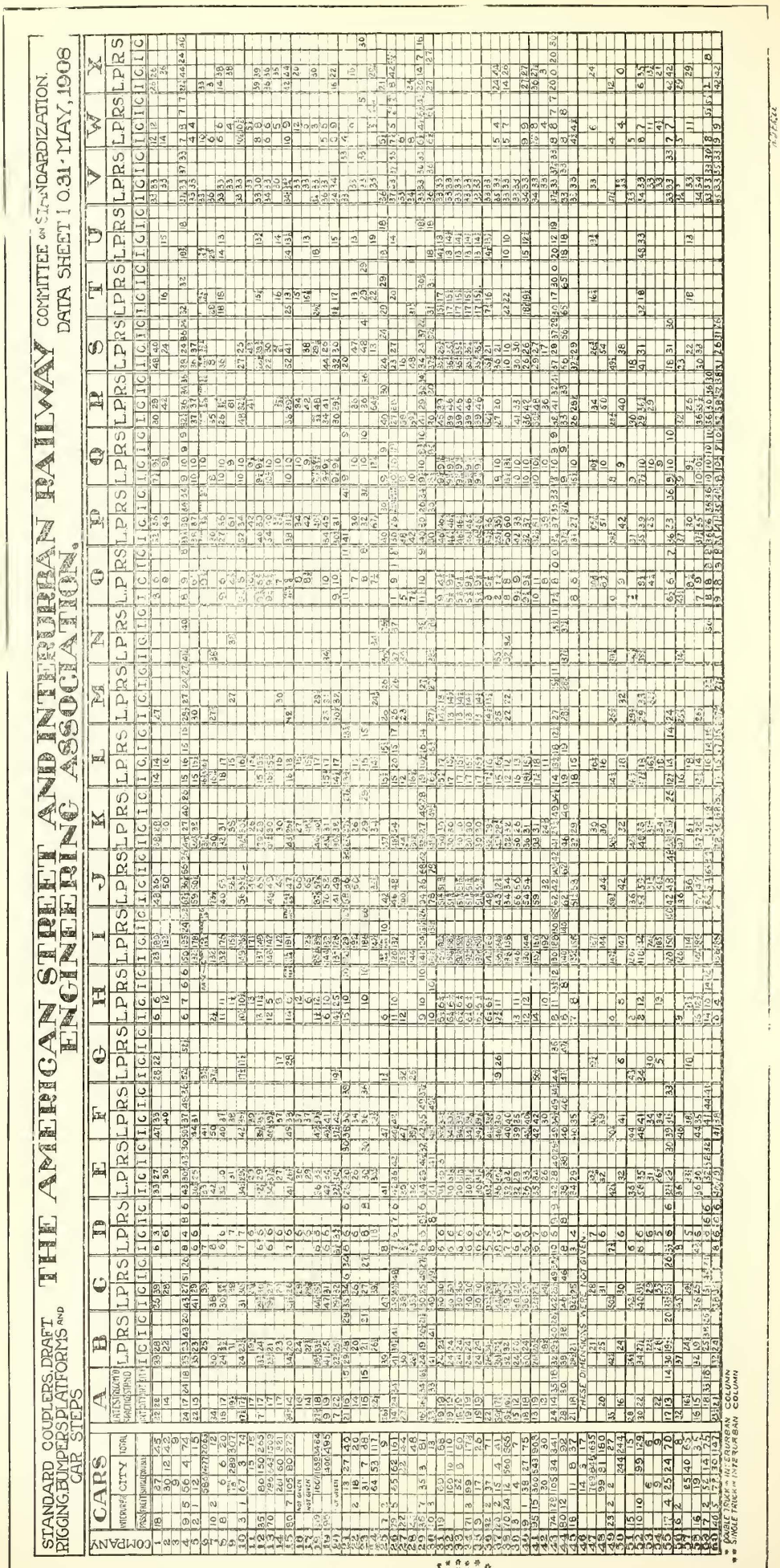
In regard to the length of a radial coupler, taking into consideration the various types of cars at present in service, your committee recommends that the distance from the center of the pocket pin to the pulling face of coupler be 54 in. This length will apply equally as well for cars in city service.

Your committee also recommends that on city cars where the bumper arrangement will permit, a pocket casting should be placed on the top of the bumper, the center of the pocket to be 35 in. above the top of the rail, and the casting to be of ample strength and properly braced, so that by means of a suitable bar city cars can be coupled on a level with the automatic couplers which will be standard for interurban cars.

For this purpose it would appear that at the present time at least it would be advisable to maintain a link slot and coupling pin hole in the knuckle of the automatic couplers recommended as standard by the committee.



Standardization—Diagram Showing Standard Dimensions for City and Interurban Cars as Recommended by the Engineering Association Standardization Committee of 1907-1908



(c) PLATFORMS

Your committee recommends that the standard height of platforms for interurban cars from the top of rail to the top of platform floor be 51 in., and that the height for city cars from the top of rail to the top of platform floor be 31 in. These dimensions appear to correspond closely with those generally adopted in the most approved designs of recently built equipment, and accord with the dimensions recommended for couplers, draft riggings, bumpers, car steps and other portions of the car which directly affect the height of platform above the top of the rail.

(d) CAR STEPS

The heights of car steps are controlled almost entirely by a number of different factors connected with the equipment of the car, such as the diameter of the wheels, the character of the motor equipment and the kind and height of the draft rigging, etc. Your committee has found that many roads have individually given the matter careful consideration, from the standpoint of having their cars as easy and convenient of entrance and exit as the conditions existing at the time when the cars were designed would permit, but that, on account of the differences both in equipment and conditions, there is wide variation in dimensions. In view of these facts, your committee does not consider it advisable at present to go farther in this respect than to recommend what it considers good practice as regards heights of car steps.

With this limitation, your committee suggests the following as recommended practice for interurban cars:

Height from top of rail to top of tread of first step, 17 in.; height from top of rail to top of tread of second step, 29 in.; height from top of rail to top of tread of third step, 40 in.; height from top of rail to top of platform floor, 51 in.

Your committee makes similar recommendations for the heights of steps on city cars as follows: Height from top of rail to top of first step, 17 in.; height from top of rail to top of second step, 31 in.; height of riser from top of vestibule floor to floor of city car, 10 in.

(e) STANDARD HEIGHT OF BUMPERS

This subject is believed by your committee to demand much greater consideration than apparently has been given it in the past, as frequently bumpers of cars on the same or connected roads differ so greatly in height as to permit the passing of one bumper over another. The height of the bumper also vitally affects the height of couplers, steps and other attachments. Your committee recommends that the bumper arrangement on interurban cars generally be made as solid and substantial as the design of the equipment will permit, and, if possible, some suitable arrangement should be provided which will prevent the bumpers of interurban cars from passing over the bumpers of the lower city cars.

The committee recommends that the standard height for bumpers on interurban cars from the top of rail to the top of bumper shall be 51 in., and the height from the top of rail to the bottom of bumper shall be 43 in.

The committee further recommends that the standard height from the top of rail to the top of bumper on city cars shall be 31 in., and the width of bumper for city cars shall be 6 in.

The committee also recommends that where possible the top of the bumper on city cars be reinforced with a bumper casting of suitable design, which will engage the bumper of the interurban cars as well as provide a wider surface, thus preventing the bumpers from passing over and the cars from telescoping in case of collision between city and interurban cars. This bumper casting could be designed to include the pocket casting already recommended for coupling city cars to interurban cars.

DIAGRAM AND TABLE

The committee submits a diagram and tabulated statement of the dimensions recommended above for adoption for standard, or suggested as recommended practice, for interurban and city cars, for ready reference:

TABLE SHOWING RECOMMENDED HEIGHTS OF COUPLERS, PLATFORMS, CAR STEPS AND BUMPERS.

	Interurban in.	City in.
Height from top of rail to center of coupler	35	20
Height from top of rail to bottom of bumper	43	25
Height from top of rail to top of bumper	51	31
Width of bumper	8	6
Length of radial coupler from center of pocket-pin to pulling face of coupler	54	54
Height from top of rail to top of tread of first step not to exceed	17	17
Height from top of rail to top of tread of second step not to exceed	29	..
Height from top of rail to top of third step not to exceed	40	..
Height from top of rail to vestibule floor not to exceed	51	31
Height of raise from vestibule platform to floor of car not to exceed	..	10

APPENDIX

A copy of the data sheet sent out by the committee is appended herewith, accompanied by a table showing the replies received. In this table the large letters A, B, C, D, etc., at the heads of columns correspond with letters on the data sheet, the city dimensions being given under the letter C, and the interurban dimensions under the letter I. L. P. stands for "latest practice," and R. S. for "recommended standard." All dimensions are in inches.

An index of the companies replying, with their key numbers, as shown in the large table, is presented below. The

Data Sheet No. 31

THE AMERICAN STREET & INTERURBAN RAILWAY ENGINEERING ASSOCIATION

COMMITTEE ON STANDARDIZATION

STANDARD COUPLERS, DRAFT RIGGING, BUMPERS, PLATFORMS AND CAR STEPS

Report of.....Railway Company
City..... State.....
City Cars Operated: Single Truck?..... Double Truck?.....
Interurban Cars Operated: Passenger?..... Freight?.....
To what extent do you operate two or more Cars together in trains in City Service? .....
In Interurban Service? .....
Number of Cars with Automatic Couplers?
Link and Pin Type: City?.... Interurban?.... Total?....
M C. B. Type: City?.... Interurban?.... Total?....

Are there any State or Municipal Laws affecting your lines regulating any of the dimensions called for in this Data Sheet?.....

In the answers to the questions which follow kindly give all dimensions in inches and indicate what is your latest or most approved practice; that is, what you consider standard for your lines. Also, kindly indicate the dimensions that you recommend should be adopted as the general standard.

	Your Latest Practice		Your Recommendations for General Standards	
Height from top of rail to the center of coupler?	IA....	CA....	IA....	CA....
Height from top of rail to the bottom of bumper?	IB....	CB....	IB....	CB....
Height from top of rail to the top of bumper?	IC....	CC....	IC....	CC....
Width of bumper?	ID....	CD....	ID....	CD....
Height from top of rail to bottom of side sills?	IE....	CE....	IE....	CE....
Height from top of rail to floor of car?	IF....	CF....	IF....	CF....
Height to the center of bumper pocket coupler casting?	IG....	CG....	IG....	CG....
Distance that coupler extends beyond bumper?	IH....	CH....	IH....	CH....
Distance from truck center to end of bumper?	II.....	CI....	II.....	CI....
The length of radial coupler from the pocket pin to the face of the coupler?	IJ.....	CJ....	IJ.....	CJ....
Height from top of rail to the top of platform floor?	IK....	CK....	IK....	CK....
Height from top of rail to the top of tread on first step?	IL....	CL....	IL....	CL....
Height from top of rail to the top of tread on second step?	IM....	CM*...	IM....	CM....
Height from top of rail to the top of third step?	IN....	CN*...	IN....	CN....
Height of raise from vestibule platform to the floor of car?	IO....	CO....	IO....	CO....
Length of step treads?	IP....	CP....	IP....	CP....
Width of step treads?	IQ....	CQ....	IQ....	CQ....
Width of door or opening, from step to platform?	IR....	CR....	IR....	CR....
Length of overhang between the center of step treads and end of bumper?	IS....	CS....	IS....	CS....
Height of motorman's step above rail?	IT....	CT....	IT....	CT....
Height of motorman's step to platform of car?	IU....	CU....	IU....	CU....
Diameter of wheels?	IV....	CV....	IV....	CV....
Height from top of rail to the bottom of pilot board or life guard?	IW....	CW...	IW....	CW...
Distance pilot or life guard extends beyond bumper?	IX....	CX...	IX....	CX....

*Not shown on drawing of city car. Indicates if more than one step is used.

The Committee will very much appreciate any drawings, cuts, photographs, suggestions or any information whatever bearing on the above subjects, as well as any information as to the style of couplers and of bumpers which you use, and any arrangement you have for a connecting bar between interurban and city cars of unequal height of drawbars; also any suggestions which you have to make of means to prevent interurban cars from telescoping or passing over cars with lower bumpers. This remark can be placed on the last page of this sheet.

names of the companies are given in the order in which the replies were received:

INDEX SHOWING NAME OF COMPANY CORRESPONDING WITH NUMBER ON INSET TABLE.

No.	Name of Company	
1	Milford & Uxbridge Street Railway Co.	Milford, Mass.
2	Lynchburg Traction & Light Co.	Lynchburg, Va.
3	Meridian Light & Railway Co.	Meridian, Miss.
4	Fort Wayne & Wabash Valley Traction Co.	Fort Wayne, Ind.
5	Pensacola Electric Co.	Pensacola, Fla.
6	Public Service Railway Co.	Newark, N. J.
7	Texas Traction Company	Dallas, Texas.
8	Northampton Traction Co.	Easton, Pa.
9	Denver City Tramway Co.	Denver, Colo.
10	Knoxville Railway & Light Co.	Knoxville, Tenn.
11	East Shore & Suburban Railway Co.	Richmond, Cal.
12	Washington Railway & Electric Co.	Washington, D. C.
13	United Railways & Electric Co.	Baltimore, Md.
14	Capital Traction Co.	Washington, D. C.
15	Northern Ohio Traction & Light Co.	Akron, Ohio.

COMPANY NAME AND NUMBER—Continued

16	Gardner, Westminster & Fitchburg Street R. R. Co.	Clinton, Mass.
17	Columbus Railway & Light Co.	Columbus, Ohio
18	Boston Elevated Railway Co.	Boston, Mass.
19	Milwaukee Electric Railway & Light Co.	Milwaukee, Wis.
20	Springfield Railway Co.	Boston, Mass.
21	Savannah Electric Co.	Savannah, Ga.
22	Fries Manufacturing & Power Co.	Winston-Salem, N. C.
23	Columbus Railway Co.	Columbus, Ga.
24	Duluth Street Railroad Co.	Duluth, Minn.
25	Iowa & Illinois Railway Co.	Clinton, Iowa.
26	Utica & Mohawk Valley Railway Co.	Utica, N. Y.
27	Southwest Missouri Railroad Co.	Webb City, Mo.
28	New Jersey & Hudson River Railway & Ferry Co.	Edgewater, N. J.
29	Louisville & Southern Indiana Traction Co.	New Albany, Ind.
30	Louisville & Eastern Railroad Co.	Louisville, Ky.
31	Altoona & Logan Valley Electric Railway Co.	Altoona, Pa.
32	The People's Railway Co.	Dayton, Ohio.
33	Springfield Railway Co.	Springfield, Ohio.
34	Scranton Railway Co.	Scranton, Pa.
35	Bridgeton & Millville Traction Co.	Bridgeton, N. J.
36	Chicago & Joliet Electric Railway Co.	Joliet, Ill.
37	Fonda Johnstown & Gloversville Railroad Co.	Gloversville, N. Y.
38	Twin City Rapid Transit Co.	Minneapolis, Minn.
39	Tri-State Traction Co.	Steubenville, Ohio.
40	Wheeling Traction Co.	Wheeling, W. Va.
41	International Railway Co.	Buffalo, N. Y.
42	Southern Wisconsin Railway Co.	Madison, Wis.
43	Indiana Union Traction Co.	Anderson, Ind.
44	The Ohio Electric Railway Co.	Columbus, Ohio.
45	Concord & Manchester Branch, B. & M. R. R. Co.	Concord, N. H.
46	Austin Electric Railway Co.	Austin, Texas.
47	Chicago City Railway Co.	Chicago, Ill.
48	Syracuse Rapid Transit Railway Co.	Syracuse, N. Y.
49	Washington Baltimore & Annapolis Electric Ry. Co.	Baltimore, Md.
50	Portland Railway, Light & Power Co.	Portland, Ore.
51	Portland Railway, Light & Power Co., Int. Div.	Portland, Ore.
52	Washington Water Power Co.	Spokane, Wash.
53	Cape Breton Electric Co., Limited.	Sydney, Nova Scotia.
54	Key West Electric Co.	Key West, Fla.
55	Charleston Cons. Railway, Gas & Electric Co.	Charleston, S. C.
56	Erie Traction Co.	Erie, Pa.
57	Newton Street Railway Co.	Newton, Mass.
58	West Penn Railways Co.	Connellsville, Pa.
59	Evansville & Southern Indiana Railway.	Evansville, Ind.
60	Schenectady Railway Co.	Schenectady, N. Y.

MEETING OF THE MANUFACTURERS' ASSOCIATION

The regular annual meeting of the American Street & Interurban Railway Manufacturers' Association was held in the Greek Temple on the Million Dollar Pier, between 5:30 and 6:30 p.m. yesterday. President Ellicott opened the meeting with appreciative remarks regarding the successful exhibits. The secretary then read the roll call, which was answered by exactly 100 representatives. The treasurer's report ending noon, Oct. 14, showed a balance from 1907, including interest, of $5,569.34, which, with the receipts made a total of $34,854.94. The total disbursements for the fiscal year were estimated at $27,918.33, leaving a surplus of $6,936.61.

After resolutions of thanks were passed to the various committees and officers, the secretary read a letter from John N. Reynold, secretary of the Road & Track Supply Association, Chicago, inviting the Manufacturers' Association to participate in the exhibits to be held in the Coliseum at the convention of the American Railway Engineering & Maintenance of Way Association, Mar. 15 to Mar. 20 1909.

The secretary also read the Executive Committee's notice that the official closing of the exhibits will be 6 p.m., Friday, Oct. 16, and members were requested not to dismantle anything before that time. A resolution was passed that ballots be mailed to members asking them whether they would approve an initiation fee of $15 for new or re-instated members.

President Ellicott then appointed a nominating committee to nominate five new members of the executive committee to serve three years, to take the places of the five members whose terms had expired, and also to nominate one member to fill one vacant unexpired term of one year. The nominating committee consisted of W. H. Heulings, of the J. G. Brill Company; Daniel M. Brady, of the Brady Brass Company; Arthur S. Partridge, of the Arthur S. Partridge Company; A. H. Sisson, of the St. Louis Car Company; and C. K. King, of the Ohio Brass Company.

The nominating committee proposed the following, who were unanimously elected: J. R. Ellicott, Westinghouse Air Brake Company, C. C. Castle, Hildreth Varnish Company; James H. McGraw, McGraw Publishing Company; W. K. Porter, Electric Service Supplies Company; Cornell S. Hawley, Consolidated Car Heating Company—all for three years; and K. D. Hequembourg, of the Walker & Bennett Manufacturing Company, for the one year term.

SMOKER OF THE A. S. & I. R. CLAIM AGENTS' ASSOCIATION

"Smile! Damn you, smile!" was the gentle watchword for Tuesday evening. Each man's coat lapel bore the legend, and each man's face the fulfillment of the command. It was a jolly half hundred that gathered at the Atlantic City Yacht Club House to attend the smoker of the Claim Agents' Association. Special conveyances were provided at the Hotel Traymore, and the start was made shortly after 8 o'clock. The early evening was devoted to general introductions among those present, after which a "handsome spread" was provided.

The meal was interrupted by music—popular, of course, accompanied by an orchestra of five pieces. Short speeches, also popular—decidedly so for that reason—were made by several members during the evening, and the affair was rendered still more enjoyable by a number of vaudeville acts from Keith's circuit. C. B. Hardin, the new president of the association, gave an enthusiastic resumé of conditions in the claim agent field; and the entertainment was brought to a close shortly after midnight by the singing en masse of Auld Lang Syne. No casualties were reported after the affair.

The entertainment committee was composed of F. W. Johnson, chairman; Peter C. Nichel, James R. Pratt and H. V. Drown.

ROLLER CHAIR ANNOUNCEMENT

The Roller Chair Committee wishes to again call to the attention of delegates and guests of the convention that a large number of chairs have been provided for their exclusive use and urges everyone to take full advantage of the opportunity to see the Boardwalk sights or to use them at any time as a matter of convenience in getting from place to place.

A BADGE SONG

"Give me a badge," the newcomer said,
"Green or blue, yellow or red.
"If I can't get pink, maroon will do,
"For only a badge will put me through.
"I'm ready to tram with any new tribe;
"Ready with any old gang to imbibe,
"But a badge I must have or miss the Show
"So fix me up on the whole rainbow."

Tennyson Swinhune Stedman.

RAILWAY MOTOR CONTROL*

BY WILLIAM COOPER, ENGINEER, WESTINGHOUSE ELECTRIC & MANUFACTURING CO., PITTSBURG, PA.

The desideratum of electric motor control is to make the rate of change of pressure during acceleration absolutely constant. There are but few devices of practical application that fulfill this condition. A water rheostat used in connection with a direct current motor and an induction potential regulator in connection with an alternating current motor might be said to fulfill this condition.

In practically all the apparatus used to control railway motors the voltage is changed in steps or increments. Since it is necessary to increase the impressed voltage in steps or increments, the value of and the rate of application of these increments constitutes the problem of control in any given case. From the control standpoint it is desirable to make the first application of current as large as possible as well as each succeeding step. The average rate of acceleration that can be maintained without discomfort to passengers depends very largely upon the fluctuations. An acceleration of 5 m.p.h.p.s. can be maintained without discomfort to the passengers, provided the rate is constant or nearly so. As it is manifestly impossible to keep the rate constant with a control apparatus in which the change in impressed voltage on the motors is made in steps, the problem is to ascertain the limit of fluctuation allowable. This limit seems to be more a matter of change of rate than a question of average rate—that is, a certain change in rate will cause an uncomfortable jerk, no matter what the average rate may be. If the rate of acceleration is 3 m.p.h.p.s. and it is instantly changed to 4 m.p.h.p.s. there will be an uncomfortable jerk. In designing a control for any given case, this is the first point to be considered and the total number of steps in the apparatus adjusted accordingly. As a general proposition the number of steps must be such that the change in rate of acceleration when changing from point to point will not be greater than 0.6 m.p.h.p.s. for passenger service.

Having determined the allowable fluctuations of current in the motors and from this the total number of steps in the whole sequence of acceleration, the next consideration is the method of obtaining these steps.

In making a determination of the increments of voltage to be impressed upon the motors during the period of acceleration the nature of the service has a very important bearing on the subject. As stated, if it is for passenger service a certain change in rate of acceleration is allowable. This same variation is not at all allowable in freight service or where the question of adhesion or capacity of motors enters into the problem. In freight service the rate of acceleration is usually quite low. This is allowable, as the time consumed in acceleration is but a small part of the total time, for the reason that the full speed is low. Under freight haulage conditions the change in rate of acceleration must be measured in percentage of total drawbar pull rather than in miles per hour per second. The fluctuations of drawbar pull should not be more than 15 per cent. and if it is desirable to get the maximum pulling power it must be even less.

Thus it is seen that in the use of electric motors for any kind of railway work some kind of control apparatus must be used to regulate the impressed voltage on the motors, the nature and refinement of which depends upon the kind of service.

The number of different kinds of control apparatus used is even greater than the different kinds of motors. There are two distinct types that cover practically the entire field, commonly known as the drum type and the unit switch type.

DIRECT CURRENT CONTROL

In designing a controller for direct current work there are two general methods followed—that of plain rheostatic control and that of series paralleling the motors. The first arrangement must of necessity be used when only one motor is employed and can be used when more than one is employed by connecting them in either series or parallel permanently. If the control is to be plain rheostatic the main consideration is the number of steps to be used. This point is often considered more from the point of simplicity of construction of the controller than from perfection of operation.

Since the fulfillment of both of these conditions is obviously impossible, a compromise must be made. The number of steps used should be regulated by the service conditions, but is usually made about the same for all kinds of service. It is safe to say that the number used is always less than desirable.

When two or more motors are used on d. c. work, it is desirable to arrange the motors, in some kind of series parallel combination. There are several ways of changing the motor connections from series to parallel while the motors are in motion. There are three that have been used extensively. They are known as the shunted motor, open circuit and bridging systems. The last system is the only one that fulfills the condition of continuous torque on the motors, or in other words, is the only perfect system.

In the bridging system, a circuit is maintained through each motor throughout the whole period of acceleration and the torque of the armatures is kept practically constant. This result is accomplished by arranging the motors first in series and in series with a certain amount of resistance and then cutting the resistance out leaving the motors in series across the line. The resistance is then arranged in two groups and connected directly across the line with the middle point connected between the motors. This establishes two paths, one through the motors and one through the resistances, with a point of equal voltage of the two connected together. If the value of the resistances is such that the current flowing through the resistance is equal to the current flowing in the motors, the bridging connection between the motors and resistance can be broken without making any change in armature current. This system of direct-current control is so far superior to any other that it is the only one that should be given consideration. This is not only true with two motor equipments but is equally true when using four. The use of this system in connection with automatic acceleration gives results that cannot be attained by any other known system.

Controllers with an insufficient number of steps have been in use in so many different places and on so many different equipments that the users have come to believe that the conditions they impose are a necessity. As before stated the design must be a compromise, but let the compromise be such that the completed machine will reasonably fulfill the conditions. The design of the resistance for direct current operation plays as important a part as the number of steps. If the resistance is not properly designed good

*Abstract of paper read before the American Street and Interurban Railway Engineering Association, at Atlantic City, N. J., Oct. 12, 13, 14, 15 and 16, 1908, as a part of the Report of the Committee on Control.

operation cannot be secured no matter how many steps there are in the controllers.

ALTERNATING CURRENT CONTROL

In the control of alternating current motors, the controller designer is not hampered by many of the limiting conditions of a direct current motor. There must, however, be a limit to the increase of current in the motor per step. This condition is not, however, nearly as exacting as in d.c. operation, owing to what is commonly known as "rubber" in the circuit. There are two points to consider in regard to the arrangement of the motors. Arranging the motors in series reduces the volume of current to be handled as compared with the parallel arrangement but increases the voltage. The advantage of the smaller current is a reduction in size of all current carrying parts, which is more a matter of first cost and weight than one of maintenance or operation. On the other hand, the motor circuits as well as the control apparatus must be subjected to the higher voltage. Also the higher voltage current is more difficult to handle on the circuit making and breaking devices. This part of the problem is quite different from d.c. control. In d.c. work the motor and control voltage is fixed by the line while in a.c. work the motor voltage is independent of the line and may be made anything that makes the best design.

The question of selecting the proper voltages for the different steps of the control is governed by the same limitations as in the d.c. The increments of current per step must be kept within certain limits and should be the same for each step. There are three things that affect the increase of voltage per step to give an equal increase in current: the resistance of the circuit, the counter electromotive force and the inductive voltage. The resistance and counter electromotive force represents the energy or inelastic portion of the circuit, while the inductive voltage represents the elastic and non-energy portion. The combination of the two tends to keep down an increase of current due to an increase in impressed voltage. The energy component of the voltage and the inductive component are at right angles. That is, there are two forces acting at right angles, the result being that they are effective in resisting the impressed voltage in an indirect proportion to their value.

The apparatus used in making the combinations and connections of circuits is in all essential details the same for both a.c. and d.c. operation. There are, however, some characteristics of the two currents that are quite radically different, the principal one being the magnetic field produced. An alternating current produces, of course, an alternating magnetic field. This alternating magnetic field has the peculiar characteristics of inducing local currents in any piece of metal that may happen to be within its range. The value of these local currents is very largely controlled by the extent of this metal and are very materially reduced by dividing the metal into small parts.

In rupturing the circuit the magnetic blowout is useful in both a.c. and d.c. It is not, however, quite as effective on a.c. as on d.c., owing to the local currents in the metal parts of the circuit, which tend to throw the magnetic flux out of time with the current.

Alternating currents, as the name implies, reverses its direction and of necessity passes through zero. This characteristic assists very materially in breaking the circuit.

AUTOMATIC ACCELERATION

As the principal function of a control apparatus is to graduate the application of the voltage to the motors in such a manner as to maintain the current within certain limits it follows that it must be actuated at certain fixed intervals. This can be done automatically with far greater precision than is possible manually even by the best trained operators.

The maintenance of rolling stock is directly affected by the manner in which the propelling power is applied. The current in the motors regulates the tractive effort and this determines the mechanical strains put upon the driving mechanism. In addition to this the current in the motors determines the heating and deterioration. For any given service there is only one rate of acceleration and time of current on the motors that gives the minimum heating effect in the motors.

On ordinary hand controllers, many so-called auto-motoneers have been applied. All these devices are operated on a time basis, that is, a certain time must be used in changing the controller from one step to another. This method, in itself, is a step in the right direction as it certainly limits the current input into the motors under certain conditions.

Automatic acceleration can be secured properly only by a current limiting device. There are no such devices applied to drum controllers. It may be possible to design such a device, but attempts in that direction have not thus far met with success. In the use of unit switches, that are separately power-operated, automatic acceleration can be secured by connecting the operating circuits through small contact making devices which are actuated by the main switches in closing and opening. By this arrangement the closing of some certain switches sets the actuating circuits for certain other switches, but these cannot close until the current limiting device says the current does not exceed the proper value. After the current has fallen to the proper value the current limiting device closes the circuit to switches and certain other switches will close, increasing the impressed voltage on the motors and increasing the current. This acts to lift the current limit and stop the progression of the switches until the current again falls to the proper predetermined value. This produces a uniformity of action of the switches and a smoothness of operation that no operator can reproduce manually, no matter what his skill may be.

There are several modifications of this method of control that are adapted to certain special conditions.

There is a method of connecting the current limit that is of considerable value in connection with d.c. roads, having a limited supply of power. If the current limit is connected in the trolley circuit, the acceleration will be a constant current from the line irrespective of whether the motors are in series or parallel. It is necessary with this arrangement to accelerate with a larger current per motor with the motors in series than when using constant motor current. That is, it is necessary to push the acceleration with the motors in series in order to give the same average. The advantage of this arrangement is that the fluctuations of power on the line are very much reduced. When using constant current per motor the demand on the line is, of course, twice as great when the motors are in parallel as when in series. By using constant line current the maximum demand on the line can be reduced from twenty-five to thirty-five per cent. This point is of more importance than it may appear at first sight.

The advantage of automatic acceleration as applied to d.c. operation are equally as great as applied to a.c. operation, although the question of fluctuation of line current does not enter into the consideration to the same extent. Some equipments are in operation on a.c. using two current limits, one to limit the motor current up to a certain value of line current and then limiting by the line current.

Of all the different functions and characteristics of rail-

way motor control, the ability to handle a number of different power units simultaneously is of vastly more importance than any other. It makes possible the fulfillment of service conditions that would be impossible without it. If the supply of electric power is sufficient, the only limit to the length of such a train is the number of cars at hand or the length of the railroad.

There have been a great many different schemes proposed for accomplishing this result, but only a few have ever been put into operation. There are certain conditions that must be fulfilled or the apparatus will fail. First, the question of safety must be as absolute as possible. There must be no possibility of false operations of the control apparatus, such that a train will start unintended, and the ability to cut the power off at will must be equally as certain.

To fulfill these conditions, the apparatus must have certain characteristics. A failure of any part to perform its proper function must be negative in its results rather than positive. This is a condition that is well recognized (or at least should be) by all designers of automatic machinery. It is safe to say that "what can happen will happen." This is appreciated by no one more fully than by one who has been connected with the development of a system of multiple-unit train control. As the operation of the appartus on each car must be controlled by electric circuits carried from car to car, the integrity of these circuits must be maintained.

In developing apparatus to meet the requirements of multiple control and automatic acceleration as set forth above, the engineers of the company with which the writer is connected have followed consistently and continuously certain well defined lines.

First.—The operation of the control apparatus is entirely independent of the main power circuit.

Second.—Maintaining relatively high pressure on all switch contacts.

Third.—Low voltage non-grounded circuits from car to car.

Fourth.—Automatic acceleration.

Fifth.—All d.c. car equipments operated on the bridging system of control.

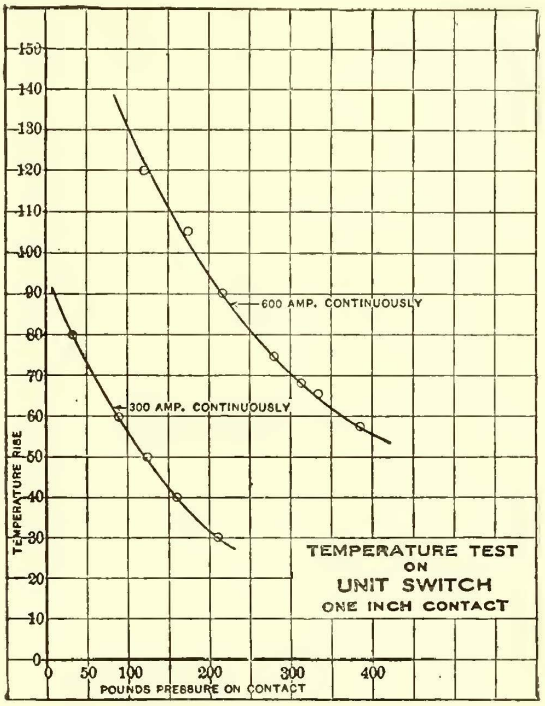
These features have been maintained in all the apparatus put into operation and as the term of service increases the value of them becomes more and more pronounced.

The value and advantage of operating the control apparatus independently of the main power circuit consists in being unaffected by any variations of line voltage and ability to operate control apparatus when the power is off. One of the advantages of this is that the motors may be "bucked" in case of an emergency. Also the control apparatus can be operated for inspection without power on, thus removing any possible chance of accident. These advantages and some others not mentioned, more than offset the trouble and disadvantage of maintaining the small storage battery used for the control circuits.

The question of switch pressure contact is under perfect control, as compressed air is used to operate the switches, thus making it easy to get any pressure required. That this is a matter of considerable importance is shown by the accompanying curves.

When it is remembered that these temperatures are the result of changing only the pressure on the contact, all the other losses being the same, the real value of the increased pressure is more fully appreciated. Also it is to be understood that these curves were plotted from actual tests and each point was secured by allowing the temperature to become constant. As is seen from the curves, the comparative heating with low pressure is excessive and often causes a welding together of the switch contacts. The principal advantage of the ability to get high contact pressures is that the switch can be made much narrower and a magnetic field of proper strength for blowout purposes can be more readily secured. With this construction, it is possible to make single switches of several thousand amperes capacity for d.c. operation. For a.c. operation the capacity of a single switch has another limitation, that of secondary currents in the metal parts of the switch exposed to the action of the magnetic field used to blow out the arc.

The use of low voltage non-grounded circuits for the train line has two very great advantages over a high voltage train line: immunity from short circuits and



Railway Motor Control—Temperatures of Unit Switch

grounds, and the absence of sparking or burning at the master controller or interlock contacts; also, from an inspection standpoint, there is no danger of getting a shock from handling the current carrying parts.

For the reason previously stated, automatic acceleration has been used on all d.c. and most a.c. car equipments. This has been an inflexible rule. As it is considered that the best methods of control available are none too good, nothing but the bridging system on d.c. and an equivalent system on a.c. has been used. The specific construction of the apparatus used to produce these results has become quite genrally known and need not be mentioned here.

The New York Switch & Crossing Company, Hoboken, N. J., has at its booth in Building No. 2 a number of switches, frogs and crossings taken from stock to illustrate the variety as well as the class of work done at its plant. The exhibit includes anti-straddling switches, switches with hard steel, manganese and hammered steel centers and switches and crossings for both electric and steam railway use. Information relative to the serviceability of this company's products is being dispensed at the booth by W. C. Wood, H. R. Sherman, W. B. Phillips and E. Armerding.

Among the Exhibits

H. Sanborn Smith, general sales agent, and C. R. Robinson, the new Chicago district sales agent of the Lackawanna Steel Company, arrived in Atlantic City on Wednesday to attend the convention.

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The automatic feature of the Jones stoker, which is distinctive of this method of mechanical stoking, renders it particularly applicable for service where loads are fluctuating in character. A full description of the Cole automatic attachment referred to will be found in the new edition of the Pocket Catalog being distributed by the Under-Feed Stoker Company of America at its exhibit, space 860.

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The new features of the exhibit of the United States Electric Signal Company, consist of a signal providing for a multiplicity of cars in a block at a time. This system has all the safety features of this company's former type G-1, namely those of anticipating grounds, crossing of wires, etc., and all line troubles to which a signal is subject. There is also shown a new trolley switch, the operating parts of which are made light and so constructed that the action is very slight, thus eliminating inertia. The exhibit is wired up to show how the signals work when in actual operation.

***

A large line of ticket punches of all types is shown in Space 824 by the Bonney-Vehslage Tool Company, New York. A punch made especially for street railway service differs from the usual type of punch, in that the tool steel die is set into the main part of the frame and the plunger is made of malleable iron. In other punches this method of construction is usually reversed.

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The American Locomotive Company, New York, is located in Machinery Hall. Its space is arranged as a reception booth where Messrs. William Wampler, W. E. Woodard and Raymond H. Baker, the representatives of the company, are greeting delegates. The company's exhibit consists of large framed photographs of some of the electric locomotives, snow plows and trucks manufactured by it.

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The Falk Company, of Milwaukee, seldom misses representation at a convention of electric railway men. This year W. Frank Carr, chief engineer, is in attendance, and is presenting his acquaintances with an attractive souvenir pamphlet illustrating the products of the Falk Company, which include gears, pinions, special track work and all manner of steel castings.

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The Verona seamless trolley pole, which is being exhibited by the manufacturers, the Pittsburg Pole & Forge Company, in spaces 608-614, main building, is made from selected seamless tubing. The outside diameter at the tip is 1 in., and as the end is tapered for 3 ft. of its length any harp can be made to fit. The butt is 1½ in. in diameter and is reinforced for 20 in. with the same material as the pole itself, making a light weight trolley pole which has high strength and which will stand up under hard service.

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Few exhibits in the line of specialties for interurban cars are attracting more attention than the Janney radial coupler exhibited by The McConway & Torley Company, Pittsburg, Pa., in spaces 707-715, Marine Hall. The device is ingenious and simple and seems to meet the peculiar requirements of electric and interurban service.

In the exhibit of the Columbia Machine & Malleable Iron Company, is a turnstile designed for pay-as-you-enter cars. It was invented and patented by C. S. Banghart, Superintendent of the New York & Queens County Railway Company. It consists of an upper and a lower set of arms fastened to a hinge attached to the center pole. These arms automatically fold or drop as soon as the passenger has entered, only two arms extending out in a horizontal position at a time. The turnstile is designed to take up little space on the platform of the car. In view of the interest at present manifested in pay-as-you-enter cars and methods of fare collection used on them, it would pay delegates to examine this exhibit.

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Considerable interest has been shown since the convention opened in the demonstrations of the Millionaire calculating machine. This remarkable mechanism can multiply and divide any sums with surprising rapidity and absolute accuracy, and is a marvel to all who call to see it in operation. It is said that no machine on the market is its equal for figuring costs, earnings and expenses per car mile or car hour, discounts, etc., and all those interested are invited to visit booth 424 where Messrs. William & George Morschhauser are prepared to demonstrate and show the machine.

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The exhibit of the Gould Storage Battery Company, New York, at spaces 818-819, includes sample cells of the various types used for railway regulating and line batteries. The type V-1541 cell is of interest as an example of the type of installation used where the demands for power are large, this cell, having a capacity of 4800 ampere hours at the 8-hour rating. The "Couple type" exhibited is used for signal, telegraph and similar installations. The Gould Storage Battery Company is distributing to users of storage batteries, temperature correction charts, showing the variation in gravity readings caused by temperature changes and affords a simple and convenient means for accurately determining the condition of charge in cells by means of the ordinary hydrometer.

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The Jewett Car Company, Newark, O., is showing on the exhibition trestle, adjoining the Main Building, one of an order of ten interurban cars built for the Indianapolis, New Castle & Toledo Railway. The design of this car is out of the ordinary in several respects. It is 62 ft. long and its front end is parabolic in shape. This departure from the ordinary design is intended to reduce the head-end air friction of the car while it is in motion. The car is of unusually substantial construction and is built to withstand the strains incident to running at a speed of 70 miles an hour. The interior is finished in mahogany and is equipped with the latest types and designs of fixtures, among which are the Jewett automatic window fixtures and nickel lamp sockets. The car is equipped with a motor generator set and is so wired that either 550 volts or 110 volts may be used on the lighting circuit. The car body is mounted on Baldwin trucks which will be equipped with Allis-Chalmers motors. The car came to Atlantic City from Newark on its own wheels. It was built from designs and specifications prepared by the Electrical Installation Company, Chicago, which is acting as engineer for the railway company. The company is also showing a section of its semi-convertible car.

C. E. Sawtelle is attending the convention in the interests of the Tool Steel Motor Gear & Pinion Company, Cincinnati, Ohio. He reports some good orders received from a number of the larger railway companies.

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The Rail Joint Company, of New York, has established a branch sales office in the Call Building, San Francisco, Cal. James A. Greer, of the sales department in New York City, will represent the company.

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The Quride car seats and the Quride silent gears shown by the Picome Hide Company, Syracuse, N. Y., are attracting attention. The representatives are being kept busy explaining the merits of Quride.

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The Union Electric Company, Pittsburgh, Pa., is represented by T. M. Cluley and Geo. W. Provost. The many friends of John P. Provost will hear with regret that he was unable to attend the convention this year.

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The National Brake Company, of Buffalo, is distributing a rhyme of the dollars written in the style of the ten little black boys, except that, one by one, ten bags of dividends disappear because a railway company does not use peacock brakes.

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The Russell Car & Snow Plow Company, Ridgway, Pa., is represented by M. S. Kline, president. Mr. Kline reports an encouraging improvement in business conditions. His Company has already booked a number of advance orders for snow plows.

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Star Brass Works, Kalamazoo, Mich., is showing, in addition to their regular line of trolley wheels and harps, a new form of 6-in. wheel with a 3-in. hub and a harp designed especially for this wheel. The exhibit is located in space 814, Building No. 3.

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Barbour & Stockwell Company, Cambridgeport, Mass., as has been their custom for a number of years, have no exhibit, but the interests of the company are being well taken care of by the representatives present, F. F. Stockwell, Wm. W. Field and H. R. Luther.

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The exhibit of the Electric Railway Improvement Company, Cleveland, O., which is located in Building No. 2, is attracting even greater attention among railway men than it did at the convention last year. Many demonstrations of the brazing of copper bands to steel rails by one of the company's welding and brazing cars were made yesterday and more will be made during the week.

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The L. K. Elliott Electric Company, successors to the Elliott Bros. Electric Company and to L. K. Elliott, Cleveland, O., is represented at the convention by C. P. Billings. This company has recently increased the capacity of its plant to facilitate the manufacture and repair of field and armature coils. The representatives claim the company now has one of the best equipped plants in the Middle West for doing this work.

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An interesting exhibit is shown at space 607 by G. M. Gest. Besides a number of types of Camp duct for underground conduit construction, a novel and ingenious method of reinforcing corroded iron poles is shown. The reinforcement is put in the pole from the inside without disturbing the sidewalk or the overhead construction. A reinforced cage of carbon steel twisted bars is dropped into the top of pole and concrete is forced in by means of compressed air. After the concrete sets, the pole is practically indestructible.

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A number of interesting appliances are exhibited by the D. & W. Fuse Company, of Providence, R. I. Both the black and white finish deltabeston magnet wire is shown, also service switch boxes with inclosed fuses for d. c. and multiphase currents; main line and branch boxes; motor and third-rail shoe fuse boxes; a line of high-tension cutouts is also exhibited.

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At the demonstration of rail welding by the Thermit process on Tuesday afternoon, a number of distinguished guests were present to witness this interesting operation. Included among them were Mr. Katsura, engineer of the South Manchuria Railway; C. O. Holmes, U. S. Steel Products Export Company; James B. Strong, Ramapo Iron Works, and W. H. Harton, Jr., engineer maintenance of way, South Covington & Cincinnati Street Railway Company. The demonstration will be repeated again to-day at 4 p.m. on the pier between Marine Hall and the Annex Building.

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The Trolley Supply Company, Canton, Ohio, is showing in its booth in Building No. 3, its new Peerless roller bearing trolley base. This base, it is claimed, is almost frictionless. Its springs and bearings are entirely enclosed in dust and moisture-proof casings. The company is also showing its new Peerless and Ideal trolley catchers, which are attracting attention. The Trolley Supply Company is also the manufacturer of the well-known Knutson trolley retriever which is now used by more than 400 railway companies. Other devices exhibited include the Starare and incandescent headlights which are interchangeable with any other type of light.

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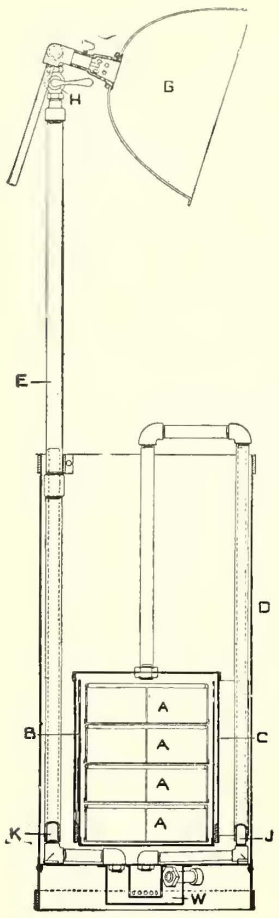
The General Storage Battery Company, Boonton, N. J., is showing a complete line of its "Bijur" plante plates as well as two types of the well-known Bijur balanced booster regulator at spaces 729-731. Bijur storage battery plates are characterized by their freedom from buckling, high durability, superior diffusion of electrolyte and particularly by the patented treatment of the negative, called "permanizing," which causes the negative plate to sustain its capacity in use. The exhibit consists of two 1400-amp. hr. cells, completely installed, a 4400-a. h. unit, similar to the cells in the Cambria Steel Company's new battery, and a number of smaller cells, giving a comprehensive idea of the Bijur line of stationary cells, from the largest size down to 6 a. h. couples. The plates of the General Storage Battery Company's are perfectly interchangeable with those of other makers and any standard battery can be renewed with them. Photographs of several installations are shown and the motor driven end cell switches, in which several marked improvements have been embodied, have evoked much interest. The addition to the company's plant at Boonton is now in full operation and is of such size that this company now ranks as the second largest battery manufacturers in the country.

THE MILBURN ACETYLENE LIGHT

The Milburn acetylene light, manufactured by Alexander Milburn Company, Baltimore, Md., is being exhibited on the pier alongside of Colonel Young's residence, which at night is ablaze with incandescent lamps. No better position could have been secured for demonstrating, by comparison, the intense power of the acetylene flame used in this lamp. The lamp is intended especially for use on night construction or repair work, to which all street railway companies frequently have to resort. The accompanying illustration shows a cross section through the acetylene generator and the burner reflector. No pump, gages, valves or moving parts are employed. The pressure of the gas is maintained by a water column which supplies the water used in the generator. The tank is 12 in. square by 36 in. high, and the lamp is mounted on it with a standard, which revolves freely in a water seal in the tank. The carbide is placed in trays in an inner cylinder of the tank. A wide-angle reflector is used to distribute the light and at the time intensifies it sufficiently so as to project the rays 1000 ft. or more in front of the lamp. The light is claimed to be perfectly safe because all joint are water-sealed. The lamp is said to give 5000 cp with a consumption of 2½ lb. of calcium carbide per hour, costing 3½ cents a pound. These lights are in use by a large number of street and steam railways, contractors, and by the United States Government.



Milburn Light

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M. M. Ely, of The Garford Company, Elyria, Ohio, is attending the convention in the interest of Shelby "Standard A" trolley poles for which this company is sole agent. An exhibit of these poles is being made in the booth of the Wallace Supply Company.

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The National Carbon Company is distributing a small booklet on carbon brushes entitled "Operation vs. Quality," covering the selection of the proper brushes, the qualities necessary to meet certain conditions, the causes of many brush troubles, the remedy, etc. Every railway representative can secure copies at this company's exhibit booth, space 812.

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The Lima Brake Shoe Company, Lima, O., is showing samples of its composition brake shoe, which are attracting considerable notice. Some of these brake shoes have been in use on several of the large interurban and steam roads in the Middle West and the company states that they are giving entire satisfaction. C. H. Doebler is in attendance at space 600, and is prepared to give any information which may be asked for.

John M. High of the Pantasote Company, New York, reports having received some very large orders for Agosote, the new waterproof fiber board used for head linings in car construction. Agosote is a foreign product, extensively used abroad in passenger car construction. It has been on the market in the United States less than a year. The following is a partial list of recent car orders on which Agosote has been specified: Chicago Railways Company, 600 cars; Northwestern Elevated Railroad Company, Chicago, 20 cars; Third Avenue Railroad, New York, 150 cars; Metropolitan Street Railway Company, New York, 125 cars; Yonkers (N. Y.) Railroad Company, 16 cars; Boston & Maine, 30 cars; Pennsylvania Lines West, 10 cars; Pullman Company, 14 sleeping cars. This product is now being used in the construction of a total of more than 1200 passenger cars of all types. Up to the present time it has been manufactured abroad and imported; arrangements have been completed, however, for its manufacture in the United States by the Pantasote Company.

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The Samson Cordage Works, Boston, Mass., is issuing a clever reminder of its product in the shape of a pencil with a celluloid holder made to represent the well-known Samson Spot Cord. It will be sent to any electric railway officer who writes.

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The Northwestern Elevated Railroad of Chicago has recently ordered from the American Mason Safety Company 2300 Mason safety step treads for use on station steps and platforms and has also specified that these treads shall be used on the new cars now building at the works of the Pullman Company. Among other orders placed for these treads are an order for 1200 from the Pullman Company for its own cars and an order from the Hudson Companies for equipping all of the stairways of the tunnel stations in New York.

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The vacuum impregnating system is being extensively adopted by leading manufacturers for impregnating armature and field coils, and the Standard Paint Company's compounds for this purpose are having a large sale. A visit to space 735 will repay itself, if only for a quiet chat on this subject with the company's representatives, and incidentally to obtain one of the new catalogs of insulating varnishes and compounds. This book is not only a catalog of the well-known line of P. & B. insulating varnishes and compounds, but also contains much practical information about insulation and methods of applying it.

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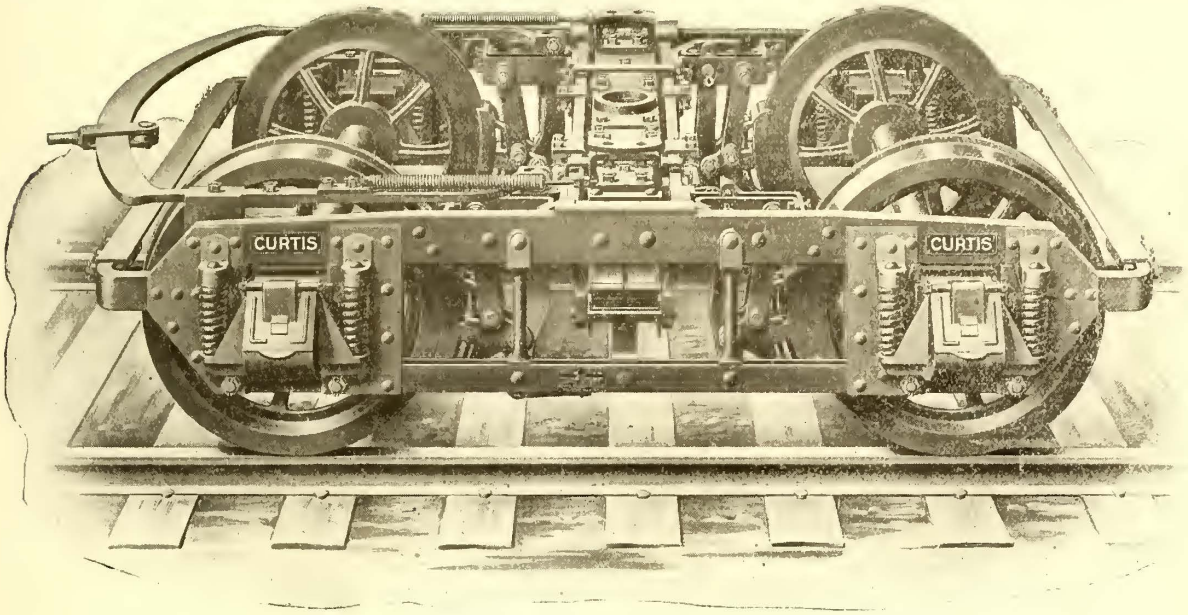
The Lord Electric Company, New York, in addition to its numerous other specialties, is exhibiting the Cosper "Controlator" (controller regulator). This device is designed to insure smooth acceleration accompanied by a material saving in maintenance cost for equipment repairs and in electrical energy. It is bolted to the top of the K type controller usually used. Also, it is designed so that it may be applied to other controllers for series-parallel service. With regard to the design of the "controlator," it is said that it is built very compactly, is strong and therefore durable, and also is unaffected by atmospheric conditions. The regulator effects, by means of a predetermined time-element feature, any desired rate of feeding. With each equipment a templet is furnished to facilitate installation. One commendable point in this device is that when the reverse lever is thrown again into the forward position, the controlator automatically puts itself into service.

THE CURTIS MOTOR TRUCK

The Curtis type CI-158-72 motor truck with motors inside the axles is on exhibition in Building No. 3, Spaces 851-53-55. It is designed for city and suburban service, and can be used in services that are usually thought to require trucks with motors outside hung, because it will pass all curves that are considered good practice. With its motors carried in the center, the strains due to the overhang of the motor load carried on the end sill are not encountered. Supporting the motors in the center is the natural place for them in a radial truck and the power of motors can be better applied than when motors are outside the axles. This type also carries the car body lower than most trucks of the same capacity and characteristics and is especially suited to cars with large overhanging platforms. Carrying its load in the center, the weight of the car is centralized and the traction is greater than with other types of trucks.



The Curtis Forged Steel Motor Truck for City Service

The truck has the Curtis all-forged steel pedestals and four coil springs. Each lower corner of the journal box is a heavy lug cast to form the seats of the pedestal coil springs that give relief to the shocks of the wheels on meeting inequalities of the track, so that they do not vibrate back and forth through the frame and car body.

The bolster is of the true swinging type, being of such design and construction that it swings freely with the shifting car body. There is no limiting device to stop its natural swing, yet it never strikes the side frames, but maintains a true central position when at rest.

The Curtis transom construction is used. This truck is equipped with the Curtis balanced non-chattering brake rigging. This rigging is designed to give powerful brake application with the least wear of shoes.

It is built of open-hearth steel forgings throughout. All castings are eliminated except journal boxes, brake heads and center plates. All parts are standard and interchangeable.

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Don't forget that you intend to call to-day on the representatives of the Speer Carbon Company in space 611 and talk over your brush troubles. They have some new improvements on their products worth looking into.

The G. Drouvé Company, of Bridgeport, Conn., was a little late in arriving, but William V. Dee, its general manager, is now here and has a space near Aquarium Hall, where a neat model of the Lovell window operator and sections of Anti-Pluvius skylight are exhibited.

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One of the exhibits of the National Lock Washer Company, Newark, N. J., at its booth, spaces 216-220, comprises a number of full-sized car windows showing in practical operation the company's car window fixtures. On account of their simplicity, small number of parts and ease with which they can be applied and maintained, these devices have been sold in large quantities to steam and electric railways. The sash locks shown on these models can be used with or without the National sash balance. It holds and positively locks the sash at any height. Furthermore, it prevents rattling, and by its use the window can be framed loose enough to be easily raised and lowered. The window cannot fall when equipped with this device, as the jar, instead of loosening it, locks it more securely.

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The Coleman fare box is attracting much attention from operating officers in attendance at the convention. The companies which have the device in use on their pay-as-you-enter type cars are strong in their praises of its efficiency in collecting all the nickels. Its mechanical construction is simple and strong and not easily deranged by rough usage or by bent or defective coins. George H. Dreybus, manager of the Coleman Fare Box Company of Buffalo, who was formerly connected with the International Railway Company, is demonstrating the operation of the Coleman system of fare collection in space 304 in the main building and is distributing a little booklet containing information worth real money.

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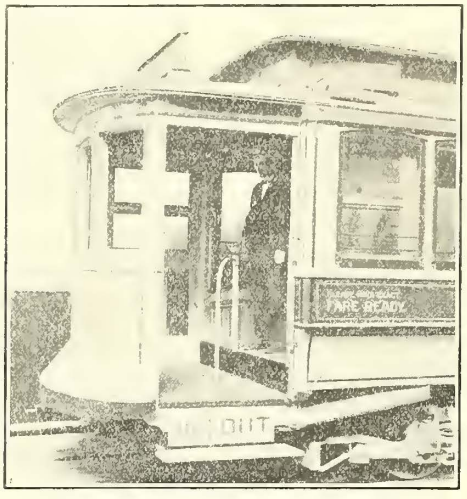
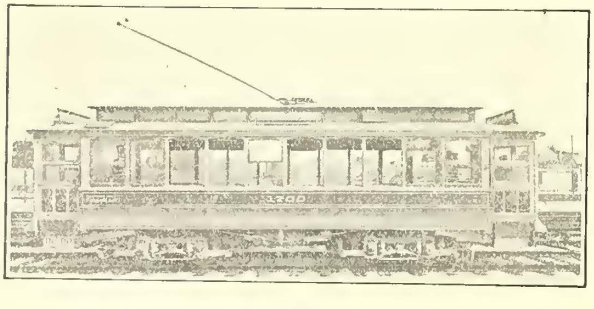
The auto-scope advertising device displayed in building 3, spaces 836-838, by the National Advertising Company of America, is designed to bring every card shown in the advertising rack of an electric car directly in view of all the passengers on the car. The cards are constantly shifted and thus attract attention. Added to this is the fact that the device allows twice as many cards to be displayed in each car as has heretofore been possible.

THE PAY-WITHIN CAR

The "pay-within" car, designed by F. H. Lincoln, assistant general manager, Philadelphia Rapid Transit Company, is being exhibited on the trestle north of the pier by the Electric Service Supplies Company, which has secured the selling rights from the Pay-Within Car Company, which owns the patents. The car exhibited is one which has recently been rebuilt from a standard double-truck car in the shops of the Philadelphia Rapid Transit Company. A full description of the pay-within principle and the method of reconstructing the Philadelphia Rapid Transit Company's cars to use this system was given in the Electric Railway Journal of Sept. 23. One or two minor improvements have been incorporated since the description appeared, the chief of which is in the form of pillar containing the door-operating valves and which separates the entrance and exit passage ways in the rear vestibule. The principle claim made for the pay-within type of car over any other prepayment plan is the additional protection afforded against accident. The rear platform is entirely enclosed by pneumatically operated sliding doors controlled with a valve conveniently placed in front of the conductor as he stands in his proper position. The platform step folds up when the door is closed and there are no grab handles on the outside of the car. It is impossible, therefore, for anyone to attempt to board the car after the door is closed and the step is up. The simplicity of converting a standard car into one of the pay-within type is also an important advantage claimed.



Rear Platform of Pay-Within Car



Philadelphia Pay-Within Car

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The Le Valley Vitae Carbon Brush Company, New York, has no exhibit, but the company's interests are looked after by M. W. Robertson, its general manager.

BRILL CENTER-BEARING MAXIMUM TRACTION TRUCK

The Brill exhibit includes a center-bearing maximum traction truck which is shown for the first time. The truck can be inspected in the Brill section on the pier and can also be seen under the Pay-As-You-Enter car of the Third Avenue Railroad Company on the exhibition trestle. It is designated as No. 39E and differs from the Brill "Eureka" maximum traction truck, in that it has a bolster with a center bearing. The bolster is supported on semi-elliptic springs which extend lengthwise of the truck and rest in links suspended from the side frames. The side frames are each solid forged in a single piece, and the entire frame is well designed with a view of reducing the weight of the truck to the minimum. Differential brake levers proportion the amount of pressure on the wheels according to the load which they carry—the load on the large wheels being 75 per cent. Four hundred and fifty of these trucks are now being built for New York.

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The Philadelphia Electric & Manufacturing Company reports a constantly increasing demand for its Antirust for preserving iron and steel work of all kinds. This product is considered by many of the largest manufacturers to be even superior to galvanizing in some respects. It is applied in the same manner as paint, and it is all that the name implies. This company has closed contracts recently for a large number of its absolute cut-outs, mast arms and malleable line material.

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The Rooke hand register is making rapid progress. About 2000 of them are now in use in six states. It is interesting to note that 20 of these registers are used on pay-as-you-enter cars in Des Moines, Ia.

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The pay-as-you-enter cars, which are shown on the exhibition track trestle, are proving of special interest to delegates. One of these cars was manufactured by the Cincinnati Car Company and the other by the J. G. Brill Company, and they were designed after the plans and manufactured under the license of the Pay-As-You-Enter Car Company, New York. The car built by the Cincinnati Car Company is one of an order built for the Municipal Traction Company, Cleveland, while the one built by the Brill Company is one of an order of 150 cars for the Third Avenue Railroad, New York. The Pay-As-You-Enter Car Company is represented at the convention by D. McDonald and T. W. Casey.

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The J. P. Devine Company, Buffalo, is represented at the convention by J. P. Warfel. This company is sole manufacturer for the United States of the Passburg vacuum impregnating and drying apparatus. He states that the company has met with great success in installing this apparatus in electrical manufacturing and repair shops.

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The Dittrick & Jordan Electric Company, Cleveland, is represented at the convention by A. R. Dittrick, who is stopping at the Chalfonte.

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The Badger Fire Extinguisher Company, of Boston, Mass., has been requested by the management of the convention to load the two 40-gallon chemical truck fire engines and be prepared in case of fire among the exhibits for quick action. This company's exhibit, besides the engines mentioned above, consisting of a full line of hand fire extinguishers, is attracting due interest.